OAKVILLE HYDRO

August 03, 2022

Ms. Nancy Marconi
Registrar and Board Secretary
Ontario Energy Board
2300 Yonge Street, 26th Floor
Toronto, ON M4P 1E4

Dear Ms. Marconi:

Re: **OEB File No. EB-2022-0055**
Oakville Hydro Electricity Distribution Inc. 2023 Distribution Rate Adjustment Application

Please find enclosed an electronic copy of Oakville Hydro Electricity Distribution Inc.'s 2023 Annual IR Application. This application is being filed in accordance with the OEB's Filing Requirements for Electricity Distribution Rate Applications – Chapter 3 Incentive Rate-Setting Applications, updated May 24, 2022 (the "Chapter 3 Filing Requirements").

The filing and supporting materials are being filed through the OEB's web portal (RESS).

Completed versions of the Rate Generator model, GA Analysis Workform, Generic LRAMVA Workform, and IRM Checklist are being filed in Excel format.

Additional excel files, unchanged since the 2021 application, filed in support of the LRAM claim are: Oakville_2011-2014 Final Results Report_20210818; Oakville_2011-2014 Persistence Report_20210818; Oakville_2017 Final Verified Annual LDC CDM Program Results_20210818; Oakville_2020_CFF-Projects_20210818; and Oakville_Participation and Cost Report_2019_20210818.

Yours truly,

David Savage
Director, Regulatory Strategy and Privacy Officer
905-825-4422
dsavage@oakvillehydro.com

2023 Distribution Rate Adjustment Application

EB-2022-0055

OAKVILLE HYDRO

Oakville Hydro Electricity Distribution Inc.

2023 Distribution Rate Adjustment Application (EB-2022-0055)

Effective January 1, 2023

IN THE MATTER OF the Ontario Energy Board Act, 1998, being Schedule B to the Energy Competition Act, 1998, S.O. 1998, c.15;

AND IN THE MATTER OF an Application by Oakville Hydro Electricity Distribution Inc. to the Ontario Energy Board for an Order or Orders approving or fixing just and reasonable rates and other service charges for the distribution of electricity as of January 1, 2023.

Filed: August 03, 2022

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1. MANAGER'S SUMMARY

Oakville Hydro is incorporated pursuant to the Ontario Business Corporations Act with its head office in the Town of Oakville. Oakville Hydro carries on the business of distributing electricity within the Town of Oakville. Oakville Hydro hereby applies to the Ontario Energy Board (the "OEB"), pursuant to Section 78 of the Ontario Energy OEB Act, 1998 (the "OEB Act"), for approval of its proposed adjustments to its distribution rates and other charges, effective January 1, 2023.

Oakville Hydro has followed Chapter 3 of the OEB's *Filing Requirements for Electricity Distribution Rate Applications – 2022 Edition for 2023 Rate Applications* dated May 24, 2022, to prepare this Annual IR Application (the "Application").

The Schedule of Rates and Charges proposed in this Application is provided as Appendix 1. The proposed rates reflect an adjustment to the rates previously approved by the OEB on December 9, 2021, OEB File Number EB-2021-0048.

The specific approvals requested are:

a) An annual IR index adjustment;
b) The continuation of the current low voltage service charges as approved in EB-2013-0159;
c) The approval for the proposed adjustments to the current Retail Transmission Service Rates as approved in Oakville Hydro's 2022 application, EB-2021-0048;
d) The approval to record a tax sharing amount of $14,603 to be recovered from customers in a deferral account;
e) The approval for the final disposition of Oakville Hydro's Group 1 variance accounts as at December 31, 2021 with interest to December 31, 2022;
f) The continuation of existing specific service charges and loss factors as approved in EB-2013-0159 and amended in EB-2021-0048; and
g) The approval to recover lost revenue related to conservation and demand management programs under the Conservation First Framework.
h) The approval of the 2023 to 2027 LRAM-eligible amounts shown in Table 1-C of the OEB's Generic LRAMVA Work Form (Version 7). Approval will mean that the LRAM-eligible amounts are accepted as final, subject only to the annual mechanistic adjustment to be completed in subsequent rate years.

If the Application is approved as filed, Oakville Hydro's residential and small business customers will see the following bill impacts:

- Residential: A typical residential customer using 750 kWh in a month will see an increase of $4.83 or 3.91% in their total monthly bill.
- General Service < 50 kW: A typical General Service < 50 kW will see an increase of $15.19 or 4.76% in their total monthly bill.

Oakville Hydro requests that this Application be disposed of by way of a written hearing. In the event that the OEB is unable to provide a Decision and Order on this Application for implementation effective January

1, 2023, Oakville Hydro requests that the OEB issue an Interim Rate Order declaring its current Tariff of Rates and Charges as interim until the implementation date of the approved 2023 distribution rates.

2. CONTACT INFORMATION

Service Address:
Oakville Hydro Electricity Distribution Inc.
861 Redwood Square
Oakville, ON L6L 6R6

Internet Address: www.oakvillehydro.com

Primary License Contact:	Primary Contact for this Application:
Scott Mudie	David Savage
Chief Operating Officer	Director, Regulatory Strategy and Privacy Officer
Telephone: 905-825-4453	Telephone: 905-825-4422
E-mail: SMudie@oakvillehydro.com	E-mail: regulatoryaffairs@oakvillehydro.com

3. CERTIFICATION OF EVIDENCE

As Chief Operating Officer of Oakville Hydro Electricity Distribution Inc. (Oakville Hydro), I certify that, to the best of my knowledge:

a) the evidence filed in this Application is accurate and that it is consistent Chapter 3 of the OEB's *Filing Requirements for Electricity Distribution Rate Applications – 2022 Edition for 2023 Rate Applications* dated May 24, 2022; and

b) that robust processes and internal controls are in place for the preparation, verification and oversight of Oakville Hydro's variance account balances; and

c) the documents filed in this Application do not include any personal information (as that phrase is defined in the Freedom of Information and Protection of Privacy Act), that is not otherwise redacted in accordance with rule 9A of the OEB's Rules of Practice and Procedure.

Scott Mudie

Chief Operating Officer

4. RATE GENERATOR

Oakville Hydro has provided a copy of the OEB's 2023 Rate Generator model, in excel format, in support of this Application. Oakville Hydro confirms that it has verified the accuracy of the billing determinants in the pre-populated Rate Generator model.

5. CURRENT TARIFF OF RATES AND CHARGES

Oakville Hydro's current tariff of rates and charges effective January 1, 2022, EB-2021-0048, is provided as Appendix 3.

6. WHO WILL BE AFFECTED?

Oakville Hydro's customers, including its embedded distributor, will be affected by this Application.

7. BILL IMPACTS

If the Application is approved as filed, a typical residential customer using 750 kWh per month will see an increase of $4.83 or 3.91% in their total monthly bill. A customer in the General Service < 50 kW class using 2,000 kWh per month will see an increase of $15.19 or 4.76% in their total monthly bill. Detailed bill impact schedules are provided in Appendix 2.

8. ANNUAL ADJUSTMENT MECHANISM

In accordance with the Filing Requirements, Oakville Hydro has used the 2022 inflation factor as a placeholder until the inflation factor for 2023 is issued by the OEB.

The price cap adjustment used in the 2023 Rate Generator is 2.7%. This calculation is based upon a price escalator of 3.3%, a productivity factor of 0.00% and the stretch factor of 0.60% assigned to distributors filing under the Annual IR framework. Oakville Hydro acknowledges that the OEB will update Oakville Hydro's 2023 Rate Generator Model with the updated price escalator once published by the OEB.

9. RATE DESIGN FOR RESIDENTIAL ELECTRICITY CUSTOMERS

On April 2, 2015, the OEB released its *OEB Policy: A New Distribution Rate Design for Residential Electricity Customers* (EB-2014-0210). This policy required that electricity distributors transition to fully fixed rates for residential customers over a period of four years, beginning in 2016, while considering the need to mitigate rate impacts for customers. Oakville Hydro completed the transition to fully fixed rates in 2019 and no further adjustments are required.

10. ELECTRICITY DISTRIBUTION RETAIL TRANSMISSION SERVICE RATES

Oakville Hydro has calculated the adjustment to the current Retail Transmission Service Rates (RSTR) as approved in its 2022 Annual IR application, EB-2021-0048. Oakville Hydro is proposing that the RSTR Connection and RSTR Network rates be adjusted as shown in Table 1. The detailed calculations can be found in the 2023 Rate Generator model filed in support of this application.

Table 1 RSTR Rates

	Current Rates		Proposed Rates	
Rate Classification	**RTSR-Network**	**RSTR-Connection**	**RTSR-Network**	**RSTR-Connection**
Residential Service Classification	0.0098	0.0062	0.0115	0.0069
General Service Less Than 50 kW Service Classification	0.0089	0.0057	0.0104	0.0064
General Service 50 To 999 kW Service Classification	3.3778	2.1354	3.9579	2.3839
General Service 50 To 999 kW Service Classification - Interval Me	3.4869	2.2045	4.0857	2.4611
General Service 1,000 kW And Greater Service Classification	3.4869	2.2045	4.0857	2.4611
Unmetered Scattered Load Service Classification	0.0089	0.0057	0.0104	0.0064
Sentinel Lighting Service Classification	0.6772	0.4280	0.7935	0.4778
Street Lighting Service Classification	2.8178	1.7816	3.3017	1.9890
Embedded Distributor Service Classification	3.4869	2.2045	4.0857	2.4611

Oakville Hydro notes that that the proposed RTSR rates for all rate classes increased on average by 15%, driven by increases in the IESO Uniform Transmission Rates and the Hydro One Sub-Transmission Rates. The IESO Uniform Transmission Rates increased by 9.4% overall while the Hydro One Sub-Transmission Rates increased overall by 16%, as shown in Table 2.

Table 2 – IESO and Hydro One Uniform Transmission Rates

IESO Uniform Transmission Rates	Unit	2022 Rate Generator Model	2023 Rate Generator Model	% Change
Network Service Rate	kW	4.9000	5.4600	11.4%
Line Connection Service Rate	kW	0.8100	0.8800	8.6%
Transformation Connection Service Rat	kW	2.6500	2.8100	6.0%
Total		***8.3600***	***9.1500***	***9.4%***
Hydro One Uniform Transmission Rates	**Unit**	**2022 Rate Generator Model**	**2023 Rate Generator Model**	**% Change**
Network Service Rate	kW	3.4778	4.3473	25.0%
Line Connection Service Rate	kW	0.8128	0.6788	(16.5)%
Transformation Connection Service Rat	kW	2.0458	2.3267	13.7%
Total		***6.3364***	***7.3528***	***16.0%***

11. REVIEW AND DISPOSITION OF GROUP 1 DEFERRAL AND VARIANCE ACCOUNT BALANCES

11.1 OVERVIEW

The *Report of the OEB on Electricity Distributors' Deferral and Variance Account Review* (the "EDVAR Report") provides that a distributors' Group 1 audited account balances be reviewed and disposed of if the disposition threshold of $0.001 per kWh is exceeded. The audited balance of Oakville Hydro's Group 1 accounts as at December 31, 2021, with project interest to December 31, 2022, excluding the LRAM variance account, is $4,595,703 or $0.0030 per kWh, which is above the disposition threshold. Therefore, Oakville Hydro is requesting approval to dispose of the balance of its 2021 Group 1 deferral and variance accounts on a final basis over a one-year period. The proposed rate riders, as calculated by the Rate Generator model, are provided in Table 4 and 5.

Oakville Hydro confirms that the balances in Account 1595 sub-accounts have only been disposed of once. Group 1 account balances as of December 31, 2020 were approved for disposition on a final basis in Oakville Hydro's 2022 application, EB-2021-0048.

Table 3 - Group 1 Account Balances

Account	Account Number	Principal	Interest	Total
LV Variance Account	1550	$ 1,359,541	$ 50,565	$ 1,410,106
Smart Metering Entity Charge Variance Account	1551	(48,683)	(1,534)	(50,217)
RSVA - Wholesale Market Service Charge	1580	1,340,554	6,235	1,346,790
Variance WMS – Sub-account CBR Class B	1580	(166,442)	(6,012)	(172,454)
RSVA - Retail Transmission Network Charge	1584	3,168,183	50,798	3,218,981
RSVA - Retail Transmission Connection Charge	1586	479,044	8,556	487,600
RSVA - Power	1588	(449,342)	(7,151)	(456,493)
RSVA - Global Adjustment	1589	(1,145,234)	(37,161)	(1,182,395)
Disposition and Recovery/Refund of Regulatory Balances (2019)	1595	(13,804)	7,589	(6,215)
Total		$ 4,523,818	$ 71,885	$ 4,595,703

Table 4 – Group 1 Variance Account Rate Riders (Excluding Global Adjustment)

Rate Class	Unit	Deferral/Variance Account Rate Rider (Excl. Global Adjustment)	Deferral/Variance Account Rate Rider for Non-WMP	Rate Rider for Disposition of Capacity Based Recovery Account for Class B Customers
RESIDENTIAL SERVICE CLASSIFICATION	kWh	0.0038	-	(0.0001)
GENERAL SERVICE LESS THAN 50 KW SERVICE CLASSIFICATION	kWh	0.0038	-	(0.0001)
GENERAL SERVICE 50 TO 999 KW SERVICE CLASSIFICATION	kW	1.2191	0.2124	(0.0469)
GENERAL SERVICE 1,000 KW AND GREATER SERVICE CLASSIFICATIO	kW	1.6974	-	(0.0426)
UNMETERED SCATTERED LOAD SERVICE CLASSIFICATION	kWh	0.0039	-	(0.0001)
SENTINEL LIGHTING SERVICE CLASSIFICATION	kW	1.3931	-	(0.0446)
STREET LIGHTING SERVICE CLASSIFICATION	kW	1.3616	-	(0.0447)
EMBEDDED DISTRIBUTOR SERVICE CLASSIFICATION	kW	1.1506	-	(0.0378)

Table 5 - Global Adjustment Rate Rider

Rate Class	Unit	Global Adjustment Rate Rider for Non-RPP Customers
RESIDENTIAL SERVICE CLASSIFICATION	kWh	(0.0024)
GENERAL SERVICE LESS THAN 50 KW SERVICE CLASSIFICATION	kWh	(0.0024)
GENERAL SERVICE 50 TO 999 KW SERVICE CLASSIFICATION	kWh	(0.0024)
GENERAL SERVICE 1,000 KW AND GREATER SERVICE CLASSIFICATION	kWh	(0.0024)
UNMETERED SCATTERED LOAD SERVICE CLASSIFICATION	kWh	-
SENTINEL LIGHTING SERVICE CLASSIFICATION	kWh	-
STREET LIGHTING SERVICE CLASSIFICATION	kWh	(0.0024)
EMBEDDED DISTRIBUTOR SERVICE CLASSIFICATION	kWh	(0.0024)

11.2 WHOLESALE MARKET PARTICIPANTS

Oakville Hydro confirms that it has not allocated any balances related to commodity and market-related charges to its wholesale market participant.

11.3 EXPLANATION OF RRR VARIANCES

The Rate Generator model is prepopulated with the Group 1 RSVA balances filed by Oakville Hydro in accordance with the OEB's Reporting and Record Keeping Requirements (RRR). Distributors are required to provide an explanation of any variances between the amounts reported through the RRR and the continuity schedule in the Rate Generator. The following table and accompanying notes summarize the variances and provide the required explanations.

Table 6 - RRR Variances

Account	Account Number	Amount
RSVA - Wholesale Market Service Charge	1580	$ (378,609)
RSVA - Power	1588	(1,039,683)
RSVA - Global Adjustment	1589	155,131
LRAM Variance Account	1568	$ (605,707)

- **RSVA - Wholesale Market Service Charge**

  In accordance with the guidance provided in the 2017 Orientation Session[1] for cost-of-service filers, Oakville Hydro has excluded amounts related to the Variance WMS – Sub-account CBR Class A and Variance WMS – Sub-account CBR Class B from the 1580 RSVA – WMS Charge account in the continuity schedule. However, the value that is automatically populated from the RRR filings includes these amounts. Therefore, the continuity schedule in the Rate Generator model shows a variance for account this account equal to the amounts in the sub-accounts.

- **RSVA – Power and RSVA – Global Adjustment**

  The Variance between RRR and 2021 balance for the RSVA – Power and RSVA - Global Adjustment is related to the principal adjustments made in the 2021 GA Workform. These adjustments are required to ensure that the account balances reflect a full calendar year and include adjustments for the true-up of GA charges based on actual non-RPP Volumes and the true-up of unbilled to actual revenue.

- **LRAM Variance Account**

  Oakville Hydro has updated the balance of the LRAM variance account to equal the amount being claimed for disposition in this Application to enable the Rate Generator Model to calculate the appropriate rate riders.

11.4 ADJUSTMENTS TO VARIANCE ACCOUNT BALANCES

In its Decision in Oakville Hydro's 2021 rate application, the OEB noted that Oakville Hydro's annual Account 1588 net transactions for the period of 2016 to 2019 have resulted in relatively large balances for certain years. Typically, large balances are not expected for Account 1588 as it should only hold the variance between commodity costs based on actual line losses and commodity revenues based on values for line losses approved by the OEB.

In its 2021 application, Oakville Hydro committed to further investigate the annual variances in Account 1588 and, in 2021, Oakville Hydro conducted a thorough review of the balances of both Account 1588 and Account 1589 for the period 2016 to 2020. Through that review, Oakville Hydro identified that, for the period November 2016 to February 2017, it had entered the Class A volumes into the Embedded Generation field in the IESO's online portal. As a result, the global adjustment charges for that period were overstated. Oakville Hydro submitted a revision to the IESO to correct this in 2021. In its 2022 application, Oakville Hydro disposed of its Group 1 account balances to 2020 on a final basis.

Oakville Hydro has not made any adjustments to balances previously approved by the OEB on a final basis.

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[1] Orientation Session for Cost of Service Applicants, Page 11, https://www.oeb.ca/oeb/_Documents/2017EDR/2017_COS_Orientation_Jul28-16_Presentationv1.pdf

11.5 CAPACITY BASED RECOVERY (CBR)

Oakville Hydro has followed the OEB's CBR accounting guidance on the disposition of CBR variances. The calculation of the CBR Class B rate riders does not result in a rate rider that rounds to zero at the fourth decimal place, therefore a separate CBR Class B rate rider has been calculated.

12. GLOBAL ADJUSTMENT

12.1 CLASS B AND A CUSTOMERS

Oakville Hydro bills its Class B customers based upon the first estimate of the global adjustment for all rate classes, including the one customer in Oakville Hydro's embedded distributor rate class. Class A customers are billed based upon actual Class A global adjustment charges therefore, there are no Class A global adjustment variance balances. In accordance with the Filing Requirements, Oakville Hydro has established a separate rate rider for its non-RPP Class B customers based on energy consumption.

12.2 GLOBAL ADJUSTMENT WORKFORM

The Global Adjustment Work Form is provided as Appendix 4. A live Excel version is also being filed in support of this Application. The unresolved differences for global adjustment and the cost of power from the Global Adjustment Work Form are within the OEB's 1% tolerance range.

12.3 COMMODITY ACCOUNTS 1588 AND 1589

On February 21, 2019, the OEB issued its letter entitled *Accounting Guidance related to Accounts 1588 Power, and 1589 Retail Settlement Variance Account (RSVA) Global Adjustment* (the "OEB Guidance") as well as the related accounting guidance. The accounting guidance was effective January 1, 2019, and was to be implemented by August 31, 2019. Oakville Hydro confirms that it has implemented the new accounting guideline effective January 1, 2019.

Distributors are also expected to consider the accounting guidance in the context of historical balances that have yet to be disposed of on a final basis

Oakville Hydro submits that it has taken the appropriate steps to ensure the accuracy of the balances of accounts 1588 and 1589 as they relate to the OEB Guidance and is seeking approval for the final disposition of its 2021 Group 1 variance account balances.

13 LOST REVENUE ADJUSTMENT MECHANISM VARIANCE ACCOUNT

13.1 OVERVIEW

On March 20, 2019, the Minister of Energy, Northern Development and Mines (the Minister) issued separate directives to the OEB and the IESO. The directive to the IESO concluded the Conservation First Framework (CFF) and replaced it with an Interim Framework that ran through December 31, 2020. The

Minister issued subsequent directives on July 22, 2020, and June 10, 2021 to the IESO, the latter of which indicated that some in-service deadlines for CFF projects may be extended until December 31, 2021, due to delays caused by the COVID-19 emergency, and that any electricity savings or demand reductions achieved during this extended time period would continue to be attributable to the CFF.

The IESO made monthly Participation and Cost Reports available to electricity distributors from January 1, 2018 to April 15, 2019. The monthly Participation and Cost Reports include, amongst other information, incremental first year energy savings as well as information related to persistence. Results from the IESO's 2017 program evaluation have been applied to the January 1, 2018 to April 15, 2019 gross unverified savings values, including net-to-gross factors and gross realization rates.

To create the Participation and Cost Reports each distributor submitted detailed project level files to the IESO that contain project level savings and costs (the monthly LDC Report submission). The detailed project level savings files include all relevant information related to each project the distributor has completed and submitted to the IESO.

These detailed files contain the same information that the IESO had used to create the Participation and Cost Reports, including Gross Energy Savings (kWh) and Gross Demand Savings (kW). Oakville Hydro has continued to maintain the detailed project level files for the Retrofit program and has relied on these files to determine the Gross Energy Savings (kWh) and Gross Demand Savings (kW) savings for retrofit projects delivered in 2019 and 2020. A copy of the detailed project information for the 2020 projects is being filed in support of this Application in Excel format in a file entitled Oakville_2020_CFF-Projects_20210818.

Oakville Hydro has relied on the IESO's 2017 program evaluation to calculate the net savings for IESO designed CFF programs as reported in the following documents:

- 2017 Business Programs Evaluation Report
- 2017 Industrial Programs Evaluation Report

A copy of these reports is provided in Appendix 5 and 6 respectively.

13.2 LRAM VA BALANCE

Oakville Hydro requests approval for the recovery of its 2021 and 2022 energy and demand related lost revenue of $914,714, including $7,362 in carrying charges, attributable to prior year persistence from 2013 to 2020 programs. Version 7 of the OEB's Generic LRAMVA Work Form is being provided in Excel format in support of this request.

Oakville Hydro confirms that it has used most recent input assumptions and the detailed project level savings to calculate the amount to be included in the LRAMVA for all projects.

13.3 LRAM RATE RIDERS

Oakville Hydro is proposing to dispose of the 2021 and 2022 LRAM amounts of $914,714 over a one-year period beginning January 21, 2023 by way of a variable rate rider for the impacted rate classes as calculated by the Rate Generator model in Table 7.

Table 7 - LRAM Rate Riders January 1, 2023 to December 31, 2023

Customer Class	Principal	Interest	Total	Variable Rate
General Service < 50 kW	$515,939	$4,167	$520,106	$0.0030
General Service > 50 kW	$337,030	$2,755	$339,785	$0.2470
General Service > 1,000 kW	$55,179	$446	$55,625	$0.1186
Street Lighting	$(796)	$(6)	$(802)	$(0.0493)
Total	**$907,352**	**$7,362**	**$914,714**	

13.4 LRAM ELIGIBLE AMOUNTS FOR 2023 TO 2027

In their applications for 2023 rates, distributors are to apply for approval of the 2023 to 2027 LRAM-eligible amounts shown in Table 1-C of the OEB's Generic LRAM Work Form (Version 7). Approval will mean that the LRAM-eligible amounts are accepted as final, subject only to the annual mechanistic adjustment to be completed in subsequent rate years.

Oakville Hydro requests approval of the 2023 to 2027 LRAM-eligible amounts as detailed in Table 1-C of the OEB's Generic LRAMVA Work Form (Version 7). Table 8 below summaries the LRAM Eligible Amounts for 2023 to 2027 requested for approval.

Table 8- LRAM Eligible Amounts for 2023 TO 2027

Description	GS<50 kW	GS>50 kW	GS>1,000 kW	Street Lighting	Total
2023 Actuals (in 2022 $)	$273,816	$448,684	$31,391	$0	$753,891
2023 Forecast (in 2022 $)	$(16,065)	$(296,370)	$(3,662)	$(403)	$(316,500)
2023 TOTAL LRAM-Eligible*	$257,751	$152,314	$27,729	$(403)	**$437,390**
2024 Actuals (in 2022 $)	$247,919	$439,142	$31,263	$0	$718,323
2024 Forecast (in 2022 $)	$(16,065)	$(296,370)	$(3,662)	$(403)	$(316,500)
2024 TOTAL LRAM-Eligible*	$231,854	$142,772	$27,600	$(403)	**$401,823**
2025 Actuals (in 2022 $)	$192,504	$415,381	$31,005	$0	$638,890
2025 Forecast (in 2022 $)	$(16,065)	$(296,370)	$(3,662)	$(403)	$(316,500)
2025 TOTAL LRAM-Eligible*	$176,439	$119,011	$27,342	$(403)	**$322,390**
2026 Actuals (in 2022 $)	$189,411	$399,342	$30,690	$0	$619,442
2026 Forecast (in 2022 $)	$(16,065)	$(296,370)	$(3,662)	$(403)	$(316,500)
2026 TOTAL LRAM-Eligible*	$173,346	$102,972	$27,027	$(403)	**$302,942**
2027 Actuals (in 2022 $)	$162,312	$387,873	$28,051	$0	$578,236
2027 Forecast (in 2022 $)	$(16,065)	$(296,370)	$(3,662)	$(403)	$(316,500)
2027 TOTAL LRAM-Eligible*	$146,247	$91,503	$24,389	$(403)	**$261,736**
Total LRAM-Eligible Amount (in 2022 $)	**$985,637**	**$608,572**	**$134,087**	**$(2,016)**	**$1,726,280**

14 Tax Changes

The OEB has determined that currently known legislated tax changes will be reflected in IRM adjustments and that a 50/50 sharing of those tax changes between Oakville Hydro and its rate payers is appropriate. Oakville Hydro notes that the OEB's 2023 Rate Generator model is applying a tax rate of 26.5% based on the 2014 approved rate base whereas the 2014 PILs model applied the small business tax rate of 15.5% based upon net income for tax purposes. As a result, the 2023 Rate Generator model is calculating a tax-sharing amount of $14,603 to be recovered from customers. Consistent with the OEB's Decision and Rate Order in Oakville Hydro's 2018 IRM Application, Oakville Hydro is requesting approval to record this amount in Account 1595 for disposition at a later date.[2]

15 IRM Check List

Oakville Hydro is filing the IRM Check List as Appendix 7 and in Excel format.

16 Conclusion

Oakville Hydro requests approval for an Order or Orders approving or fixing just and reasonable rates and other service charges for the distribution of electricity effective January 1, 2023 as set out in the Proposed

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[2] Decision and Order – EB-2017-0067, page 4.

Tariff of Rates and Charges in Appendix 1 of this Application, subject to a change in the price cap formula to reflect the 2023 rate-setting parameters.

All of which is respectfully submitted this 3rd day of August 2022.

David Savage
Director, Regulatory Strategy and Privacy Officer

Appendix 1 – Proposed Tariff of Rates and Charges

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2022-0055

RESIDENTIAL SERVICE CLASSIFICATION

This class refers to the supply of electrical energy to detached and semi-detached residential buildings as well as farms as defined in the local zoning by-laws. Where the residential dwelling comprises the entire electrical load of a farm, it is defined as a residential service. Where electricity is provided to a combined residential and business (including agricultural usage) and the service does not provide for separate metering, the classification shall be at the discretion of Oakville Hydro and shall be based on such considerations as the estimated predominant consumption. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	32.03
Smart Metering Entity Charge - effective until December 31, 2023	$	0.43
Low Voltage Service Rate	$/kWh	0.0004
Rate Rider for Disposition of Global Adjustment Account (2023) - effective until December 31, 2023 Applicable only for Non-RPP Customers	$/kWh	(0.0024)
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kWh	0.0038
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kWh	(0.0001)
Retail Transmission Rate - Network Service Rate	$/kWh	0.0115
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kWh	0.0069

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2022-0055

GENERAL SERVICE LESS THAN 50 KW SERVICE CLASSIFICATION

This class refers to customers who do not qualify as residential customers and whose monthly average peak demand in the preceding twelve months is less than 50kW. For new customers without prior billing history, the peak demand will be based on 90% of the proposed capacity or installed transformation. Note: Apartment buildings or multi-unit complexes and subdivisions that are not individually metered are treated as General Service. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor’s Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	40.35
Smart Metering Entity Charge - effective until December 31, 2023	$	0.43
Distribution Volumetric Rate	$/kWh	0.0180
Low Voltage Service Rate	$/kWh	0.0003
Rate Rider for Disposition of Global Adjustment Account (2023) - effective until December 31, 2023 Applicable only for Non-RPP Customers	$/kWh	(0.0024)
Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2023) - effective until December 31, 2023	$/kWh	0.0030
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kWh	0.0038
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kWh	(0.0001)
Retail Transmission Rate - Network Service Rate	$/kWh	0.0104
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kWh	0.0064

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2022-0055

GENERAL SERVICE 50 TO 999 KW SERVICE CLASSIFICATION

This class refers to customers who do not qualify as residential customers whose monthly average peak demand in the preceding twelve months is in the range of 50 to 999 kW. There are two sub categories within this class, those being non-interval and interval metered accounts. For new customers without prior billing history, the peak demand will be based on 90% of the proposed capacity or installed transformation. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of WMS - Sub-account CBR Class B is not applicable to wholesale market participants (WMP), customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new Class B customers.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of Global Adjustment is only applicable to non-RPP Class B customers. It is not applicable to WMP, customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new non-RPP Class B customers.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	137.71
Distribution Volumetric Rate	$/kW	5.3847
Low Voltage Service Rate	$/kW	0.1313
Rate Rider for Disposition of Global Adjustment Account (2023) - effective until December 31, 2023 Applicable only for Non-RPP Customers	$/kWh	(0.0024)

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

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This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

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Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2023) - effective until December 31, 2023	$/kW	0.2470
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023 Applicable only for Non-Wholesale Market Participants	$/kW	0.2124
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kW	1.2191
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kW	(0.0469)
Retail Transmission Rate - Network Service Rate	$/kW	3.9579
Retail Transmission Rate - Network Service Rate - Interval Metered	$/kW	4.0857
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	2.3839
Retail Transmission Rate - Line and Transformation Connection Service Rate - Interval Metered	$/kW	2.4611

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2022-0055

GENERAL SERVICE 1,000 KW AND GREATER SERVICE CLASSIFICATION

This class refers to customers who do not qualify as residential customers whose monthly average peak demand in the preceding twelve months is equal to or greater than 1,000 kW. These accounts will all be interval metered accounts. For new customers without prior billing history, the peak demand will be based on 90% of the proposed capacity or installed transformation. Class A and Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of WMS - Sub-account CBR Class B is not applicable to wholesale market participants (WMP), customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new Class B customers.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of Global Adjustment is only applicable to non-RPP Class B customers. It is not applicable to WMP, customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new non-RPP Class B customers.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	3,952.30
Distribution Volumetric Rate	$/kW	3.1254
Low Voltage Service Rate	$/kW	0.1313

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

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Rate Rider for Disposition of Global Adjustment Account (2023) - effective until December 31, 2023 Applicable only for Non-RPP Customers	$/kWh	(0.0024)
Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2023) - effective until December 31, 2023	$/kW	0.1186
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kW	1.6974
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kW	(0.0426)
Retail Transmission Rate - Network Service Rate - Interval Metered	$/kW	4.0857
Retail Transmission Rate - Line and Transformation Connection Service Rate - Interval Metered	$/kW	2.4611

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

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UNMETERED SCATTERED LOAD SERVICE CLASSIFICATION

This classification applies to an account taking electricity at 750 volts or less whose average monthly maximum demand is less than, or is forecast to be less than, 50 kW and the consumption is unmetered. Such connections include cable TV power packs, bus shelters, telephone booths, traffic lights, pedestrian X-Walk signals/beacons, railway crossings, etc. The level of the consumption will be agreed to by the distributor and the customer, based on detailed manufacturer information and documentation with regard to electrical consumption of the unmetered load or periodic monitoring of actual consumption. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge (per connection)	$	11.41
Distribution Volumetric Rate	$/kWh	0.0109
Low Voltage Service Rate	$/kWh	0.0003
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kWh	(0.0001)
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kWh	0.0039
Retail Transmission Rate - Network Service Rate	$/kWh	0.0104
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kWh	0.0064

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

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SENTINEL LIGHTING SERVICE CLASSIFICATION

This classification refers to accounts that are an unmetered lighting load supplied to a sentinel light. Further servicing details are available in the distributor’s Conditions of Service. Class B consumers are defined in accordance with O. Reg. 429/04.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge (per connection)	$	3.12
Distribution Volumetric Rate	$/kW	52.9826
Low Voltage Service Rate	$/kW	0.0255
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kW	(0.0446)
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kW	1.3931
Retail Transmission Rate - Network Service Rate	$/kW	0.7935
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	0.4778

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2022-0055

STREET LIGHTING SERVICE CLASSIFICATION

All services supplied to street lighting equipment owned by or operated for the Municipality, the Region or the Province of Ontario shall be classified as Street Lighting Service. Street Lighting plant, facilities, or equipment owned by the customer are subject to the Electrical Safety Authority (ESA) requirements and Oakville Hydro specifications. Class B consumers are defined in accordance with O. Reg. 429/04.Further servicing details are available in the distributor’s Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge (per connection)	$	4.28
Distribution Volumetric Rate	$/kW	26.3181
Low Voltage Service Rate	$/kW	0.1061
Rate Rider for Disposition of Global Adjustment Account (2023) - effective until December 31, 2023 Applicable only for Non-RPP Customers	$/kWh	(0.0024)
Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2023) - effective until December 31, 2023	$/kW	(0.0493)
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kW	1.3616
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kW	(0.0447)
Retail Transmission Rate - Network Service Rate	$/kW	3.3017
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	1.9890

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

**This schedule supersedes and replaces all previously
approved schedules of Rates, Charges and Loss Factors**

EB-2022-0055

EMBEDDED DISTRIBUTOR SERVICE CLASSIFICATION

This classification applies to an electricity distributor licenced by the Ontario Energy Board, which is provided electricity by means of this distributor's facilities. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	5,896.36
Distribution Volumetric Rate	$/kW	3.2204
Low Voltage Service Rate	$/kW	0.1313
Rate Rider for Disposition of Global Adjustment Account (2023) - effective until December 31, 2023 Applicable only for Non-RPP Customers	$/kWh	(0.0024)
Rate Rider for Disposition of Deferral/Variance Accounts (2023) - effective until December 31, 2023	$/kW	1.1506
Rate Rider for Disposition of Capacity Based Recovery Account (2023) - effective until December 31, 2023 Applicable only for Class B Customers	$/kW	(0.0378)
Retail Transmission Rate - Network Service Rate	$/kW	4.0857
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	2.4611

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

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microFIT SERVICE CLASSIFICATION

This classification applies to an electricity generation facility contracted under the Independent Electricity System Operator's microFIT program and connected to the distributor's distribution system. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	4.55

ALLOWANCES

Transformer Allowance for General Service > 50 to 999kW customers that own their transformers (per kW of billing demand/month)	$/kW	(0.50)
Primary Metering Allowance for Transformer Losses - applied to measured demand & energy	%	(1.00)

SPECIFIC SERVICE CHARGES

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

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Customer Administration

Statement of account	$	15.00
Pulling post dated cheques	$	15.00
Duplicate invoices for previous billing	$	15.00
Easement letter	$	15.00
Account history	$	15.00

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Credit reference/credit check (plus credit agency costs)	$	15.00
Returned cheque (plus bank charges)	$	15.00
Account set up charge/change of occupancy charge (plus credit agency costs if applicable)	$	30.00
Meter dispute charge plus Measurement Canada fees (if meter found correct)	$	30.00

Non-Payment of Account

Late payment - per month (effective annual rate 19.56% per annum or 0.04896% compounded daily rate)	%	1.50
Reconnection at meter - during regular hours	$	65.00
Reconnection at meter - after regular hours	$	185.00
Reconnection at pole - during regular hours	$	185.00
Reconnection at pole - after regular hours	$	415.00

Other

Special meter reads	$	30.00
Service call (after first service call in a 12-month period) - during regular hours	$	30.00
Service call (after first service call in a 12-month period) - after regular hours	$	165.00
Temporary service - install & remove - overhead - no transformer	$	500.00
Temporary service - install & remove - underground - no transformer	$	300.00
Specific charge for access to the power poles - $/pole/year (with the exception of wireless attachments) - Approved on an Interim Basis	$	35.52

RETAIL SERVICE CHARGES (if applicable)

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

Retail Service Charges refer to services provided by a distributor to retailers or customers related to the supply of competitive electricity.

One-time charge, per retailer, to establish the service agreement between the distributor and the retailer	$	110.05
Monthly fixed charge, per retailer	$	44.03
Monthly variable charge, per customer, per retailer	$/cust.	1.09
Distributor-consolidated billing monthly charge, per customer, per retailer	$/cust.	0.65
Retailer-consolidated billing monthly credit, per customer, per retailer	$/cust.	(0.65)
Service Transaction Requests (STR)		
Request fee, per request, applied to the requesting party	$	0.55
Processing fee, per request, applied to the requesting party	$	1.09
Request for customer information as outlined in Section 10.6.3 and Chapter 11 of the Retail Settlement Code directly to retailers and customers, if not delivered electronically through the Electronic Business Transaction (EBT) system, applied to the requesting party		

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2023

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2022-0055

Up to twice a year	$	no charge
More than twice a year, per request (plus incremental delivery costs)	$	4.40
Notice of switch letter charge, per letter (unless the distributor has opted out of applying for the charge as per the Ontario Energy Board's Decision and Order EB-2015-0304, issued on February 14, 2019)	$	2.15

LOSS FACTORS

If the distributor is not capable of prorating changed loss factors jointly with distribution rates, the revised loss factors will be implemented upon the first subsequent billing for each billing cycle.

Total Loss Factor - Secondary Metered Customer < 5,000 kW	1.0376
Total Loss Factor - Secondary Metered Customer > 5,000 kW	1.0145
Total Loss Factor - Primary Metered Customer < 5,000 kW	1.0272
Total Loss Factor - Primary Metered Customer > 5,000 kW	1.0045

Appendix 2 – Bill Impact Schedules

Ontario Energy Board

Incentive Rate-setting Mechanism Rate Generator for 2023 Filers

The bill comparisons below must be provided for typical customers and consumption levels. Bill impacts must be provided for residential customers consuming 750 kWh per month and general service customers consuming 2,000 kWh per month and having a monthly demand of less than 50 kW. Include bill comparisons for Non-RPP (retailer) as well. **To assess the combined effects of the shift to fixed rates and other bill impacts associated with changes in the cost of distribution service, applicants are to include a total bill impact for a residential customer at the distributor's 10th consumption percentile (In other words, 10% of a distributor's residential customers consume at or less than this level of consumption on a monthly basis). Refer to section 3.2.3 of the Chapter 3 Filing Requirements For Electricity Distribution Rate Applications.**

For certain classes where one or more customers have unique consumption and demand patterns and which may be significantly impacted by the proposed rate changes, the distributor must show a typical comparison, and provide an explanation.

Note:
1. For those classes that are not eligible for the RPP price, the weighted average price including Class B GA through end of June 2022 of $0.0967/kWh (IESO's Monthly Market Report for April 2022) has been used to represent the cost of power. For those classes on a retailer contract, applicants should enter the contract price (plus GA) for a more accurate estimate. Changes to the cost of power can be made directly on the bill impact table for the specific class.
2. Please enter the applicable billing determinant (e.g. number of connections or devices) to be applied to the monthly service charge for unmetered rate classes in column N. If the monthly service charge is applied on a per customer basis, enter the number "1". Distributors should provide the number of connections or devices reflective of a typical customer in each class.

Note that cells with the highlighted color shown to the left indicate quantities that are loss adjusted.

Table 1

RATE CLASSES / CATEGORIES *(eg: Residential TOU, Residential Retailer)*	**Units**	**RPP? Non-RPP Retailer? Non-RPP Other?**	**Current Loss Factor** (eg: 1.0351)	**Proposed Loss Factor**	**Consumption (kWh)**	**Demand kW (if applicable)**	**RTSR Demand or Demand-Interval?**	**Billing Determinant Applied to Fixed Charge for Unmetered**
RESIDENTIAL SERVICE CLASSIFICATION	**kWh**	RPP	1.0376	1.0376	750			
GENERAL SERVICE LESS THAN 50 KW SERVICE CLASSIFICATION	**kWh**	RPP	1.0376	1.0376	2,000			
GENERAL SERVICE 50 TO 999 KW SERVICE CLASSIFICATION	**kW**	Non-RPP (Other)	1.0376	1.0376	200,000	500		
GENERAL SERVICE 1,000 KW AND GREATER SERVICE CLASSIFICATION	**kW**	Non-RPP (Other)	1.0376	1.0376	1,000,000	2,200		
UNMETERED SCATTERED LOAD SERVICE CLASSIFICATION	**kWh**	RPP	1.0376	1.0376	250			1
SENTINEL LIGHTING SERVICE CLASSIFICATION	**kW**	RPP	1.0376	1.0376	1,000	25		1
STREET LIGHTING SERVICE CLASSIFICATION	**kW**	Non-RPP (Other)	1.0376	1.0376	700,000	2,000		9,300
EMBEDDED DISTRIBUTOR SERVICE CLASSIFICATION	**kW**	Non-RPP (Other)	1.0376	1.0376	2,810,800	6,000		
RESIDENTIAL SERVICE CLASSIFICATION	**kWh**	RPP	1.0376	1.0376	250			

Table 2

RATE CLASSES / CATEGORIES *(eg: Residential TOU, Residential Retailer)*	**Units**	**Sub-Total**						**Total**	
		A		**B**		**C**		**Total Bill**	
		$	**%**	**$**	**%**	**$**	**%**	**$**	**%**
RESIDENTIAL SERVICE CLASSIFICATION - RPP	kWh	$ 0.84	2.7%	$ 3.17	9.0%	$ 5.03	10.5%	$ 4.83	3.9%
GENERAL SERVICE LESS THAN 50 KW SERVICE CLASSIFICATION - RPP	kWh	$ 5.06	6.5%	$ 11.26	12.9%	$ 15.83	13.5%	$ 15.19	4.8%
GENERAL SERVICE 50 TO 999 KW SERVICE CLASSIFICATION - Non-RPP (Other)	kW	$ 135.02	4.8%	$ 902.52	38.8%	$ 1,316.82	25.9%	$ 1,488.01	5.1%
GENERAL SERVICE 1,000 KW AND GREATER SERVICE CLASSIFICATION - Non-RPP (C	kW	$ 410.37	3.8%	$ 4,296.97	51.6%	$ 4,296.97	51.6%	$ 4,855.58	3.8%
UNMETERED SCATTERED LOAD SERVICE CLASSIFICATION - RPP	kWh	$ 0.38	2.7%	$ 1.18	7.9%	$ 1.75	9.3%	$ 1.68	3.8%
SENTINEL LIGHTING SERVICE CLASSIFICATION - RPP	kW	$ 34.90	2.7%	$ 63.13	4.8%	$ 67.28	5.1%	$ 64.59	4.7%
STREET LIGHTING SERVICE CLASSIFICATION - Non-RPP (Other)	kW	$ 2,356.00	2.6%	$ 5,318.00	6.0%	$ 6,700.60	6.9%	$ 7,571.68	3.9%
EMBEDDED DISTRIBUTOR SERVICE CLASSIFICATION - Non-RPP (Other)	kW	$ 663.22	2.7%	$ 8,270.46	46.8%	$ 13,402.86	25.9%	$ 15,145.23	3.9%
RESIDENTIAL SERVICE CLASSIFICATION - RPP	kWh	$ 0.84	2.7%	$ 1.62	4.9%	$ 2.24	6.0%	$ 2.15	3.5%

Customer Class: RESIDENTIAL SERVICE CLASSIFICATION
RPP / Non-RPP: RPP
Consumption 750 kWh
Demand - kW
Current Loss Factor 1.0376
Proposed/Approved Loss Factor 1.0376

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	Volume	Charge ($)	Rate ($)	Volume	Charge ($)	$ Change	% Change
Monthly Service Charge	$ 31.19	1	$ 31.19	$ 32.03	1	$ 32.03	$ 0.84	2.69%
Distribution Volumetric Rate	$ -	750	$ -	$ -	750	$ -	$ -	
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ -	750	$ -	$ -	750	$ -	$ -	
Sub-Total A (excluding pass through)			**$ 31.19**			**$ 32.03**	**$ 0.84**	**2.69%**
Line Losses on Cost of Power	$ 0.1034	28	$ 2.92	$ 0.1034	28	$ 2.92	$ -	0.00%
Total Deferral/Variance Account Rate Riders	$ 0.0007	750	$ 0.53	$ 0.0038	750	$ 2.85	$ 2.33	442.86%
CBR Class B Rate Riders	-$ 0.0001	750	$ (0.08)	-$ 0.0001	750	$ (0.08)	$ -	0.00%
GA Rate Riders	$ -	750	$ -	$ -	750	$ -	$ -	
Low Voltage Service Charge	$ 0.0004	750	$ 0.30	$ 0.0004	750	$ 0.30	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ 0.43	1	$ 0.43	$ 0.43	1	$ 0.43	$ -	0.00%
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	750	$ -	$ -	750	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 35.29**			**$ 38.45**	**$ 3.17**	**8.97%**
RTSR - Network	$ 0.0098	778	$ 7.63	$ 0.0115	778	$ 8.95	$ 1.32	17.35%
RTSR - Connection and/or Line and Transformation Connection	$ 0.0062	778	$ 4.82	$ 0.0069	778	$ 5.37	$ 0.54	11.29%
Sub-Total C - Delivery (including Sub-Total B)			**$ 47.74**			**$ 52.77**	**$ 5.03**	**10.54%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	778	$ 2.65	$ 0.0034	778	$ 2.65	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	778	$ 0.39	$ 0.0005	778	$ 0.39	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
TOU - Off Peak	$ 0.0820	480	$ 39.36	$ 0.0820	480	$ 39.36	$ -	0.00%
TOU - Mid Peak	$ 0.1130	135	$ 15.26	$ 0.1130	135	$ 15.26	$ -	0.00%
TOU - On Peak	$ 0.1700	135	$ 22.95	$ 0.1700	135	$ 22.95	$ -	0.00%
Total Bill on TOU (before Taxes)			**$ 128.59**			**$ 133.62**	**$ 5.03**	**3.91%**
HST	13%		$ 16.72	13%		$ 17.37	$ 0.65	3.91%
Ontario Electricity Rebate	17.0%		$ (21.86)	17.0%		$ (22.72)	$ (0.86)	
Total Bill on TOU			**$ 123.44**			**$ 128.28**	**$ 4.83**	**3.91%**

Customer Class: GENERAL SERVICE LESS THAN 50 KW SERVICE CLASSIFICATION
RPP / Non-RPP: RPP
Consumption 2,000 kWh
Demand - kW
Current Loss Factor 1.0376
Proposed/Approved Loss Factor 1.0376

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	Volume	Charge ($)	Rate ($)	Volume	Charge ($)	$ Change	% Change
Monthly Service Charge	$ 39.29	1	$ 39.29	$ 40.35	1	$ 40.35	$ 1.06	2.70%
Distribution Volumetric Rate	$ 0.0175	2000	$ 35.00	$ 0.0180	2000	$ 36.00	$ 1.00	2.86%
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ 0.0015	2000	$ 3.00	$ 0.0030	2000	$ 6.00	$ 3.00	100.00%
Sub-Total A (excluding pass through)			**$ 77.29**			**$ 82.35**	**$ 5.06**	**6.55%**
Line Losses on Cost of Power	$ 0.1034	75	$ 7.78	$ 0.1034	75	$ 7.78	$ -	0.00%
Total Deferral/Variance Account Rate Riders	$ 0.0007	2,000	$ 1.40	$ 0.0038	2,000	$ 7.60	$ 6.20	442.86%
CBR Class B Rate Riders	-$ 0.0001	2,000	$ (0.20)	-$ 0.0001	2,000	$ (0.20)	$ -	0.00%
GA Rate Riders	$ -	2,000	$ -	$ -	2,000	$ -	$ -	
Low Voltage Service Charge	$ 0.0003	2,000	$ 0.60	$ 0.0003	2,000	$ 0.60	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ 0.43	1	$ 0.43	$ 0.43	1	$ 0.43	$ -	0.00%
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	2,000	$ -	$ -	2,000	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 87.30**			**$ 98.56**	**$ 11.26**	**12.90%**
RTSR - Network	$ 0.0089	2,075	$ 18.47	$ 0.0104	2,075	$ 21.58	$ 3.11	16.85%
RTSR - Connection and/or Line and Transformation Connection	$ 0.0057	2,075	$ 11.83	$ 0.0064	2,075	$ 13.28	$ 1.45	12.28%
Sub-Total C - Delivery (including Sub-Total B)			**$ 117.60**			**$ 133.42**	**$ 15.83**	**13.46%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	2,075	$ 7.06	$ 0.0034	2,075	$ 7.06	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	2,075	$ 1.04	$ 0.0005	2,075	$ 1.04	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
TOU - Off Peak	$ 0.0820	1,280	$ 104.96	$ 0.0820	1,280	$ 104.96	$ -	0.00%
TOU - Mid Peak	$ 0.1130	360	$ 40.68	$ 0.1130	360	$ 40.68	$ -	0.00%
TOU - On Peak	$ 0.1700	360	$ 61.20	$ 0.1700	360	$ 61.20	$ -	0.00%
Total Bill on TOU (before Taxes)			**$ 332.78**			**$ 348.60**	**$ 15.83**	**4.76%**
HST	13%		$ 43.26	13%		$ 45.32	$ 2.06	4.76%
Ontario Electricity Rebate	17.0%		$ (56.57)	17.0%		$ (59.26)	$ (2.69)	
Total Bill on TOU			**$ 319.47**			**$ 334.66**	**$ 15.19**	**4.76%**

Customer Class: GENERAL SERVICE 50 TO 999 KW SERVICE CLASSIFICATION
RPP / Non-RPP: Non-RPP (Other)
Consumption 200,000 kWh
Demand 500 kW
Current Loss Factor 1.0376
Proposed/Approved Loss Factor 1.0376

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	Volume	Charge ($)	Rate ($)	Volume	Charge ($)	$ Change	% Change
Monthly Service Charge	$ 134.09	1	$ 134.09	$ 137.71	1	$ 137.71	$ 3.62	2.70%
Distribution Volumetric Rate	$ 5.2431	500	$ 2,621.55	$ 5.3847	500	$ 2,692.35	$ 70.80	2.70%
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ 0.1258	500	$ 62.90	$ 0.2470	500	$ 123.50	$ 60.60	96.34%
Sub-Total A (excluding pass through)			**$ 2,818.54**			**$ 2,953.56**	**$ 135.02**	**4.79%**
Line Losses on Cost of Power	$ -	-	$ -	$ -	-	$ -	$ -	
Total Deferral/Variance Account Rate Riders	$ 0.2202	500	$ 110.10	$ 1.4315	500	$ 715.75	$ 605.65	550.09%
CBR Class B Rate Riders	-$ 0.0506	500	$ (25.30)	-$ 0.0469	500	$ (23.45)	$ 1.85	-7.31%
GA Rate Riders	-$ 0.0032	200,000	$ (640.00)	-$ 0.0024	200,000	$ (480.00)	$ 160.00	-25.00%
Low Voltage Service Charge	$ 0.1313	500	$ 65.65	$ 0.1313	500	$ 65.65	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	500	$ -	$ -	500	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 2,328.99**			**$ 3,231.51**	**$ 902.52**	**38.75%**
RTSR - Network	$ 3.3778	500	$ 1,688.90	$ 3.9579	500	$ 1,978.95	$ 290.05	17.17%
RTSR - Connection and/or Line and Transformation Connection	$ 2.1354	500	$ 1,067.70	$ 2.3839	500	$ 1,191.95	$ 124.25	11.64%
Sub-Total C - Delivery (including Sub-Total B)			**$ 5,085.59**			**$ 6,402.41**	**$ 1,316.82**	**25.89%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	207,520	$ 705.57	$ 0.0034	207,520	$ 705.57	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	207,520	$ 103.76	$ 0.0005	207,520	$ 103.76	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
Average IESO Wholesale Market Price	$ 0.0967	207,520	$ 20,067.18	$ 0.0967	207,520	$ 20,067.18	$ -	0.00%
Total Bill on Average IESO Wholesale Market Price			**$ 25,962.35**			**$ 27,279.17**	**$ 1,316.82**	**5.07%**
HST	13%		$ 3,375.11	13%		$ 3,546.29	$ 171.19	5.07%
Ontario Electricity Rebate	17.0%		$ -	17.0%		$ -		
Total Bill on Average IESO Wholesale Market Price			**$ 29,337.46**			**$ 30,825.46**	**$ 1,488.01**	**5.07%**

Customer Class: GENERAL SERVICE 1,000 KW AND GREATER SERVICE CLASSIFICATION
RPP / Non-RPP: Non-RPP (Other)
Consumption 1,000,000 kWh
Demand 2,200 kW
Current Loss Factor 1.0376
Proposed/Approved Loss Factor 1.0376

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	Volume	Charge ($)	Rate ($)	Volume	Charge ($)	$ Change	% Change
Monthly Service Charge	$ 3,848.39	1	$ 3,848.39	$ 3,952.30	1	$ 3,952.30	$ 103.91	2.70%
Distribution Volumetric Rate	$ 3.0432	2200	$ 6,695.04	$ 3.1254	2200	$ 6,875.88	$ 180.84	2.70%
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ 0.0615	2200	$ 135.30	$ 0.1186	2200	$ 260.92	$ 125.62	92.85%
Sub-Total A (excluding pass through)			**$ 10,678.73**			**$ 11,089.10**	**$ 410.37**	**3.84%**
Line Losses on Cost of Power	$ -	-	$ -	$ -	-	$ -	$ -	
Total Deferral/Variance Account Rate Riders	$ 0.3141	2,200	$ 691.02	$ 1.6974	2,200	$ 3,734.28	$ 3,043.26	440.40%
CBR Class B Rate Riders	-$ 0.0623	2,200	$ (137.06)	-$ 0.0426	2,200	$ (93.72)	$ 43.34	-31.62%
GA Rate Riders	-$ 0.0032	1,000,000	$ (3,200.00)	-$ 0.0024	1,000,000	$ (2,400.00)	$ 800.00	-25.00%
Low Voltage Service Charge	$ 0.1313	2,200	$ 288.86	$ 0.1313	2,200	$ 288.86	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	2,200	$ -	$ -	2,200	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 8,321.55**			**$ 12,618.52**	**$ 4,296.97**	**51.64%**
RTSR - Network	$ -	2,200	$ -	$ -	2,200	$ -	$ -	
RTSR - Connection and/or Line and Transformation Connection	$ -	2,200	$ -	$ -	2,200	$ -	$ -	
Sub-Total C - Delivery (including Sub-Total B)			**$ 8,321.55**			**$ 12,618.52**	**$ 4,296.97**	**51.64%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	1,037,600	$ 3,527.84	$ 0.0034	1,037,600	$ 3,527.84	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	1,037,600	$ 518.80	$ 0.0005	1,037,600	$ 518.80	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
Average IESO Wholesale Market Price	$ 0.0967	1,037,600	$ 100,335.92	$ 0.0967	1,037,600	$ 100,335.92	$ -	0.00%
Total Bill on Average IESO Wholesale Market Price			**$ 112,704.36**			**$ 117,001.33**	**$ 4,296.97**	**3.81%**
HST	13%		$ 14,651.57	13%		$ 15,210.17	$ 558.61	3.81%
Ontario Electricity Rebate	17.0%		$ -	17.0%		$ -		
Total Bill on Average IESO Wholesale Market Price			**$ 127,355.93**			**$ 132,211.50**	**$ 4,855.58**	**3.81%**

Customer Class: UNMETERED SCATTERED LOAD SERVICE CLASSIFICATION
RPP / Non-RPP: RPP
Consumption 250 kWh
Demand - kW
Current Loss Factor 1.0376
Proposed/Approved Loss Factor 1.0376

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	Volume	Charge ($)	Rate ($)	Volume	Charge ($)	$ Change	% Change
Monthly Service Charge	$ 11.11	1	$ 11.11	$ 11.41	1	$ 11.41	$ 0.30	2.70%
Distribution Volumetric Rate	$ 0.0106	250	$ 2.65	$ 0.0109	250	$ 2.73	$ 0.08	2.83%
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ -	250	$ -	$ -	250	$ -	$ -	
Sub-Total A (excluding pass through)			**$ 13.76**			**$ 14.14**	**$ 0.38**	**2.73%**
Line Losses on Cost of Power	$ 0.1034	9	$ 0.97	$ 0.1034	9	$ 0.97	$ -	0.00%
Total Deferral/Variance Account Rate Riders	$ 0.0007	250	$ 0.18	$ 0.0039	250	$ 0.98	$ 0.80	457.14%
CBR Class B Rate Riders	-$ 0.0001	250	$ (0.03)	-$ 0.0001	250	$ (0.03)	$ -	0.00%
GA Rate Riders	$ -	250	$ -	$ -	250	$ -	$ -	
Low Voltage Service Charge	$ 0.0003	250	$ 0.08	$ 0.0003	250	$ 0.08	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	250	$ -	$ -	250	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 14.96**			**$ 16.13**	**$ 1.18**	**7.86%**
RTSR - Network	$ 0.0089	259	$ 2.31	$ 0.0104	259	$ 2.70	$ 0.39	16.85%
RTSR - Connection and/or Line and Transformation Connection	$ 0.0057	259	$ 1.48	$ 0.0064	259	$ 1.66	$ 0.18	12.28%
Sub-Total C - Delivery (including Sub-Total B)			**$ 18.74**			**$ 20.49**	**$ 1.75**	**9.31%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	259	$ 0.88	$ 0.0034	259	$ 0.88	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	259	$ 0.13	$ 0.0005	259	$ 0.13	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
TOU - Off Peak	$ 0.0820	160	$ 13.12	$ 0.0820	160	$ 13.12	$ -	0.00%
TOU - Mid Peak	$ 0.1130	45	$ 5.09	$ 0.1130	45	$ 5.09	$ -	0.00%
TOU - On Peak	$ 0.1700	45	$ 7.65	$ 0.1700	45	$ 7.65	$ -	0.00%
Total Bill on TOU (before Taxes)			**$ 45.86**			**$ 47.61**	**$ 1.75**	**3.81%**
HST	13%		$ 5.96	13%		$ 6.19	$ 0.23	3.81%
Ontario Electricity Rebate	17.0%		$ (7.80)	17.0%		$ (8.09)	$ (0.30)	
Total Bill on TOU			**$ 44.03**			**$ 45.70**	**$ 1.68**	**3.81%**

Customer Class:	SENTINEL LIGHTING SERVICE CLASSIFICATION	
RPP / Non-RPP:	RPP	
Consumption	1,000	kWh
Demand	25	kW
Current Loss Factor	1.0376	
Proposed/Approved Loss Factor	1.0376	

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	Volume	Charge ($)	Rate ($)	Volume	Charge ($)	$ Change	% Change
Monthly Service Charge	$ 3.04	1	$ 3.04	$ 3.12	1	$ 3.12	$ 0.08	2.63%
Distribution Volumetric Rate	$ 51.5897	25	$ 1,289.74	$ 52.9826	25	$ 1,324.57	$ 34.82	2.70%
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ -	25	$ -	$ -	25	$ -	$ -	
Sub-Total A (excluding pass through)			**$ 1,292.78**			**$ 1,327.69**	**$ 34.90**	**2.70%**
Line Losses on Cost of Power	$ 0.1034	38	$ 3.89	$ 0.1034	38	$ 3.89	$ -	0.00%
Total Deferral/Variance Account Rate Riders	$ 0.2676	25	$ 6.69	$ 1.3931	25	$ 34.83	$ 28.14	420.59%
CBR Class B Rate Riders	-$ 0.0483	25	$ (1.21)	-$ 0.0446	25	$ (1.12)	$ 0.09	-7.66%
GA Rate Riders	$ -	1,000	$ -	$ -	1,000	$ -	$ -	
Low Voltage Service Charge	$ 0.0255	25	$ 0.64	$ 0.0255	25	$ 0.64	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	25	$ -	$ -	25	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 1,302.79**			**$ 1,365.92**	**$ 63.13**	**4.85%**
RTSR - Network	$ 0.6772	25	$ 16.93	$ 0.7935	25	$ 19.84	$ 2.91	17.17%
RTSR - Connection and/or Line and Transformation Connection	$ 0.4280	25	$ 10.70	$ 0.4778	25	$ 11.95	$ 1.25	11.64%
Sub-Total C - Delivery (including Sub-Total B)			**$ 1,330.42**			**$ 1,397.71**	**$ 67.28**	**5.06%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	1,038	$ 3.53	$ 0.0034	1,038	$ 3.53	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	1,038	$ 0.52	$ 0.0005	1,038	$ 0.52	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
TOU - Off Peak	$ 0.0820	640	$ 52.48	$ 0.0820	640	$ 52.48	$ -	0.00%
TOU - Mid Peak	$ 0.1130	180	$ 20.34	$ 0.1130	180	$ 20.34	$ -	0.00%
TOU - On Peak	$ 0.1700	180	$ 30.60	$ 0.1700	180	$ 30.60	$ -	0.00%
Total Bill on TOU (before Taxes)			**$ 1,438.14**			**$ 1,505.42**	**$ 67.28**	**4.68%**
HST	13%		$ 186.96	13%		$ 195.70	$ 8.75	4.68%
Ontario Electricity Rebate	17.0%		$ (244.48)	17.0%		$ (255.92)	$ (11.44)	
Total Bill on TOU			**$ 1,380.61**			**$ 1,445.21**	**$ 64.59**	**4.68%**

Customer Class: STREET LIGHTING SERVICE CLASSIFICATION
RPP / Non-RPP: Non-RPP (Other)
Consumption 700,000 kWh
Demand 2,000 kW
Current Loss Factor 1.0376
Proposed/Approved Loss Factor 1.0376

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	Volume	Charge ($)	Rate ($)	Volume	Charge ($)	$ Change	% Change
Monthly Service Charge	$ 4.17	9300	$ 38,781.00	$ 4.28	9300	$ 39,804.00	$ 1,023.00	2.64%
Distribution Volumetric Rate	$ 25.6262	2000	$ 51,252.40	$ 26.3181	2000	$ 52,636.20	$ 1,383.80	2.70%
Fixed Rate Riders	$ -	9300	$ -	$ -	9300	$ -	$ -	
Volumetric Rate Riders	-$ 0.0239	2000	$ (47.80)	-$ 0.0493	2000	$ (98.60)	$ (50.80)	106.28%
Sub-Total A (excluding pass through)			**$ 89,985.60**			**$ 92,341.60**	**$ 2,356.00**	**2.62%**
Line Losses on Cost of Power	$ -	-	$ -	$ -	-	$ -	$ -	
Total Deferral/Variance Account Rate Riders	$ 0.1647	2,000	$ 329.40	$ 1.3616	2,000	$ 2,723.20	$ 2,393.80	726.72%
CBR Class B Rate Riders	-$ 0.0488	2,000	$ (97.60)	-$ 0.0447	2,000	$ (89.40)	$ 8.20	-8.40%
GA Rate Riders	-$ 0.0032	700,000	$ (2,240.00)	-$ 0.0024	700,000	$ (1,680.00)	$ 560.00	-25.00%
Low Voltage Service Charge	$ 0.1061	2,000	$ 212.20	$ 0.1061	2,000	$ 212.20	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ -	9300	$ -	$ -	9300	$ -	$ -	
Additional Fixed Rate Riders	$ -	9300	$ -	$ -	9300	$ -	$ -	
Additional Volumetric Rate Riders	$ -	2,000	$ -	$ -	2,000	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 88,189.60**			**$ 93,507.60**	**$ 5,318.00**	**6.03%**
RTSR - Network	$ 2.8178	2,000	$ 5,635.60	$ 3.3017	2,000	$ 6,603.40	$ 967.80	17.17%
RTSR - Connection and/or Line and Transformation Connection	$ 1.7816	2,000	$ 3,563.20	$ 1.9890	2,000	$ 3,978.00	$ 414.80	11.64%
Sub-Total C - Delivery (including Sub-Total B)			**$ 97,388.40**			**$ 104,089.00**	**$ 6,700.60**	**6.88%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	726,320	$ 2,469.49	$ 0.0034	726,320	$ 2,469.49	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	726,320	$ 363.16	$ 0.0005	726,320	$ 363.16	$ -	0.00%
Standard Supply Service Charge	$ 0.25	9300	$ 2,325.00	$ 0.25	9300	$ 2,325.00	$ -	0.00%
Average IESO Wholesale Market Price	$ 0.0967	726,320	$ 70,235.14	$ 0.0967	726,320	$ 70,235.14	$ -	0.00%
Total Bill on Average IESO Wholesale Market Price			**$ 172,781.19**			**$ 179,481.79**	**$ 6,700.60**	**3.88%**
HST	13%		$ 22,461.55	13%		$ 23,332.63	$ 871.08	3.88%
Ontario Electricity Rebate	17.0%		$ -	17.0%		$ -		
Total Bill on Average IESO Wholesale Market Price			**$ 195,242.75**			**$ 202,814.42**	**$ 7,571.68**	**3.88%**

Customer Class:	**EMBEDDED DISTRIBUTOR SERVICE CLASSIFICATION**
RPP / Non-RPP:	**Non-RPP (Other)**
Consumption	**2,810,800** kWh
Demand	**6,000** kW
Current Loss Factor	**1.0376**
Proposed/Approved Loss Factor	**1.0376**

	Current OEB-Approved			**Proposed**			**Impact**	
	Rate ($)	**Volume**	**Charge ($)**	**Rate ($)**	**Volume**	**Charge ($)**	**$ Change**	**% Change**
Monthly Service Charge	$ 5,741.34	1	$ 5,741.34	$ 5,896.36	1	$ 5,896.36	$ 155.02	2.70%
Distribution Volumetric Rate	$ 3.1357	6000	$ 18,814.20	$ 3.2204	6000	$ 19,322.40	$ 508.20	2.70%
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ -	6000	$ -	$ -	6000	$ -	$ -	
Sub-Total A (excluding pass through)			**$ 24,555.54**			**$ 25,218.76**	**$ 663.22**	**2.70%**
Line Losses on Cost of Power	$ -	-	$ -	$ -	-	$ -	$ -	
Total Deferral/Variance Account Rate Riders	$ 0.2860	6,000	$ 1,716.00	$ 1.1506	6,000	$ 6,903.60	$ 5,187.60	302.31%
CBR Class B Rate Riders	-$ 0.0663	6,000	$ (397.80)	-$ 0.0378	6,000	$ (226.80)	$ 171.00	-42.99%
GA Rate Riders	-$ 0.0032	2,810,800	$ (8,994.56)	-$ 0.0024	2,810,800	$ (6,745.92)	$ 2,248.64	-25.00%
Low Voltage Service Charge	$ 0.1313	6,000	$ 787.80	$ 0.1313	6,000	$ 787.80	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	6,000	$ -	$ -	6,000	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 17,666.98**			**$ 25,937.44**	**$ 8,270.46**	**46.81%**
RTSR - Network	$ 3.4869	6,000	$ 20,921.40	$ 4.0857	6,000	$ 24,514.20	$ 3,592.80	17.17%
RTSR - Connection and/or Line and Transformation Connection	$ 2.2045	6,000	$ 13,227.00	$ 2.4611	6,000	$ 14,766.60	$ 1,539.60	11.64%
Sub-Total C - Delivery (including Sub-Total B)			**$ 51,815.38**			**$ 65,218.24**	**$ 13,402.86**	**25.87%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	2,916,486	$ 9,916.05	$ 0.0034	2,916,486	$ 9,916.05	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	2,916,486	$ 1,458.24	$ 0.0005	2,916,486	$ 1,458.24	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
Average IESO Wholesale Market Price	$ 0.0967	2,916,486	$ 282,024.20	$ 0.0967	2,916,486	$ 282,024.20	$ -	0.00%
Total Bill on Average IESO Wholesale Market Price			**$ 345,214.13**			**$ 358,616.99**	**$ 13,402.86**	**3.88%**
HST	13%		$ 44,877.84	13%		$ 46,620.21	$ 1,742.37	3.88%
Ontario Electricity Rebate	17.0%		$ -	17.0%		$ -		
Total Bill on Average IESO Wholesale Market Price			**$ 390,091.97**			**$ 405,237.20**	**$ 15,145.23**	**3.88%**

Customer Class: RESIDENTIAL SERVICE CLASSIFICATION
RPP / Non-RPP: RPP
Consumption 250 kWh
Demand - kW
Current Loss Factor 1.0376
Proposed/Approved Loss Factor 1.0376

	Current OEB-Approved			Proposed			Impact	
	Rate ($)	**Volume**	**Charge ($)**	**Rate ($)**	**Volume**	**Charge ($)**	**$ Change**	**% Change**
Monthly Service Charge	$ 31.19	1	$ 31.19	$ 32.03	1	$ 32.03	$ 0.84	2.69%
Distribution Volumetric Rate	$ -	250	$ -	$ -	250	$ -	$ -	
Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Volumetric Rate Riders	$ -	250	$ -	$ -	250	$ -	$ -	
Sub-Total A (excluding pass through)			**$ 31.19**			**$ 32.03**	**$ 0.84**	**2.69%**
Line Losses on Cost of Power	$ 0.1034	9	$ 0.97	$ 0.1034	9	$ 0.97	$ -	0.00%
Total Deferral/Variance Account Rate Riders	$ 0.0007	250	$ 0.18	$ 0.0038	250	$ 0.95	$ 0.78	442.86%
CBR Class B Rate Riders	-$ 0.0001	250	$ (0.03)	-$ 0.0001	250	$ (0.03)	$ -	0.00%
GA Rate Riders	$ -	250	$ -	$ -	250	$ -	$ -	
Low Voltage Service Charge	$ 0.0004	250	$ 0.10	$ 0.0004	250	$ 0.10	$ -	0.00%
Smart Meter Entity Charge (if applicable)	$ 0.43	1	$ 0.43	$ 0.43	1	$ 0.43	$ -	0.00%
Additional Fixed Rate Riders	$ -	1	$ -	$ -	1	$ -	$ -	
Additional Volumetric Rate Riders	$ -	250	$ -	$ -	250	$ -	$ -	
Sub-Total B - Distribution (includes Sub-Total A)			**$ 32.84**			**$ 34.46**	**$ 1.62**	**4.92%**
RTSR - Network	$ 0.0098	259	$ 2.54	$ 0.0115	259	$ 2.98	$ 0.44	17.35%
RTSR - Connection and/or Line and Transformation Connection	$ 0.0062	259	$ 1.61	$ 0.0069	259	$ 1.79	$ 0.18	11.29%
Sub-Total C - Delivery (including Sub-Total B)			**$ 36.99**			**$ 39.23**	**$ 2.24**	**6.05%**
Wholesale Market Service Charge (WMSC)	$ 0.0034	259	$ 0.88	$ 0.0034	259	$ 0.88	$ -	0.00%
Rural and Remote Rate Protection (RRRP)	$ 0.0005	259	$ 0.13	$ 0.0005	259	$ 0.13	$ -	0.00%
Standard Supply Service Charge	$ 0.25	1	$ 0.25	$ 0.25	1	$ 0.25	$ -	0.00%
TOU - Off Peak	$ 0.0820	160	$ 13.12	$ 0.0820	160	$ 13.12	$ -	0.00%
TOU - Mid Peak	$ 0.1130	45	$ 5.09	$ 0.1130	45	$ 5.09	$ -	0.00%
TOU - On Peak	$ 0.1700	45	$ 7.65	$ 0.1700	45	$ 7.65	$ -	0.00%
Total Bill on TOU (before Taxes)			**$ 64.11**			**$ 66.35**	**$ 2.24**	**3.49%**
HST	13%		$ 8.33	13%		$ 8.63	$ 0.29	3.49%
Ontario Electricity Rebate	17.0%		$ (10.90)	17.0%		$ (11.28)	$ (0.38)	
Total Bill on TOU			**$ 61.54**			**$ 63.69**	**$ 2.15**	**3.49%**

Appendix 3 – Current Tariff of Rates and Charges

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2022

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2021-0048

RESIDENTIAL SERVICE CLASSIFICATION

This class refers to the supply of electrical energy to detached and semi-detached residential buildings as well as farms as defined in the local zoning by-laws. Where the residential dwelling comprises the entire electrical load of a farm, it is defined as a residential service. Where electricity is provided to a combined residential and business (including agricultural usage) and the service does not provide for separate metering, the classification shall be at the discretion of Oakville Hydro and shall be based on such considerations as the estimated predominant consumption. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor’s Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	31.19
Smart Metering Entity Charge - effective until December 31, 2022	$	0.57
Low Voltage Service Rate	$/kWh	0.0004
Rate Rider for Disposition of Global Adjustment Account (2022) - effective until December 31, 2022 Applicable only for Non-RPP Customers	$/kWh	(0.0032)
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kWh	0.0007
Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kWh	(0.0001)
Retail Transmission Rate - Network Service Rate	$/kWh	0.0098
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kWh	0.0062

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2022

**This schedule supersedes and replaces all previously
approved schedules of Rates, Charges and Loss Factors**

EB-2021-0048

GENERAL SERVICE LESS THAN 50 KW SERVICE CLASSIFICATION

This class refers to customers who do not qualify as residential customers and whose monthly average peak demand in the preceding twelve months is less than 50kW. For new customers without prior billing history, the peak demand will be based on 90% of the proposed capacity or installed transformation. Note: Apartment buildings or multi-unit complexes and subdivisions that are not individually metered are treated as General Service. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	39.29
Smart Metering Entity Charge - effective until December 31, 2022	$	0.57
Distribution Volumetric Rate	$/kWh	0.0175
Low Voltage Service Rate	$/kWh	0.0003
Rate Rider for Disposition of Global Adjustment Account (2022) - effective until December 31, 2022 Applicable only for Non-RPP Customers	$/kWh	(0.0032)
Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2022) - effective until December 31, 2022	$/kWh	0.0015
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kWh	0.0007
Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kWh	(0.0001)
Retail Transmission Rate - Network Service Rate	$/kWh	0.0089
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kWh	0.0057

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2022

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2021-0048

GENERAL SERVICE 50 TO 999 KW SERVICE CLASSIFICATION

This class refers to customers who do not qualify as residential customers whose monthly average peak demand in the preceding twelve months is in the range of 50 to 999 kW. There are two sub categories within this class, those being non-interval and interval metered accounts. For new customers without prior billing history, the peak demand will be based on 90% of the proposed capacity or installed transformation. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor’s Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of WMS - Sub-account CBR Class B is not applicable to wholesale market participants (WMP), customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new Class B customers.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of Global Adjustment is only applicable to non-RPP Class B customers. It is not applicable to WMP, customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new non-RPP Class B customers.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	134.09
Distribution Volumetric Rate	$/kW	5.2431
Low Voltage Service Rate	$/kW	0.1313
Rate Rider for Disposition of Global Adjustment Account (2022) - effective until December 31, 2022 Applicable only for Non-RPP Customers	$/kWh	(0.0032)
Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2022) - effective until December 31, 2022	$/kW	0.1258

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2022

This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

EB-2021-0048

Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022 Applicable only for Non-Wholesale Market Participants	$/kW	(0.1179)
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kW	0.3381
Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kW	(0.0506)
Retail Transmission Rate - Network Service Rate	$/kW	3.3778
Retail Transmission Rate - Network Service Rate - Interval Metered	$/kW	3.4869
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	2.1354
Retail Transmission Rate - Line and Transformation Connection Service Rate - Interval Metered	$/kW	2.2045

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2022

**This schedule supersedes and replaces all previously
approved schedules of Rates, Charges and Loss Factors**

EB-2021-0048

GENERAL SERVICE 1,000 KW AND GREATER SERVICE CLASSIFICATION

This class refers to customers who do not qualify as residential customers whose monthly average peak demand in the preceding twelve months is equal to or greater than 1,000 kW. These accounts will all be interval metered accounts. For new customers without prior billing history, the peak demand will be based on 90% of the proposed capacity or installed transformation. Class A and Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor’s Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of WMS - Sub-account CBR Class B is not applicable to wholesale market participants (WMP), customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new Class B customers.

If included in the following listing of monthly rates and charges, the rate rider for the disposition of Global Adjustment is only applicable to non-RPP Class B customers. It is not applicable to WMP, customers that transitioned between Class A and Class B during the variance account accumulation period, or to customers that were in Class A for the entire period. Customers who transitioned are to be charged or refunded their share of the variance disposed through customer specific billing adjustments. This rate rider is to be consistently applied for the entire period to the sunset date of the rate rider. In addition, this rate rider is applicable to all new non-RPP Class B customers.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	3,848.39
Distribution Volumetric Rate	$/kW	3.0432
Low Voltage Service Rate	$/kW	0.1313
Rate Rider for Disposition of Global Adjustment Account (2022) - effective until December 31, 2022 Applicable only for Non-RPP Customers	$/kWh	(0.0032)
Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2022) - effective until December 31, 2022	$/kW	0.0615
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kW	0.3141

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

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This schedule supersedes and replaces all previously approved schedules of Rates, Charges and Loss Factors

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Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kW	(0.0623)
Retail Transmission Rate - Network Service Rate - Interval Metered	$/kW	3.4869
Retail Transmission Rate - Line and Transformation Connection Service Rate - Interval Metered	$/kW	2.2045

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

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UNMETERED SCATTERED LOAD SERVICE CLASSIFICATION

This classification applies to an account taking electricity at 750 volts or less whose average monthly maximum demand is less than, or is forecast to be less than, 50 kW and the consumption is unmetered. Such connections include cable TV power packs, bus shelters, telephone booths, traffic lights, pedestrian X-Walk signals/beacons, railway crossings, etc. The level of the consumption will be agreed to by the distributor and the customer, based on detailed manufacturer information and documentation with regard to electrical consumption of the unmetered load or periodic monitoring of actual consumption. Class B consumers are defined in accordance with O. Reg. 429/04. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge (per connection)	$	11.11
Distribution Volumetric Rate	$/kWh	0.0106
Low Voltage Service Rate	$/kWh	0.0003
Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kWh	(0.0001)
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kWh	0.0007
Retail Transmission Rate - Network Service Rate	$/kWh	0.0089
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kWh	0.0057

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

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SENTINEL LIGHTING SERVICE CLASSIFICATION

This classification refers to accounts that are an unmetered lighting load supplied to a sentinel light. Further servicing details are available in the distributor’s Conditions of Service. Class B consumers are defined in accordance with O. Reg. 429/04.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge (per connection)	$	3.04
Distribution Volumetric Rate	$/kW	51.5897
Low Voltage Service Rate	$/kW	0.0255
Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kW	(0.0483)
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kW	0.2676
Retail Transmission Rate - Network Service Rate	$/kW	0.6772
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	0.4280

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

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STREET LIGHTING SERVICE CLASSIFICATION

All services supplied to street lighting equipment owned by or operated for the Municipality, the Region or the Province of Ontario shall be classified as Street Lighting Service. Street Lighting plant, facilities, or equipment owned by the customer are subject to the Electrical Safety Authority (ESA) requirements and Oakville Hydro specifications. Class B consumers are defined in accordance with O. Reg. 429/04.Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge (per connection)	$	4.17
Distribution Volumetric Rate	$/kW	25.6262
Low Voltage Service Rate	$/kW	0.1061
Rate Rider for Disposition of Global Adjustment Account (2022) - effective until December 31, 2022 Applicable only for Non-RPP Customers	$/kWh	(0.0032)
Rate Rider for Disposition of Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) (2022) - effective until December 31, 2022	$/kW	(0.0239)
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kW	0.1647
Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kW	(0.0488)
Retail Transmission Rate - Network Service Rate	$/kW	2.8178
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	1.7816

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2022

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EB-2021-0048

EMBEDDED DISTRIBUTOR SERVICE CLASSIFICATION

This classification applies to an electricity distributor licenced by the Ontario Energy Board, which is provided electricity by means of this distributor's facilities. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable. In addition, the charges in the MONTHLY RATES AND CHARGES - Regulatory Component of this schedule do not apply to a customer that is an embedded wholesale market participant.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	5,741.34
Distribution Volumetric Rate	$/kW	3.1357
Low Voltage Service Rate	$/kW	0.1313
Rate Rider for Disposition of Global Adjustment Account (2022) - effective until December 31, 2022 Applicable only for Non-RPP Customers	$/kWh	(0.0032)
Rate Rider for Disposition of Deferral/Variance Accounts (2022) - effective until December 31, 2022	$/kW	0.2860
Rate Rider for Disposition of Capacity Based Recovery Account (2022) - effective until December 31, 2022 Applicable only for Class B Customers	$/kW	(0.0663)
Retail Transmission Rate - Network Service Rate	$/kW	3.4869
Retail Transmission Rate - Line and Transformation Connection Service Rate	$/kW	2.2045

MONTHLY RATES AND CHARGES - Regulatory Component

Wholesale Market Service Rate (WMS) - not including CBR	$/kWh	0.0030
Capacity Based Recovery (CBR) - Applicable for Class B Customers	$/kWh	0.0004
Rural or Remote Electricity Rate Protection Charge (RRRP)	$/kWh	0.0005
Standard Supply Service - Administrative Charge (if applicable)	$	0.25

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microFIT SERVICE CLASSIFICATION

This classification applies to an electricity generation facility contracted under the Independent Electricity System Operator's microFIT program and connected to the distributor's distribution system. Further servicing details are available in the distributor's Conditions of Service.

APPLICATION

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

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It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

MONTHLY RATES AND CHARGES - Delivery Component

Service Charge	$	4.55

ALLOWANCES

Transformer Allowance for General Service > 50 to 999kW customers that own their transformers (per kW of billing demand/month)	$/kW	(0.50)
Primary Metering Allowance for Transformer Losses - applied to measured demand & energy	%	(1.00)

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

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SPECIFIC SERVICE CHARGES

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor’s Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

It should be noted that this schedule does not list any charges, assessments, or credits that are required by law to be invoiced by a distributor and that are not subject to the Ontario Energy Board approval, such as the Global Adjustment and the HST.

Customer Administration

Statement of account	$	15.00
Pulling post dated cheques	$	15.00
Duplicate invoices for previous billing	$	15.00
Easement letter	$	15.00
Account history	$	15.00
Credit reference/credit check (plus credit agency costs)	$	15.00
Returned cheque (plus bank charges)	$	15.00
Account set up charge/change of occupancy charge (plus credit agency costs if applicable)	$	30.00
Meter dispute charge plus Measurement Canada fees (if meter found correct)	$	30.00

Non-Payment of Account

Late payment - per month (effective annual rate 19.56% per annum or 0.04896% compounded daily rate)	%	1.50
Reconnection at meter - during regular hours	$	65.00
Reconnection at meter - after regular hours	$	185.00
Reconnection at pole - during regular hours	$	185.00
Reconnection at pole - after regular hours	$	415.00

Other

Special meter reads	$	30.00
Service call (after first service call in a 12-month period) - during regular hours	$	30.00
Service call (after first service call in a 12-month period) - after regular hours	$	165.00
Temporary service - install & remove - overhead - no transformer	$	500.00
Temporary service - install & remove - underground - no transformer	$	300.00
Specific charge for access to the power poles - $/pole/year (with the exception of wireless attachments) - Approved on an Interim Basis	$	44.50

Oakville Hydro Electricity Distribution Inc.

TARIFF OF RATES AND CHARGES

Effective and Implementation Date January 1, 2022

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EB-2021-0048

RETAIL SERVICE CHARGES (if applicable)

The application of these rates and charges shall be in accordance with the Licence of the Distributor and any Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, which may be applicable to the administration of this schedule.

No rates and charges for the distribution of electricity and charges to meet the costs of any work or service done or furnished for the purpose of the distribution of electricity shall be made except as permitted by this schedule, unless required by the Distributor's Licence or a Code or Order of the Ontario Energy Board, and amendments thereto as approved by the Ontario Energy Board, or as specified herein.

Unless specifically noted, this schedule does not contain any charges for the electricity commodity, be it under the Regulated Price Plan, a contract with a retailer or the wholesale market price, as applicable.

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Retail Service Charges refer to services provided by a distributor to retailers or customers related to the supply of competitive electricity.

One-time charge, per retailer, to establish the service agreement between the distributor and the retailer	$	107.68
Monthly fixed charge, per retailer	$	43.08
Monthly variable charge, per customer, per retailer	$/cust.	1.07
Distributor-consolidated billing monthly charge, per customer, per retailer	$/cust.	0.64
Retailer-consolidated billing monthly credit, per customer, per retailer	$/cust.	(0.64)
Service Transaction Requests (STR)		
Request fee, per request, applied to the requesting party	$	0.54
Processing fee, per request, applied to the requesting party	$	1.07
Request for customer information as outlined in Section 10.6.3 and Chapter 11 of the Retail Settlement Code directly to retailers and customers, if not delivered electronically through the Electronic Business Transaction (EBT) system, applied to the requesting party		
Up to twice a year	$	no charge
More than twice a year, per request (plus incremental delivery costs)	$	4.31
Notice of switch letter charge, per letter (unless the distributor has opted out of applying for the charge as per the Ontario Energy Board's Decision and Order EB-2015-0304, issued on February 14, 2019)	$	2.15

LOSS FACTORS

If the distributor is not capable of prorating changed loss factors jointly with distribution rates, the revised loss factors will be implemented upon the first subsequent billing for each billing cycle.

Total Loss Factor - Secondary Metered Customer < 5,000 kW	1.0376
Total Loss Factor - Secondary Metered Customer > 5,000 kW	1.0145
Total Loss Factor - Primary Metered Customer < 5,000 kW	1.0272
Total Loss Factor - Primary Metered Customer > 5,000 kW	1.0045

Appendix 4 – Global Adjustment Analysis Work Forms

Ontario Energy Board

GA Analysis Workform for 2023 Rate Applications

Version 1.0

Input cells
Drop down cells

Utility Name OAKVILLE HYDRO ELECTRICITY DISTRIBUTION INC.

Note 1

For Account 1589 and Account 1588, determine if a or b below applies and select the appropriate year related to the account balance in the drop-down box to the right.
a) If the account balances were last approved on a final basis, select the year of the year-end balances that were last approved on a final basis.
b) If the account balances were last approved on an interim basis, and
  i) there are no changes to the previously approved interim balances, select the year of the year-end balances that were last approved for diposition on an interim basis. OR
  ii) there are changes to the previously approved interim balances, select the year of the year-end balances that were last approved for disposition on a final basis. An explanation should be provided to explain the reason for the change in the previously approved interim balances.

(e.g. If the 2020 balances that were reviewed in the 2022 rate application were to be selected, select 2020)

Year Selected

2020

Instructions:
1) Determine which scenario above applies (a, bi or bii). Select the appropriate year to generate the appropriate GA Analysis Workform tabs, and information in the Principal Adjustments tab and Account 1588 tab.
For example:
- Scenario a -If 2020 balances were last approved on a final basis - Select 2020 and a GA Analysis Workform for 2021 will be generated. The input cells required in the Principal Adjustment and Account 1588 tabs will be generated accordingly as well.
- Scenario bi - If 2020 balances were last approved on an interim basis and there are no changes to 2020 balances - Select 2020 and a GA Analysis Workform for 2021 will be generated. The input cells required in the Principal Adjustment and Account 1588 tabs will be generated accordingly as well.
- Scenario bii - If 2020 balances were last approved on an interim basis, there are changes to 2020 balances, and 2019 balances were last approved for disposition - Select 2019 and GA Analysis Workforms for 2020 and 2021 will be generated. The input cells required in the Principal Adjustment and Account 1588 tabs will be generated accordingly as well.

2) Complete the GA Analysis Workform for each year generated.
3) Complete the Account 1588 tab. Note that the number of years that require the reasonability test to be completed are shown in the Account 1588 tab, depending on the year selected on the Information Sheet.
4) Complete the Principal Adjustments tab. Note that the number of years that require principal adjustment reconciliations are all shown in the one Principal Adjustments tab, depending on the year selected on the Information Sheet.

See the separate document GA Analysis Workform Instructions for detailed instructions on how to complete the Workform and examples of

Year	Annual Net Change in Expected GA Balance from GA Analysis	Net Change in Principal Balance in the GL	Reconciling Items	Adjusted Net Change in Principal Balance in the GL	Unresolved Difference	$ Consumption at Actual Rate Paid	Unresolved Difference as % of Expected GA Payments to IESO
2021	$ (1,271,179)	$ (5,286,312)	$ 4,199,849	$ (1,086,463)	$ 184,716	$ 40,938,495	0.5%
Cumulative Balance	**$ (1,271,179)**	**$ (5,286,312)**	**$ 4,199,849**	**$ (1,086,463)**	**$ 184,716**	**$ 40,938,495**	**N/A**

Account 1588 Reconciliation Summary

Year	Account 1588 as a % of Account 4705
2021	0.0%
Cumulative Balance	0.0%

Ontario Energy Board

GA Analysis Workform

Note 2 **Consumption Data Excluding for Loss Factor (Data to agree with RRR as applicable)**

Year		**2021**		
Total Metered excluding WMP	C = A+B	1,550,132,163	kWh	100%
RPP	A	857,458,117	kWh	55.3%
Non RPP	B = D+E	692,674,046	kWh	44.7%
Non-RPP Class A	D	191,011,654	kWh	12.3%
Non-RPP Class B*	E	501,662,393	kWh	32.4%

*Non-RPP Class B consumption reported in this table is not expected to directly agree with the Non-RPP Class B Including Loss Adjusted Billed Consumption in the GA Analysis of Expected Balance table below. The difference should be equal to the loss factor.

Note 3 **GA Billing Rate**

GA is billed on the 1st Estimate Note that this GA rate for 2021 includes the GA recovery rate to recover the 2020 deferred Class B amount for non-RPP market participants and consumers.

Please confirm that the same GA rate is used to bill all customer classes. If not, please provide further details Yes

Please confirm that the GA Rate used for unbilled revenue is the same as the one used for billed revenue in any paticular month Yes

Note 4 **Analysis of Expected GA Amount**

Year **2021**

Calendar Month	**Non-RPP Class B Including Loss Factor Billed Consumption (kWh)**	**Deduct Previous Month Unbilled Loss Adjusted Consumption (kWh)**	**Add Current Month Unbilled Loss Adjusted Consumption (kWh)**	**Non-RPP Class B Including Loss Adjusted Consumption, Adjusted for Unbilled (kWh)**	**GA Rate Billed ($/kWh)**	**$ Consumption at GA Rate Billed**	**GA Actual Rate Paid ($/kWh)**	**$ Consumption at Actual Rate Paid**	**Expected GA Price Variance ($)**
	F	**G**	**H**	**I = F-G+H**	**J**	**K = I*J**	**L**	**M = I*L**	**N=M-K**
January	43,853,271			43,853,271	0.09092	$ 3,987,139	0.08798	$ 3,858,211	$ (128,929)
February	39,640,021			39,640,021	0.10485	$ 4,156,256	0.05751	$ 2,279,698	$ (1,876,559)
March	42,911,034			42,911,034	0.08420	$ 3,613,109	0.09668	$ 4,148,639	$ 535,530
April	39,584,721			39,584,721	0.06969	$ 2,758,659	0.11589	$ 4,587,473	$ 1,828,814
May	40,195,243			40,195,243	0.10531	$ 4,232,961	0.10675	$ 4,290,842	$ 57,881
June	44,494,712			44,494,712	0.11352	$ 5,051,040	0.09216	$ 4,100,633	$ (950,407)
July	45,099,973			45,099,973	0.07612	$ 3,433,010	0.07918	$ 3,571,016	$ 138,006
August	46,442,743			46,442,743	0.08734	$ 4,056,309	0.05107	$ 2,371,831	$ (1,684,478)
September	44,514,066			44,514,066	0.05519	$ 2,456,731	0.08234	$ 3,665,288	$ 1,208,557
October	42,233,645			42,233,645	0.07402	$ 3,126,134	0.05840	$ 2,466,445	$ (659,690)
November	42,552,995			42,552,995	0.06342	$ 2,698,711	0.06012	$ 2,558,286	$ (140,425)
December	46,663,604			46,663,604	0.05443	$ 2,539,900	0.06515	$ 3,040,134	$ 500,234
Net Change in Expected GA Balance in the Year (i.e. Transactions in the Year)	**518,186,028**	**-**	**-**	**518,186,028**		**$ 42,109,960**		**$ 40,938,495**	**$ (1,171,465)**

Annual Non-RPP Class B Wholesale kWh *	**Annual Non-RPP Class B Retail billed kWh****	**Annual Unaccounted for Energy Loss kWh**	**Weighted Average GA Actual Rate Paid ($/kWh)*****	**Expected GA Volume Variance ($)**
O	**P**	**Q=O-P**	**R**	**P= Q*R**
516,950,001	518,186,028	- 1,236,027	0.08067	$ (99,713)

Equal to (AQEW - Class A + embedded generation kWh)(Non-RPP Class B retail kwh/Total retail Class B kWh).
**Equal to the total Non-RPP Class B Including Loss Adjusted Consmption, Adjusted for Unbilled (i.e. cell F53), unless a reconciling item for "Impacts of GA deferral/recovery" is quantified and an alternative methodology for calculating the Expected GA Volume Variance is proposed.
**Equal to annual Non-RPP Class B $ GA paid (i.e. non-RPP portion of CT 148 on IESO invoice) divided by Non-RPP Class B Wholesale kWh (as quantified in column O in the table above). The weighted average GA actual rate paid in 2021 is generally expected to include the GA recovery rate, unless a reconciling item for "Impacts of GA deferral/recovery" is quantified and an alternative methodology for calculating the Expected GA Volume Variance is proposed.

The weighted average GA actual rate paid in 2021 is generally expected to include the GA recovery rate, unless the distributor is proposing an alternative methodology in calculating the Expected GA Volume Variance and proposing to quantify the reconciling item for "Impacts of GA deferral/recovery.

Total Expected GA Variance	**$ (1,271,179)**

Calculated Loss Factor	1.0329
Most Recent Approved Loss Factor for Secondary Metered Customer < 5,000kW	1.0376
Difference	**-0.0047**

a) Please provide an explanation in the text box below if columns G and H for unbilled consumption are not used in the table above.

Actual consumption is available and provided above in Column F.

b) Please provide an explanation in the text box below if the difference in loss factor is greater than 1%

Not applicable

Note 5 **Reconciling Items**

	Item	**Amount**	**Explanation**	**Principal Adjustments**	
	Net Change in Principal Balance in the GL (i.e. Transactions in the Year)	$ (5,286,312)		**Principal Adjustment on DVA Continuity Schedule**	**If "no", please provide an explanation**
1a	CT 148 True-up of GA Charges based on Actual Non-RPP Volumes - prior year	$ 186,539		Yes	
1b	CT 148 True-up of GA Charges based on Actual Non-RPP Volumes - current year	$ (178,382)		Yes	
2a	Remove prior year end unbilled to actual revenue differences	$ 352,588		Yes	
2b	Add current year end unbilled to actual revenue differences	$ 678,939		Yes	
3a	Significant prior period billing adjustments recorded in current year				
3b	Significant current period billing adjustments recorded in other year(s)				
4	CT 2148 for prior period corrections	$ 3,160,166		No	One time adjustment
5	Impacts of GA deferral/recovery				
6					
7					
8					
9					
10					
11					

Note 6

Adjusted Net Change in Principal Balance in the GL	$ (1,086,463)
Net Change in Expected GA Balance in the Year Per Analysis	$ (1,271,179)
Unresolved Difference	$ 184,716
Unresolved Difference as % of Expected GA Payments to IESO	0.5%

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Account 1588 Reasonability

Note 7 **Account 1588 Reasonability Test**

	Account 1588 - RSVA Power				
Year	**Transactions[1]**	**Principal Adjustments[1]**	**Total Activity in Calendar Year**	**Account 4705 - Power Purchased**	**Account 1588 as % of Account 4705**
2021	106,405	- 155,131	- 48,726	103,018,031	0.0%
Cumulative	**106,405**	**- 155,131**	**- 48,726**	**103,018,031**	**0.0%**

Notes

1) The transactions should equal the "Transaction" column in the DVA Continuity Schedule. This is also expected to equal the transactions in the general ledger (excluding transactions relating to the removal of approved disposition amounts as that is shown in a separate column in the DVA Continuity Schedule)
2) Principal adjustments should equal the "Principal Adjustments" column in the DVA Continuity Schedule. Principal adjustments adjust the transactions in the general ledger to the amount that should be requested for disposition.

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GA Analysis Workform -
Account 1588 and 1589
Principal Adjustment Reconciliation

Note 8 **Breakdown of principal adjustments included in last approved balance:**

Account 1589 - RSVA Global Adjustment

	Adjustment Description	Amount	To be reversed in current application?	Explanation if not to be reversed in current application
1	CT 148 true-up of GA Charges based on actual Non-RPP volumes	(352,588)	Yes	
2	Unbilled to actual revenue differences	(186,539)	Yes	
3				
4				
5				
6				
7				
8				
	Total	(539,127)		
	Total principal adjustments included in last approved balance			
	Difference	(539,127)		

Account 1588 - RSVA Power

	Adjustment Description	Amount	To be Reversed in Current Application?	Explanation if not to be reversed in current application
1	CT 148 true-up of GA Charges based on actual RPP volumes	(53,834)	Yes	
2	CT 1142 true-up based on actuals	153,067	Yes	
3	Unbilled to actual revenue differences	601,827	Yes	
4				
5				
6				
7				
8				
	Total	701,061		
	Total principal adjustments included in last approved balance			
	Difference	701,061		

Note 9 **Principal adjustment reconciliation in current application:**

Notes
1) The "Transaction" column in the DVA Continuity Schedule is to equal the transactions in the general ledger (excluding transactions relating to the removal of approved disposition amounts as that is shown in a separate column in the DVA Continuity Schedule)
2) Any principal adjustments needed to adjust the transactions in the general ledger to the amount that should be requested for disposition should be shown separately in the "Principal Adjustments" column of the DVA Continuity Schedule
3) The "Variance RRR vs. 2020 Balance" column in the DVA Continuity Schedule should equal principal adjustments made in the current disposition period. It should not be impacted by reversals from prior year approved principal adjustments.
4) Principal adjustments to the pro-ration of CT 148 true-ups (i.e. principal adjustment #1 in tables below) are expected to be equal and offsetting between Account 1588 and Account 1589, if not, please explain. If this results in further adjustments to RPP settlements, this should be shown separately as a principal adjustment to CT 1142/142 (i.e. principal adjustment #2 in tables below)

Complete the table below for the current disposition period. Complete a table for each year included in the balance under review in this rate application. The number of tables to be completed is automatically generated based on data provided in the Information Sheet

Account 1589 - RSVA Global Adjustment

Year		Adjustment Description	Amount	Year Recorded in GL
2021		*Reversals of prior approved principal adjustments (auto-populated from table above)*		
	1	CT 148 true-up of GA Charges based on actual Non-RPP volumes	352,588	2021
	2	Unbilled to actual revenue differences	186,539	2021
	3			
	4			
	5			
	6			
	7			
	8			
		Total Reversal Principal Adjustments	539,127	
2021		*Current year principal adjustments*		
	1	CT 148 true-up of GA Charges based on actual Non-RPP volumes	(178,382)	2022
	2	Unbilled to actual revenue differences	678,939	2022
	3			
	4			
	5			
	6			
	7			
	8			
		Total Current Year Principal Adjustments	500,556	
		Total Principal Adjustments to be Included on DVA Continuity Schedule/Tab 3 - IRM Rate Generator Model	1,039,683	

Account 1588 - RSVA Power

Year		Adjustment Description	Amount	Year Recorded in GL
2021		*Reversals of prior approved principal adjustments (auto-populated from table above)*		
	1	CT 148 true-up of GA Charges based on actual RPP volumes	53,834	2,021
	2	CT 1142 true-up based on actuals	(153,067)	2,021
	3	Unbilled to actual revenue differences	(601,827)	2,021
	4			
	5			
	6			
	7			
	8			
		Total Reversal Principal Adjustments	(701,061)	
2021		*Current year principal adjustments*		
	1	CT 148 true-up of GA Charges based on actual RPP volumes	178,382	2,022
	2	CT 1142/142 true-up based on actuals	(17,577)	2,022
	3	Unbilled to actual revenue differences	385,124	2,022
	4			
	5			
	6			
	7			
	8			
		Total Current Year Principal Adjustments	545,929	
		Total Principal Adjustments to be Included on DVA Continuity Schedule/Tab 3 - IRM Rate Generator Model	(155,131)	

Appendix 5 – 2017 Business Programs Evaluation Report

Evaluation of 2017 Business Programs

Submitted to Independent Electricity System Operator

November 15, 2018

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List of Acronyms

BRI = Business Refrigeration Incentive Program

CDM = Conservation Demand Management

CFF = Conservation First Framework

Cv = Coefficient of variance

EBCx = Existing Building Commissioning Program

FCR = Full Cost Recovery

FR = Free ridership

GWh = Gigawatt-hour

HP = Horsepower

HPNC = High Performance New Construction Program

HVAC = Heating, ventilation, and air conditioning

kW = Kilowatt

kWh = Kilowatt-hour

IESO = Independent Electricity System Operator

LDC = Local Distribution Company

LPD = Lighting Power Density

LUEC = Levelized Unit Energy Cost

MW = Megawatt

MWh = Megawatt-hour

n = Sample size (number of respondents)

NTG = Net-to-gross

NTGR = Net-to-gross ratio

P4P = Pay for Performance

PAC = Program administrator cost

PDA = Program Delivery Agent

SBL = Small Business Lighting Program

SO = Spillover

TPE = Technical Project Evaluator

TRC = Total resource cost

VFD = Variable frequency drive

1 Executive Summary

The Independent Electricity System Operator (IESO) retained Nexant, Inc., to conduct an evaluation of its business energy conservation programs for the 2017 evaluation cycle. The evaluation team also includes NMR Group, Inc. This section provides a high-level summary of results of the impact and process evaluation of IESO's Save on Energy business programs for program year 2017.

The business sector represents more than 40% of Ontario's total electricity consumption, and thus offers significant potential for demand and energy savings. The 2015-2020 Conservation First Framework (CFF) maps out Ontario's energy conservation goals over the six year period. The CFF emphasizes a coordinated effort within all stages of energy planning, as well as more effective teamwork among sector partners, particularly with local distribution companies (LDCs). The goal of CFF is a total reduction of 8.7 TWh of electricity consumption in Ontario by December 31, 2020 with 1.3 TWh to be achieved through conservation projects with transmission-connected customers, and 7.4 TWh from conservation programs delivered by LDCs and the IESO to residential and business customers across the province. The following IESO Save on Energy Business Programs were designed to tap into the existing savings potential and help LDCs meet their Conservation Demand Management (CDM) targets in the province of Ontario:

- The Retrofit Program provides incentives to businesses in the industrial, commercial, institutional and multi-family residential sectors for the purchase and operation of energy efficient equipment. Incentives are based on a per-unit basis for the prescriptive track and on a per-kWh or per-kW basis for the custom track.
- The Small Business Lighting (SBL) Program provides small business owners and tenants of commercial, institutional, agricultural facilities, and multifamily buildings who are not residential distribution customers the opportunity to receive up to $2,000 in free lighting upgrades.
- The Business Refrigeration Incentive (BRI) Program provides small business owners and tenants of commercial, institutional, agricultural facilities, and multifamily buildings who are not residential distribution customers the opportunity to receive up to $2,500 in free refrigeration equipment upgrades.
- The Audit Funding Program provides funding of up to half of the cost of certain Energy Audits that are undertaken to identify opportunities to reduce electricity consumption at industrial, commercial, institutional, and multi
- -family residential buildings; this program also acts as a feeder for the Retrofit Program.
- The High Performance New Construction (HPNC) Program provides design assistance and incentives for building owners and planners who design and implement energy efficient equipment within commercial, institutional, industrial, or multi-residential occupancy new construction or major renovation projects. Incentives are offered for measures or designs that exceed the current Ontario Building Code requirements.
- The Existing Building Commissioning (EBCx) Program provides funding for projects comprised of commissioning phases and the installation of measures to reduce electricity consumption

associated with chilled water systems in existing industrial, commercial, institutional, and multifamily residential buildings.

Additional details on each programs purpose and goal is provided in Appendix A.

1.1 Evaluation Goals and Objectives

The goals and objectives of the 2017 evaluation of the Save on Energy Business Programs are as follows:

- Verify gross energy and peak demand savings for each of the programs at a 90% level of confidence and at 10% precision;
- Assess free-ridership and participant spillover to determine an appropriate net-to-gross ratio for each program at the LDC, regional or province-wide level;
- Determine the cost effectiveness of each program using the Total Resource Cost (TRC) test, Program Administrator's Cost (PAC) test and Levelized Unit Energy Costs (LUEC).
- Review and compare key program elements and results across business or property types (i.e., office, retail, warehouse, hospital, etc.);
- Review and compare key program elements and results across delivery/sales channels; and
- Provide thoughtful recommendations on program improvements based on feedback obtained through the evaluations.

The program-specific impact and process evaluation results for each of the four Business Programs can be found in Sections 4 through 9.

1.2 Results and Findings

The total 2017 first-year net verified energy and summer peak demand savings across all business programs was 783.40 GWh and 126.69 MW, respectively. A total of 785.21 GWh and 128.79 MW of the 2017 Program Year net verified energy and summer peak demand savings persist until 2020. The contribution of each program to the total energy savings is presented in Figure 1-1. Cost effectiveness results for each program in terms of TRC test, PAC test and LUEC is presented in Figure 1-1 and Figure 1-2.

Figure 1-1: 2017 Portfolio Net Verified Energy Savings (GWh)

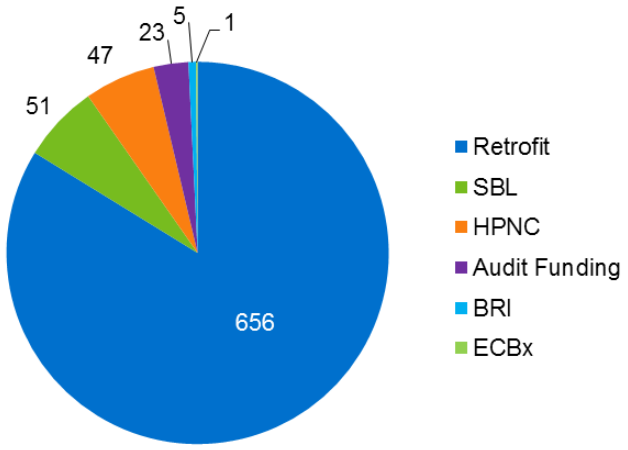
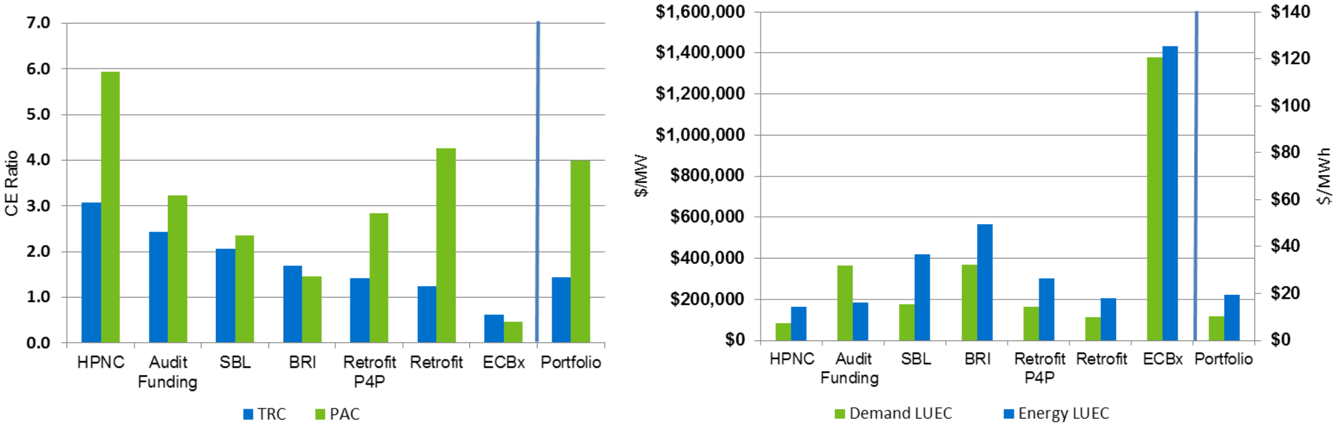


Figure 1-2: 2017 Portfolio Cost Effectiveness



The 2015-2017 Business Program have resulted in a total of 1,754.90 GWh and 265.56 MW net verified energy and summer peak demand savings that persist until 2020 and count toward the CFF targets.

Please note, wherever energy or demand savings are mentioned in this report it is referring to first-year savings unless otherwise described as lifetime or savings in 2020.

1.2.1 Retrofit Program – Full Cost Recovery

The Retrofit Program offers incentives for the installation of energy saving equipment in commercial and industrial facilities. It offers incentives for lighting and non-lighting equipment and LDCs are provided the option of two payment methods to re-coup costs associated with the program; Full Cost Recovery or Pay for Performance[1].

---

[1] Results from the Retrofit P4P Program are summarized in Section 1.2.2 of the Executive Summary

- **Full Cost Recovery (FCR)** – Nearly all LDCs choose the Retrofit FCR Program and receive set incentive levels based on the type of equipment installed (prescriptive track) during a project or the reported energy savings (custom track) estimated on the project application.
- **Pay for Performance (P4P)** – Under the Retrofit P4P Program payments to the LDC are based on evaluated net energy savings attributable to the project.

The 2017 Retrofit FCR Program achieved a total net verified energy and net verified summer peak demand savings of 636.4 GWh and 103.1 MW across 8,783 projects. Most (79%) of the energy savings are attributable to lighting equipment upgrades. Project participation within the 2017 program was consistent with 2016 results, but still down significantly from 2015. The drop in completed projects was most prominent for smaller projects (annual savings lower than 10 MWh) and the program had increases in mid-sized (10-90 MWh) and very large (greater than 150 MWh) projects resulting in a larger average project energy savings and an overall increase in energy savings from the program.

Total summer peak demand savings in 2017 exceeded the savings achieved in either of the previous program years due to higher realization rates for custom track projects and a higher percentage of projects reporting demand savings[2].

The 2017 Retrofit FCR Program exceeded the cost effectiveness (CE) benchmarks of 1.0 with a TRC ratio of 1.25 and a PAC ratio of 4.26. The 2017 program year LUEC results were $111,489 $/MW and $18.14/MWh.

The evaluation identified the following high impact observations and recommendations:

- **Observations:** Assumed hours of use (HOU) for LED tube re-lamping may be inconsistent with actual operation. Review of evaluated prescriptive lighting projects containing LED tube re-lamping provided 3,325 hours per year of lighting operation, which is lower than the program assumed HOU of 4,594.

  Recommendation: *Review the hour of use (HOU) input assumptions applied to omni-directional A-shape lamps and LED tube re-lamps to determine if they are consistent with lamp operation in the field. Assumed HOU for omni-directional A-shape lamps may be inconsistent with actual operation. A review of evaluated prescriptive lighting projects containing omni-directional A-shape lamps provided 6,350 hours per year of lighting operation, which is much higher than the program assumed HOU of 3,911.*

Please refer to Section 12.1 for the Retrofit Program medium and low impact recommendations and observations.

1.2.2 Retrofit Program – Pay for Performance

A total of 544 projects[3] were reported for evaluation under the Retrofit P4P Program in 2017 accounting for energy and summer demand savings of 39.2 GWh and 6.2 MW. In a change from the methodology

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[2] 78% of custom projects reported demand savings greater than zero in 2017, compared to 72% in 2016

[3] These results only include projects from Q1 through Q3 that were submitted through the LDC Reports. Additional 2017 projects were evaluated during the quarterly Retrofit P4P evaluations and results from these other projects will be accounted for in the PY2018 evaluation cycle.

applied to the Retrofit FCR Program, P4P results are evaluated on a quarterly basis to provide savings to the LDC on an accelerated timeline. Similar to the Retrofit FCR Program P4P is lighting dominant, with 81% of energy savings attributable to lighting projects.

The 2017 Retrofit FCR Program exceeded the CE benchmarks of 1.0 with a TRC ratio of 1.43 and a PAC ratio of 2.85. The 2017 program year LUEC results were $163,644/MW and $26.45/MWh. Full cost effectiveness results are summarized in section 5.1.7.

No high-impact recommendations and observations were identified for the Retrofit P4P Program. Please refer to Section 12.1 for the Retrofit P4P Program medium and low impact recommendations and observations.

1.2.3 Small Business Lighting Program

A total of 7,565 projects were completed under the SBL Program in 2017. This represents a 212% increase in the number of projects from 2016. The SBL program achieved a total net verified energy and demand savings of 51.44 GWh, 441 MWh and 10.7 MW, respectively. The net verified energy and demand savings at year 2020 are 46.43 GWh and 10.2 MW, respectively.

The program cost effectiveness is improved considerably compared to 2016 and 2015. SBL program passed the TRC and PAC tests with a benefit ratio of 2.07 and 2.35 respectively. The 2017 program year LUEC results were $174,058/MW and $36.50/MWh. Full cost effectiveness results are summarized in section 5.1.7.

The evaluation identified the following high impact observations and recommendations:

- **Observations:** The new SBL Assessment Tool for the updated program is an improvement from the previous version. The evaluator understands that it is important for the Assessment tool not be overly complicated but discrepancies between the operating schedules reported on the application and those verified in the field still contribute significantly to the realization rates being less than 100%.

  Recommendation: *Provide clear instructions on what hours of operation should be entered in the SBL Assessment Tool. It should be clarified that the schedule entered in the Hours of Operation tab should be the hour the new efficient lamps are expected to operate and not the hours of operation of the business. Another option is to clarify in the Assessment Tool instructions and in contractor trainings that in cases where multiple schedules exist, the schedule entered should be for the lights that are expected to generate most of the energy savings.*

- **Observations:** For certain SBL measures, a range of allowable wattages is allowed. These measures typically allow an LED lamps to have up to a certain maximum wattage, less than or equal to 15W, for example. The prescriptive savings calculations for these measures assume the maximum wattage allowed as the new efficiency wattage. A discrepancy exists when the verified wattage of the actual lamp is found to be less that this maximum wattage values. This discrepancy leads to the reported savings to be less than the gross verified savings.

  Recommendation: *Provide an optional field for contractors to enter the wattage of the new efficient lamp or fixture in the SBL Assessment Tool. This would only be necessary for measures that only specify a maximum wattage. The wattage value could be made to be optional in that if a value was not entered then the default lookup value could be used.*

Please refer to Section 12.2 for the SBL Program medium and low impact recommendations and observations.

1.2.4 Business Refrigeration Incentive Program

The BRI program achieved a total net verified energy and demand savings of 5,220 MWh, and 0.73 MW, respectively. In the year 2020, these measures are expected to still provide 4,715 MWh and 0.64 MW of energy and demand savings, respectively. The program included 1,077 projects, which were comprised of 11,095 measures. The ECM fan motor measure was by far the largest contributor to the program, which made up 52% of the program's total measure quantity and provided 77% of the program's net verified energy savings.

The program passed the TRC and PAC tests with ratios of 1.69 and 1.47, respectively. The 2017 program year LUEC results were $367,163/MW and $49.56/MWh. Cost effectiveness was analyzed at the measure level for comparison purposes. ECM fan motors tended to have the highest cost effectiveness (by TRC ratio), suggesting that the program should maintain a high focus on this measure. Similar to other programs, the two lighting measures offered in this program proved to also have high cost effectiveness.

The evaluation identified the following high impact observations and recommendations:

- **Observations:** Measure descriptions, such as ECM fan horsepower and LED case lighting length were captured in the program's tracking database; however, the measure savings were not reflective of differences within the broader measure type. In particular, the ECM fan motor measure has a very large influence on the program (77% of verified energy savings) yet only used a single deemed value for reported savings. Verified savings varied substantially per ECM fan motor measure depending on the motor's application and size. By way of using more granular measure savings will allow for improved precision in savings estimates.

  Recommendation: *Prioritize disaggregating the single ECM fan motor measure to distinguish sub-measure type key characteristics, as these variations have a significant influence on the measure's savings. The most influential characteristics on the savings are the application of the motor (evaporator vs. condenser) and the size of the motor (Watts or HP).*

- **Observations:** Assumed baseline types impact measure savings significantly, specifically for ECM fan motor and lighting measure types. However, baseline information was inconsistently captured in the BRI program's tracking database and project files. Some measures were listed in the program tracking database with no reference to a baseline type while other measures included a baseline description.

  Recommendation: *Standardizing a menu of measures for program implementers to select from when entering project data (such as Microsoft Excel's data validation feature) will help ensure baseline information is included in the program tracking data, as well as standardize measure names used across LDCs.*

  Recommendation: *Consider requiring equipment installers submit proof (e.g. photos) of baseline equipment at the time it is removed from service for all equipment, and provide these files to IESO. This would ensure the baseline is accurate and consistent between reported and verified savings estimates.*

- **Observations:** Project file organization and available data supporting reported savings estimates was inconsistent between LDCs.

  Recommendation: *Across all LDCs, standardize how project files are collected, stored, and provided to IESO. It is recommended to have one main file folder for each project, with all supporting documents for the project contained within that folder, such as work orders and photos. Similarly, standardizing file naming conventions for different file types (e.g. work orders, photos) may prove to help program staff and evaluators alike quickly navigate project files.*
- **Observations:** The refrigeration technician reported shortages of program qualifying ECM motors. However, the motor supplier did not think there were any product or supply-related issues.
- ***Recommendation:*** *Ensure that the supplier maintains adequate inventory of program-qualifying equipment. Insufficient equipment availability will hinder the program from deriving all achievable savings and reaching its full potential.*

Please refer to Section 12.3 for the BRI Program medium and low impact recommendations and observations.

1.2.5 Audit Funding Program

For Program Year 2017, the net verified first-year energy savings are estimated to be 22.8 GWh with the net verified energy savings at 2020 estimated to be 22.8 GWh. The net summer peak demand savings at 2020 are estimated to be 1.0 MW. There were a total of 349 audits completed in the 2017 reporting period across 19 contributing LDCs for a growth of 64% over the 2016 audit count of 213 (without true ups).

The Audit Funding program passed both the TRC and PAC tests with benefit cost ratios of 2.44 and 3.22 respectively. The 2017 program year LUEC results were $365,171/MW and $16.22/MWh. The program observed a 715% increase in net verified energy savings and a 178% increase in net verified demand savings between 2016 (not including true-ups) and 2017. This increase in net verified savings is due to a large increase in per audit energy savings and the program's participation and had a positive impact on the program cost effectiveness compared to PY2016.

The evaluation identified the following high impact observations and recommendations:

- **Observations:** Of the 36 total measures implemented, it was estimated that 16 (44%) were likely eligible for incentives in 2017; this figure was 38% in 2016. In order to further increase the number of measures implemented as a result of the Audit Funding program the audit reports should clearly state which recommended measures may qualify for incentives through other CDM programs.

  Recommendation: *Provide clear information on all available incentives for measures that are recommended in audit reports including contact information and instructions on how to apply for them.*

- **Observations:** In addition to the shortcomings in participant comprehension of program structure, there is also some customer skepticism regarding savings data provided by auditors that would be addressed with additional documentation.

  Recommendation: *Program resources should be readily available to customers through multiple channels. Materials need to be available to help clarify incentives, timelines deadlines, and financing options. Easily accessible case study and benchmark data will help recruit customers into the* *program and will also help those already enrolled to successfully complete the program and continue on with retrofits and installations of recommended equipment.*

Please refer to Section 12.4 for the Audit Funding Program medium and low impact recommendations and observations.

1.2.6 High Performance New Construction

A total of 172 projects[4] were completed at approximately 152 buildings[5] under the HPNC Program in 2017. This is a 9% increase in participating buildings from 2016 participation levels. Total 2017 net verified energy and demand savings significantly increased compared to 2016 program year from 18.77 GWh and 5.69 MW in 2016 to 46.8 GWh and 7.7 MW in 2017. Total net verified energy and demand savings at 2020 are 46.8 GWh and 7.7 MW, respectively.

The HPNC program passed the TRC and PAC test with both benefits exceeding their respective costs. TRC net benefit ratio is 3.07 and PAC net benefit ratio is 5.94. The program cost effectiveness improved considerably compared to 2016 in which the program passed the TRC test with a benefit-cost ratio of 2.54 and PAC ratio of 3.56. The 2017 program year LUEC results were $83,422/MW and $14.43/MWh.

The evaluation identified the following high impact observations and recommendations:

- **Observations:** In the case of new construction the baseline equipment should at least be assumed to be code-compliant as a non-compliant piece of equipment is not a realistic alternative. As the code specifies lighting compliance in terms of LPD calculations, it follows that energy savings should also be calculated via this method.

  Recommendation: *IESO to update the prescriptive worksheet assumptions and make the allowable lighting baseline for engineered worksheets be based on LDP requirements of the code for the space or building type.*

Please refer to Section 12.5 for the HPNC Program medium and low impact recommendations and observations.

1.2.7 Existing Building Commissioning Program

In 2017, there were 15 projects in various stages of completion in the EBCx pipeline. Six projects completed the hand-off stage in 2017. This is a slight decrease from the seven projects completed in 2016. The six projects in the 2017 EBCx program population resulted in a total of 882 MWh or net verified energy savings and 0.080 MW of net summer peak demand savings. This is a 31% increase from the 2016 EBCx program year net savings. This increase in total savings between 2016 and 2017 is due to the average net energy savings per project of the 2017 projects was 53% greater than the 2016 projects. This increase in the average net savings per project is due to one very large project in the 2017 population. Total net verified summer peak demand savings decreased slightly (-3%) compared to 2016.

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[4] One project is considered to be all measures within one track at one address. As there are three tracks in the HPNC Program, one address can be associated with up to three projects.

[5] Building count cannot be corroborated exactly as the tracking data is incomplete. Crucial fields needed, such as applicant name, applicant address, and application identification number make it unclear whether or not any of these line items occur at the same building.

The EBCx program failed the TRC and PAC test with both costs exceeding their respective benefits. TRC net benefit ratio is 0.63 and PAC net benefit ratio is 0.46. The program cost effectiveness declined considerably compared to 2016 in which the program passed the both tests with a benefit-cost ratio of 1.37 and PAC ratio of 1.19. The 2017 program year LUEC results were $1,377,831/MW and $125.20/MWh.

No high impact recommendations were identified for the EBCx Program. Please refer to Section 12.6 for the EBCx Program medium and low impact recommendations and observations.

1.2.8 Cross-Cutting

The process evaluation identified the following cross-cutting high impact recommendation and supporting observation:

- **Observations:** Continue to provide educational opportunities or materials to LDC staff and associated program delivery partners regarding NTG and related best practices as these educational opportunities or materials may be helpful when working to improve NTG scores.

  Recommendation: *Continue to foster understanding of NTG and related best practices.*

Please refer to Section 12.7 for the cross-cutting medium and low impact recommendations and observations.

2 Evaluation Goals and Objectives

The following are goals and objectives of the 2017 evaluation of the Business Programs:

- Evaluate the following province-wide Save on Energy Programs: Retrofit, SBL, BRI, Audit Funding, HPNC, and EBCx Programs.
- Verify energy and demand savings with a high degree of confidence and precision, taking into account:
    - Project track: prescriptive, engineered, or custom;
    - Measure type: lighting and non-lighting;
    - Spillover savings and program-enabled savings; and
    - Savings from interactive effects.
- Assess free-ridership and participant/non-participant spillover to determine an appropriate net-to-gross ratio for each program at the LDC level.
- Review and compare key program elements and results across business or property types (i.e., office, retail, warehouse, hospital, etc.).
- Review and compare key program elements and results across delivery/sales channels.
- Report and attribute savings to individual LDCs at the track level, segmented by commercial.
- Conduct annual cost-effectiveness analyses.
- Provide recommendations on program improvements based on feedback obtained through the evaluations.

A summary of the impact and process evaluation methodologies is presented in Section 3 and the results of the impact and process evaluations are presented and discussed in Sections 5 through 10.

3 Evaluation Methodology

3.1 Impact Evaluation Methodology

The evaluation team verified the energy and demand savings by conducting the following impact evaluation activities:

- Sampling projects;
- Performing project audits on sampled sites;
- Comparing gross reported savings to the savings established by site visits to determine “gross verified” savings; and
- Estimating net-to-gross ratios and “net verified” savings through the use of attribution surveys.

3.1.1 Impact Evaluation Sampling Plan

Independently verifying the energy and demand savings and attributing savings first requires thoughtful selection of sample projects that represent the program’s population. Random sampling of projects under each program was done by studying the population distributions and developing a sampling plan based on the following points:

- Preliminary 2017 participation levels provided in program database extracts.
- Overall confidence/precision targets of 90/10 at the program level for each program year assuming a coefficient of variation (CV) of 0.5.
- Historical participation levels and relative proportions of the 2016 program year’s samples to understand the necessary size of the 2017 sample. This comparison was made for each program and, for the Retrofit Program, at the different tracks (prescriptive, engineered, and custom) and measure type (lighting / non-lighting) sub strata.
- Historical reported savings and relative proportions of the 2016 program years’ samples to understand where to focus the limited evaluation resources. Again this comparison was made for each program and, for the Retrofit Program, at the different tracks and measure type sub strata.
- Historical sample statistics such as CVs and relative precision from the 2016 cross-cutting Business Programs evaluations to inform where the most uncertainty and variability can be expected.
- Historical sample counts from the 2015-2016 cross-cutting Business Programs evaluations to build upon the evaluation work that has already been completed. The use of historical impact samples allow higher confidence and precision reporting at the program and business sector levels, or track levels.
- Historical samples from the 2015-2016 evaluations were incorporated into the 2017 Retrofit sample.
- Only 2016 historical samples were incorporated into the 2017 SBL sample due to the redesign of the SBL Program.
- The Audit Funding Program did incorporate 2015 and 2016 historical samples into the 2017 sample. Only 2016 historical sample data was included in the 2017 HPNC sample.

- No historical samples were incorporated into the 2017 BRI or EBCx samples.

The total 2017 sample size was 379 projects. By including the sample projects collected during the 2015-2016 cross-cutting Business Program evaluations, an additional 105 Retrofit, 77 SBL, 17 Audit Funding and 48 HPNC sample projects were utilized in this year's analysis. These additional sample projects leverage the prior evaluation work and improve the confidence and precision of the 2016 results. The sample projects from the 2016 impact evaluation were used because the programs have not changed significantly and are still representative of the populations. The total effective sample size for the entire evaluation is 723 projects. The overall sampling plan for the 2017 impact evaluation is displayed in Table 3-1.

Table 3-1: Impact Evaluation Sampling Plan

Program	Strata	Historical 2015 Sample	Historical 2016 Sample	2017 Sample	Total Sample
Retrofit FCR	Prescriptive	11	53	37	101
	Engineered	14	49	-	63
	Custom	8	40	68	116
Total Retrofit FCR		**33**	**142**	**105**	**280**
Total Retrofit P4P		-	-	61	61
Total SBL		-	68	77	145
Total Audit Funding		18	38	17	73
Total HPNC		-	45	48	93
Total BRI		-	-	65	65
Total EBCx		-	-	6	6
Total Evaluation		**51**	**293**	**379**	**723**

The sampling plan was carefully designed to achieve high levels of precision allocated to the right measure categories, considering the value of information gained by each sample. Based on the evaluation team's experience on evaluating similar programs in other jurisdictions and the 2008-2016 Commercial and Industrial (C&I) evaluations for the IESO, the sampling plans ensure higher levels of precision for the entire four-year evaluation effort. Samples are allocated annually to the programs using precision requirements by project size.

Details of the program specific objectives and targets of the sampling plan are contained in Appendix B.1.1.

The sampling criteria defined above were used to determine the final sample sizes.

3.1.2 Retrofit P4P Quarterly Evaluation Methodology

In contrast to the rest of the programs offered through the CFF that are evaluated on an annual basis, the Retrofit P4P Program reviewed and evaluated projects quarterly. LDCs who opted into this program forego set incentive levels dependent on ex-ante equipment installed or reported energy savings, and instead were provided set payments based on evaluated net verified energy ex-post savings. Quarterly evaluation of these projects provided a consistent accounting of program savings and expected payments to the LDCs. Quarterly impact evaluation realization rates are calculated through the use of a four-quarter rolling sample, while quarterly NTG rates are calculated independently for each quarter through participant surveys.

LDCs that opt into the Retrofit P4P Program are required to submit their projects to IESO in two different ways:

1. Quarterly: Allowing the evaluation team to verify the projects and provide net verified energy savings estimates that are used to calculate incentive payments; and

2. Annually: Through the use of the LDC Reports projects are submitted to IESO for inclusion in the annual accounting of savings that are attributable to the LDC and their CDM Plan.

In 2017 the Retrofit P4P Program submitted 749 projects for review through the quarterly reporting process, but only 544 of these projects were provided through the LDC Reports and included in the Retrofit P4P Impact Evaluation (Section 4.3). The evaluation team expects the remaining 205 projects to be included in the PY2018 evaluation as true-ups.

3.1.3 Retrofit Program Evaluation Project Counts

Due to the scale of energy and summer demand savings along with the broad range of measures incentivized through the Retrofit Program the evaluation team considered many variables when defining what creates a unique project. The evaluation defined a project as a unique application submitted for a given LDC, separated by track, and lighting/non-lighting designation. As a result some IESO defined projects are split into multiple evaluation projects, often due to different tracks on the same application or multi-site applications than span multiple LDCs. As a result the count of evaluated Retrofit projects may exceed number provided for evaluation.

3.1.4 Project Audits

Once sampling was complete, the evaluation team set out to complete project audits that were specific to the programs and the types of implemented measures.

Sampled Retrofit Program projects received both Level 1 and Level 2 audits. Level 1 audits consist of desk reviews of project documentation available in IESO’s iCon database such as project application worksheets, IESO savings worksheets, savings calculations performed by participants or third-party contractors (if applicable), audits, metered data, invoices for equipment or contracting services, and any other documentation submitted to the IESO. The level 2 audit expanded upon the work conducted for the level 1 audit by conducting an on-site review of the equipment installation.

Analysis of the SBL, BRI, HPNC, and EBCx programs involved both Level 1 and Level 2 audits. The first step of the Level 1 audits was a review of the measure types and quantities from the program database and available program applications. The Level 2 audits evaluated inputs pertinent to the calculation of gross savings based on telephone surveys of participants and site visits. For the HPNC Custom track projects, the evaluation team compared the modeling documentation to the buildings as-built conditions.

Level 1 audits were completed for the 2017 Audit Funding Program sample projects. Level 1 audits included a review of the audit reports and other project documentation (invoices, applications, etc.). Desk reviews and telephone interviews were used to confirm which recommended measures were installed and which installed measures received incentives. All estimated savings of the recommended measures identified in the reports were compiled and used to develop the reported program savings.

Details of the different types of project audits are provided in Appendix B.1.2.

3.1.5 Gross Reported Savings

Gross reported savings are the energy and summer peak demand savings that are derived from information submitted on participant applications. For the Retrofit, SBL, BRI, HPNC and EBCx Programs gross reported savings were available in the program database. The Audit Funding Program database does not provide accurate estimates of the gross reported savings for each project so the review of the sample project audit reports were used to determine the average amount of attributable savings.

3.1.6 Gross Verified Savings

The data collected as a result of the project audit activities described in Section 3.1.2 and in detail in Appendix B.1.2 were used to calculate energy and summer peak demand savings for each of the Retrofit, SBL, BRI, Audit Funding, HPNC, and EBCx sample projects. These gross verified energy and demand savings represented estimates for the actual savings achieved as a result of the individual incentivized project.

A realization rate is then calculated for each stratum (e.g., program, track, etc.) identified in the sampling plan and applied to gross reported savings of projects in that stratum's population. Equation 3-1 shows the basic formula for calculating the gross verified savings.

Equation 3-1: Realization Rate

$$\text{Realization Rate}_{Stratum\ X} = \frac{\sum_i^n Savings_{\text{Verified}-Stratum\ X}}{\sum_i^n Savings_{\text{Reported}-Stratum\ X}}$$

Where:

$Savings_{\text{Verified}-Stratum\ X}$ = Gross savings (kWh or kW) verified by the evaluation team for each sample project in stratum X

$\text{Savings}_{\text{Reported}-Stratum\ X}$ = Gross savings (kWh or kW) reported by the program for each sample project in stratum X

A realization rate of 1.0 indicates that the verified savings are equivalent to the reported savings. A deviation from 1.0 indicates that the actual savings are more or less than what was reported.

For each stratum (e.g., program, track, etc.) identified in the sampling plan, a stratum-level realization rate was calculated as the weighted average of the project-level realization rates. Total stratum-level gross verified savings for all projects in that stratum are then calculated as the product of the reported savings of that stratum and the stratum's realization rate. These total stratum-level gross verified savings reflect the direct energy and demand impact of the program's operations. However, these stratum-level gross verified savings do not account for customer or market behaviour impact that may have been added to or subtracted from the program's direct results—these market effects are accounted for through the net verified impact analysis.

3.1.6.1 Interactive Equipment Energy Changes for Lighting Retrofits

The IESO's CDM programs incentivize the installation of equipment that has higher efficiency levels compared to commonly installed equipment. By definition, this high-efficiency equipment should consume less input energy per unit of output energy. However, the evaluation team understands that the energy consumption of equipment in an enclosed space cannot be viewed in isolation. Building systems interact with one another and a change in one system can affect the energy consumption of another. This interaction is important to consider when calculating the benefits provided by CDM Programs. Examining cross-system interactions provides a comprehensive view of building-level energy changes, rather than limiting the analysis to solely the energy change that directly relates to the modified equipment. Indeed, the IESO Evaluation Measurement and Verification (EM&V) Protocols state that interactive energy changes should be quantified and accounted for whenever possible.

Based on the information that the IESO tracks, it was agreed that interactive energy changes would only be applied to lighting retrofits since lighting projects, aside from generating significant interactive savings, generate the majority of savings in the Business Programs. These energy changes have been included in verified savings estimates. For a more detailed review of the methodology for calculating interactive energy changes for lighting retrofits, see Appendix H.

3.1.7 Lifetime Savings

The total amount of savings that occur over the lifetime of the retrofitted equipment is an important consideration in the impact evaluation since energy savings, demand savings, avoided energy costs, avoided capacity costs, and other benefits continue to accrue each year the equipment is in service. A basic method of calculating lifetime energy savings on a measure level is shown in Equation 3-2.

Equation 3-2: Lifetime Savings

$$\text{Lifetime Energy Savings} = \text{EUL} \times \text{Annual Energy Savings}$$

Where:

EUL = Estimated Useful Life of the retrofitted equipment

3.1.8 Net Verified Savings

To calculate net verified savings, the team evaluation the portion of gross verified savings that were specifically attributable to each program. Net verified savings were determined by multiplying the gross verified savings by the net-to-gross (NTG) ratio, as shown in Equation 3-3.

Equation 3-3: Net Verified Savings

$$Savings_{Net} = Savings_{Gross} \times NTG \text{ Where:}$$

Where:

$Savings_{Net}$ = Net verified savings impact (kW or kWh)

$Savings_{Gross}$ = Gross verified savings (kW or kWh)

NTG = Net-to-gross

To estimate the direct influence of the Save on Energy Business Programs in generating net verified energy savings, the team implemented attribution surveys to calculate the free-ridership (FR) and spillover (SO) rates, assessed as percentages of total reported savings. Free-ridership is the program savings attributable to free riders (program participants who would have implemented a program measure or practice in the absence of the program). Spillover refers to additional reductions in energy consumption and demand that are due to program influences beyond those directly associated with program participation.[1] For nearly every program, the NTG ratio is defined by Equation 3-4, where *FR* is the participant free-ridership percentage and *SO* is the participant spillover percentage.[2]

Equation 3-4: Net-to-Gross Ratio

$$NTG = 100\% - FR + SO$$

For Retrofit, SBL, BRI, and HPNC, free-ridership and spillover were calculated for a single incented project for each sampled participant. For Audit Funding, project savings were claimed based on audit-recommended equipment upgrades done without incentives from other programs. The evaluation team calculated free-ridership for such upgrades and calculated spillover based on upgrades that were influenced, but not specifically recommended, by the program.

Unless otherwise stated, all savings values discussed in the report are based on net verified energy and net verified demand estimates. Additional detail regarding the NTG methodology can be found in Appendix C.

3.2 Process Evaluation Methodology

3.2.1 Sampling, Interviews, and Surveys

The process evaluation focused on program design, implementation, and delivery. Program processes were evaluated through interviews and surveys with relevant program actors, including IESO and LDC staff, Program Delivery Partners (PDAs), Technical Project Evaluators (TPEs), contractors, assessors, builders, developers, architects, engineers, auditors, commissioning agents, and participants. For each population, a customized interview guide or survey instrument was developed to ensure responses produced comparable data and to allow the evaluation team to draw meaningful conclusions.

Common interview topics for the IESO staff, LDCs and PDA/TPEs addressed program roles and responsibilities, program administration, marketing and outreach, program delivery, NTG perspectives and best practices, and interactions with the IESO, LDCs, or customers.

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[1] Free-ridership and spillover definitions are sourced from p.3 of Chapter 21: Estimating Net Savings – Common Practices of the Uniform Methods Project. Web: www.nrel.gov/docs/fy17osti/68578.pdf.

[2] For the Retrofit Program, the NTG ratio also includes spillover associated with active non-participants. Additional detail regarding the Retrofit Program NTG methodology can be found in Appendix C

Common interview topics for program delivery partners addressed company role and firmographics, sales by equipment type (both in general and through the Program), program awareness, training and education received, outreach and marketing to customers, their roles in implementing projects and advising customers, program satisfaction, and suggestions for program improvement. For the Retrofit program, the survey also asked for estimates of participant intent to complete the upgrades in the absence of the program (free-ridership), and whether participants were influenced by the program to undertake energy efficient projects for which they did not receive program incentives (spillover).

Common interview topics for participants addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for doing the upgrades, the role of the contractor in the process, satisfaction with various aspects of the program process, reasons why it could be difficult to make future energy efficient equipment upgrades, participant intent to complete the upgrade in the absence of the program (free-ridership), whether participants undertook energy efficient projects without program incentives (spillover), and firmographics.

Table 3-2 shows for each respondent type, the survey methodology, the total population that was invited to participate in the surveys or interviews, the total number of completed surveys, and the sampling error at the 90% confidence level. The subsections below provide additional context about each group surveyed with details provided in Appendix F.

Table 3-2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Completed	Population	90% CI Error Margin
IESO Staff	Phone	4	4	0%
LDC Representatives	Web & Phone	34	56	0.9
PDAs and TPEs	Web & Phone	21	43	N/A*
Retrofit Active Non-participants	Web	89	2,856	8.6%
Retrofit Contractors	Web	97	404	7.3%
Retrofit Participants	Web & Phone	987	4,889	2.3%
Retrofit Pay-for-Performance Participants	Web & Phone	115	341	6.3%
SBL Installers and Assessors	Web	27	104	N/A*
SBL Participants	Web & Phone	827	7,136	2.7%
BRI Program Staff and Implementers	Phone	3	3	0%
BRI Supplier and Technician	Phone	2	2	0%
BRI Participants	Web	72	481	9.0%
Audit Funding Auditors	Phone	10	81	N/A*
Audit Funding Participants	Web	33	123	12%
HPNC Builders and Developers	Web	8	18	N/A*
HPNC Architects and Engineers	Phone	6	22	N/A*
HPNC Participants	Web	18	78	N/A*
EBCx Commissioning Agents	Phone	1	1	N/A*
EBCx Participants	Phone	3	13	N/A*

*Error margin not displayed if the respondent count is below 30 unless census achieved.
**CI: Confidence interval

3.2.1.1 IESO Staff Interviews

The evaluation team interviewed four IESO staff to obtain a detailed understanding of the implementation of the Save on Energy Business Programs in 2017. To complete these IESO staff interviews, the IESO EM&V staff sent a notification email to the appropriate IESO staff about the interview by the evaluation team.

3.2.1.2 LDC Staff Interviews and Surveys

The evaluation team e-mailed 56 LDCs to request their participation in the survey. A total of 34 LDC companies responded to this request and completed the survey. LDC staff was interviewed to better understand their perspectives regarding the design and implementation of the Save on Energy Business Programs in 2017. As part of this effort, the evaluation team sent a web-based survey to 51 LDCs, and 30 completes were achieved. The evaluation team also conducted in-depth interviews with the five LDCs in 2017 that focused more specifically on the Retrofit and/or the SBL Programs. Following the in-depth interviews, these five LDCs were sent an abbreviated version of the web-based survey, which focused more broadly on the Save on Energy Business Programs overall. To complete these LDC staff interviews and survey, the IESO EM&V staff provided the evaluation team with a contact list of LDCs as well as and sent an introductory notification email to the appropriate LDC staff.

3.2.1.3 Program Delivery Partners and Technical Project Evaluators Survey

The evaluation team e-mailed 43 unique companies to request their participation in the survey. A total of 21 Program Delivery Agents (PDAs) and Technical Project Evaluators (TPEs) responded to this request and completed the survey. Three preliminary in-depth interviews with PDA and TPE staff were conducted to better understand the roles of the PDAs and TPEs before launching a web-based survey. The web-based survey was sent to 40 PDAs and TPEs, and 18 completes were achieved. The sample list used to complete the PDA and TPE interviews and surveys was provided by the IESO EM&V staff to the evaluation team. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff.

3.2.1.4 Retrofit Program Active Non-participant Survey

The evaluation team e-mailed 2,856 unique companies to request their participation in the survey. A total of 89 retrofit active non-participants (59 completes; 30 partial completes) responded to this request and completed the survey. The survey addressed company role and firmographics, confirmation of whether the respondent applied for but did not ultimately participate in the Retrofit Program for reasons other than ineligibility, program awareness, reasons for applying to the program, reasons for not participating in the program, likelihood of future participation, and spillover questions. The sample list used to complete these Retrofit active non-participants surveys was developed from a database of Retrofit business customers whose applications had been submitted two to three years prior without any further activity or follow-through on the project. The IESO's iCon database extract was provided to the evaluation team by IESO EM&V staff.

3.2.1.5 Retrofit Program Contractor Survey

The evaluation team e-mailed all 404 unique companies in the sample to request their participation in the survey. A total of 97 Retrofit contractors (77 completes; 20 partial completes) responded to this request and completed the survey. The sample list used to complete these Retrofit contractor surveys was developed by using an extract from the IESO's iCon database that was provided to the evaluation team by IESO EM&V staff. The free-ridership information collected from Retrofit Contractors was used to adjust participant free-ridership values for those participants who reported the contractor was influential on their installation decision-making. Spillover information was collected for qualitative purposes only and to inform future program evaluations.

3.2.1.6 Retrofit Program Participant Survey

The evaluation team e-mailed or called all 4,889 unique companies in the sample to request their participation in the survey. A total of 987 Retrofit Program participants responded to this request and completed the survey. The sample list used to complete these Retrofit participant surveys was developed by using an extract from the IESO's iCon database that was provided to the evaluation team by IESO EM&V staff.

3.2.1.7 Retrofit Pay-for-Performance Program Participant Survey

The evaluation team e-mailed or called 341 unique companies in the sample to request their participation in the survey. A total of 115 Retrofit P4P Program participants responded to this request and completed the survey. Surveys were conducted on a quarterly basis to adhere to this program's impact reporting requirements. The sample list used to complete these Retrofit P4P participant surveys was developed from reports submitted by the LDCs either monthly or quarterly to the IESO. It was provided to the evaluation team by IESO EM&V staff.

3.2.1.8 SBL Program Assessors and Installer Survey

The evaluation team e-mailed or called 104 unique companies to request their participation in the survey. A total of 27 Installers and Assessors associated with the SBL Program responded to this request and completed the survey. The sample list used to complete these SBL assessor and installer interviews and surveys was provided by the IESO EM&V staff to the evaluation team. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff. Free-ridership and spillover information was collected from SBL Assessor and Installer in 2017 for qualitative purposes and to inform future program evaluations. The data was not used for estimating the net-to-gross ratio.

3.2.1.9 SBL Program Participant Survey

The evaluation team e-mailed or called 7,136 unique companies to request their participation in the survey. A total of 827 SBL participants responded to this request and completed the survey. The sample list used to complete these SBL participant surveys was developed by using an extract from the IESO's iCon database that was provided to the evaluation team by IESO EM&V staff.

3.2.1.10 BRI Program Staff and Implementers

The evaluation team interviewed one LDC program staff person and two implementers from a sample of three unique companies. The sample list used to complete these BRI program staff interviews was provided to the evaluation team by the IESO. The sample list used to complete interviews with the program implementer was provided to the evaluation team by LDC staff.

3.2.1.11 BRI Program Supplier and Technician Interviews

The evaluation team interviewed one BRI motor supplier and one installation technician from a sample of two unique companies. The sample list used to complete these BRI motor supplier and one installation technician interviews was provided to the evaluation team by LDC staff.

3.2.1.12 BRI Program Participant Survey

The evaluation team e-mailed 481 unique companies to request their participation in the survey. A total of 72 BRI participants (60 completes; 12 partial completes) responded to this request and completed the survey. The sample list used to complete these BRI participant surveys was developed by using an extract from the IESO's iCon database. In addition to the common process and NTG survey questions asked of all participants, the BRI participants we asked additional questions about what worked well about the application process and what challenges existed with that process that was provided to the evaluation team by IESO EM&V staff.

3.2.1.13 Audit Funding Program Auditor Interviews

The evaluation team e-mailed or called 81 unique companies to request their participation in the survey. A total of 10 Audit Funding Program auditors responded to this request and completed the survey. The sample list used to complete the Audit Funding auditor interviews and surveys was provided by the IESO EM&V staff to the evaluation team. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff.

3.2.1.14 Audit Funding Program Participant Survey

The evaluation team e-mailed 123 unique companies to request their participation in the survey. A total of 33 audit participants responded to this request and completed the survey. The sample list used to complete these Audit Funding participant surveys was developed by using an extract from the IESO's iCon database. Audit Funding participants were asked a unique set of free-ridership and spillover questions given the nature of the Audit Funding. Participants were asked what recommendations were made during their audit, which measures they installed, and whether they received an incentive for their installation. If the participant had made a recommended upgrade, but did not receive a program incentive for it, they were asked to rate the influence of the program in their decision to install it. Participants were also asked to describe reasons why they may not have made some of the recommendations, and whether and how their auditor presented the associated incentive amounts to them as part of their audit report that was provided to the evaluation team by IESO EM&V staff. The survey addressed how participants learned about the program, which other business programs

3.2.1.15 HPNC Program Builders and Developers Survey

The evaluation team e-mailed or called 18 unique companies to request their participation in the survey. A total of eight builders and developers (7 completes; 1 partial complete) responded to this request and completed the survey. The sample list used to complete these HPNC builder and developer interviews and surveys was provided by the IESO EM&V staff to the evaluation team. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff.

3.2.1.16 HPNC Program Architects and Engineers Interviews

The evaluation team e-mailed or called 22 unique companies to request their participation in the survey. A total of six HPNC engineers and architects responded to this request and completed the survey. The sample list used to complete these HPNC architect and engineer interviews and surveys was provided by the IESO EM&V staff to the evaluation team. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff.

3.2.1.17 HPNC Program Participant Survey

The evaluation team e-mailed 78 unique companies to request their participation in the survey. A total of 18 participants (16 completes; 2 partial completes) responded to this request and completed the survey. The sample list used to complete these HPNC participant surveys was developed by using an extract from the IESO's iCon database that was provided to the evaluation team by IESO EM&V staff.

3.2.1.18 EBCx Program Commissioning Agent Interviews

The evaluation team interviewed one EBCx commissioning agent from a sample of one unique company. The sample list used to complete the EBCx commissioning agent interview was provided by the IESO EM&V staff to the evaluation team. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff.

3.2.1.19 EBCx Program Participant Survey

The evaluation team e-mailed or called 13 unique companies to request their participation in the survey. A total of three EBCx participants responded to this request and completed the survey. The sample list used to complete these EBCx participant surveys was developed by using an extract from the IESO's iCon database. In addition to the common process and NTG survey questions asked of all participants, EBCx participants were also asked to describe their primary reasons for conducting chiller commissioning through the program.

3.3 Cost Effectiveness

The evaluation team used the IESO CDM Energy Efficiency Cost Effectiveness Tool to calculate multiple measures of cost effectiveness, including the TRC Test, the PAC Test, and LUEC.

The evaluation team populated the IESO cost-effectiveness tool with the measures and archetype level benefits as gross verified and net verified energy and summer peak demand savings. When estimates of incremental equipment and installation costs were not provided in the program reporting databases, the evaluation team used the measures level estimates in the IESO Measures and Assumptions List (MAL)[3], or conducted their own secondary research of similar measures in comparable jurisdictions

Benefits and costs were stated in present value terms, using the appropriate discount and inflation rates, and conform to IESO requirements as set forth in the IESO CDM Cost-Effectiveness Test Guide. Measure life inputs align with the updated IESO MAL, or are calculated based on hours of use data collected from participants as in the case of the SBL Program.

3.4 Research Studies

3.4.1 Lighting Baseline Shift Study

Changes to Canada’s energy efficiency regulations are impacting the availability of specific lighting technologies in the marketplace, namely general-service linear fluorescent T12s and general service screw-in incandescent lamps. These technologies are part of the blended baseline lighting equipment for several lighting measures in the Save on Energy Retrofit, SBL, and Industrial Programs. To address the impact of changing efficiency requirements, baseline assumptions must reflect current market conditions when lighting efficiency projects are completed. In order to address the changes of certain baseline technologies within the market during a measure’s EUL, future savings are adjusted by updating the assumed efficiency of the baseline technology at a certain point in the measure life (i.e., a dual baseline approach). This concept is illustrated in Figure 3-1.

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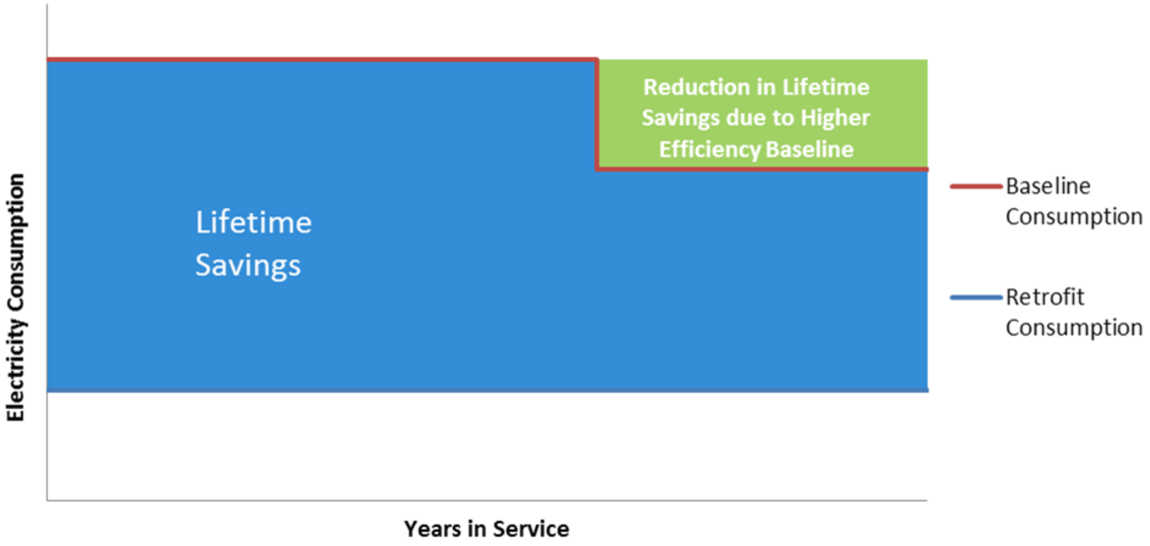
[3] http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/Measures-and-Assumptions/IESO-Prescriptive-Measures-Assumptions-List-April-2018.pdf?la=en

Figure 3-1: Illustration of Adjusted Lifetime Savings Calculation[4]



In order to address the phase-out of certain baseline technologies, Nexant Inc. (Nexant) with its sub-consultant EcoMetric Consulting (EcoMetric) performed a study to identify the market conditions relevant to these technologies. As part of the study, several data collection tasks were performed. The tasks included:

- Online surveys of participating program contractors and other trade allies
- Phone and online surveys of program participants
- Analysis of manufacturing data provided by Electro-Federation Canada
- Analysis of sales data through in-depth interviews of distributors, retailers, and other market actors

The data resulting from these tasks were analyzed to identify relative market shares of various baseline lighting technologies at different points in time within the CFF timeline. An approach involving calculating a blended baseline for each effected measure was established factoring in the relative shares of legacy lighting products.

The outcome of the study was provided in a separate report[5] which assisted the IESO to make any appropriate retroactive adjustment to previously reported savings and updates to the assumed baselines for the effected program going forward.

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[4] Nexant, *Final Report: Evaluation of 2015 Business Incentive Programs* (Oct 2016), p. H-4.

[5] IESO Business Programs: Lighting Baseline Shift Study, April 30, 2018

3.4.2 Evaluation of Participant Intent to Apply

In October of 2017, the Nexant team sent a web-based survey to LDCs to gather information about how each LDC managed relationships with their 2016 Retrofit Program participants who needed to demonstrate a prior intent to apply to the program.

The purpose of the survey was to help understand the possible reasons for variances between LDCs 2016 Net-to-Gross (NTG) results for the Retrofit Program. The survey questions were designed to explore whether there exists a correlation between LDC NTG values and the percentage of LDC participants that were required to demonstrate a prior intent to apply to the program to be considered eligible program participants. This type of participant would have already entered into a binding commitment to acquire the relevant program measures or services required to install the measures prior to submitting the program application. If sufficient evidence existed to demonstrate to the LDC that the participant intended to apply to the program prior to entering into a binding contract, the LDC could deem the participant’s project eligible to receive program incentives and support.

Please refer to Appendix J for the findings of this research study.

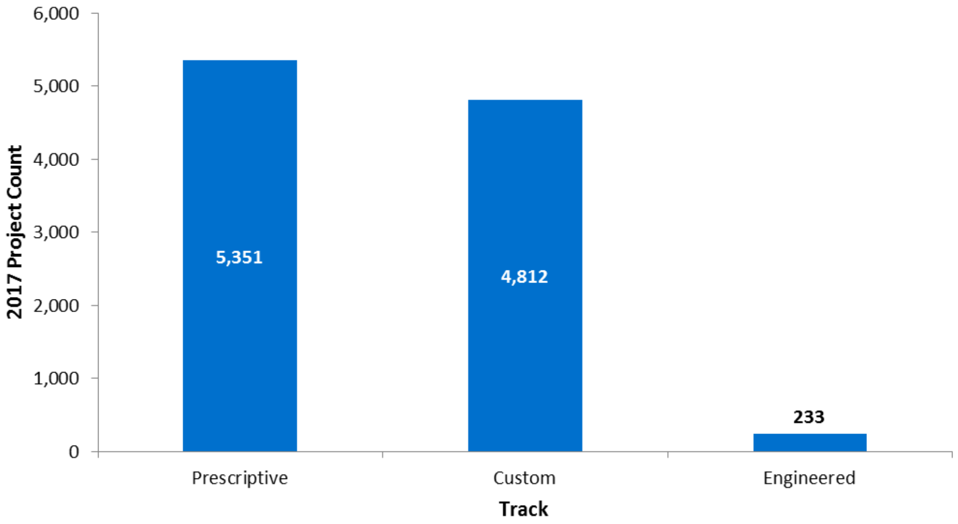
4 Retrofit Program

4.1 Impact Evaluation: Retrofit Full Cost Recovery

4.1.1 Retrofit Participation

A total of 8,783 evaluation projects were completed under the Retrofit FCR Program in 2017. This value is based on a unique application number and facility LDC. To provide a more detailed look at program participation and savings the evaluation team further separated these projects using the track and measure type (lighting/non-lighting) reported by the program. This additional step accounts for applications that include multiple tracks or lighting and non-lighting measures on the same application. The following analyses are based on a total project count of 10,396 evaluation projects. Annual net verified energy savings for individual projects ranged from 3 kWh to over 9.5 GWh. Figure 4-1 shows the count of projects by track for the 2017 Retrofit FCR Program.

Figure 4-1: 2017 Project Count by Track



4.1.2 Retrofit Impact Results

Figure 4-2 shows the 2017 net verified energy savings across program tracks and lighting/non-lighting measures.

Figure 4-2: 2017 First-year Net Verified Energy Savings by Track and Type

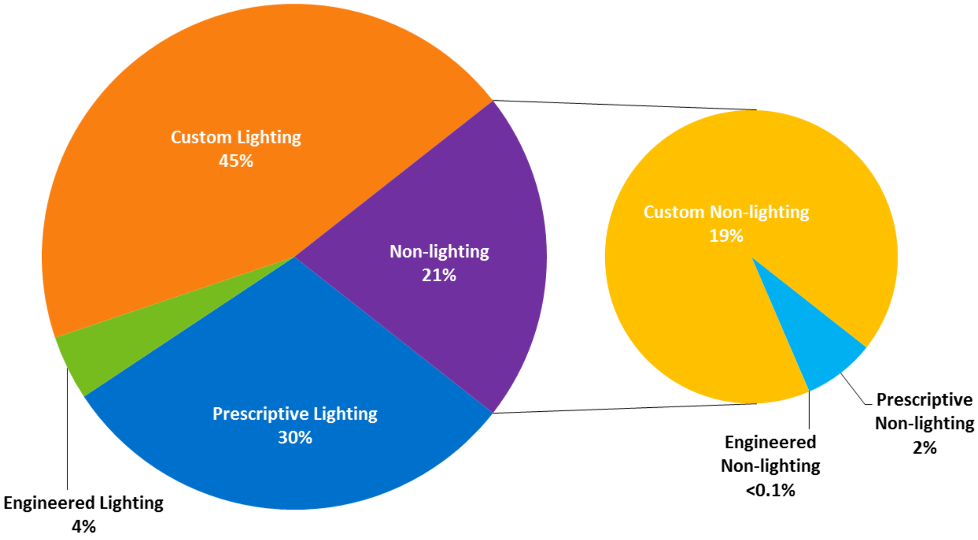


Table 4-1 and Table 4-2 show the province-wide results of the 2017 Retrofit Program impact evaluation. Interactive effects were added to the program realization rates to account for the influence of lighting savings on heating and cooling loads at the project site. The calculation of these interactive effects is explained in Appendix H.

Table 4-1: 2017 Retrofit Program Impact Results – Energy

Track	Measure Type	Gross Reported Energy Savings (GWh)	Realization Rate	Gross Verified Energy Savings (GWh)	Interactive Energy Savings* (GWh)	Gross Verified Energy Savings (Inc. Interactive Energy) (GWh)	Net-to-Gross Ratio	Net Verified Energy Savings (GWh)	Lifetime Net Verified Energy Savings (GWh)	Net Verified Energy Savings at 2020 (GWh)	Net Interactive Natural Gas Savings* (decatherms)
Prescriptive	Lighting	220.8	94.7%	209.1	4.9	214.0	88.4%	189.3	2,020.2	196.6	-124,056
	Non-Lighting	9.0	132.7%	12.0	0	12.0	88.3%	10.6	157.1	10.6	0
Engineered	Lighting	32.6	87.5%	28.6	0.8	29.4	88.6%	26.1	302.7	26.1	-24,726
	Non-Lighting	0.04	89.2%	0.04	0	0.04	89.9%	0.04	0.77	0.03	0
Custom	Lighting	300.9	103.2%	310.6	7.7	318.3	88.1%	280.5	340,931	280.5	-351,980
	Non-Lighting	137.5	100.9%	138.8	0	138.8	88.4%	122.7	1,727.1	122.6	0
Total		701.0	99.7%	699.1	13.5	712.6	88.3%	629.1	7,616.9	636.5	-500,763

* Interactive energy changes were only calculated for lighting projects. See Section 3.1.6 above for more information

Table 4-2: 2017 Retrofit Program Impact Results – Summer Peak Demand

Track	Measure Type	Gross Reported Demand Savings (MW)	Realization Rate	Gross Verified Summer Demand Savings (MW)	Interactive Summer Demand Savings* (MW)	Gross Verified Summer Demand Savings (Inc. Interactive Demand) (MW)	Net-to-Gross Ratio	Net Verified Summer Demand Savings (MW)	Net Verified Summer Demand Savings at 2020 (MW)
Prescriptive	Lighting	34.6	62.8%	21.7	3.0	24.7	96.5%	23.8	26.5
	Non-Lighting	1.6	49.2%	0.8	0.0	0.8	96.8%	0.8	0.8
Engineered	Lighting	5.5	80.6%	4.4	0.5	4.9	94.1%	4.6	4.6
	Non-Lighting	0.1	103.9%	0.1	0.0	0.1	110.1%	0.1	0.1
Custom	Lighting	44.7	122.1%	54.6	5.0	59.5	94.0%	56.0	56.0
	Non-Lighting	14.5	129.3%	18.8	0.0	18.8	95.3%	17.9	17.9
Total		**101.0**	**99.4%**	**100.4**	**8.4**	**108.8**	**94.8%**	**103.1**	**105.8**

* Interactive energy changes were only calculated for lighting projects. See Section 3.1.6 above for more information

4.1.3 Retrofit Results Comparison of 2017 with 2015/2016

Project participation within the 2017 Retrofit Program was consistent with 2016 results, but still down significantly from 2015. Figure 4-3 presents the completed project count during each year of the current framework. Results from 2015/2016 are separated into two segments representing projects reported during the annual evaluation cycle, and true-up projects that were evaluated in later years. True-ups consist of projects reported during the current evaluation with a project completion date from prior years that were not accounted for in past evaluations. The histogram in Figure 4-4 shows the number of completed projects by project size in MWh.

Figure 4-3: Projects by Track and Year

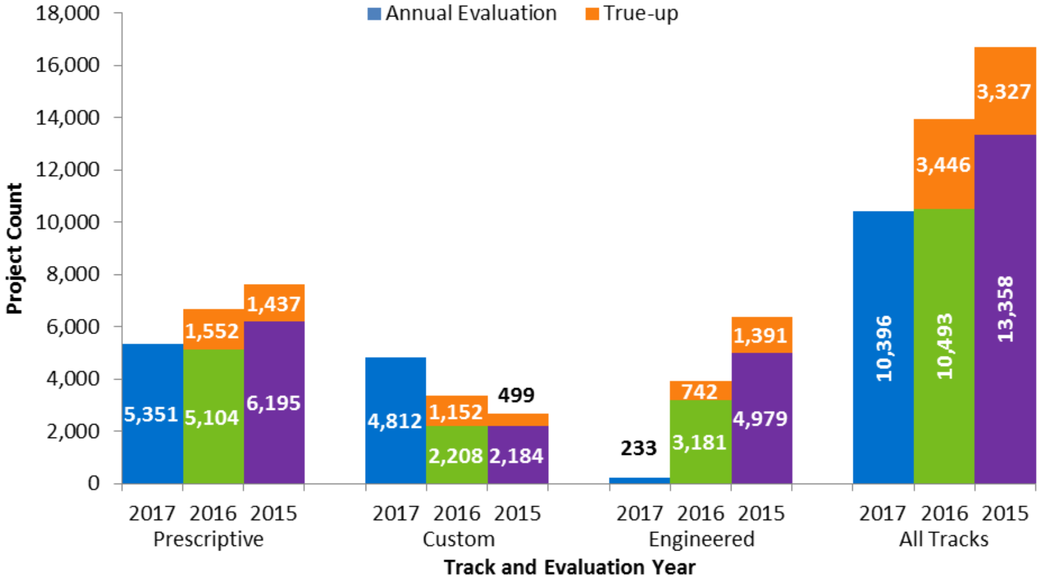
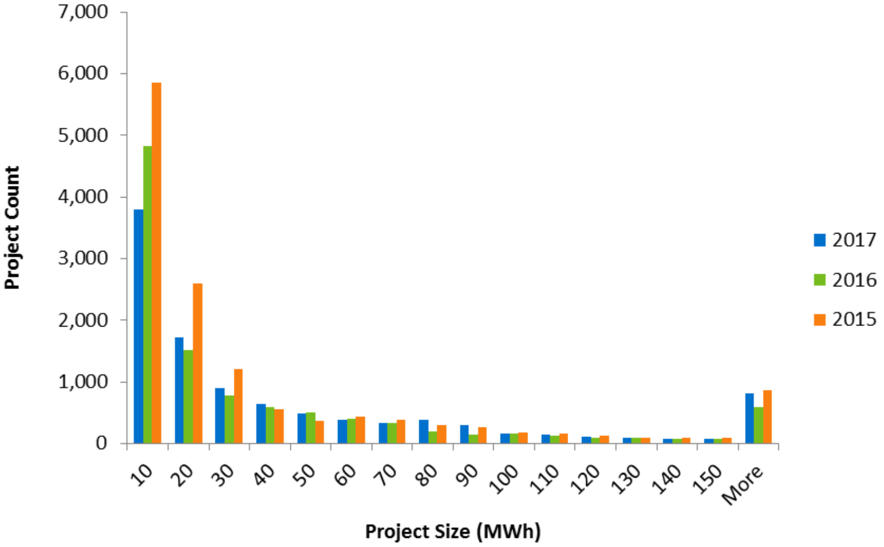
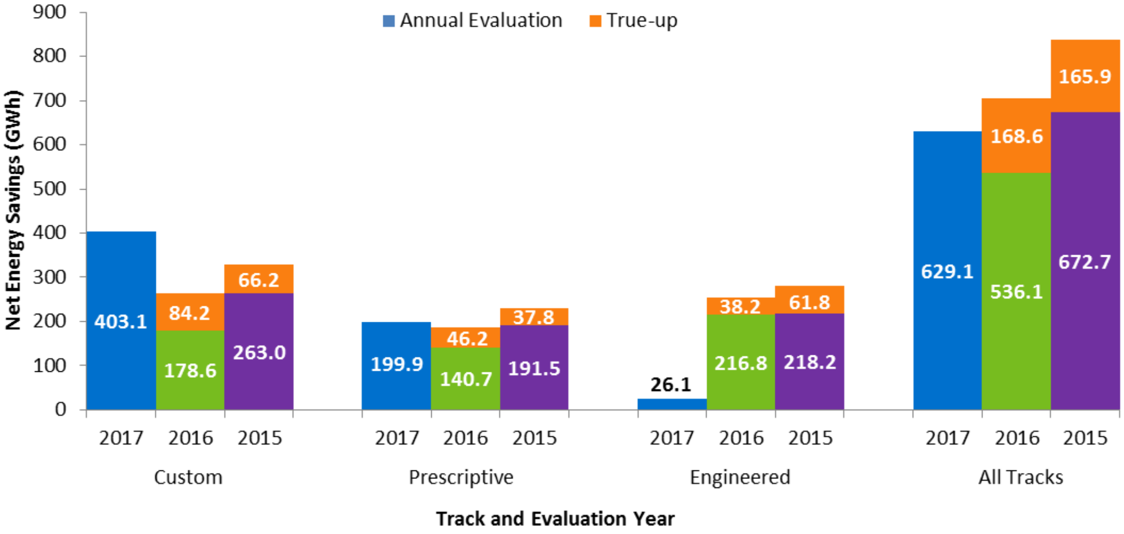


Figure 4-4: Project Sizes by Year



The drop in completed projects was most prominent for small projects with annual savings lower that 10 MWh. However, increases in mid-sized (10-90 MWh) projects and very large (greater than 150 MWh) projects resulted in higher savings for the program as in 2017 as shown in Figure 4-5.

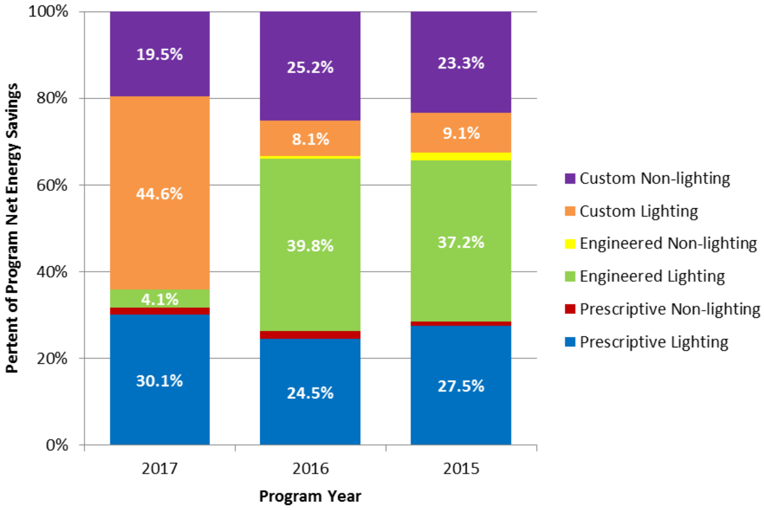
Figure 4-5: Net Verified Energy Savings by Year



Annual net verified energy savings increased for both the prescriptive and custom tracks and the engineered track is going towards zero savings due to its removal from the program. Most of the engineered track savings shifted into the custom track. Overall program savings increased from 2016, despite a lower number of completed projects, due to an increased average project size (+18.5% to 60.5 MWh per project).

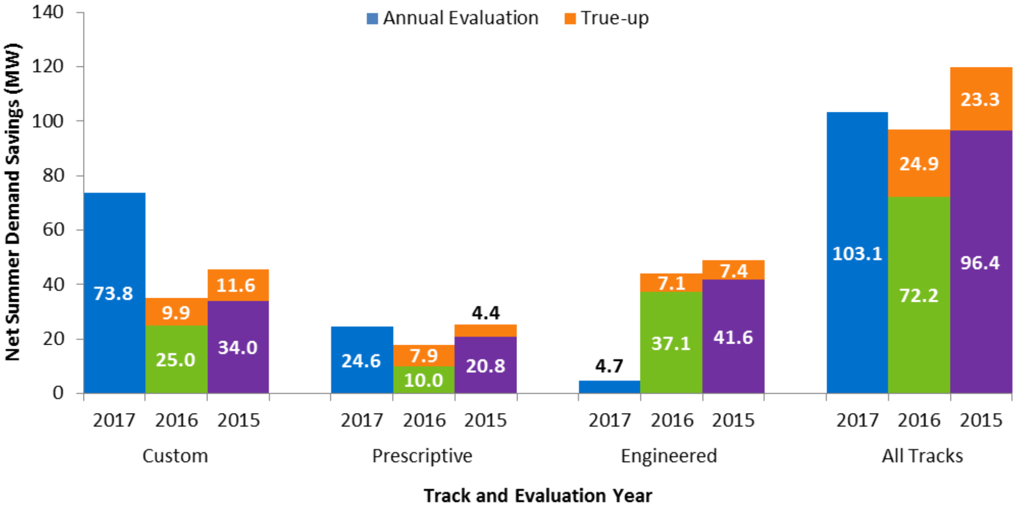
Figure 4-6 shows the relative size of each track and measure type (lighting/non-lighting) in the Retrofit Program. Lighting projects claim the majority of energy savings with custom lighting accounting for over 44% of program savings.

Figure 4-6: Proportion of Net Verified Energy Savings by Track, Measure Type, and Year



Total summer peak demand savings in 2017 exceeded the savings achieved in either of the previous program years (Figure 4-7) due to larger realization rates for custom track projects and a higher percentage of projects that reported summer peak demand savings. In 2016 only 72% of projects reported summer peak demand savings greater than zero, and this increased to 78% in 2017. Additional reported summer peak demand savings plus improved realization rates from the evaluation sample pushed annual net verified summer peak demand savings over 100 MWh.

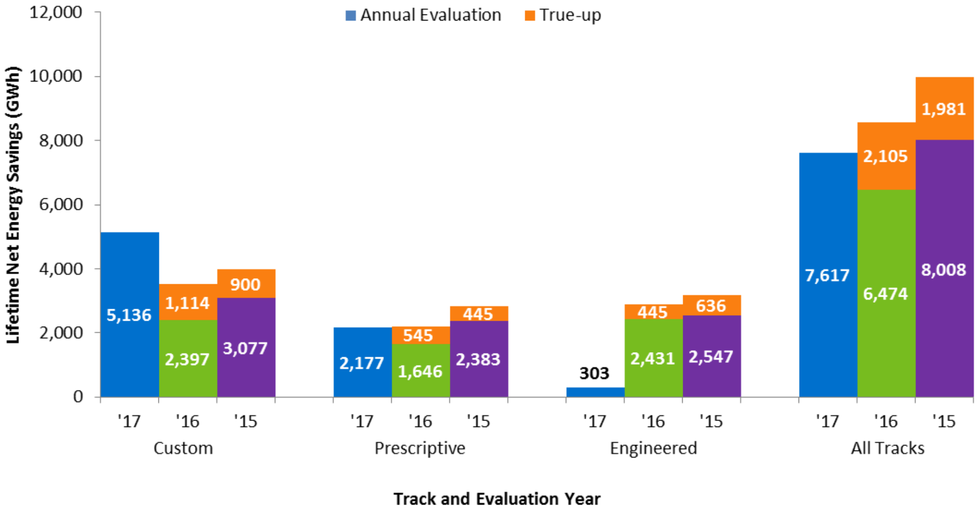
Figure 4-7: Net Verified Summer Peak Demand Savings by Track and Year



4.1.4 Retrofit Lifetime Savings and Savings in 2020

The 2017 Retrofit Program achieved 7,617 GWh of lifetime net verified energy savings (Figure 4-8). This incorporates the annual savings from each project, along with the expected useful life of equipment, and any adjustments to lighting measures influenced by the lighting baseline study.

Figure 4-8: Lifetime Verified Energy Savings



CFF extends through 2020, and as such energy and summer peak demand savings attributed to this program in 2020 are a key point of interest for this evaluation. Depending on the EUL of a piece of equipment, or any adjustments applied to project impacts, savings in 2020 may differ from the annual first year savings provided by evaluation. First year net verified energy savings by evaluation year are provided in Table 4-3 along with estimated net verified energy savings in 2020. Energy increases in the 2017 and 2016 evaluation years are due to lighting baseline adjustments that occur in 2018 and increase the annual energy savings on some prescriptive lighting measures. A decrease in 2020 energy savings from the 2015 evaluation is attributed to the installation of some measures with EULs less than 6 years that causes savings for these projects to go to zero before 2020.

Table 4-3: Net Verified Energy Savings – First Year and 2020

Evaluation Year	First Year Net Verified Energy Savings (GWh)	Net Verified Energy Savings in 2020 (GWh)	Change
2017	629.1	636.5	+1.2%
2016	536.1	545.8	+1.8%
2015	672.7	670.4	-0.3%

4.1.5 Retrofit Impact Observations

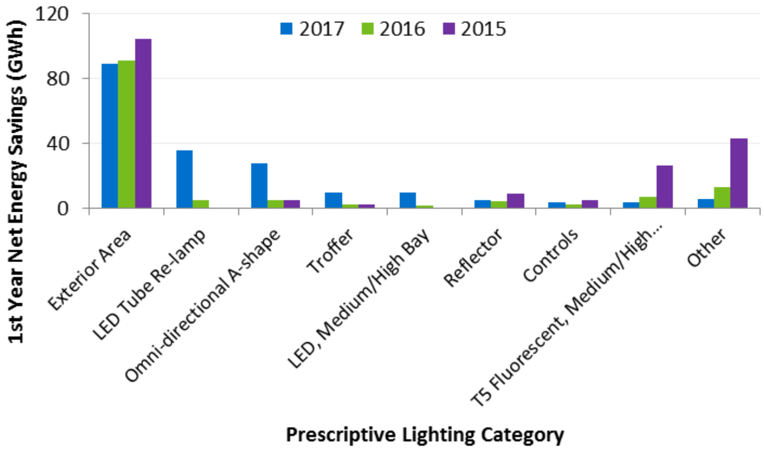
4.1.5.1 Prescriptive Track

The prescriptive track encourages building improvements through the use of per-unit incentives for lighting and non-lighting equipment, along with contractor friendly documentation requirements and minimal post-retrofit measurement and verification. The track is lighting dominant, with minimal savings (5%) derived from the available non-lighting measures.

Prescriptive Lighting Measures

Prescriptive lighting projects account for 25% of the 2017 Retrofit Program. Exterior lamps (primarily street lighting and parking lots) remain the most popular measure generating nearly half the prescriptive lighting net verified savings. Additional contributions come from re-lamping linear fluorescents with LED tubes, A-shape LED bulbs, full fixture replacements with LED troffers, and high bay LEDs (Figure 4-9).

Figure 4-9: Prescriptive Lighting Measures



Energy and summer peak demand savings for a given measure are dependent on three factors: the power draw from the baseline equipment that is removed; power draw on the retrofit equipment added to the facility; and hours of operation. The product of these values, combined with the quantity of lamps/fixtures and inclusion of interactive effects, determined the savings for a given project. The rolling sample of evaluated projects allowed Nexant to review trends across measures or categories of lights to determine the accuracy of per unit values applied to prescriptive lighting projects. The observations and recommendations are:

- **Observations:** Assumed hours of use (HOU) for omni-directional A-shape lamps may be inconsistent with actual operation. Review of evaluated prescriptive lighting projects containing omni-directional A-shape lamps provided 6,350 hours per year of lighting operation, which is much higher than the program assumed HOU of 3,911.

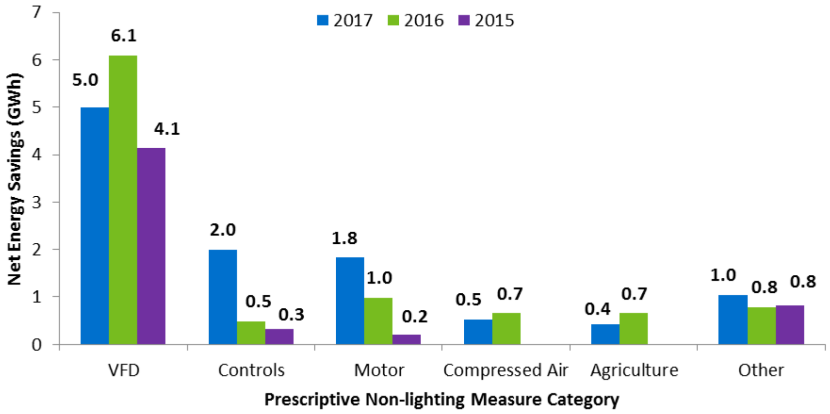
  Assumed hours of use (HOU) for LED tube re-lamping may be inconsistent with actual operation. Review of evaluated prescriptive lighting projects containing LED tube re-lamping provided 3,325 hours per year of lighting operation, which is lower than the program assumed HOU of 4,594.

  Recommendation: *Review the HOU input assumptions applied to omni-directional A-shape lamps and LED tube re-lamps to determine if they are consistent with lamp operation in the field.*

Prescriptive Non-lighting Measures

Non-lighting measures in the prescriptive track account for under two-percent of the Retrofit program's annual net verified energy savings at 10.6 GWh. Installation of variable speed drives accounts for nearly half of all energy savings for prescriptive non-lighting projects, and controls upgrades and motor replacements capture an additional 35% of savings. These three closely related measures combine for 82% of savings from these projects, with the remaining savings captured by compressed air systems, agriculture measures, Unitary AC replacements, and refrigeration measures (Figure 4-10). Net verified energy savings from prescriptive non-lighting measures had a modest increase of 12% from 2016 to 2017.

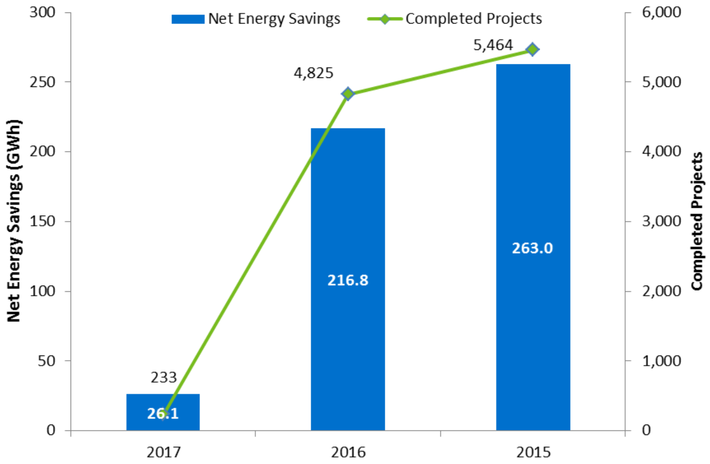
Figure 4-10: Prescriptive Non-lighting Measures



4.1.5.2 Engineered Track

The engineered track was removed from the Retrofit Program in June 2016 and the number of completed projects and energy/summer peak demand savings attributable to the track has been on decline since mid-2016 (Figure 4-11).

Figure 4-11: Engineered Track Participation and Energy Savings



PY 2017 is when the program experienced a substantial shift of projects away from engineered to the custom track, with completed projects falling 95% and net verified energy savings down 88%. This reduction was expected due to removal of the engineered track from the program design. The evaluation reviewed preliminary versions of the PY17 dataset and saw early signs that the engineered track was likely to move in this direction, and determined that the historical sample of evaluated engineered projects (n = 63) was sufficient to represent this track in the 2017 population. As a result the evaluation sample projects were shifted away from the engineered track and into prescriptive and custom tracks. All engineered projects in 2017 received impact adjustment factors (realization rates) from the rolling sample of evaluated engineered projects that occurred in previous years.

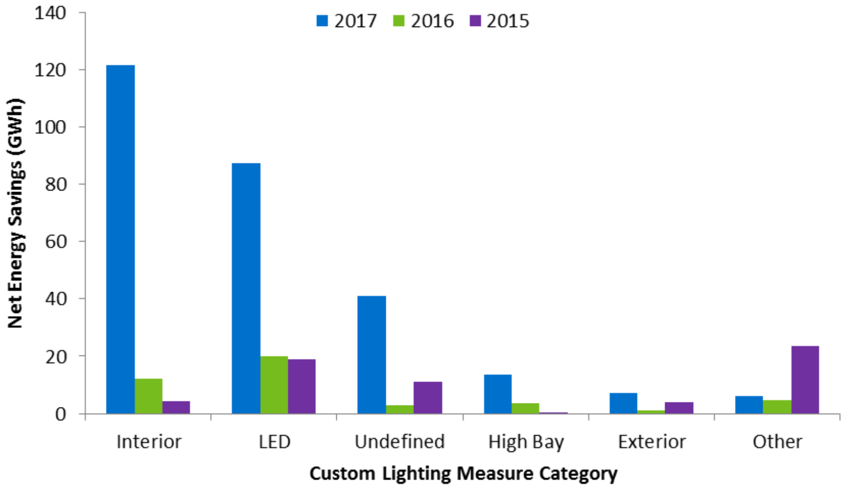
4.1.5.3 Custom Track

Custom projects provide incentives for equipment unavailable in the prescriptive track, along with an incentive based on reported energy savings. These projects often include larger, more complicated systems including unique process based improvements. Historically, the custom track has been a large segment of the Retrofit Program, but as engineered projects declined, the custom track doubled from 2016 to 2017 and now over 64% of all net verified energy savings are from the custom track of the program.

Custom Lighting Measures

The shift from engineered lighting to custom lighting projects can easily be seen when considering the types of lighting measures installed between 2016 and 2017 (Figure 4-12). Net verified energy savings associated with custom lighting measures in 2017 (280.5 GWh) is five times larger than 2016.

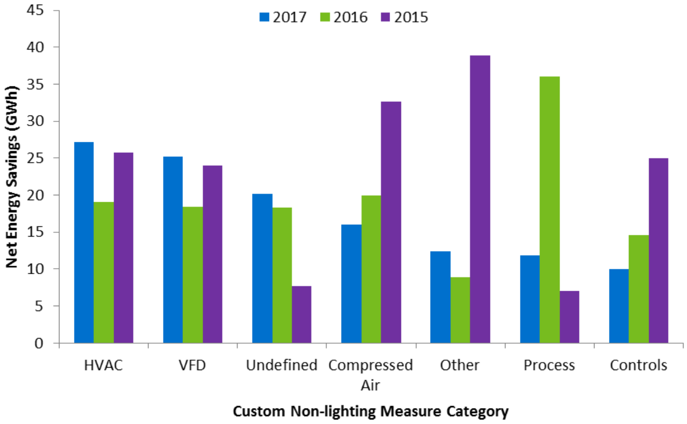
Figure 4-12: Custom Lighting Measures



Custom Non-lighting Measures

Non-lighting custom measures pull from a broad range of end-uses that have significant variation year to year. These projects average over 100 MWh of annual net verified savings. At the program level, one-fifth of savings are provided by custom non-lighting projects and cover end uses such as HVAC upgrades, VFD installations, compressed air systems, process improvements, and controls upgrades.

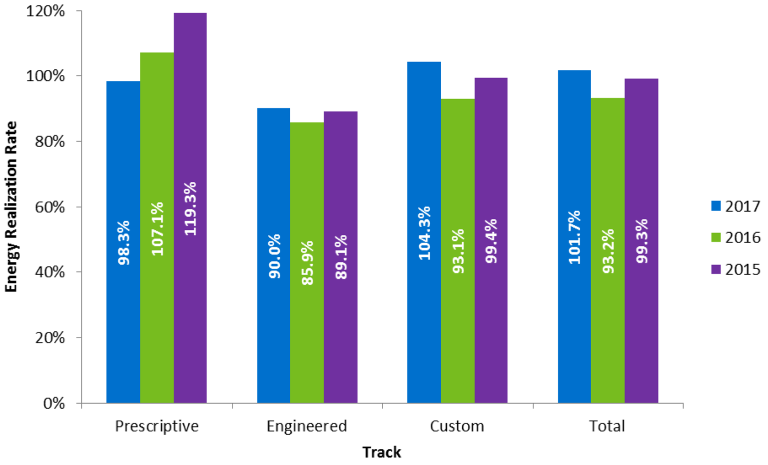
Figure 4-13: Custom Non-lighting Measures



4.1.5.4 Energy Realization Rates

The 2017 evaluation applied a rolling sample that included sample projects from the past two program years (2015-2017) to increase the total number of projects evaluated during the program cycle and achieve greater precision and accuracy for program and track level results. This allows the realization rates for each track to converge on a value with a greater level of confidence due to a larger sample. Energy realization rates are presented in Figure 4-14. Changing realization rates year to year are dependent on shifting the rolling sample frame from 2014 - 2016 for last year’s evaluation to 2015 - 2017 in the current evaluation. These changes in sample projects shifted the energy realization rates down in the prescriptive track and up in the custom track. Overall program level energy realization rate increased to a value over 100% in 2017.

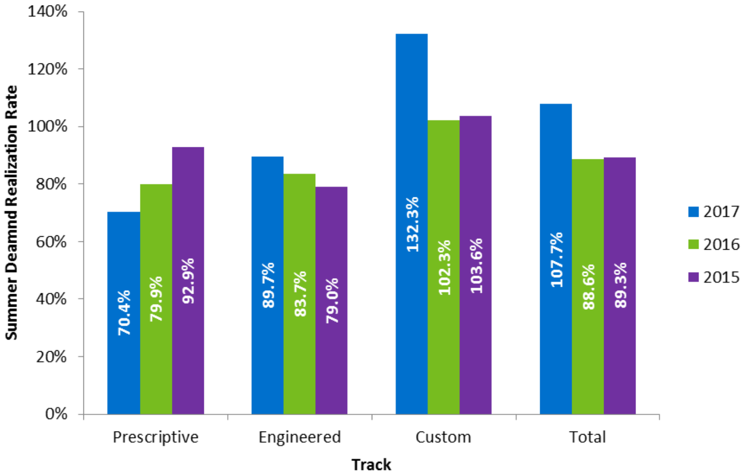
Figure 4-14: Energy Realization Rates



4.1.5.5 Summer Peak Demand Realization Rates

Similar to energy realization rates, summer peak demand realization rates used a rolling sample from 2015-2017. This allowed the summer peak demand realization rate to converge on a track level value with a greater level of confidence. Figure 4-15 shows an increase in the program level summer peak demand realization rate due to a large increase in the custom track demand realization rates.

Figure 4-15: Summer Peak Demand Realization Rates



4.1.6 Retrofit Avoided Greenhouse Gas Emissions

The evaluation team used the IESO CDM Energy Efficiency Cost Effectiveness Tool to calculate avoided GHG emissions. Avoided GHG emissions were calculated for the first year or the 2017 program year and for the lifetime of the measures. Table 4-4 below presents the results of these calculations.

Table 4-4: Retrofit Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided (Tonnes CO_2 equivalent)		
	Electric	Gas*	Total	Electric	Gas*	Total
2017	125,275.92	(30,395.36)	94,880.56	2,174,564.93	(345,528.23)	1,829,036.70

*Based on additional natural gas heating usage from lighting interactive effects

4.1.7 Retrofit Cost Effectiveness

Cost effectiveness (CE) for the 2017 Retrofit FCR Program achieved a TRC ratio of 1.25 and PAC ratio of 4.26 (Table 4-5). Each of these tests exceeded the targets of 1.00 set to determine if a program is cost effective.

Table 4-5: 2017 Retrofit FCR Cost Effectiveness Results

Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	$ 364,616,765
TRC Benefits ($)	$ 454,823,717
TRC Net Benefits ($)	$ 90,206,952
TRC Net Benefit (Ratio)	1.25
Program Administrator Cost (PAC)	
PAC Costs ($)	$ 101,328,008
PAC Benefits ($)	$ 431,543,086
PAC Net Benefits ($)	$ 330,215,078
PAC Net Benefit (Ratio)	4.26
Levelized Unit Energy Cost (LUEC)	
$/MWh	$18.14
$/MW	$111,489

Table 4-6: Cost Effectiveness Comparison

Evaluation Year	TRC Test	PAC Test	Demand LUEC ($/MW)	Energy LUEC ($/MWh)
2017	1.25	4.26	$111,489	$18.14
2016	1.14	2.95	$169,766	$23.02
2015	1.04	2.68	$133,392	$21.20

The 2017 CE results for the TRC and PAC tests extend the continuous improvements that began with the 2016 results (Table 4-6). The improvements from 2016 to 2017 are due to larger average project savings with an 18% increase in the amount of net verified energy savings associated with each completed project, along with a substantial increase (44%) in the average net verified summer peak demand savings per project.

4.1.8 Retrofit Net-to-Gross

NTG observations for the Retrofit Program are provided in the following subsections and detailed observations are provided in Appendix D. Additional details regarding the NTG methodology can be found in Appendix C.

4.1.8.1 Key Observations

- In the absence of program, more participants would have carried out the same upgrade but scaled back its size/extent (27%) or postponed it for more than a year (24%) than those who would have cancelled the upgrade altogether (14%). One-fourth (24%) would have done the exact same upgrade, which is indicative of some level of free-ridership.
- The availability of program incentives (73%) and information from contractors, vendors, or suppliers (66%) were most influential in driving customers to participate in the program.
- The evaluation team derived an overall contractor free-ridership score of 10.6% which indicates that contractors view free-ridership as relatively low—and thus favorable for the Retrofit Program.
- Eleven percent of Retrofit Program participants reported spillover-related projects in 2017. Lighting, lighting controls, and air conditioning replacements above the code minimum were most common among the cases of spillover that Retrofit Program participation produced.
- Twenty-four percent of active non-participants reported spillover-related projects in 2017, with lighting being the most common project type to complete.

4.1.8.2 NTG Strata Level Results

Table 4-7 shows the results of the 2017 Retrofit Program NTG evaluation and the NTG category assignments (e.g., individual, regional, or provincial). Most LDCs (86%) that received individual NTG scores had high or moderate NTG values. Scores ranged from 74.5% to 98.2% (energy savings-weighted means). The province-wide NTG score was also favorable at 89.8%. A smaller percentage of LDCs (14%) received less favorable NTG scores (below 80% NTG), which suggests that room for improvement still exists in terms of reducing free-ridership and ensuring that the customers most in need of the program’s support are identified. The following subsections summarize the analyses done to help interpret those differences.

Table 4-7 NTG Assignments – Retrofit Program

NTG Assignment	Facility LDC Name	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Active Non-part SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Individual	Alectra Utilities Corporation	137	12.2%	1.8%	3.3%	2.01%	91.6%	94.3%
Individual	Atikokan Hydro Inc.	2	26.0%	0.0%	0.0%	2.01%	76.0%	77.2%
Individual	Bluewater Power Distribution Corporation	15	23.4%	3.0%	3.3%	2.01%	81.6%	83.1%
Individual	Burlington Hydro Inc.	17	14.0%	0.0%	0.0%	2.01%	88.1%	89.3%
Individual	Canadian Niagara Power Inc.	24	9.6%	0.6%	1.0%	2.01%	93.0%	94.6%
Individual	E.L.K. Energy Inc.	4	21.2%	0.0%	0.0%	2.01%	80.8%	81.9%
Individual	Energy+ Inc.	33	20.7%	0.0%	1.0%	2.01%	81.4%	83.5%
Individual	Entegrus Powerlines Inc.	24	6.2%	2.3%	6.9%	2.01%	98.2%	103.9%
Individual	Erie Thames Powerlines Corporation	12	14.9%	0.1%	0.4%	2.01%	87.2%	88.7%
Individual	Essex Powerlines Corporation	2	7.5%	0.0%	0.0%	2.01%	94.5%	95.7%
Individual	Festival Hydro Inc.	12	10.9%	0.4%	13.0%	2.01%	91.5%	105.3%
Individual	Greater Sudbury Hydro Inc.	17	19.5%	4.6%	11.5%	2.01%	87.1%	95.2%
Individual	Guelph Hydro Electric Systems Inc.	21	9.4%	2.8%	7.5%	2.01%	95.4%	101.2%
Individual	Hydro One Networks Inc.	218	17.9%	1.9%	1.7%	2.01%	86.0%	87.0%
Individual	InnPower Corporation	3	8.5%	0.0%	0.0%	2.01%	93.5%	94.7%
Individual	Kenora Hydro Electric Corporation Ltd.	3	20.0%	0.0%	0.0%	2.01%	82.0%	83.2%
Individual	Kingston Hydro Corporation	6	12.4%	0.6%	1.4%	2.01%	90.3%	92.2%
Individual	London Hydro Inc.	40	10.4%	4.5%	14.2%	2.01%	96.1%	107.0%
Individual	Milton Hydro Distribution Inc.	6	16.2%	0.0%	0.0%	2.01%	85.8%	87.0%
Individual	Newmarket-Tay Power Distribution Ltd.	11	17.6%	0.0%	0.0%	2.01%	84.4%	85.5%
Individual	Niagara Peninsula Energy Inc.	15	20.4%	0.7%	0.3%	2.01%	82.3%	83.1%
Individual	Northern Ontario Wires Inc.	3	15.9%	0.0%	0.0%	2.01%	86.1%	87.3%
Individual	Orillia Power Distribution Corporation	5	21.2%	0.0%	0.0%	2.01%	80.8%	82.0%
Individual	Renfrew Hydro Inc.	2	23.7%	0.0%	0.0%	2.01%	78.3%	79.5%
Individual	Rideau St. Lawrence Distribution Inc.	2	24.4%	0.0%	0.0%	2.01%	77.6%	78.7%

NTG Assignment	Facility LDC Name	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Active Non-part SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Individual	Sioux Lookout Hydro Inc.	3	6.6%	0.0%	0.0%	2.01%	95.4%	96.6%
Individual	St. Thomas Energy Inc.	2	27.5%	0.0%	0.0%	2.01%	74.5%	75.7%
Individual	Thunder Bay Hydro Electricity Distribution Inc.	16	27.5%	0.0%	0.0%	2.01%	74.5%	75.7%
Individual	Tillsonburg Hydro Inc.	5	6.7%	0.0%	0.0%	2.01%	95.3%	96.5%
Individual	Toronto Hydro-Electric System Limited	133	19.6%	2.8%	3.9%	2.01%	85.3%	87.5%
Individual	Veridian Connections Inc.	34	19.4%	3.7%	4.9%	2.01%	86.3%	88.7%
Individual	Waterloo North Hydro Inc.	25	14.8%	0.2%	0.3%	2.01%	87.4%	88.7%
Individual	Welland Hydro-Electric System Corp.	3	21.4%	0.0%	0.0%	2.01%	80.6%	81.8%
Individual	West Coast Huron Energy Inc.	4	10.6%	0.0%	0.0%	2.01%	91.4%	92.6%
Individual	Westario Power Inc.	10	25.8%	3.0%	2.6%	2.01%	79.2%	80.0%
Individual	Whitby Hydro Electric Corporation	3	12.8%	0.0%	0.0%	2.01%	89.2%	90.4%
Province-wide	29 LDCs[1]	242	22.80%	10.60 %	31.40%	2.01%	89.80%	111.90%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net to gross.

4.1.8.3 Participant Free-ridership

The evaluation team assessed the extent of free-ridership within the program by asking participants a series of questions about their experiences and plans before learning about the program, what they would have done in the absence of the program, and how influential the program was on the participant's decision to do the energy-efficient upgrades.

The survey first asked participants when they first learned they could receive energy-efficiency incentives through the Retrofit Program (Figure 4-16). About three-fourths (76%) reported that they learned about the incentives prior to planning the project, and approximately one-fifth (18%) learned about the incentives after planning but before implementing the project. While this feedback is suggestive of relatively low levels of overall program free-ridership, there were a small percentage of participants who reported learning about the incentives either after initiating but before completing the project (2%) or after

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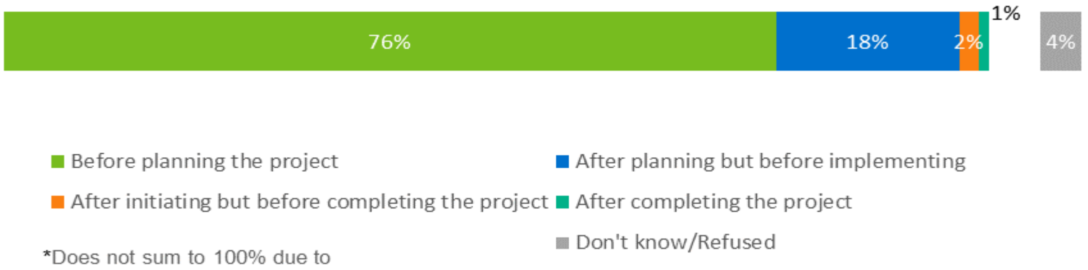
[1] The 29 LDCs that received the Province-wide score for the Retrofit Program include Algoma Power Inc., Brantford Power Inc., Centre Wellington Hydro Ltd., Chapleau Public Utilities Corporation, COLLUS PowerStream Corp., Cooperative Hydro Embrun Inc., EnWin Utilities Ltd., Espanola Regional Hydro Distribution Corporation, Fort Frances Power Corporation, Grimsby Power Incorporated, Halton Hills Hydro Inc., Hearst Power Distribution Company Limited, Hydro 2000 Inc., Hydro Hawkesbury Inc., Hydro Ottawa Limited, Kitchener-Wilmot Hydro Inc., Lakefront Utilities Inc., Lakeland Power Distribution Ltd., Midland Power Utility Corporation, Niagara-on-the-Lake Hydro Inc., North Bay Hydro Distribution Limited, Oakville Hydro Electricity Distribution Inc., Orangeville Hydro Limited, Oshawa PUC Networks Inc., Ottawa River Power Corporation, Peterborough Distribution Incorporated, PUC Distribution Inc., Wasaga Distribution Inc., Wellington North Power Inc.

completing the project entirely (1%). While responses to this question do not directly impact the free-ridership score, they provide additional context for understanding the participants' decision-making.

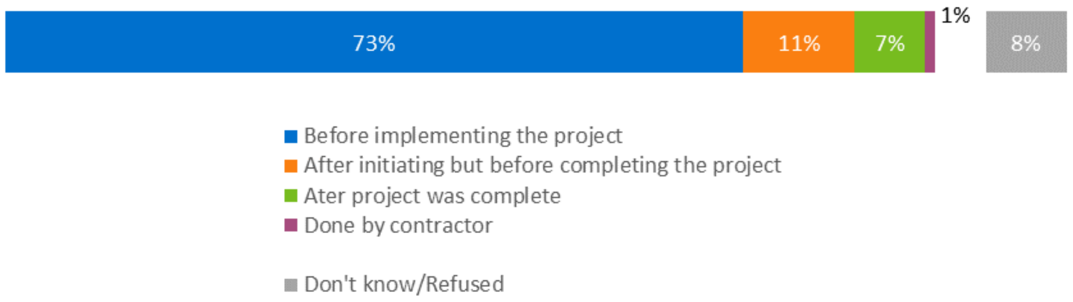
Figure 4-16 When Participants Heard about the Program (n=995)*



*Does not sum to 100% due to rounding.

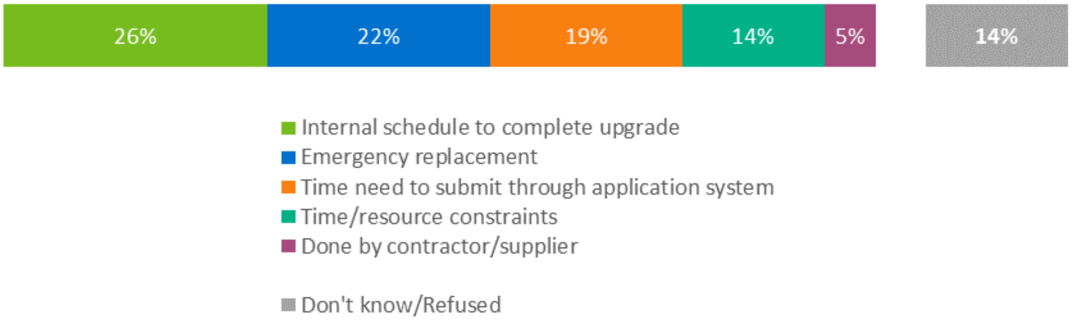
The survey next asked participants about the timing of their application relative to the beginning of their projects. Figure 4-17 shows that nearly three-fourths (73%) said they submitted the application prior to beginning their project. Close to one-fifth (18%) said that their submissions occurred after projects had begun (18%), which may be suggestive of some levels of free-ridership. Like the previous question, this question is not used to calculate free-ridership but is intended to provide additional context around participant intentions.

Figure 4-17 Timing of Retrofit Program Application Submissions (n=580)



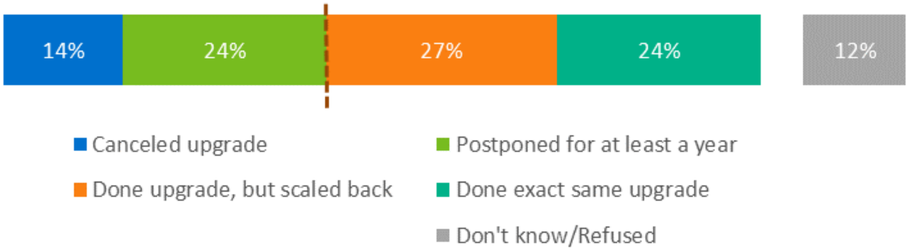
To better understand the reasons some participants applied to the program after beginning or completing their project, the survey asked these participants why they applied when they did (Figure 4-18). One-fourth (26%) reported that an internal schedule to complete the upgrade impelled them to do so. Another two-fifths said they applied due to an unplanned replacement (22%) or wanted to allow enough time to process their application through the program's system (19%). Other time and/or resource constraints at the respondents' organization accounted for one-eighth of responses (14%). This feedback suggests that many of these participants likely would have applied earlier if it had been feasible.

Figure 4-18 Reasons for Beginning Installations before Retrofit Program Application (n=105)



The survey next asked participants to describe what their actions would have been in the absence of the program incentives (Figure 4-19). Close to two-fifths (38%) would have either cancelled the upgrade altogether or postponed it for at least one year. There is some evidence of free-ridership, however, as about one-half (51%) would have either would have done the upgrade though scaled it back (27%) or would have done the exact same upgrade (24%). Responses to this participant intent question along with the later question on program influence are factored into the free-ridership analysis.

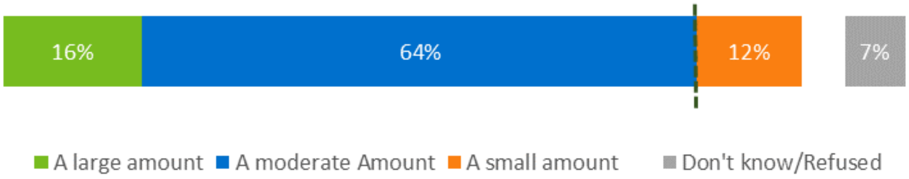
Figure 4-19 Actions in Absence of Program Incentives (n=995)*



*Does not sum to 100% due to rounding.

The survey asked the 27% of participants who would have scaled back their upgrades a follow-up question about the degree of reduction (in size or extent) (Figure 4-20). Four out of five (80%) said the reduction would have either been moderate (64%) or large (16%), which suggests the program was able to help many of these customers increase the size or extent of their projects in ways that they would not have been able to do on their own.

Figure 4-20: Scaled Back Size or Extent of Upgrade in Absence of Program Incentives (n=269)*



*Does not sum to 100% due to rounding.

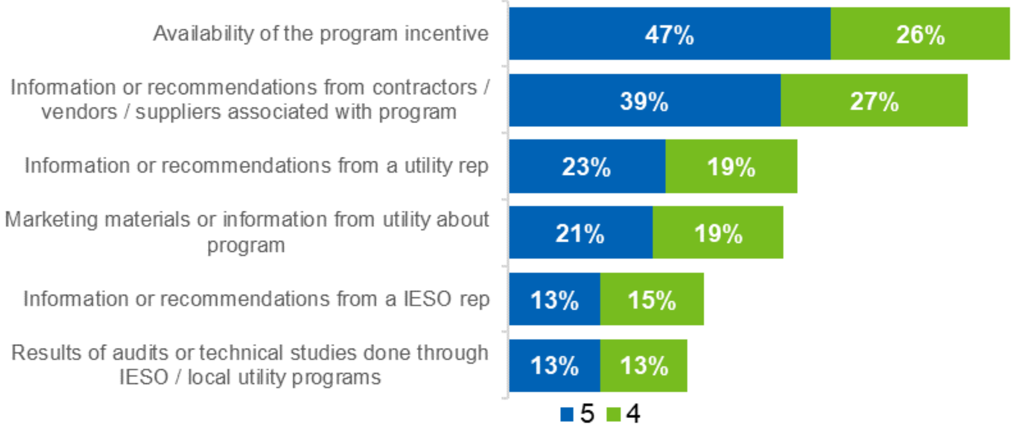
The group of participants who reported that they would have gone ahead with the same upgrade in the absence of program incentives were asked a follow-up question about whether they would have had the funds to do so (Figure 4-21). About two-thirds (67%) definitely would have had the funds, which is indicative of high levels of free-ridership among these respondents.

Figure 4-21: Availability of Funds in Absence of Program Incentives (n=237)

*Does not sum to 100% due to rounding.

Next, the survey asked respondents to use a 1 to 5 scale to rate how influential program features, such as the availability of the incentive, were on their decision to participate in the program (Figure 4-22).[2] Responses to these program influence questions are factored into the free-ridership analysis along with the participant intent questions. The availability of program incentives (73%) and information from contractors, vendors, or suppliers (66%) were most influential to participants. Information from LDC representatives (42%) and LDC marketing materials (40%) formed a second tier of influential factors, followed by information from the IESO (28%) and the results of technical studies through the IESO and/or LDCs (26%).

Figure 4-22: Influence of Program Features on Participation (n=995) (Rating of 4 or 5 on a scale of 1 to 5)



The survey also asked respondents if there were any other factors that played a great role in influencing their organization to carry out energy efficient equipment upgrades (Figure 4-23). Among those responses, two dominant factors emerged: lowering energy bills (31%) and replacing old or failing equipment (19%).

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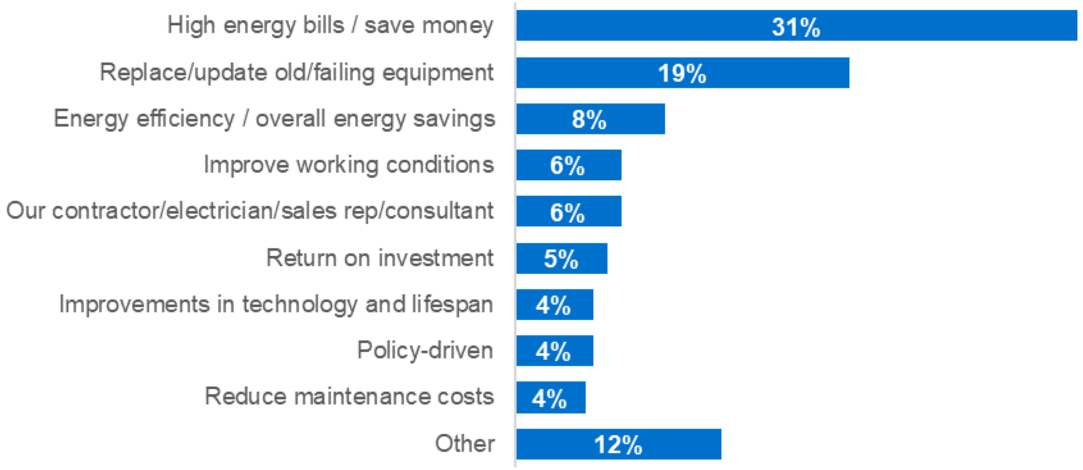
[2] Scale is 1 to 5, where 1 means “not at all influential,” 2 means “not very influential,” 3 means “influential,” 4 means “very influential,” and 5 means “extremely influential.”

Figure 4-23: Other Influential Factors on Upgrade Decision (multiple response allowed; n=226)*



*Does not sum to 100% due to rounding.

In summary, the participant free-ridership results for Retrofit Program participants were mostly positive as nearly two-thirds (65%) of respondents would not have completed an upgrade, would have postponed it, or would have completed a scaled back version of it without program incentives. Still, free-ridership performance could improve in future program years, as roughly one-half (51%) reported that they would have completed the exact same project (24%) or a scaled back version of it (27%) in the absence of the program.

4.1.8.4 Contractor Free-Ridership

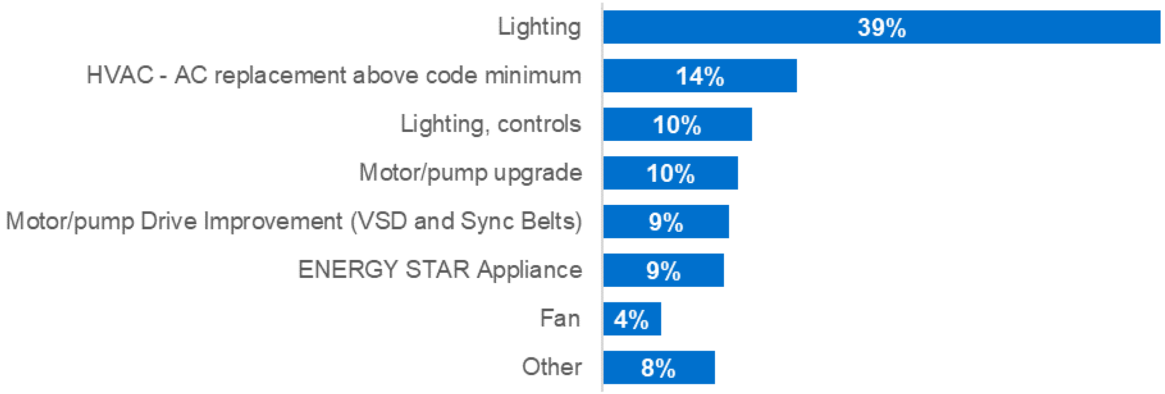
The evaluation team conducted a survey of contractors to better understand their perspectives regarding the extent of free-ridership within the Retrofit Program. The survey asked contractors to estimate the percentage of various equipment types that would have been installed with the same efficiency level had there been no incentive available through the program. The evaluation team derived an overall contractor free-ridership score of 10.6% by taking a project volume-weighted average of individual contractors' scores. Lighting projects were by far the largest contributors to contractor free-ridership. This average value indicates that contractors assess free-ridership to be relatively low—and thus favorable for the Retrofit Program.

4.1.8.5 Participant Spillover

The survey asked Retrofit participants a battery of questions to determine program-related spillover. Less than one-fifth of participants (18%) reported making upgrades after program participation.

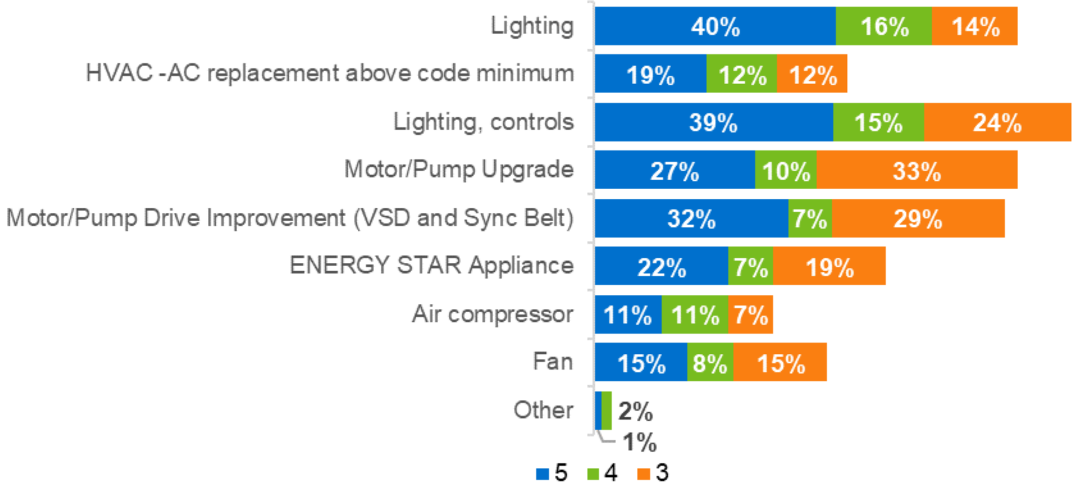
Among those who did perform such upgrades, lighting accounted for about two-fifths of projects (39%). HVAC replacement (14%), lighting controls (10%), motor or pump upgrades (10%), drive improvements (9%), and ENERGY STAR appliances (9%) rounded out the second tier of upgrades (Figure 4-24).

Figure 4-24: Types of Upgrades Conducted After Program Participation (multiple responses allowed; n=177)



The survey next asked participants to use a 1 to 5 scale to rate how influential their earlier involvement with the Retrofit Program was on their decision to implement these equipment upgrades.[3] Figure 4-25 shows that the greatest proportion of equipment upgrades highly influenced by the program were lighting-related. Spillover associated with motor and pump upgrades was less frequent, but a similar percentage of these upgrades was highly influenced by participants' prior experience with the Retrofit Program.

Figure 4-25 : Program Influence on Equipment Installed Outside the Program (multiple response allowed; n=175) (Rating of 3 through 5 on a scale of 1 to 5)



The survey asked participants who indicated that they installed the program-influenced non-incentivized equipment a series of follow-up questions (e.g. capacity, annual hours of operation, etc.). These detailed questions are not displayed here but are instead used within the NTG algorithm to attribute spillover savings to each equipment installation.

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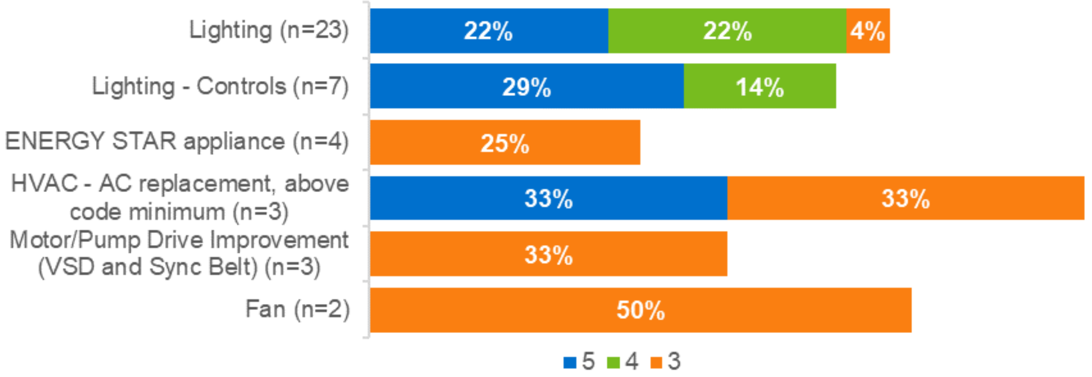
[3] Scale is 1 to 5, where 1 means "not at all influential," 2 means "not very influential," 3 means "influential," 4 means "very influential," and 5 means "extremely influential."

4.1.8.6 Active Non-Participant Spillover

The Active Non-Participant survey assessed the extent of active non-participant[4] spillover. Altogether, about one-third (31%) of active non-participants reported installing or upgrading energy-efficient equipment in 2017 for which they did not receive an incentive, many of which were related to lighting (27%) and/or lighting controls (8%). To assess whether these additional upgrades could be included in spillover estimates for the Retrofit Program, the survey next asked these active non-participants to use a 1 to 5 scale to rate how influential their experience with the program in their decision to do the upgrades (Figure 4-26).[5] Measures are considered program spillover if they receive program influence ratings of 3 or higher. Overall, slightly less than half (46%) of participants who indicated they had installed measures without the program incentive also indicated at least a moderate program influence on their installations across most equipment types. However, only three *types of equipment*—lighting (n=23), air conditioning replacement above the code minimum (n=3), and fans (n=2)—surpassed this threshold. This reported equipment was indicative of active-nonparticipant spillover; the evaluation team calculated the average percent energy and summer peak demand active non-participant spillover of 2.01% and 3.2%, respectively).

Figure 4-26 Program Influence on Equipment Installations Outside of Program
(Multiple response allowed; n=28) (Rating on a scale of 1 to 5)



4.2 Process Evaluation: Retrofit Full Cost Recovery

The following subsections outline the process evaluation results of the Retrofit Program. Responses have been summarized and detailed observations are provided in Appendix I. Additional details regarding the process methodology can be found in Appendix F.

4.2.1 Retrofit Program LDC Staff Perspectives

The following subsections highlight the feedback received from LDC staff about the design and implementation of the Retrofit Program in 2017.

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[4] A Retrofit Program active non-participant is defined as any customer who applied to but did not ultimately participate in the Retrofit Program for reasons other than ineligibility.

[5] Scale is 1 to 5, where 1 means “not at all influential,” 2 means “not very influential,” 3 means “influential,” 4 means “very influential,” and 5 means “extremely influential.”

4.2.1.1 Key Observations

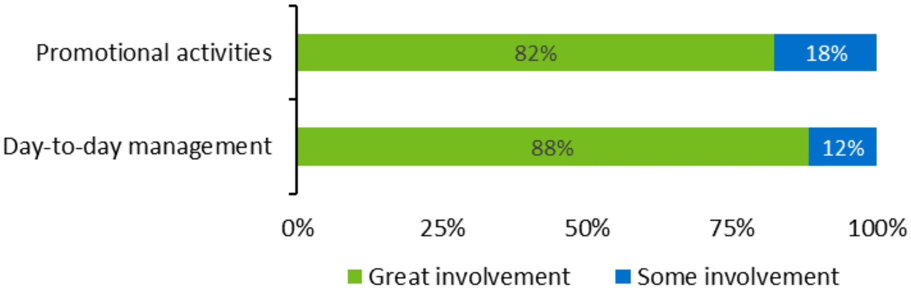
Key observations from the LDC staff survey include the following:

- The Retrofit Program was allocated the highest percent of total resources (61%) dedicated to CFF Business Programs; the LDCs expect the Retrofit Program will achieve 61% of their total expected savings target.
- All LDC staff are involved in the day-to-day management and promotional activities of the Retrofit Program.
- Most LDCs (68%) managed the Retrofit Program by primarily using in-house staff.

4.2.1.2 LDC Staff Involvement

Most LDC staff were greatly involved in the day-to-day management (88%) of and promotional activities (82%) for the Retrofit Program (Figure 4-27). The remaining LDC staff was somewhat involved.

Figure 4-27 Level of LDC Staff Involvement in Retrofit Program Activities (n=34)

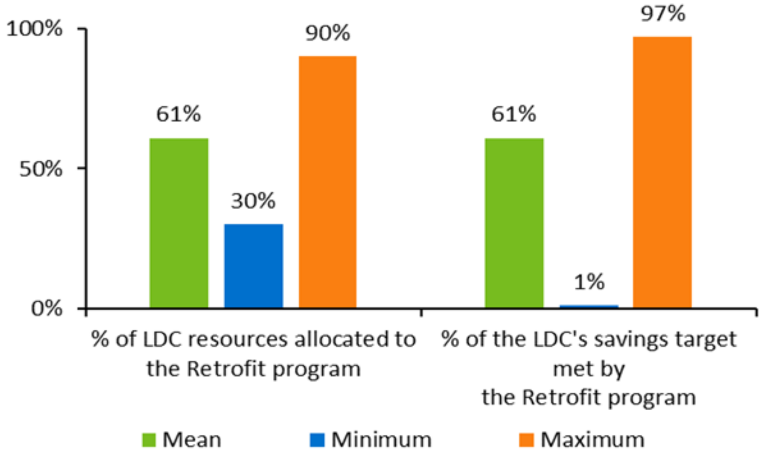


Over three-quarters (82%) of LDC staff expect that in 2018 their LDC will maintain its same level of involvement and engagement in the Retrofit Program, with the remaining 18% expecting to become more involved. As compared to 2016, the 2017 projected level of involvement in the Retrofit Program has seen a significant shift away from expectations of more involvement (44% and 18%, respectively) and towards maintaining the current level of involvement (56% and 82%, respectively). These results may indicate that LDCs have started to find an optimal balance of involvement level and expected savings.

4.2.1.3 Allocated Resources and Expected Savings

The survey asked the LDC staff to estimate the approximate percentage of total resources their LDC allocated to the Retrofit Program in 2017. On average, LDC staff estimated 61% of their LDC's total resources were allocated to the Retrofit Program (Figure 4-28). Responses ranged from 30% to 90% of resources. When asked what percent of their LDC's 2017 savings target would be met by the Retrofit Program, LDC staff estimated an average of 61% with a minimum answer of 1% and a maximum of 97% (please refer to Table 10-1 in Section 10.1.1 for more details).

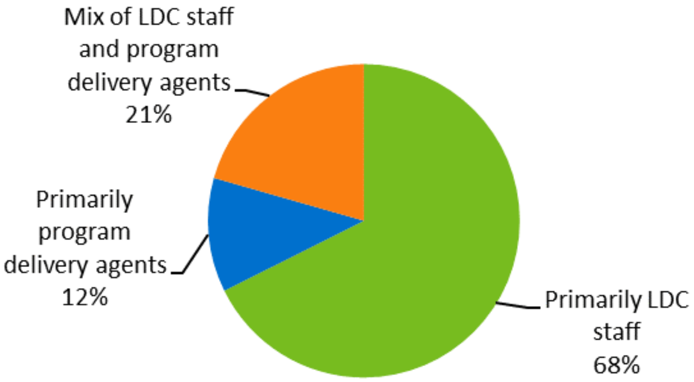
Figure 4-28 Allocated Resources and Expected Savings (n=32)



4.2.1.4 Program Management and Implementation

Most LDCs (68%) managed and delivered the Retrofit Program by primarily using in-house LDC staff (Figure 4-29). The remainder used a mixture of LDC staff and program delivery agents (21%) or went entirely through program delivery agents (12%).

Figure 4-29 Program Management and Delivery (n=34)

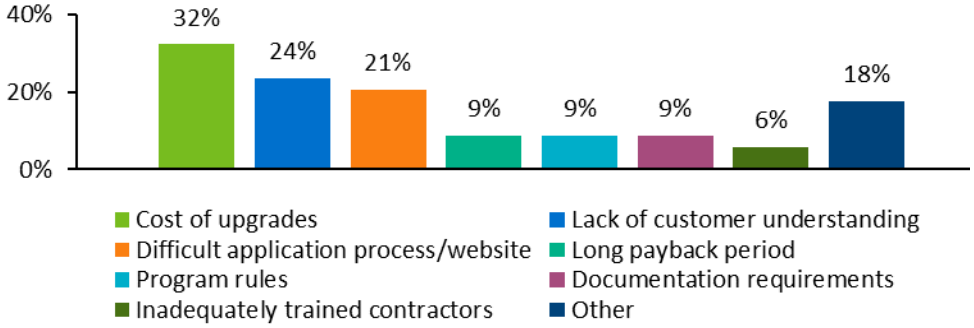


The survey asked LDC staff (n=34) how their LDC managed the contractors that were necessary to conduct any audits and/or installations for the Retrofit Program in 2017. Most commonly, LDC staff indicated that they engaged one contractor who was responsible for all aspects of the program (24%). As compared to 2016, the 2017 results indicate that LDCs are significantly less frequently likely to manage the logistics of multiple contractors on their own (34% and 12%, respectively). These results may indicate that LDCs prefer a single liaison communicating with and managing all contractors.

4.2.1.5 Barriers to Increased Customer Participation

The survey asked LDC staff about the single largest barrier to greater customer participation for each program (Figure 4-30). For the Retrofit Program, the most common responses included the cost of upgrades (32%) and lack of customer understanding (24%). As compared to 2016, the percentages of respondents that mentioned the program rules and documentation requirements increased in 2017 (0% and 9%, respectively).

Figure 4-30 Barriers to Customer Participation (multiple response allowed; n=34)



4.2.1.6 Expected Changes for 2018

The majority (93%) of surveyed LDC staff (n=30) indicated that their LDC's approach to implementing the Retrofit Program in 2018 did not change from 2017. One respondent provided feedback on the changes their LDC has made, indicating that they began targeting customers and technology segments. As compared to 2016, more respondents reported no change to their implementation approach (75% and 93%, respectively) and fewer respondents reported making a change to implementation (38% and 7%, respectively). Results were significantly different across program years. This may indicate that LDCs are more satisfied with the current program and see fewer reasons to make changes to its implementation.

4.2.2 Retrofit Program PDA and TPE Staff Perspectives

The following subsections highlight the feedback received from the program delivery agent (PDA) and technical project evaluator (TPE) staff who provided support to the implementation of the Retrofit Program in 2017. Feedback was received through a web survey that was administered in April 2018. Responses have been summarized and detailed findings are provided in Appendix I. As the sample size of Retrofit PDAs and/or TPEs is small (six respondents), counts are reported instead of percentages.

4.2.2.1 Key Observations

Key observations from PDA and TPE staff survey include the following:

- While all six PDA/TPE respondents reported doing one or more types of customer marketing such as customer calls, advertising, social media marketing, only one out of six firms reported that they actively market the Retrofit program through face-to-face interactions with customers at events.
- Four of the six PDA/TPE respondents thought that customers may need additional support as they likely do not have the time to research the appropriate equipment upgrades and often do not know where to get the help they need to make an educated decision.
- One PDA/TPE firm suggested simplifying the application submission process to increase participation in the program. Another firm suggested revising IESO's iCon database to be more streamlined and accessible.

4.2.2.2 Respondent Roles and LDCs Supported

The six responding PDA and TPEs each supported multiple LDCs in the delivery of the Retrofit Program. The number of LDCs served by these firms ranged from two to eighteen different LDCs (Table 4-8). On average, the respondents served 6.3 LDCs.

Four out of the six firms provided multiple supporting roles to at least some of the Retrofit Program projects completed in 2017. None of the firms who provided multiple services indicated that there were any issues with having multiple roles on a project. As seen in Table 4-8, five out of the six responding firms provided TPE support to the Retrofit Program in 2017, and three provided PDA support. Two out of the six firms also provided assessor or auditor services to the Retrofit Program, in addition to their TPE services. Two out of the six firms provided both PDA and TPE services in support to the Retrofit Program in 2017.

Table 4-8 Roles of PDA and TPE Firms (n=6)

PDA/TPE Respondents	Firm Roles			LDCs Served
	PDA	TPE	Assesor/ Auditor	
Firm 1	--	✓	✓	18
Firm 2	✓	✓	--	6
Firm 3	✓	--	--	5
Firm 4	--	✓	--	4
Firm 5	✓	✓	--	3
Firm 6	--	✓	✓	2

The survey asked respondents who provided PDA services what activities or duties were involved in supporting the Retrofit Program in 2017. All three firms indicated providing customer outreach services. Additionally, one firm scheduled audits. Another firm provided door-to-door marketing, coordinated with installation contractors, and provided industrial/commercial program support.

The survey asked respondents who provided TPE services what activities or duties were involved in supporting the Retrofit Program in 2017. All five firms indicated providing a mix of services as part of their role as a TPE. A review of customer applications for completeness was conducted by all five firms. Three out of the five said they provided detailed review of M&V calculations (Table 4-9).

Table 4-9 Responsibilities of TPE Firms (n=5)

TPE Respondents	TPE Respondents				
	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5
Review applications for completeness	✓	✓	✓	✓	✓
Coordinate with LDCs to verify applications	✓	--	--	--	✓
Ensure applicants follow program rules	✓	✓	✓	--	--
Ensure applicants receive the correct incentive	✓	--	✓	--	--
Detailed review of M&V calculations	✓	--	--	✓	✓
Pre-approve applications	--	--	✓		--
Post installation review	--	--	✓	✓	--
Technical Support	--	--	--	✓	--
Conduct site visits	✓	--	--	--	--

4.2.2.3 Review of Customer Applications

All six Retrofit PDAs and TPEs were responsible for reviewing customer applications for the Retrofit Program. The survey asked respondents if their application review included assessing if the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program. Five out of six respondents indicated making this type of assessment as part of their application review process. One respondent, a TPE, indicated their firm does not make this type of assessment when reviewing customer applications; however, it is possible that the LDC or some other entity performs this level of review.

The survey asked these five respondents to briefly describe how their firm went about assessing if the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program. Three of the five firms indicated verifying that the dates on quotes and/or work invoices are in fact after the project was pre-approved or after the application was submitted to the LDC. One TPE firm provided the following description:

"We verify the estimated project start and installation dates that are entered by the applicant on the Save on Energy website and compare that against the project submission date. This is done to check if the installation was completed [or] will be completed at a future date. Also, if the applicant uploads the invoice we verify to make sure the invoice date post-dates the project submission to make sure of the applicant's intent to participate in the Save on Energy program."

The other two firms indicated a direct engagement with the customer, in addition to verifying the invoice and application dates, to determine program eligibility.

4.2.2.4 PDA and TPE Interactions with LDCs, IESO, and Customers

Interactions and Satisfaction with LDCs: The survey asked Retrofit PDAs and TPEs about the nature or purpose of their interactions with the LDCs when providing support services to the Retrofit Program in 2017. The level of interaction with the LDCs varies greatly depending on the LDC, as well as the specific role of the responding firm. Some TPE firms communicated closely with the LDC on energy savings goals but left the customer outreach and administration functions of the program to the PDA. In contrast, other PDA and/or TPE firms closely communicated with the LDCs throughout the application process. One TPE respondent provided the following description:

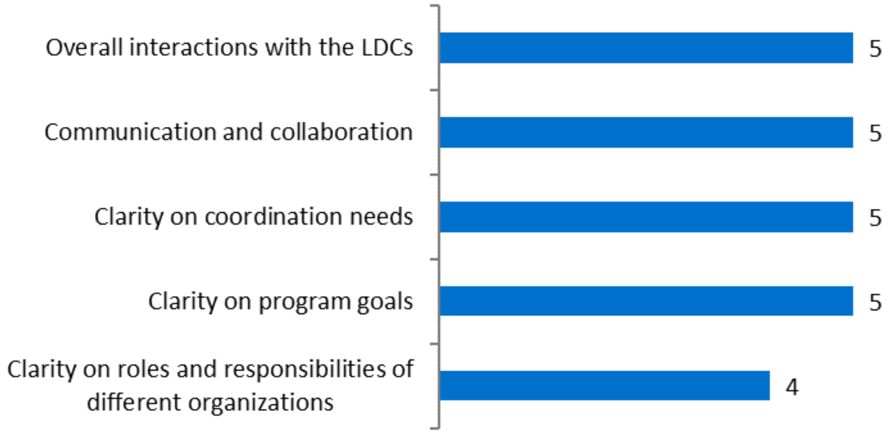
"Typically, we receive emails from the LDC when an application is ready for a pre- or post-project review. We then review the application and send any questions or concerns we have to the LDC. If a site visit is required, we typically have the LDCs coordinate with the applicants to set up an appropriate date and time. When we have finished our reviews, we send the LDC all the required documents and a letter recommending pre-approval or payment of the incentive, depending on the stage of the application."

One-half (3 out of 6) of the firms reported that they interacted with some of the LDCs they support in different ways than others. Differences were due to either providing variations in services to the LDCs, or the levels of support required by an individual LDC. For example, a firm could act as both the PDA and TPE for one LDC but might only provide TPE services for another LDC who may handle their program delivery in-house. One PDA/TPE firm commented:

"We provided a different mix of services for each LDC, so our interaction was different based on the individual requirements [of each LDC]."

The survey asked respondents to rate their level of satisfaction with specific elements of communications with the LDCs on a scale of 1 to 5.[6] Five out of six firms were somewhat satisfied or completely satisfied (rating of 4 or 5) with their overall interactions with the LDCs, level of communication and collaboration, clarity on coordination needs, as well as program goals. Slightly fewer respondents, four out of six, were somewhat satisfied or completely satisfied (rating of 4 or 5) with the clarity on roles and responsibilities of the different organizations involved in administering the Retrofit Program (Figure 4-31).

Figure 4-31 PDA and TPE Satisfaction with LDC Interactions (n=6)
(Rating of 4 or 5 on a scale of 1 to 5)



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[6] Scale is 1 to 5, where 1 means "not at all satisfied," 2 means "somewhat dissatisfied," 3 means "neither satisfied nor dissatisfied," 4 means "somewhat satisfied," and 5 means "completely satisfied."

Two firms indicated that some LDCs are more efficient in their communications than others. One TPE firm explained that some LDCs are "*not quite as effective in terms of organization and relaying information between [the PDA or TPE firm] and the applicants*." For example, the LDC is often the "middleman" between the PDA and/or TPE and the customer. When there is fast and efficient communication, this dynamic can be effective, but when the communication is not as efficient it can hold up the process. This model is likely to be more effective for those LDCs that have many staff dedicated to program management. The second firm indicated that some LDCs are more "*customer focused*" than others.

Program Support Received from the LDCs: The survey asked Retrofit PDA and TPEs what support their firm received from the LDC(s) to help in their role as the PDA and/or TPE in 2017. Over two-thirds (5 out of 6) of firms indicated receiving one-on-one in-person support from the LDC staff (Table 4-10) Two firms indicated that the level of support they received varied depending on the LDC, and that some LDCs were just more involved and worked more closely with the PDAs and TPEs than others.

Table 4-10 Retrofit Program Support Received from LDCs (multiple responses allowed; n=6)

Type of Support	Respondents
Responses to questions	5
One-on-one in-person support from LDC staff	4
Marketing and outreach support	3
Coordination with applicants to gather responses to questions or schedule a site visit	1

PDA and TPE Interactions with the IESO: The survey asked Retrofit PDA and TPEs about the nature or purpose of their interactions with the IESO when providing support services to the Retrofit Program in 2017. Two of the six PDA and TPE firms indicated having direct contact with the IESO regarding their support to the Retrofit Program. These interactions were for clarification on program rules, reassigning applications, reporting, and IT support related to program administration.

The survey asked respondents to rate their level of satisfaction with specific elements of communications with the IESO on a scale of 1 to 5.[7] Both firms reported being somewhat satisfied or completely satisfied (rating of 4 or 5) with all aspects of communications with the IESO including, clarity on program goals, clarity on roles and responsibilities of different organizations, clarity on coordination needs, communication and collaboration, and overall interactions with the IESO.

PDA and TPE Interactions with Customers, Marketing, and Outreach: The survey asked Retrofit PDA and TPEs how frequently their firm interacted directly with customers. Four firms had daily or weekly interactions with customers, and the other two had less frequent bi-weekly interactions with customers.

The survey asked respondents to describe the nature of their interactions with customers. All the firms indicated they typically interacted with customers to provide application support in applying to the Retrofit Program. Other ways in which the respondents reported interacting with customers included performing customer outreach, providing technical support, and conducting site visits.

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[7] Scale is 1 to 5, where 1 means "not at all satisfied," 2 means "somewhat dissatisfied," 3 means "neither satisfied nor dissatisfied," 4 means "somewhat satisfied," and 5 means "completely satisfied."

The survey asked respondents what role their companies played in marketing the Retrofit Program. Almost all (5 out of 6) of the firms made direct calls to potential program participants. Only one firm reported that they actively meet customers face-to-face at events, and another firm leveraged the interactions during the audit and audit report to communicate the potential energy savings (Table 4-11).

Table 4-11 PDA and TPE Retrofit Program Marketing Activities

(Multiple responses allowed; n=6)

PDA/TPE Respondents	Firm Marketing Activities				
	Customer calls	Communicated potential energy savings in audit reports	Attended Events	Social media marketing	Advertisements via television, radio, internet, etc.
Firm 1	✓	--	✓	--	--
Firm 2	✓	--	--	--	--
Firm 3	✓	--	--	--	--
Firm 4	✓	--	--	--	--
Firm 5	✓	--	--	✓	✓
Firm 6	--	✓	--	--	--

The survey asked the responding PDA and/or TPE firms how customers were targeted for participation in the Retrofit Program. Five out of the six firms said the LDC provided a list of potential customers. The sixth firm said their participant list is made up of the customers they provided the energy audit reports for. This TPE respondent said, "*Typically these customers contact us for energy auditing services.*"

4.2.2.5 Perspectives on Motivations, Barriers, and Suggestions for Program Improvement

The survey asked Retrofit PDA and TPEs for their perspective on how influential certain factors were on the customer's decision to install the program-qualifying equipment. Respondents rated the different factors on a scale of 1 to 5.[8] All of the responding PDA and TPE firms indicated the program incentive and ability to save energy or lowering energy bills was very influential or extremely influential (rating of 4 or 5) on the customers decision. Four out of the six respondents indicated that being associated with "green" or "sustainable" actions was very influential or extremely influential (rating of 4 or 5) on their customer's decision to participate (Figure 4-32).

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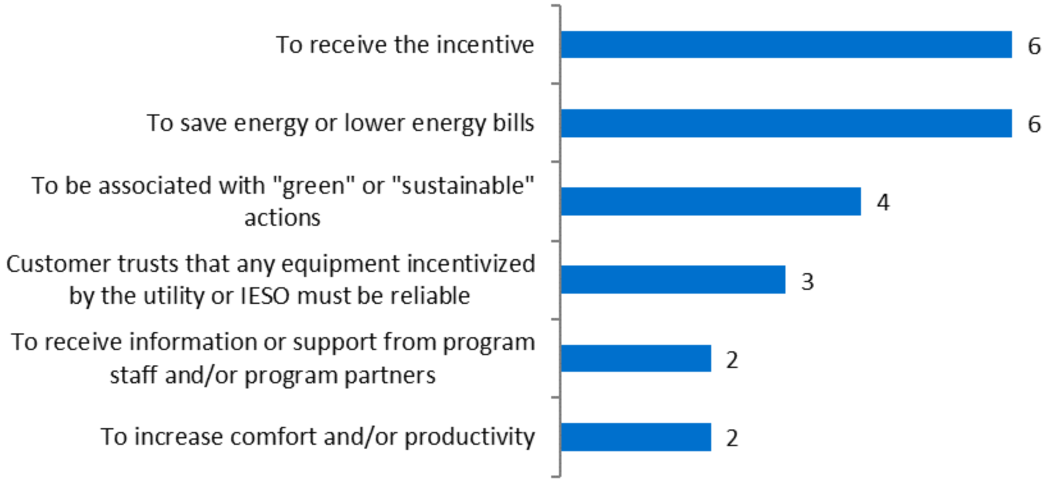
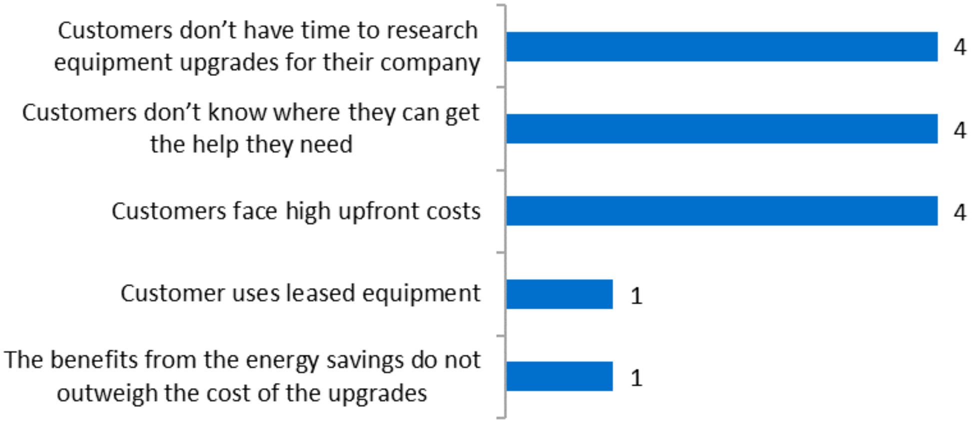
[8] Scale is 1 to 5, where 1 means the factor had "no influence at all," 2 means it was "slightly influential," 3 means it was "somewhat influential," 4 means it was "very influential," and 5 means it had a "extremely influential."

Figure 4-32 PDA and TPE Perspective on Customer Motivation to Install Program-Qualifying Equipment (n=6)
(Rating of 4 or 5 on a scale of 1 to 5)



The survey also asked PDA and TPE respondents what they thought were the primary barriers to increased customer participation. Four of the PDA and TPE respondents thought that customers do not have the time to research the appropriate equipment upgrades, often do not know where to get the help they need, and simply face a high upfront cost (Figure 4-33).

Figure 4-33 PDA and TPE Perspectives on Barriers to Increased Customer Participation (multiple responses allowed; n=6)



The survey asked Retrofit PDA and TPEs if they had any suggestions for improvements to the Retrofit Program. These suggestions are as follows:

- Simplifying application submission (one respondent)
- Revise IESO's iCon database to be more streamlined and accessible (one respondent)

4.2.3 Retrofit Program Contractor Perspectives

The following subsections highlight the feedback received from the Retrofit Program Contractor survey. Responses have been summarized and detailed findings are provided in Appendix I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

4.2.3.1 Key Observations

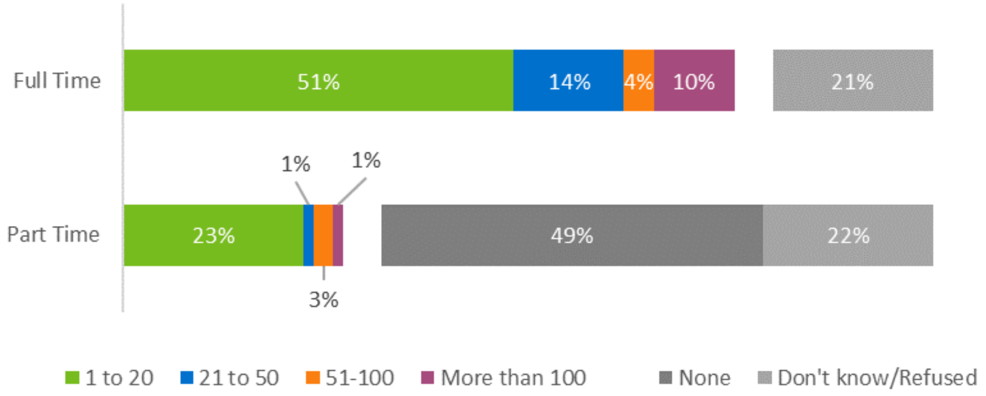
Key observations from contractors' survey include the following:

- Overall, about two-thirds of surveyed contractors (64%) were satisfied with the program.
  - Contractors gave the highest satisfaction ratings for application consistency across LDCs (64%), program training and education (60%), and the dollar amount of the incentives (59%).
  - Contractors were least satisfied with the ease of submitting applications (25%) and the speed of application processing (26%).
- Contractors reported the most frequent sources of awareness of the program to be colleagues and competitors (28%), previous experience with LDC or IESO energy efficiency initiatives (27%) and contact with LDC representatives (20%).
- Roughly one-half of surveyed contractors (54%) reported that less than 25% of their sales were through the program, compared to nearly one-fifth (22%) with more than 50% of sales.
- Nearly three in every four contractors (73%) reported that they had a great deal of influence on customers' decisions to install equipment. This aligns with the finding that most contractors provide a significant amount of support for their clients, with nearly three-fifths (57%) reporting that they typically are responsible for not only installing the equipment but also alerting clients about the program and designing the project on their behalf.
- Lighting, HVAC, and HVAC controls were the most frequent equipment types contractors installed through the program, reporting between 34% and 67% of sales of those equipment types.
- Contractors who participated in program-affiliated projects are more likely to be associated with companies that have fewer than 50 full-time employees (64%) and less than 25 years in business (53%).

4.2.3.2 Firmographics

Over four-fifths of responding Retrofit contractors (83%) provided information about the number of full- and part-time employees at their companies (Figure 4-34). Approximately two out of three (65%) were affiliated with companies having 50 or fewer full-time positions. Most respondents either did not know or did not have part time staff working at their companies, but of those that did, part-time staff positions most often accounted for between 1 to 20 employees (23%).

Figure 4-34 Contractors' Company Full- and Part-time Employees (n=77)



Roughly one-half (53%) of contractors were affiliated with companies that had been in business less than 25 years, and another 31% with companies that had been in business between 26 and 50 years (Table 4-12).

Table 4-12: Contractors' Company Age (n=58)*

Years in Business	Respondents
0-5	12%
6-10	22%
11-25	19%
26-50	31%
51-100	12%
100+	3%

*Does not sum to 100% due to rounding.

4.2.3.3 Company Background and Participation in Retrofit Program

The survey asked Retrofit contractors to provide a description of their company, including the number of projects their company completed in total and for the Retrofit Program in 2017. On average, 60% of all projects that these contractors completed in 2017 participated in the Retrofit Program (Figure 4-35 and Table 4-13). The highest proportion of projects completed through the Retrofit Program was among contractors with ten or fewer projects (n=27), where nine out of every ten projects went through the Retrofit Program. Contractors with larger project volumes reported lower participation rates between 50% and 79%. This suggests that there may be opportunities to promote the program with larger contractors to encourage more of their customers to apply to the program.

Figure 4-35 Average Contractor Project Volume through Retrofit Program (n=74)

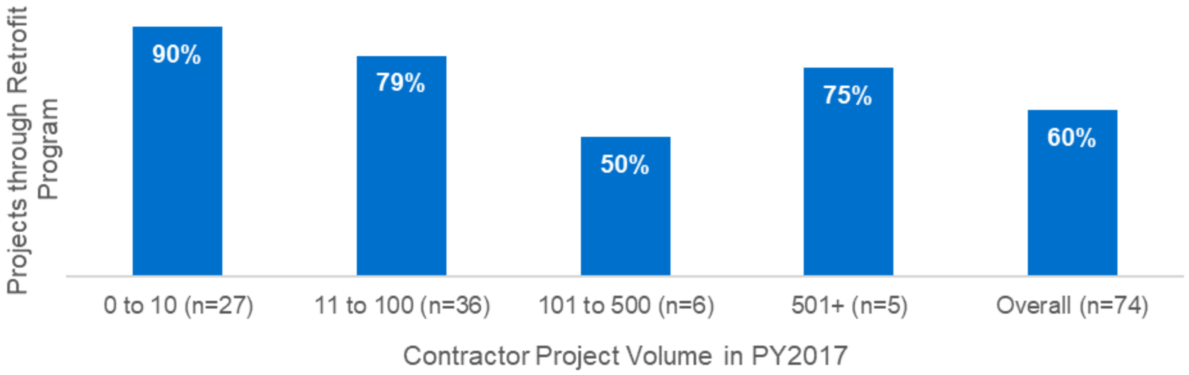


Table 4-13: Contractor Project Volume (n=74)

Projects Per Respondent	Tot. Projects	Retrofit Program Projects	Average Percent Through Program
0-10 (n=27)	115	102	90%
10-100 (n=36)	1,480	1,175	79%
100-500 (n=6)	1,791	646	50%
500+ (n=5)	49,985	29,993	75%
Overall (n=74)	**53,371**	**31,916**	**60%**

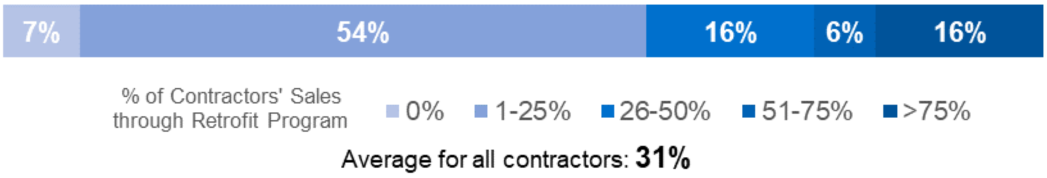
The survey asked contractors to estimate how many of their 2017 Retrofit Program projects went through the prescriptive and custom tracks. Table 4-14 shows that contractors typically reported installing both custom and prescriptive projects, and on average, reported installing their custom projects in similar volumes as prescriptive projects (46% and 42%, respectively). Roughly one-quarter (12%) of respondents did not specify a track.

Table 4-14: Contractor Project Volume through Retrofit Program by Track (n=63)

Track	Total Projects	Respondents
Custom	831	46%
Prescriptive	765	42%
Don’t know	213	12%

Figure 4-36 shows that Retrofit projects made up less than 25% of *project sales* for three-fifths of respondents (61%). By comparison, less than one-fourth (22%) reported that most of their sales passed through the Retrofit Program. This result contrasts sharply with Table 4-13 above which shows that contractors reported 60% of their retrofit projects going through the program. This discrepancy could indicate that even though contractors, on average, completed a majority of their projects through the Retrofit Program in 2017, those projects did not make up the majority of their sales, and this in turn may suggest that some contractors may be completing larger scale or higher revenue projects without applying for incentives through the program.

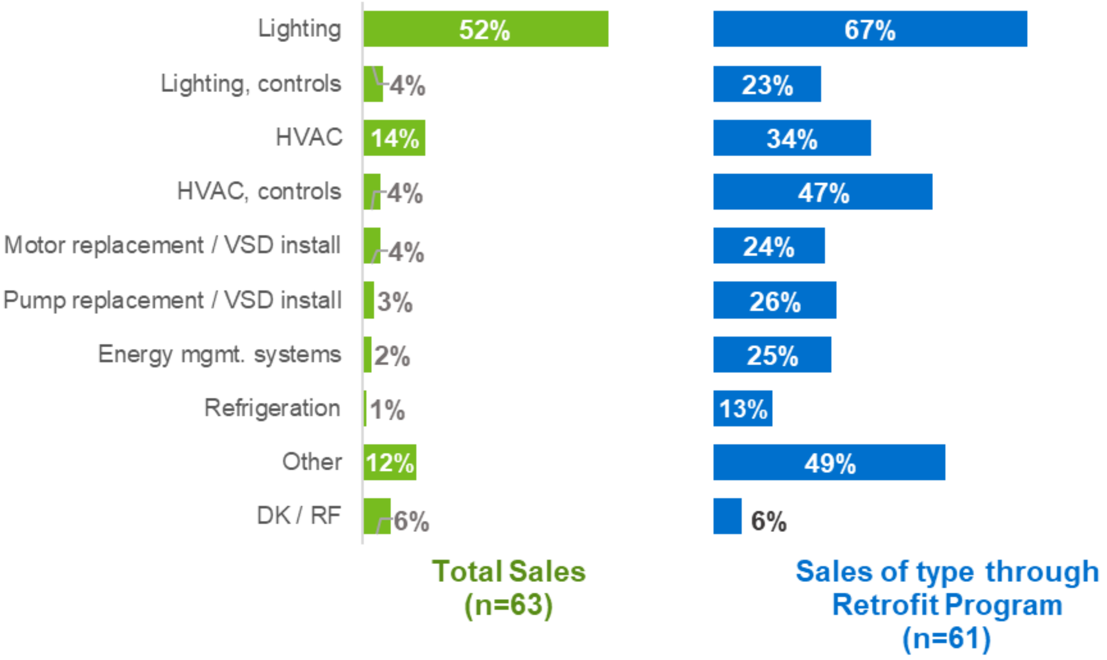
Figure 4-36: Retrofit Projects as Percent of Contractors' Total Sales (n=68)*



*Does not sum to 100% due to rounding.

As seen in Figure 4-37, lighting projects represented the greatest average share (52%) of total sales and highest proportion of projects (67%) through the Retrofit Program. There are sizeable gaps between those values and the next-highest shares of both total sales—HVAC, 14%—and projects through the program (HVAC controls, 47%). Across all equipment types, the share of projects through the program tended to be higher than the corresponding share of total sales; this may suggest that even though an equipment type may not make up a significant portion of a contractor's total sales, the portion that was sold may be trending towards higher efficiency given the percentages being sold through the program. The survey suggested that respondents include compressed air, insulation, shell measures, and process equipment as categories to be grouped as "Other."

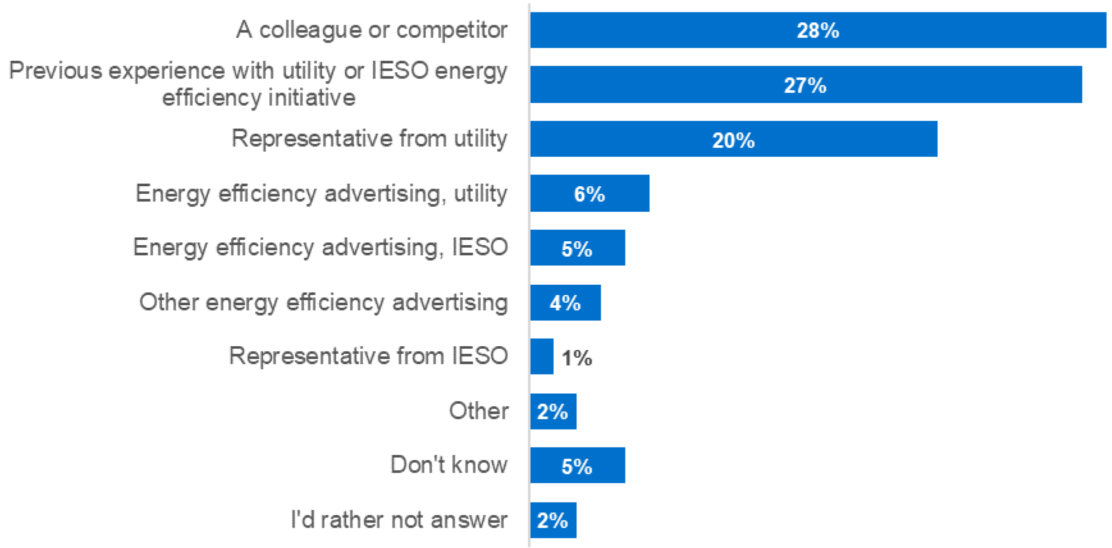
Figure 4-37: Retrofit Contractor Project Sales by Equipment Type*



4.2.3.4 Program Outreach and Marketing

The survey asked contractors to describe how they first heard about the program, and subsequent role(s) in carrying out incentivized retrofits. Figure 4-38 shows colleagues and competitors (28%) alongside previous experience with energy efficiency initiatives (27%) to be the primary sources of contractors' initial exposure to the program. LDC representatives were another frequently cited channel for learning about the program, mentioned by 20% of respondents. They reported comparatively little exposure by way of advertising.

Figure 4-38: How Contractors First Heard about the Retrofit Program (n=85)



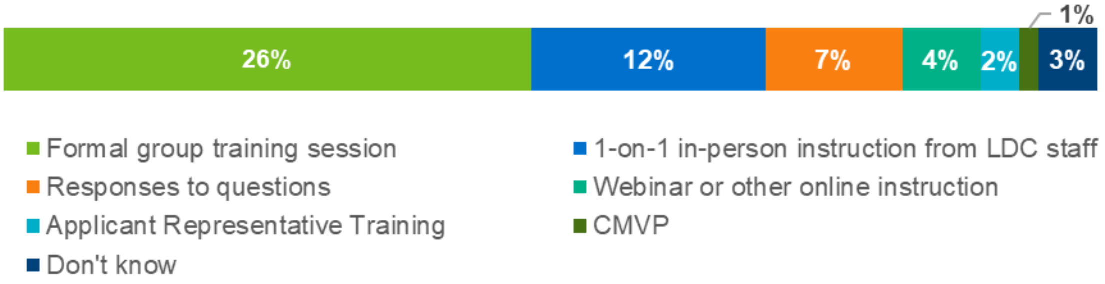
Nearly two-thirds of respondents (65%) reported first learning about the program in 2012 or later, with one-third (33%) having learned about it since 2015 (Table 4-15).

Table 4-15: How Contractors First Heard about the Retrofit Program (n=84)

When did you first hear about the Retrofit Program?	Respondents
2015 and later	33%
2012-2014	32%
2009-2011	17%
Before 2009	7%
Don't know	11%

A slight majority (55%) of respondents received formal training or education through the program; this was a minor though not statistically significant increase from 2016 where 44% of contractors reported receiving formal training. Figure 4-39 illustrates that formal group sessions were the most common form of training, accounting for about half of those who received any training (26%). One-on-one instruction from LDC staff and responses to questions were also mentioned with some frequency (12% and 7%, respectively).

Figure 4-39: Retrofit Contractor Participation in Program Training (Multiple response; excludes respondents with no training; n=85)



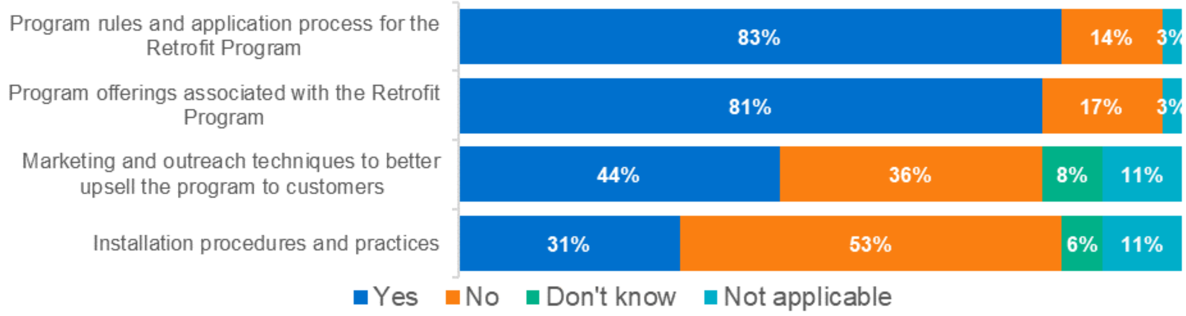
Contractors who had received formal group training and/or online instruction most often cited end-use training and Dollars to $ense Energy Management Workshops as the training or certification path they completed (Table 4-16). Fewer contractors, by comparison, mentioned Certified Energy Manager (CEM) and Certified Measurement and Verification Professional (CMVP) training paths.

Table 4-16: Retrofit Contractors' Energy Management Training and Certification Paths (multiple response allowed; n=28)

What energy management training path or certification did you complete?	Formal group	Formal group + online	Online
Certified Energy Manager (CEM)	2	2	--
Certified Measurement and Verification Professional (CVMP)	2	1	--
Dollars to $ense Energy Management Workshops	5	2	--
End-Use Training	6	2	--
RETScreen Expert Training	1	2	--
Don't know	1	1	1
Not Applicable	10	1	--

As for the content of contractors' training and certification, Figure 4-40 highlights program rules and application processes as the most common topic covered, with over four out of every five (83%) contractors mentioning it. A similar percentage (81%) mentioned that their training consisted of information on Retrofit Program offerings.

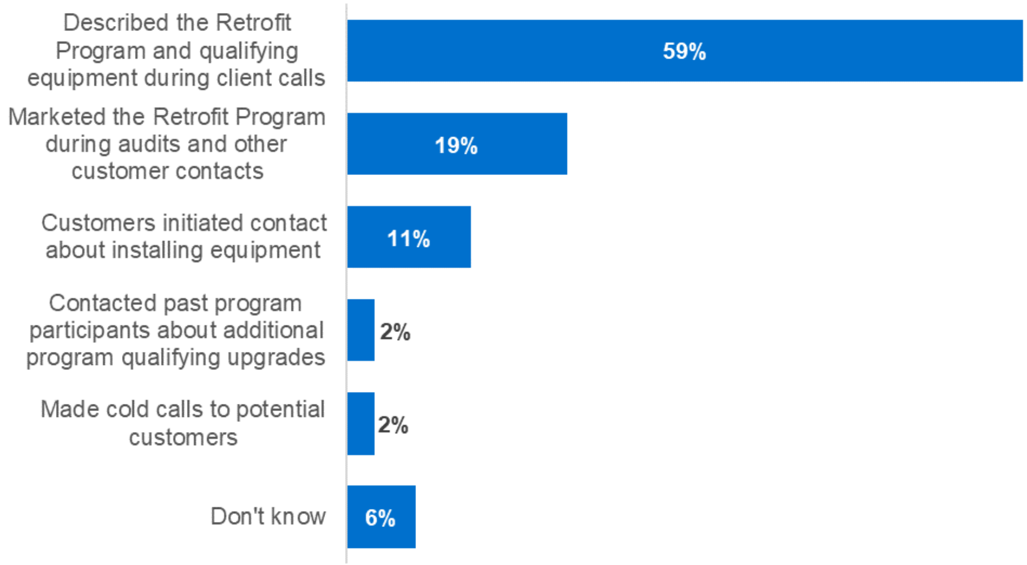
Figure 4-40: Retrofit Contractors' Training Topics (n=36)*



*Some responses do not sum to 100% due to rounding.

As a further step in assessing program outreach, the survey asked contractors how they interacted with customers and informed them about the program. Client calls, though not cold calls, served as the primary means for customers' exposure to the program in most cases (59%), as seen in Figure 4-41. Other customer contacts, including audits, were the main channel for customer participation cited by 19% of respondents. Contractors reported customers initiating contact about equipment installations in only 11% of cases.

Figure 4-41: How Contractors Interacted with Customers (n=83)*

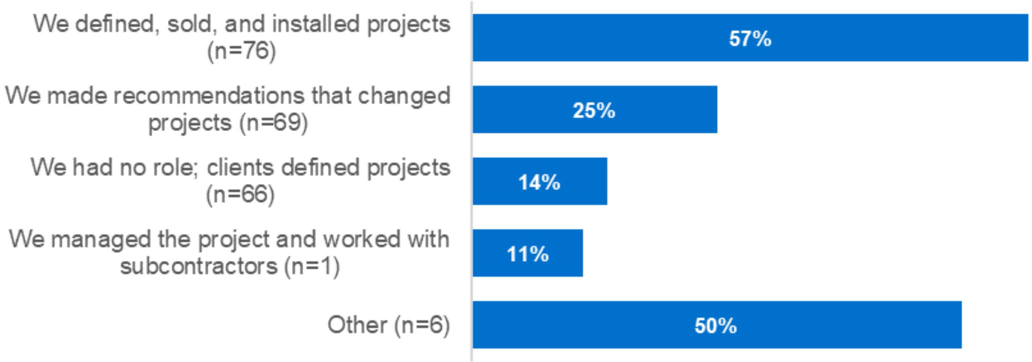


*Does not sum to 100% due to rounding.

The survey asked contractors to use a 1 to 5 scale to rate how influential their advice and recommendations were on their customers' equipment decisions. Most contractors rated their influence on customers' equipment decisions as very influential (40%) or extremely influential (33%).

Figure 4-42 shows contractors’ roles in carrying out retrofits. For most, their primary role—accounting for 57% of projects on average—was defining, selling, and implementing Retrofit Program projects; though some mentioned other roles as well, including making recommendations (25%) and managing subcontractors (11%).

Figure 4-42: Average Distribution of Contractors' Roles in Retrofit Program Projects (multiple responses allowed)



4.2.3.5 Contractor Satisfaction

Retrofit contractors used a scale of 1 to 5 to rate their satisfaction with several aspects of the Retrofit Program (Figure 4-43).[9] Nearly two-thirds (64%) were satisfied with the program as a whole. The highest

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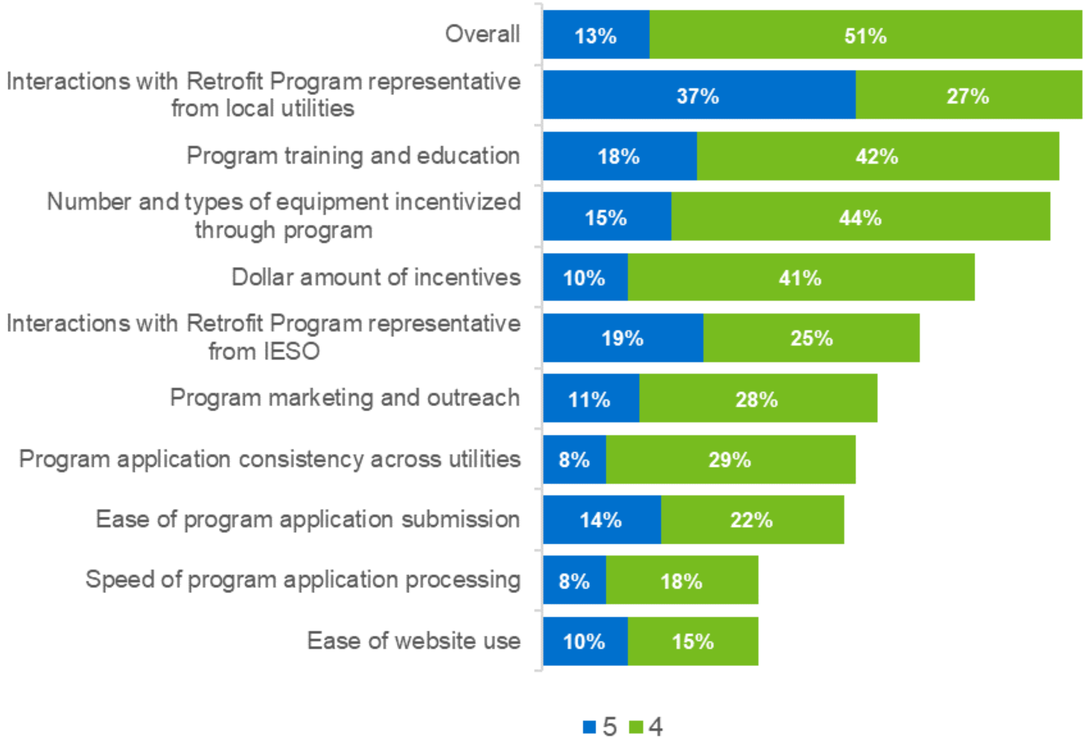
[9] Scale is 1 to 5, where 1 means “not at all satisfied,” 2 means “somewhat dissatisfied,” 3 means “neither satisfied nor dissatisfied,” 4 means “somewhat satisfied,” and 5 means “completely satisfied.”

proportion of 4 and 5 ratings were for interactions with program representatives at LDCs, program training and education, and the number and types of equipment on offer. Satisfaction with the dollar amount of incentives, interactions with IESO representatives, and program marketing was relatively low. Application consistency, speed of application processing, and ease of application submission received neutral or negative ratings from three-fourths of respondents.

Figure 4-43: Contractors' Satisfaction with Different Retrofit Program Aspects (n=79) (Rating of 4 or 5 on a scale of 1 to 5)



4.2.3.6 Suggestions for Program Improvement

Retrofit contractors who reported very low satisfaction for the program overall (ten respondents) provided the following suggestions for program improvement. Given that these suggestions were provided by a small percentage of overall survey respondents, the underlying issues may not be representative the experiences of all contractors; regardless, they may provide general guidance or direction to help improve the program experience for both contractors and participants.

- Improving specific application elements:
  - Making audit, review, and pre-approval process more consistent across different LDCs (three respondents)
  - Reducing turnaround time for audit approval (three respondents)
  - Reducing number of steps / criteria for submitting application (three respondents)
- Simplifying online submission and worksheet processes (seven respondents)
- Reducing website crashes and hang-ups (five respondents)

Other suggested improvements mentioned once include reducing the knowledge gap and realigning incentives between vendors and reviewers; fixing or increasing incentive levels; centralizing the application system; using field experts for application review; allowing for greater reviewer flexibility in assessing project compliance; and for greater customization for non-custom track projects.

Contractors provided the following suggestions for additional equipment types to consider for inclusion in the program. Since most of these measures can be included in the Retrofit Program through the custom track, these suggestions can help begin a conversation with LDCs, contractors, and participants about the feasibility of including these types of equipment in the prescriptive track.

- Controls, sensors, energy management systems (three respondents)
- Solar PV (three respondents)
- Specific LED types (T5s, luminaires) (three respondents)
- Building envelope upgrades, Passivhaus (two respondents)
- Specific lengths (>8') of fluorescent lighting (two respondents)
- Upgrades to reduce number of lamps (one respondent)
- CHP (one respondent)
- Fuel conversion (one respondent)

4.2.4 Retrofit Program Participant Perspectives

The following subsections highlight the feedback received from the Retrofit Program participant survey. Responses have been summarized and detailed findings are provided in Appendix I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

4.2.4.1 Key Observations

Key observations from participants' survey include the following:

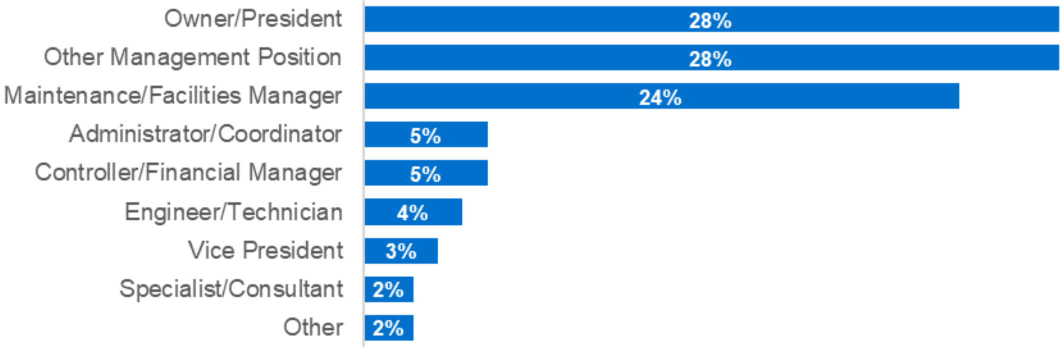
- Overall, about four-fifths of surveyed participants (82%) were satisfied with the program.
  - Participants gave the highest satisfaction ratings for the operational performance of incentivized equipment (87%) and the quality of installer/contractor work (84%).
  - Participants were least satisfied with the time it took to receive the incentive (63%), the dollar amount of the incentive (68%), and the interactions they had with their LDC (69%).
- Nearly half of surveyed participants (43%) reported first hearing about the program through a contractor, equipment vendor, or electrician.
- Participants' awareness of other CFF Business Programs was highest in the case of SBL (57%), but lower than 25% for all others.
- Nearly all surveyed program participants (95%) mentioned saving energy and lowering energy bills as the primary motivator for their participation, followed by increasing comfort and/or productivity at their facilities (59%) and being associated with "green" or "sustainable" actions (53%).
- Retrofit program participants who responded to the survey are more likely to be independent businesses (85%) with fewer than 50 full-time employees (56%).

4.2.4.2 Firmographics

The survey asked participants their position and ownership status at the company, as well as the company's primary activities, chain or franchise status, number of employees, and facility square footage.

More than one-fourth of responses (28%) were from owners and/or presidents of the company, with management-level employees accounting for another 28%, followed by another one-fourth (24%) who specified their roles as maintenance or facilities managers (Figure 4-44).

Figure 4-44 : Titles of Respondent (multiple response allowed; n=994)

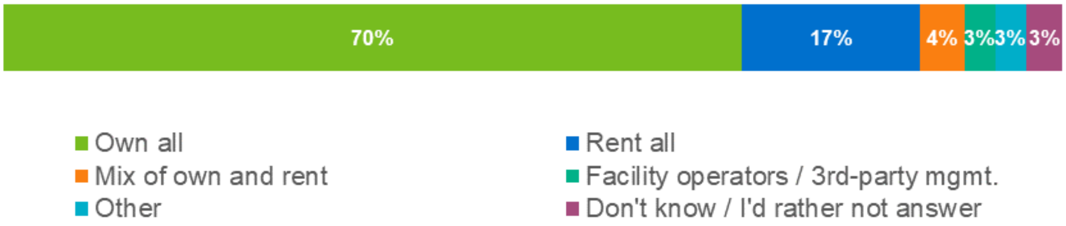


Probing further, the survey asked respondents to describe their level of responsibility for the budget and/or expenditures related to the upgrades or retrofits their company performed. The results in Figure 4-45 show a roughly even split between primary (45%) and shared (48%) responsibility, though nearly one in ten (7%) participants reported no such responsibilities.

Figure 4-45: Responsibility for Budgets and Expenditures (n=995)

When asked about the ownership status at the facility where the upgrades were made, nearly three out of every four participants (70%) in Figure 4-46 reported full ownership of the facility. By comparison, this was about four times the proportion of participants who rented the facility (17%).

Figure 4-46: Ownership Status (multiple response allowed; n=995)*



As seen in Table 4-17 the most common primary activities represented among surveyed participants were manufacturing (13%), warehouse (9%), office (6% large, 5% small), and retail (4% large and 7% small). Government and public administration buildings were also among the more-frequent types surveyed, comprising 5% of those surveyed.

Table 4-17: Primary Activity at Facility(ies) (multiple responses allowed; n=984)

Top 20 Primary Activities at Facilities where Upgrades were Performed	Respondents
Manufacturing	13%
Warehouse	9%
Small Retail	7%
Large Office	6%
Government/public administration	5%
Small Office	5%
Other commercial	4%
Entertainment	4%
Large Retail	4%
Place of Worship	3%
Agricultural	3%
Rental Apartment	3%
Condominium	3%
Office/Professional	3%
Food Retail	2%
School (K-12)	2%
Social Housing Provider	2%
Food sales or service (restaurant, bar)	2%
Hospital	2%
Automotive	2%

The survey also asked participants whether their business was part of a chain or franchise. Overall, less than one-fifth (15%) of participants reported that their businesses were part of one, though it is worth noting the differences between the primary activities of the chain or franchise subgroup and the full sample of businesses. Manufacturing and warehouse facilities top the list in both cases, but retailer, entertainment stores, restaurants, and hotels made up a higher share of program participants at a chain or franchise than in the sample as a whole.

Over one-half (56%) of participants reported that the facilities where upgrades were made had between one and 50 employees, and over one-fourth (29%) had between one and 10 employees. One in five participants (20%) reported that more than 100 employees were located at their facilities.

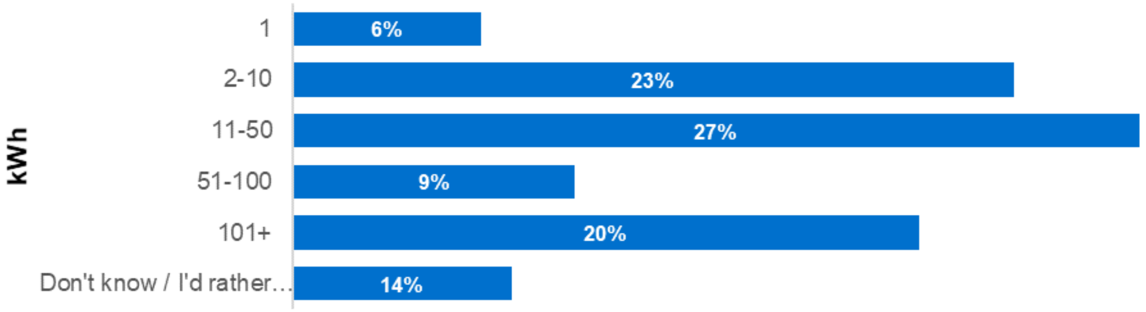
Though about one-half (53%) of the participants who were asked about the square footage of their facility(ies) either did not know or refused to provide an answer, the most frequently cited ranges – provided as an average across multiple facilities – were 50,001-100,000 sq. ft. (13%) and 10,001-25,000 sq. ft. (10%). Relatively few respondents provided total square footage values, but the most frequently cited totals were 1,001 up to 5,000.

Table 4-18: Facility Area (n=995)

Building Area (sq ft)	Respondents
Up to 1,000	2%
1,001 up to 5,000	8%
5,001 up to 10,000	6%
10,001 up to 25,000	9%
25,001 up to 50,000	6%
50,001 up to 100,000	11%
Don't know	45%
Refused	8%

The survey asked participants to provide the average monthly electricity (kWh) consumption at their facilities. Nearly three-fourths (72%) of participants reported not knowing their consumption levels or refusing to answer the question. The most frequently cited consumption range was between 1,001 and 10,000 kWh (10%). From there, the results diverged, with equal numbers of participants in both the 1-1,000 kWh and 100,001-500,000 kWh ranges.

Figure 4-47: Average Monthly kWh Consumption at Facility(ies) (n=995)*

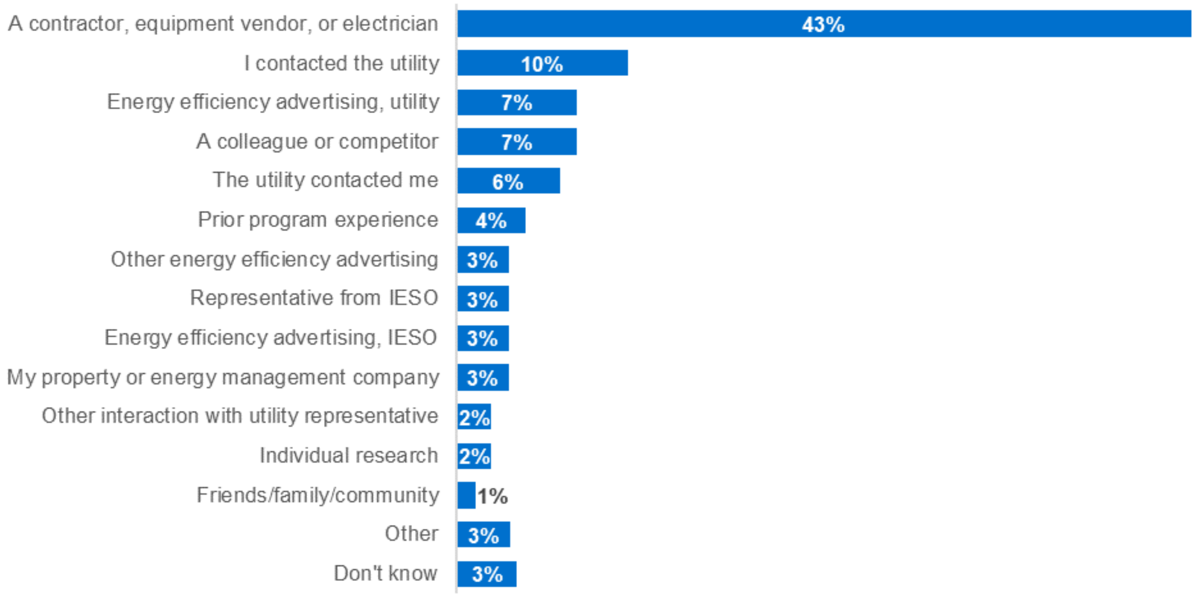


*Does not sum to 100% due to rounding.

4.2.4.3 Program Outreach and Marketing

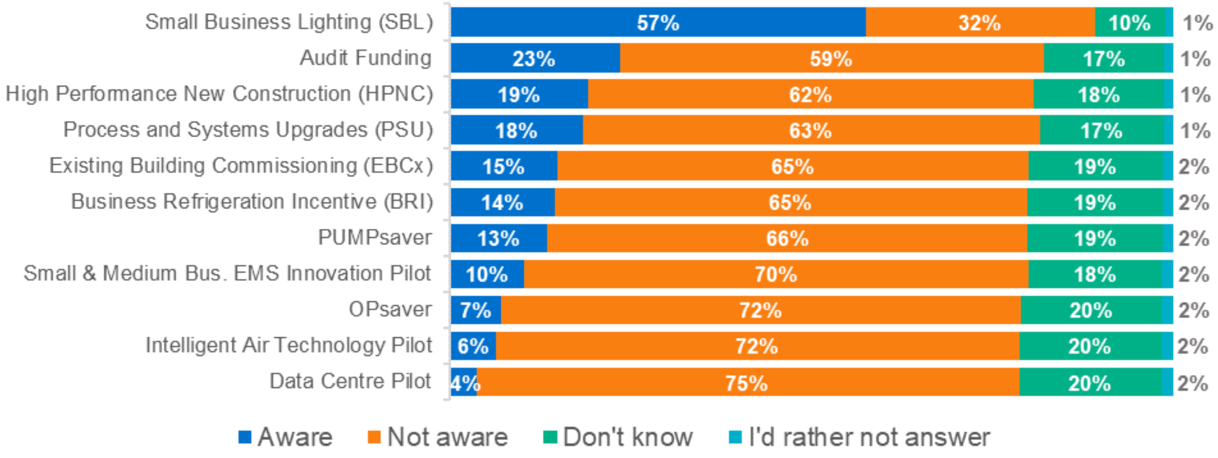
Over two-fifths of Retrofit participants (43%) cited a contractor, equipment vendor, or electrician as the source from whom they first heard about the Retrofit Program—more than four times as often as any other option, including direct communication with LDCs and LDCs' advertising (Figure 4-48). Other program awareness sources that rated high among participants included direct communication to/from their LDC (16%), energy efficiency advertising from their LDC (7%), and colleagues or competitors (7%). Altogether, these results suggest that the strength of the contractor and vendor network is dominant, but it is worth noting more generally that four of the top five responses (66% of all responses) involve some direct communication with the participant, as opposed to advertising. While this feedback suggests that contractors and other vendors are doing a good job of promoting the program to others, it may also suggest that there is likely still room for LDCs and other program delivery partners to further promote the program to customers as well.

Figure 4-48: How Participants First Heard about the Program (n=992)



The survey next asked participants to describe their awareness of other business programs on offer through their LDC. Nearly three-fifths of participants (57%) reported that they were aware of the SBL Program. Audit Funding (23%), HPNC (19%), and Process and Systems Upgrades (18%) filled out a second tier of programs that respondents were aware of, followed by the BRI (14%), PUMPsaver Program (13%), and Small & Medium Business EMS Innovation Pilot (10%). In addition to the programs listed in Figure 4-49, a small number (11 respondents) also referenced the Embedded Energy Manager initiative (now the Energy Manager Program).

Figure 4-49: Awareness of Other Business Programs (n=995)

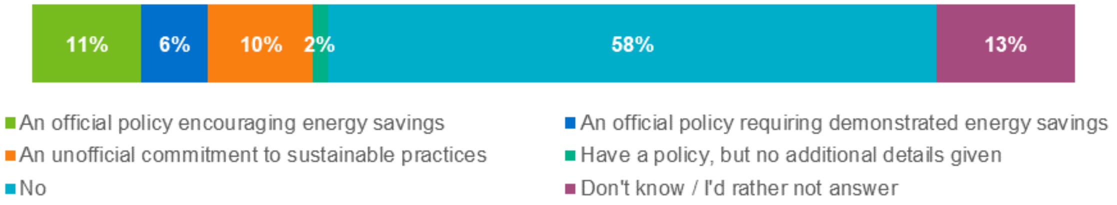


4.2.4.4 Participation Motives and Decision Making

The survey asked all Retrofit participants whether their organization has a policy related to energy efficiency or sustainability and sought more details from those who responded in the affirmative (Figure

4-50). Less than one-third (29%) of all responding participants reported having such a policy, and less than one-tenth (6%) had policies that required demonstrated savings.

Figure 4-50: Sustainability or Energy Efficiency Policy (n=995)



Among respondents who reported official energy reduction targets (n=163), about two-fifths (38%) specified targets between 1% and 5%, roughly equal to the amount who reported no specific targets (42%) (Figure 4-51). Among respondents who provided a time period associated with their policy targets, over one-fourth (28%) cited an annual or bi-annual time period (Figure 4-52).

Figure 4-51 Energy Reduction Target of Sustainability or Energy Efficiency Policy (n=163)

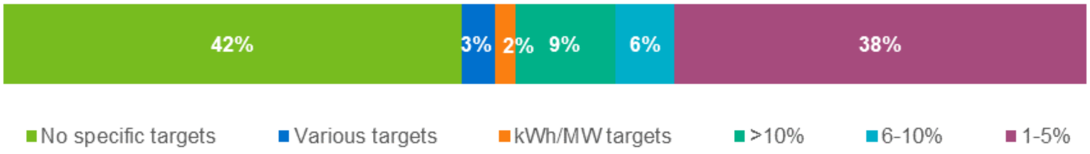
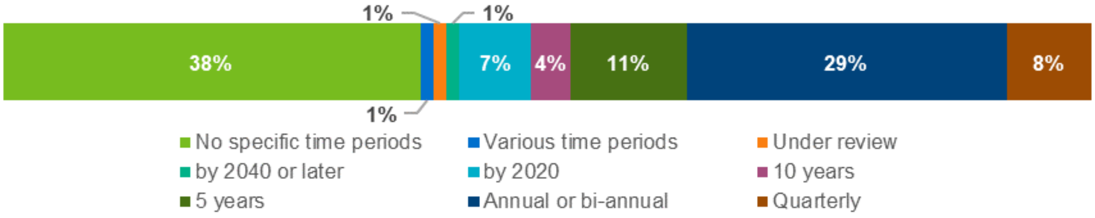


Figure 4-52 Time Period Reduction of Sustainability or Energy Efficiency Policy (n=167)



The survey asked participants to use a 1 to 5 scale to rate several non-program specific factors on their influence in motivating them to become program participants (Compared to 2016 survey results, ratings of 1 for “adherence to a sustainability or energy efficiency policy” decreased significantly, and ratings of 4 for the same category increased significantly—both at the 90% confidence level; this may suggest this factor is becoming more influential on respondents and may in turn be important to speak to in marketing and outreach activities.

Figure 4-53).[10] Nearly all participants (95%) gave a 4 or 5 rating to saving energy and lowering energy bills. About three-fifths gave a 4 or 5 rating to increased comfort and/or productivity (59%); and about one-half (53%) each cited association with “green” or “sustainable” actions and ease of participation.

Compared to 2016 survey results, ratings of 1 for “adherence to a sustainability or energy efficiency policy” decreased significantly, and ratings of 4 for the same category increased significantly—both at the

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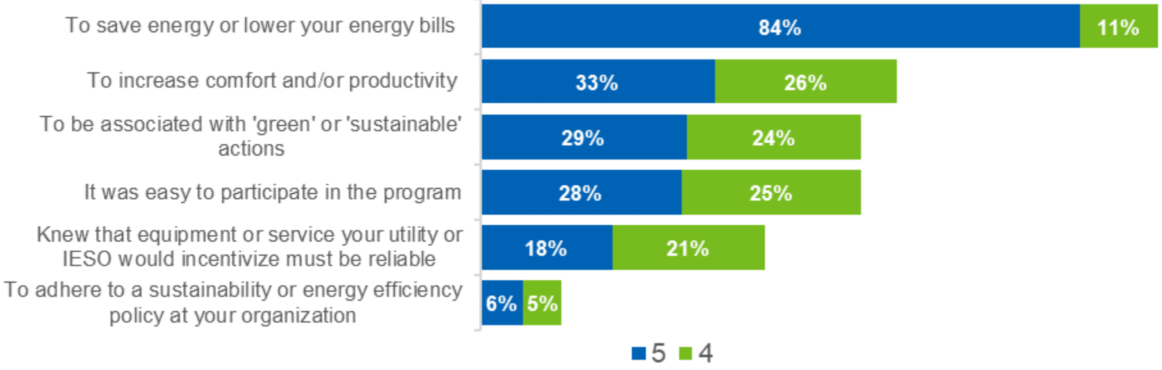
[10] Scale is 1 to 5, where 1 means “not at all influential,” 2 means “not very influential,” 3 means “influential,” 4 means “very influential,” and 5 means “extremely influential.”

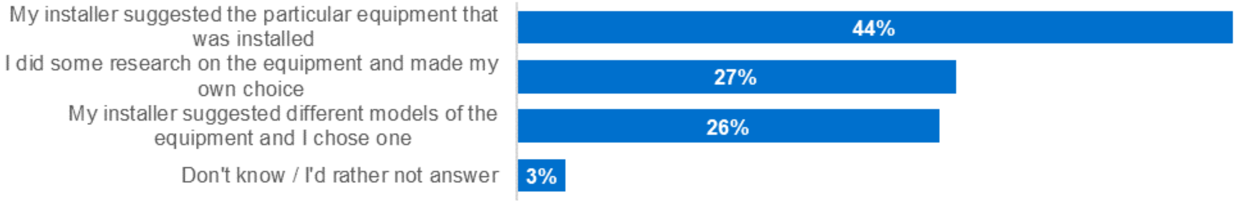
90% confidence level; this may suggest this factor is becoming more influential on respondents and may in turn be important to speak to in marketing and outreach activities.

Figure 4-53: Motives for Participating in the Program (n=995) (Rating of 4 or 5 on a scale of 1 to 5)



Over two-fifths (44%) of participants reported their installer suggested the equipment that was eventually installed, while about one-fourth each either did their own research (27%) or choose from among a few different models that their installer suggested (26%). The results are summarized in Figure 4-54.

Figure 4-54: Equipment Selection (n=995)



4.2.4.5 Participant Satisfaction

The survey asked Retrofit participants to use a 1 to 5 scale to rate the clarity and adequacy of the materials provided to them through the program, as well as the ease of the application process (Figure 4-55).[11] Overall, between over one-half (54%) and over three-fifths (63%) of participants gave ratings of 4 or 5 to the clarity and adequacy of these program components. Respondents did not give overwhelmingly high ratings to any of these categories, which may suggest that an opportunity may exist to better meet customers information and participation decision process needs.

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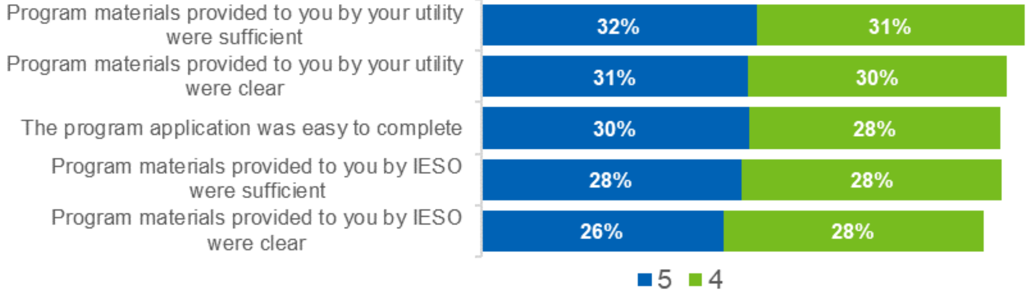
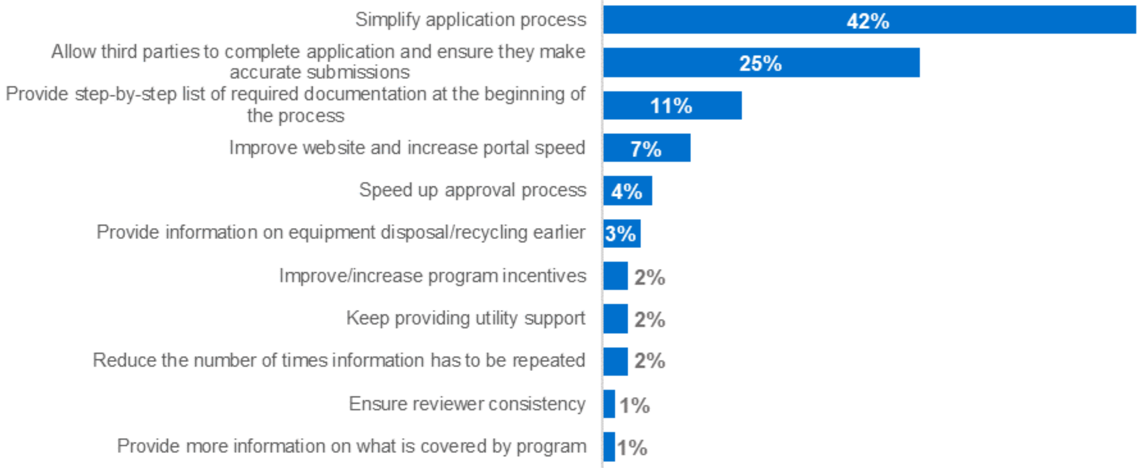
[11] Scale is 1 to 5, where 1 means “do not agree at all,” 2 means “somewhat disagree,” 3 means “neither agree nor disagree,” 4 means “somewhat agree,” and 5 means “completely agree.”

Figure 4-55: Assessment of Program Materials and Application Process (n=995) (Rating of 4 or 5 on a scale of 1 to 5)



Participants who provided low ratings for the application process or the program materials had the opportunity to provide feedback on possible improvements to that process or those materials. Among their responses, a few themes emerged, summarized in Figure 4-56 and Table 4-19. The most frequent suggestions related to the application process were to simplify it overall (42%); to allow third parties to complete the application (along with some process for ensuring the accuracy of their submissions) (25%); to provide clearer steps for completing the application (11%); and to improve the speed / ease of use of the portal that customers use (7%).

Figure 4-56: Program Application Process Recommendations (open end response; n=62)



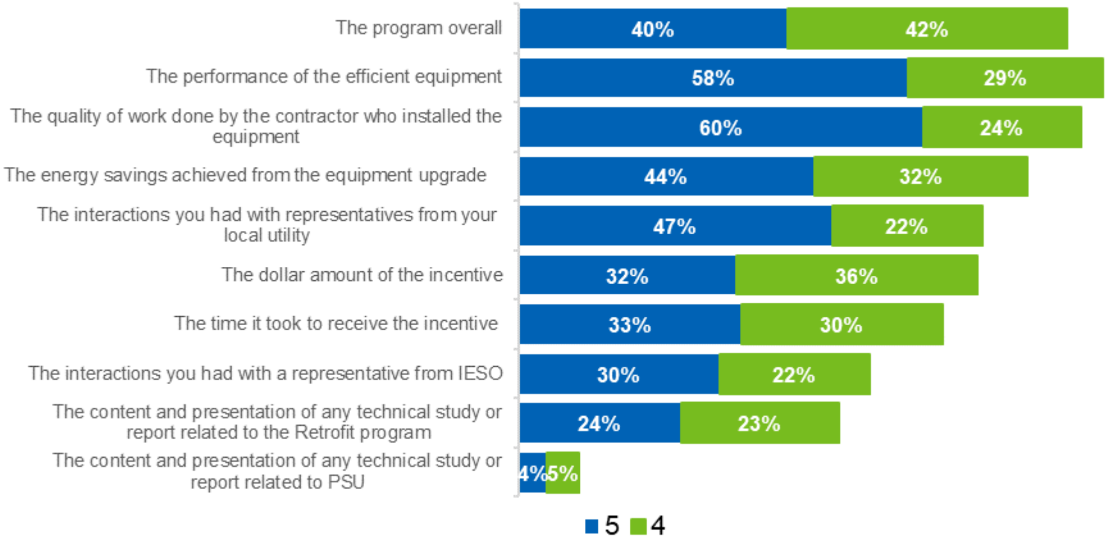
Suggestions for improving program materials were similar, emphasizing simpler, less-frequent materials (7) and more processes for ensuring information from vendors (such as contractors and suppliers) and LDCs do not conflict (4).

Table 4-19: Program Material Recommendations (open end response; n=18)

Program Material Suggestions	Respondents
Reduce frequency and simplify materials	7
Ensure information from LDC and vendors do not conflict	4
Ensure delivery of materials	3
Include customer project number or reference number on any program materials shared with customer after the project is initiated	3
Reduce frequency of mailers	1

Next, the survey asked participants to use a 1 to 5 scale to rate their satisfaction with the program, both overall and with several non-program specific elements (Figure 4-57).[12] Altogether, more than four-fifths of participants (82%) rated the program overall a 4 or 5. Two factors—equipment performance (87%) and quality of contractor/installer work (84%)—were rated even more highly, followed by the energy savings achieved from the upgrade (76%). These results are quite similar to results from 2016.

Figure 4-57: Participant Satisfaction (n=995)
(Rating of 4 or 5 on a scale of 1 to 5)



Participants who provided a low rating for the program overall had the opportunity to provide feedback on possible improvements to the program. Table 4-20 summarizes the most common responses.

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[12] Scale is 1 to 5, where 1 means “not at all satisfied,” 2 means “somewhat dissatisfied,” 3 means “neither satisfied nor dissatisfied,” 4 means “somewhat satisfied,” and 5 means “completely satisfied.”

Table 4-20: Suggestions for Program Improvement (open end response; n=25)

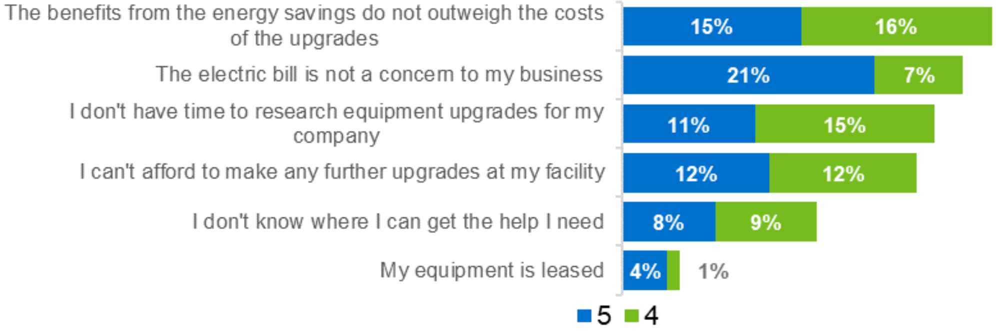
Program Improvement Suggestions	Respondents
Simplify application process	7
Offer multi-lingual service	6
Allow third parties to complete application and ensure they make accurate submissions	4
Reduce the number of times application information must be repeated	3
Provide step-by-step list of required documentation at the beginning of the process	2
Provide information on equipment disposal/recycling earlier	2
Improve/increase program incentives	1

The survey also asked participants to use a 1 to 5 scale to rate the likelihood that they would recommend the program to others.[13] Roughly nine in every ten participants (91%) said they were somewhat likely or extremely likely to recommend the program to others, with two-thirds (69%) indicating they were extremely likely.

4.2.4.6 Barriers to Future Participation

The survey asked participants to use a 1 to 5 scale to rate how relevant several barriers were to their ability to make future energy efficient upgrades.14 Altogether, none of the factors listed in Figure 4-58 received ratings of 4 or 5 from more than one-third of participants, which may suggest these barriers may not be impediments for many respondents. Regardless, between one-fourth and one-third of participants cited costs outweighing the benefits from energy savings (31%), electric bills not being a concern (28%), not having time for research (26%), and/or not being able to afford further upgrades (24%).

Figure 4-58: Barriers to Future Participation (n=995)
(Rating of 4 or 5 on a scale of 1 to 5)



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[13] Scale is 1 to 5, where 1 means “extremely unlikely,” 2 means “somewhat unlikely,” 3 means “neither likely nor unlikely,” 4 means “somewhat likely,” and 5 means “extremely likely.”

[14] Scale is 1 to 5, where 1 means “not at all relevant,” 2 means “slightly relevant,” 3 means “somewhat relevant,” 4 means “very relevant,” and 5 means “extremely relevant.”

4.2.5 Retrofit Program Active Non-Participant Perspectives

The following subsections highlight the feedback received from the Retrofit Program active-nonparticipant[15] survey. Responses have been summarized and detailed findings are provided in Appendix I for selected questions. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

Key observations from active non-participants' survey includes the following:

- One in three (33%) active non-participants heard about the Retrofit program through a contractor or vendor. About half as many (15%) heard about it through their LDCs' energy efficiency advertising.
- Upgrading to more energy-efficient equipment (87%) or higher quality equipment (80%), as well as saving energy (86%) and keeping energy bills low (82%), were the most influential factors in active non-participants' decision to apply to the program.
- The inadequacy of incentives relative to required time and effort (40%), high project costs (32%), and a time-consuming or burdensome application process (33%) were the most influential factors in active non-participants' decision to discontinue participation in the program.
- When asked how likely they would be to participate in the program in the future, three-fifths of active non-participants (60%) indicated future involvement was either extremely likely (42%) or likely (18%).
- Active non-participants typically owned the facilities where the upgrades would have been made (75%) and were typically not part of a chain or franchise (85%).
- Primary activities conducted at the facilities were mixed, with manufacturing and agriculture making up the greatest percentages (16% and 13%, respectively).

4.2.5.1 Firmographics

Three of four Retrofit active non-participants (75%) reported that they owned the facilities where they would have made upgrades through the Retrofit Program while approximately one-sixth (16%) were renting the facilities.

Table 4-21: Ownership Status (n=55)*

Status	Respondents
Own all	75%
Rent all	16%
Mix of own and rent	4%
Other	4%
Refused	2%

*Does not sum to 100% due to rounding.

As seen in Table 4-22, four primary activity categories—manufacturing, agriculture, office, and warehouse—accounted for half (51%) of all reported activity types. The top ten activities covered 89% of reported activity types.

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[15] A Retrofit Program active non-participant is defined as any customer who applied to but did not ultimately participate in the Retrofit Program for reasons other than ineligibility.

Table 4-22: Top Ten Primary Activities at Facilities (multiple response allowed; n=54)

Primary Activity	Respondents
Manufacturing	16%
Agriculture, Farming	13%
Office/Professional	11%
Warehouse, Storage	11%
Lodging	8%
Real Estate/Property Management	8%
Non-Food Retail	6%
Wholesale Trade	6%
Government/Public Administration	5%
Healthcare	5%

Table 4-23 shows that nearly seven out of every eight (85%) respondents did not work for a chain or franchise.

Table 4-23: Chain or Franchise Status (n=55)

Chain or Franchise?	Respondents
Yes	11%
No	85%
Refused	4%

As seen in Table 4-24, a majority (69%) of respondents reported that the facilities where upgrades would have been made had between 1-50 employees and over two-fifths (45%) had between 1-10 employees. One in five respondents (21%) reported that more than 100 employees were located at their facilities.

Table 4-24: Employment Count (n=37)

Number of Employees	Respondents
1	11%
2-10	34%
11-50	24%
51-100	11%
101+	21%

Though nearly two out of three (64%) respondents asked about the square footage of their facility(ies) either did not know or refused to provide an answer, the most frequently cited total areas were between 25,001 up to 50,000 sq. ft. (10%) and 50,001 up to 100,000 sq. ft. (6%) (Table 4-25). A few respondents provided average square footage values of 1,000 up to 5,000 sq. ft. (2%) and 10,001 up to 25,000 (1%) across multiple facilities.

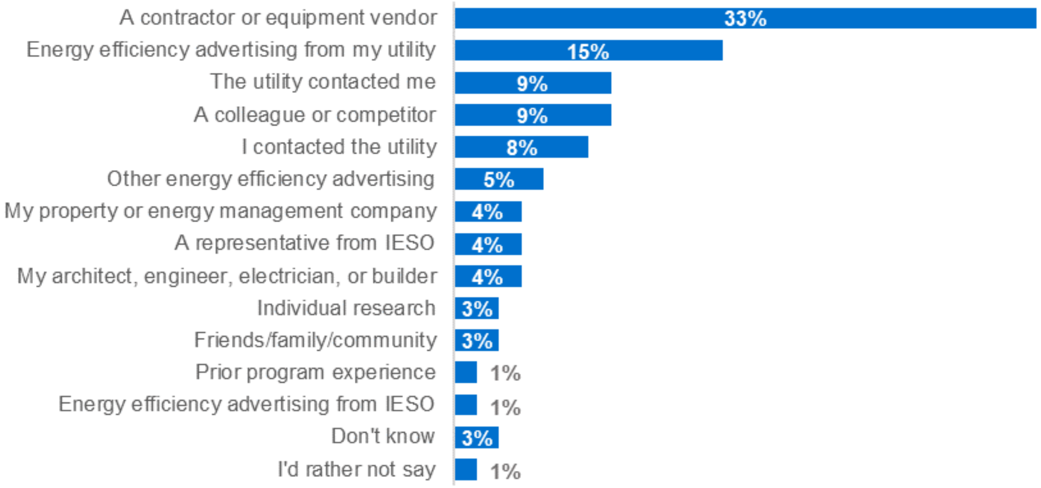
Table 4-25 Facility Area (n=52)

Building Area (sq ft)	Respondents
1,000 up to 5,000	5%
5,001 up to 10,000	2%
10,001 up to 25,000	4%
25,001 up to 50,000	10%
50,001 up to 100,000	6%
100,001 up to 500,000	4%
500,001 or more	1%
Don’t know	54%
Refused	10%

4.2.5.2 Deciding to Apply

Retrofit active non-participants described how they initially heard about the program. Figure 4-59 show that contractors and/or equipment vendors were the main channels for exposure to the program (33%), followed by LDC advertising (15%), a LDC representatives contacting them (9%), and colleagues or competitors (9%).

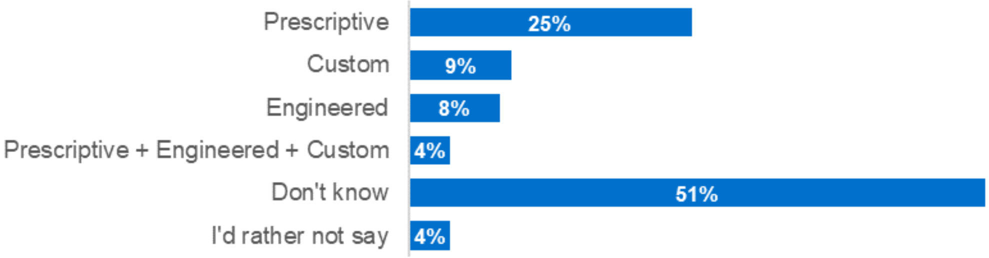
Figure 4-59: How Active Non-Participants First Heard about the Program (n=80)*



*Does not sum to 100% due to rounding.

As seen in Figure 4-60, only a minority of active non-participants surveyed could recall what track(s) they considered applying for, with the prescriptive track cited most frequently (25%). Meanwhile, about half (51%) of the responses to this question were “Don’t know.”

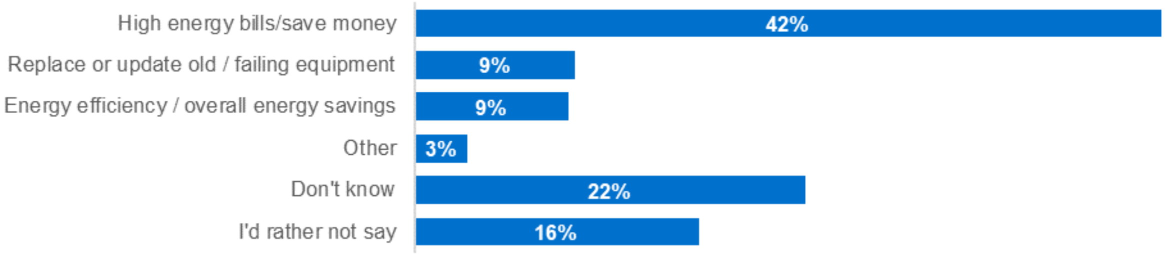
Figure 4-60: Retrofit Program Project Tracks among Active Non-Participants (n=79)*



*Does not sum to 100% due to rounding.

When asked an open-ended question about the primary motivating factors behind their applications to participate in the program, a clear plurality (42%) of respondents in Figure 4-61 cited high energy bills and saving money. In comparison, this was nearly five times the number of respondents who referenced the need to replace or update equipment (9%), or the number who cited energy efficiency or energy savings (9%).

Figure 4-61: Primary Influence on Active Non-Participants' Decision to Apply*
(open end response; n=7)



*Does not sum to 100% due to rounding.

This is corroborated by respondents' answers when asked to use a scale of 1 to 5 to rate the influence of specific factors on their decision to apply to the program.[16] Figure 4-62 shows that about three of every four respondents rated a saving energy and keeping energy bills lows as highly influential. The same share of respondents also rated upgrading to more energy efficient equipment as highly influential.

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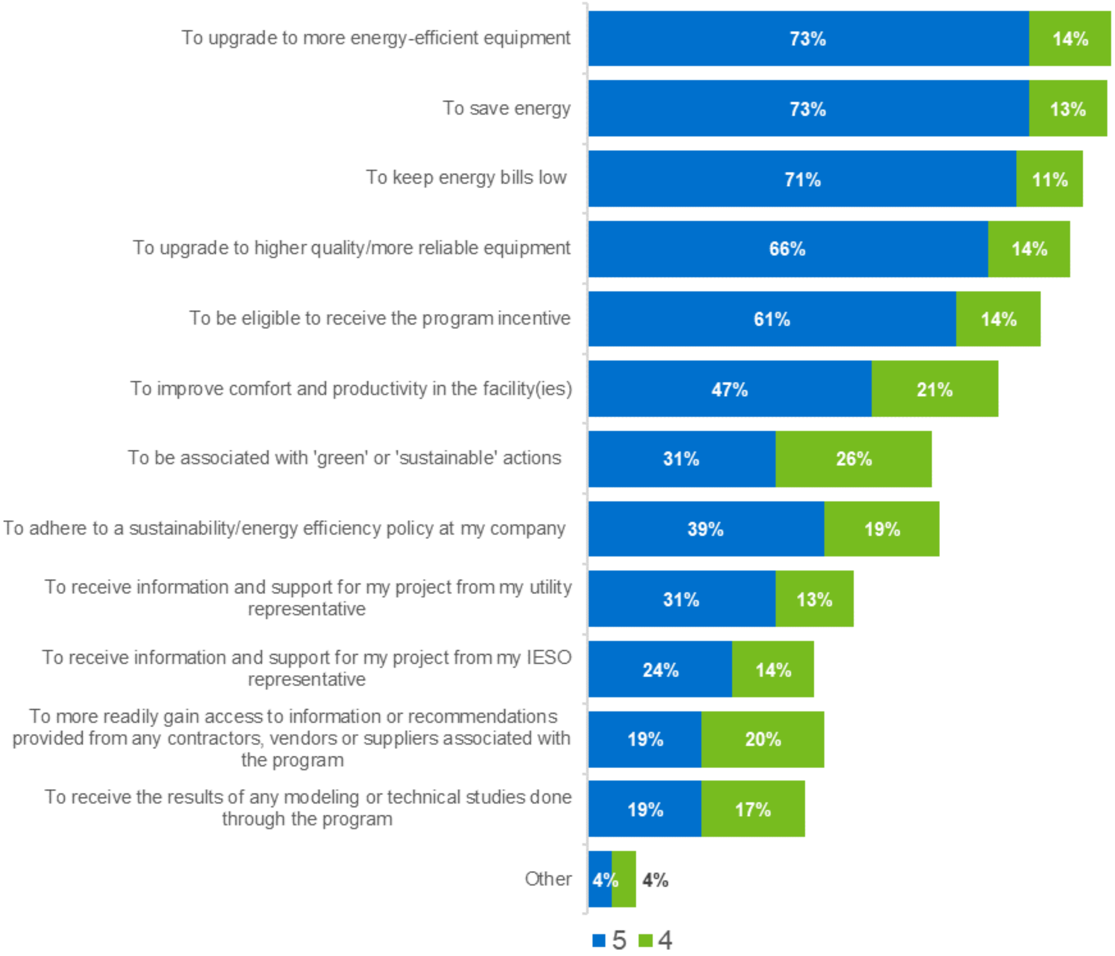
[16] Scale is 1 to 5, where 1 means "not at all influential," 2 means "slightly influential," 3 means "somewhat influential," 4 means "very influential," and 5 means "extremely influential."

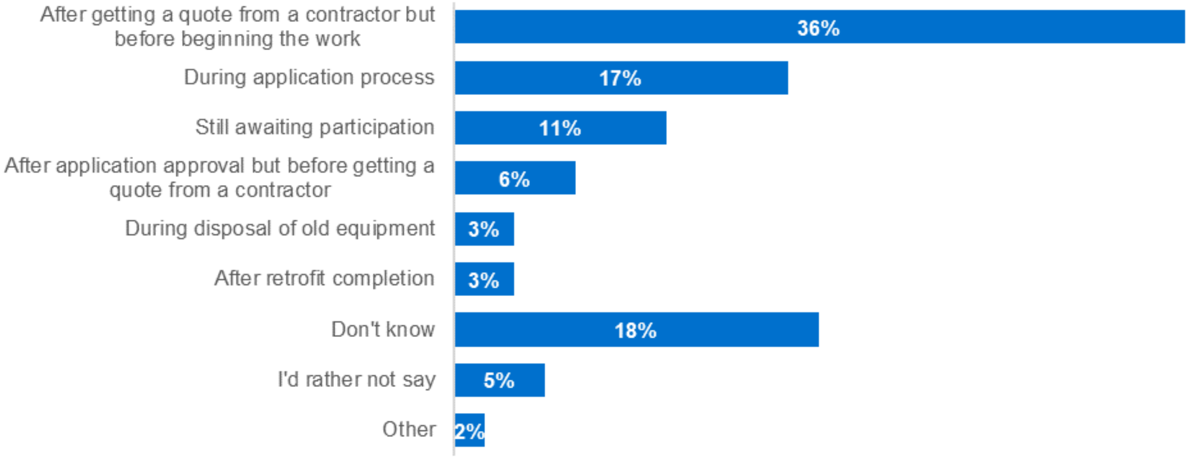
Figure 4-62: Influence of Retrofit Program Factors on Active Non-Participants' Decisions to Initially Apply (n=70)
(Rating of 4 or 5 on a scale of 1 to 5)



4.2.5.3 Discontinuing Participation

When asked about when their company discontinued participation in the program, Retrofit active non-participants most frequently (36%) mentioned the period between getting a quote from a contractor and beginning the incentivized work (Figure 4-63). About half as many said their participation ended during the application process (17%) or did not know when it did (18%), while roughly one-tenth said they were still awaiting an opportunity to participate (11%).

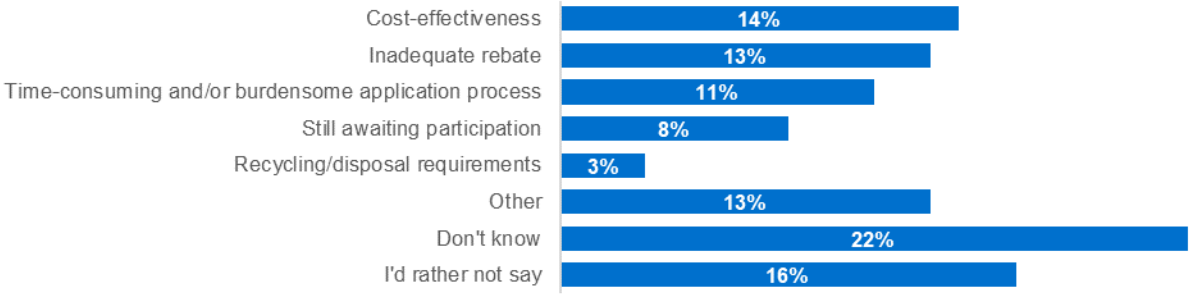
Figure 4-63: Timing of Active Non-Participants' Decision to Discontinue Participating (n=66)*



*Does not sum to 100% due to rounding.

To gain a better perspective on respondents' decisions to discontinue participation, the survey asked respondents to describe the primary reason behind their decision (Figure 4-64). Cost-effectiveness (14%), inadequate incentive levels (13%), and a burdensome application process (11%) were most frequently cited as the primary reasons. That said, more than one-third (36%) of respondents said they either did not know (22%) or would rather not disclose their reasons (16%).

Figure 4-64: Primary Influence on Active Non-Participants' Decision to Discontinue Participation (open end response; n=63)



The survey separately asked respondents to use a 1 to 5 scale to rate how much of a role several specific factors had on their decision to withdraw from the program.[17] The results in Figure 4-65 indicate that none of these factors were highly influential among more than two-fifths of respondents.

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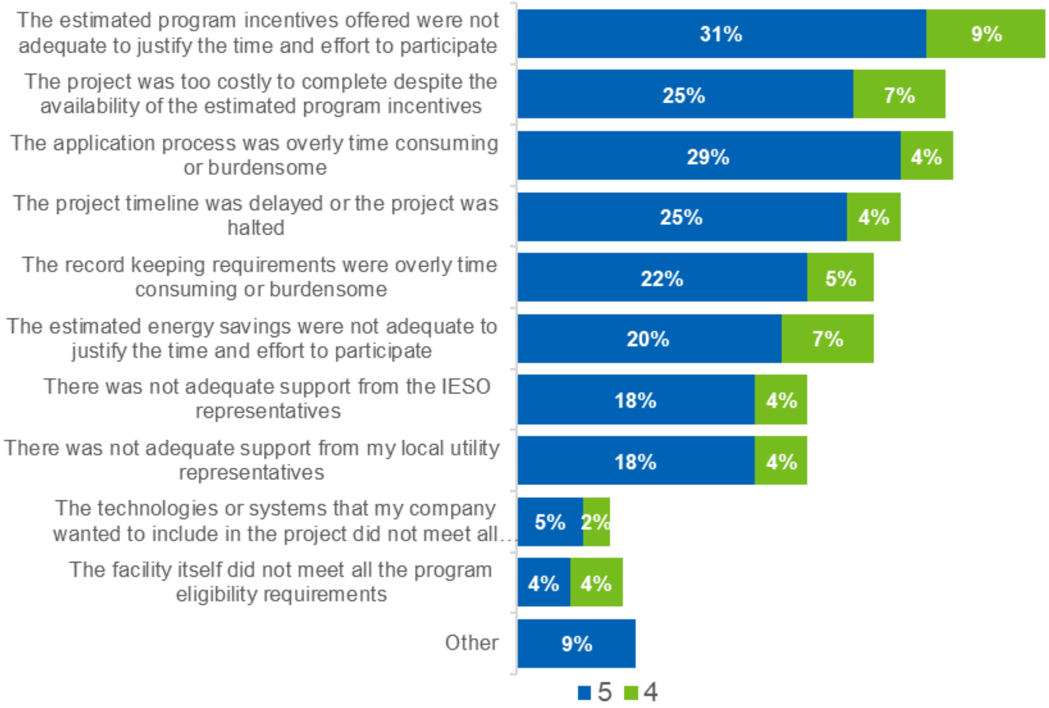
[17] Scale is 1 to 5, where 1 means "not at all influential," 2 means "slightly influential," 3 means "somewhat influential," 4 means "very influential," and 5 means "extremely influential."

Figure 4-65: Influence of Retrofit Program Factors on Active Non-Participants' Decision to Discontinue Participating (n=55) (Rating of 4 or 5 on a scale of 1 to 5)



The survey then asked respondents to use a 1 to 5 scale to rate how likely their company would be to participate in the program in the future.[18] Three-fifths (60%) indicated future involvement was either extremely likely (42%) or somewhat likely (18%).

Finally, the surveys asked the 23% of respondents who indicated a low likelihood of future participation in the Retrofit Program (1 or 2 rating) to provide an additional explanation for their rating. A few themes emerged from their answers, with the number of responses indicated in parenthesis:

- Program requirements are too burdensome (4)
- The cost of participation is too great (2)
- The associated savings are inadequate to justify participation (1)
- The time required for participation is too great (1)
- The project will be completed outside of the program (1)

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[18] Scale is 1 to 5, where 1 means “extremely unlikely,” 2 means “somewhat unlikely,” 3 means “neither likely nor unlikely,” 4 means “somewhat likely,” and 5 means “extremely likely.”

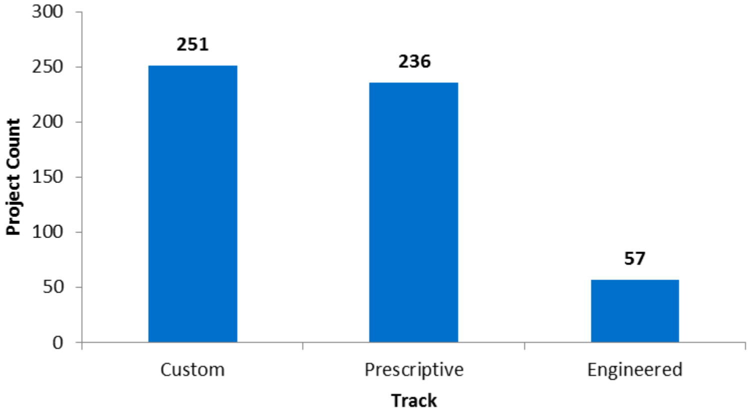
4.3 Impact Evaluation: Retrofit Pay for Performance

In 2017, Alectra opted to implement the Retrofit Program using the P4P funding mechanism starting October 1, 2017. Any P4P projects completed before this date were verified under Enersource Retrofit P4P. Under this approach projects reported in the Retrofit P4P Program received set funding amount on a per net verified energy savings calculated savings on a quarterly basis.

4.3.1 Retrofit Pay for Performance Participation

A total of 440 projects were reported for annual results under the Retrofit P4P Program in 2017. These 440 projects are only a portion of 611 projects that were evaluated during the quarterly evaluations for the program. Impact results for the remaining 171 projects will be included in the program year 2018 evaluation. As mentioned in Section 4.1.1 the evaluation separates these projects to allow for additional detail in the program summary. All detailed discussion on the Retrofit P4P Program uses a count of 544 evaluation projects. Annual net verified energy savings for individual projects ranged from 165 kWh to 2.36 GWh. Figure 4-66 shows a count of projects, by track, for the 2017 Retrofit P4P Program.

Figure 4-66: Completed Retrofit P4P Projects



4.3.2 Retrofit Pay for Performance Impact Results

Figure 4-67 provides 2017 Retrofit P4P net verified energy savings across program tracks and lighting/non-lighting measures. Similar to the Retrofit FCR program P4P is lighting dominant, with 82% of energy savings attributable to lighting projects.

Figure 4-67: P4P Retrofit Net Verified Energy Savings by Track and Measure Type

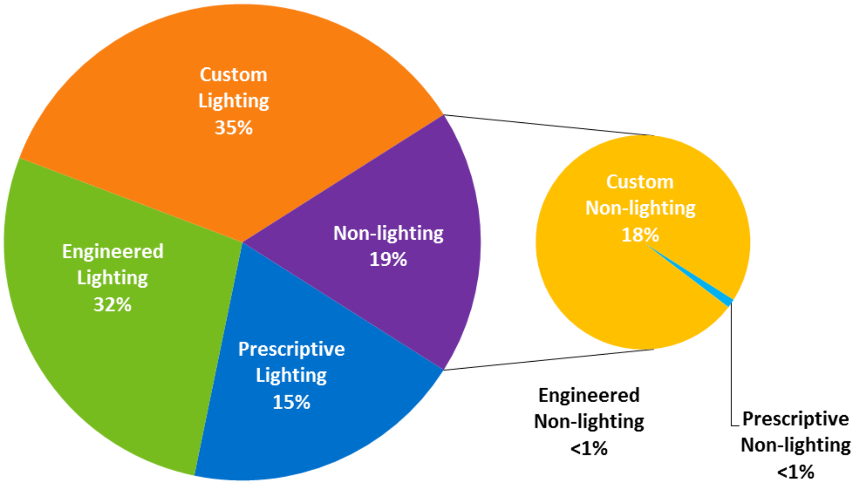


Table 4-26 and Table 4-27 show the results of the 2017 Retrofit P4P Program impact evaluation. Interactive effects were added to the program realization rates to account for the influence of lighting savings on heating and cooling loads at the project site. The calculation of these interactive effects is explained in Appendix H.

Table 4-26: Retrofit P4P Program Impact Results – Energy

Track	Measure Type	Gross Energy Savings (GWh)	Realization Rate	Gross Verified Energy Savings (Inc. Interactive Energy) (GWh)	Net-to-Gross Ratio	Net Verified Energy Savings (GWh)	Net Verified Energy Savings at 2020 (GWh)
Prescriptive	Lighting	7.8	124.5%	9.7	80.9%	7.9	7.9
	Non-Lighting	0.099	116.6%	0.116	80.4%	0.093	0.093
Engineered	Lighting	13.8	96.6%	13.3	80.2%	10.7	10.7
	Non-Lighting	0.004	93.4%	0.004	79.5%	0.003	0.003
Custom	Lighting	16.3	103.0%	16.8	81.6%	13.7	13.7
	Non-Lighting	8.7	97.6%	8.5	81.0%	6.9	6.9
Total		**46.6**	**103.7%**	**48.3**	**81.0%**	**39.1**	**39.2**

Table 4-27: Retrofit P4P Program Impact Results – Summer Peak Demand

Track	Measure Type	Gross Demand Savings (MW)	Realization Rate	Gross Verified Summer Demand Savings (Inc. Interactive Demand) (MW)	Net-to-Gross Ratio	Net Verified Summer Demand Savings (MW)	Net Verified Summer Demand Savings at 2020 (MW)
Prescriptive	Lighting	1.0	117.8%	1.1	82.8%	0.9	1.0
	Non-Lighting	0.0	99.3%	0.0	82.3%	0.0	0.0
Engineered	Lighting	1.9	105.4%	2.0	82.6%	1.6	1.6
	Non-Lighting	0.0	87.9%	0.0	82.0%	0.0	0.0
Custom	Lighting	2.6	111.1%	2.9	82.9%	2.4	2.4
	Non-Lighting	1.3	108.6%	1.5	82.8%	1.2	1.2
Total		**6.9**	**109.9%**	**7.5**	**82.8%**	**6.2**	**6.3**

The P4P Retrofit Program target of 10% precision at a 90% confidence interval was achieved for program level energy and demand realization rates. Net verified energy savings, including interactive effects, for the program are estimated at 39.2 GWh with a precision of 6.7% at a 90% confidence interval. This means that at 90% confidence the net verified energy results for the Retrofit Program would range from 39.2 GWh ± 6.7% (36.6 to 41.8 GWh).

4.3.3 Retrofit Pay for Performance Avoided Greenhouse Gas Emissions

The evaluation team used the IESO CDM Energy Efficiency Cost Effectiveness Tool to calculate avoided GHG emissions. Avoided GHG emissions were calculated for the first year or the 2017 program year and for the lifetime of the measures and only include Retrofit P4P projects that were provided for annual impact results. Table 4-28 below presents the results of these calculations.

Table 4-28: Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided (Tonnes CO_2 equivalent)		
	Electric	Gas*	Total	Electric	Gas*	Total
2017	6,561.21	(2,409.74)	4,151.47	140,165.13	(27,591.55)	112,573.58

*Based on additional natural gas heating usage from lighting interactive effects

4.3.4 Retrofit Pay for Performance Cost Effectiveness

Cost effectiveness for the 2017 Retrofit P4P Program achieved a TRC ratio of 1.43 and PAC ratio of 2.85 (Table 4-29). Each of these tests exceeded the targets of 1.00 set to determine if a program is cost effective. The improvements in the CE results between the 2016 and 2017 program years are shown in Table 4-30.

Table 4-29: 2017 Retrofit P4P Cost Effectiveness Results

Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	$ 19,438,585
TRC Benefits ($)	$ 27,788,080
TRC Net Benefits ($)	$ 8,349,495
TRC Net Benefit (Ratio)	1.43
Program Administrator Cost (PAC)	
PAC Costs ($)	$ 9,409,185
PAC Benefits ($)	$ 26,802,268
PAC Net Benefits ($)	$ 17,393,083
PAC Net Benefit (Ratio)	2.85
Levelized Unit Energy Cost	
$/MWh	$26.45
$/MW	$163,644

Table 4-30: Cost Effectiveness Comparison

Evaluation Year	TRC Test	PAC Test	Demand LUEC ($/MW)	Energy LUEC ($/MWh)
2017	1.43	2.85	$163,644	$26.45
2016	0.93	2.34	$255,506	$26.61

4.3.5 Retrofit Pay for Performance Net-to-Gross

NTG observations for the Retrofit P4P Program are provided in the following subsections and detailed observations are provided in Appendix D. Additional details regarding the NTG methodology can be found in Appendix C.

4.3.5.1 Key Observations

- When asked about their actions in the absence of program incentives, nearly two-fifths (38%) of participants said the Retrofit P4P Program helped them make upgrades that they otherwise would not have been able to implement or would have had to postpone for at least a year. However, some evidence of free-ridership exists as about one-fifth (19%) would have done the exact same upgrade without the program.

- Information or recommendations provided from contractors, vendors, or suppliers associated with the program (75%), and the availability of the program (70%), had the most influence on customer decisions to participate in the program.
- Participants indicated some instances of spillover. Lighting was the most frequently installed equipment that did not receive an incentive; nine out of 11 respondents indicated that they were influenced by their Retrofit P4P Program participation.

4.3.5.2 NTG Strata Level Results

Table 4-31 shows the results of the 2017 Retrofit P4P Program NTG evaluation. Only projects reported for evaluation in 2017 are included in the table. The following subsections summarize the analyses done to help interpret these values.

Table 4-31: NTG Assignments – Retrofit P4P Program

NTG Assignment	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG *%	Demand Savings Weighted NTG* %
Province-wide	89	21.1%	2.6%	4.0%	81.5%	82.9%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net to gross.

4.3.5.3 Free-Ridership

Free-ridership results for the Retrofit P4P Program presented in this subsection include all participant survey responses received from all four quarterly NTG surveys regarding projects completed in 2017. Note that some participants who responded to the survey had completed projects in a year other than 2017; these projects will be included in impact-related true-ups associated with this program.

The survey asked participants when they had learned that they could get energy efficiency incentives through the Retrofit P4P Program (Table 4-32). More than four-fifths of respondents (85%) stated they learned about the incentives before they started planning the upgrade. One-tenth (10%) learned about the program after they started planning, but before they started implementing the upgrade. Two percent indicated they had already started implementing the upgrades when they learned about the incentives, which may indicate these respondents were free-riders. While responses relating to upgrade planning did not directly impact free-ridership, they provided additional context around the respondent's decision-making.

Table 4-32: When Participants Heard about the Program (n=114)

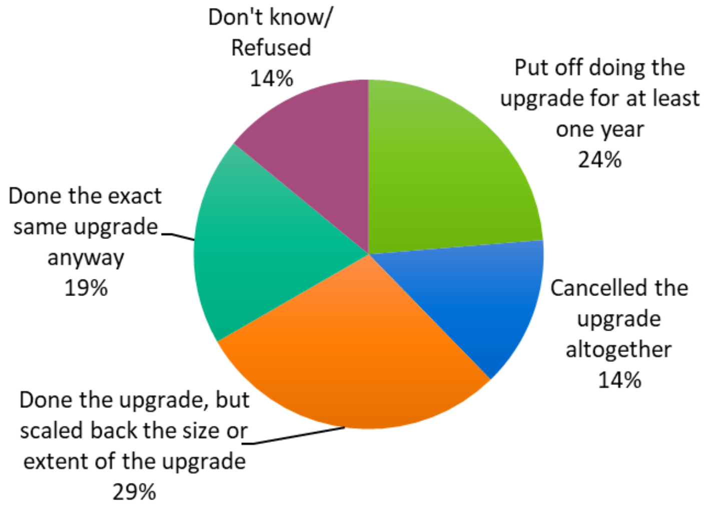
When did you first learn you could get energy efficiency incentives through your utility?	Respondents
Before you started planning this upgrade	85%
After you started planning, but before you started implementing this upgrade?	10%
After you started implementing but before you completed this project?	2%
Don't know/ Refused	3%

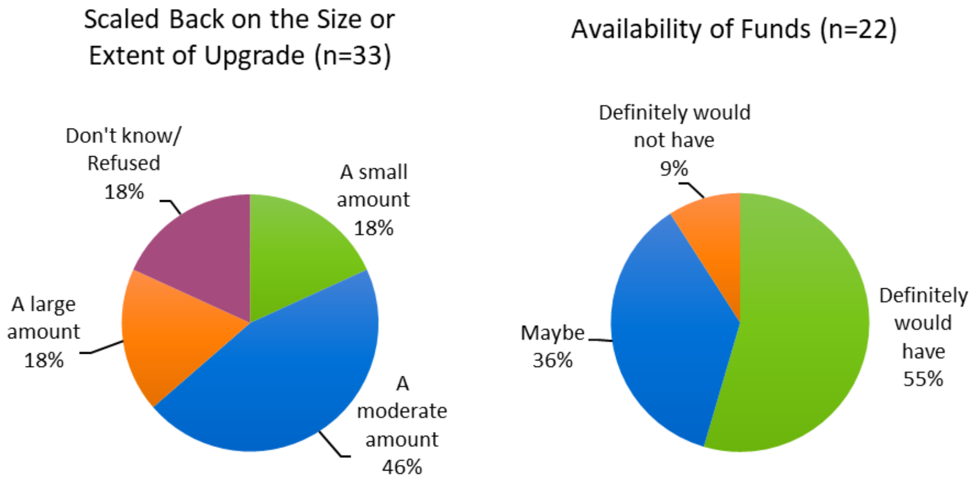
Participants were next asked what they would have done if they had never learned they could get incentives from their LDC (Figure 4-68). The respondents who reported they would have done the exact same upgrade anyway (19%) or that they would have scaled back on the size or extent of the upgrade (29%) were assigned higher intention scores (and higher free-ridership).

Of the respondents who would have scaled back the size or extent of the upgrade, about one-third (34%) would have reduced the scope by a large amount, which suggests the program likely helped these respondents to complete larger projects than they could have on their own. The two-fifths of respondents (38%) who would have delayed the upgrade by at least one year or cancelled the project altogether were not considered free-riders.

Of the respondents who stated they would have done the exact same upgrade anyway, more than one-half (55%) reported that funds to cover the entire cost of the project *definitely would have* been available, compared to about one-tenth (9%) who reported that they *definitely would not have* had the funds. Respondents who indicated they definitely or might have had the funds to cover the cost of the project were given higher intention scores (and higher free-ridership) than respondents who did not have the funds. Responses to these participant intent questions along with the next question on program influence are factored into the free-ridership analysis.

Figure 4-68: Actions in Absence of Program Incentives (n=114)

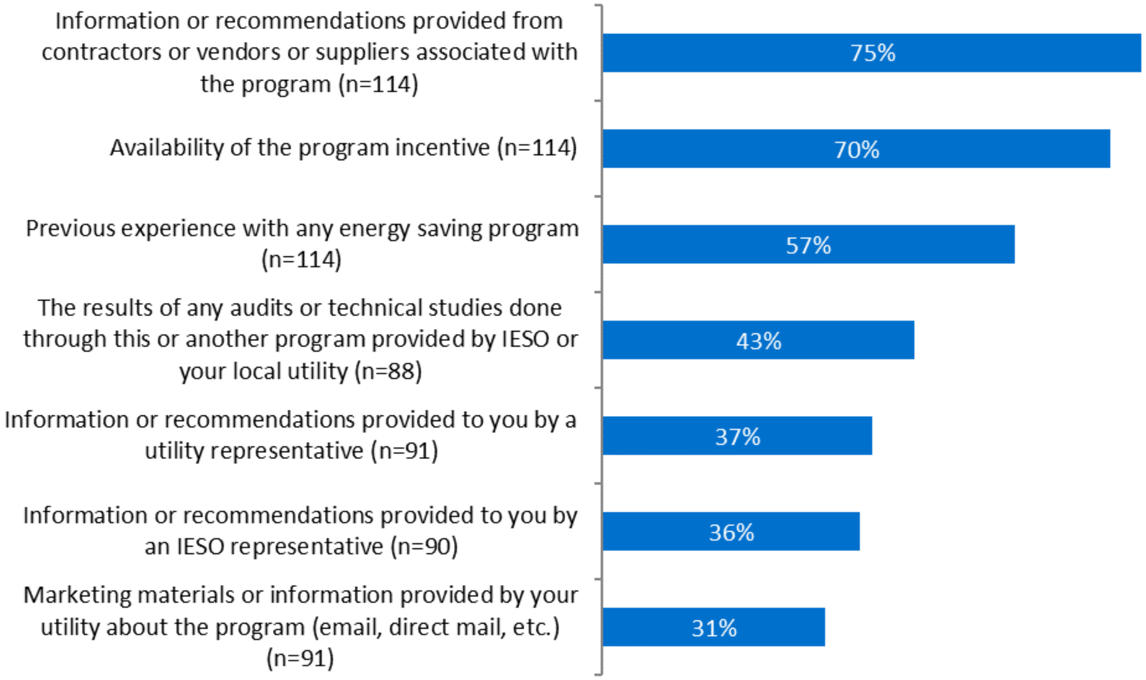




The survey also asked respondents to use a scale of 1 to 5 to rate how much influence program features, such as the availability of the program incentive, information provided by representatives and contractors, and marketing had on their decision to participate in the program ((Figure 4-69).[29] Results suggest that information and recommendations from contractors, vendors, or suppliers was very or extremely influential in the upgrade decisions of respondents (75%), as did the availability of the program incentive (70%). Respondents who indicated they participated in the program due to the influence of program features were given lower influence scores (and lower free-ridership).

Nearly three-fifths of respondents (57%) indicated that prior experience with an energy saving program also had a notable influence. However, results from audits or technical studies, information and recommendations from a LDC or IESO representative, and LDC marketing materials were less influential.

Figure 4-69: Influence of Program Features on Participation (Rating of 4 or 5 on a scale of 1 to 5)



The survey asked participants to describe anything else that played a great role in influencing their organization to do the energy efficient equipment upgrades. The most frequently mentioned drivers were as follows:

- Feedback from other customers, colleagues, and/or friends (five respondents)
- Replace or update old or failing equipment (five respondents)
- Recommended by a contractor, electrician, sales representative, or consultant (five respondents)
- Energy efficiency or overall energy savings (four respondents)

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[29] Scale is 1 to 5, where 1 means “not influential at all”, 2 means “slightly influential”, 3 means “somewhat influential”, 4 means “very influential” and 5 means “extremely influential”.

- Affordability of the upgrades (four respondents)

In summary, the free-ridership results for Retrofit P4P Program participants were mostly positive. Room for improvement exists, though, in terms of identifying participants who are most in need of program support—two percent indicated they had already started implementing the upgrades when they learned about the incentives, and more respondents said they would have made the same upgrades in the absence of the program (19%) than respondents who said they would not have made the upgrades without the program (14%).

4.3.5.4 Spillover

Spillover results for the Retrofit P4P Program presented in this subsection include all participant survey responses received from all four quarterly NTG surveys for projects completed in 2017. Note that some participants who responded to the survey had completed projects in a year other than 2017; these projects will be included in impact-related true-ups associated with this program. The survey asked participants if they had installed or upgraded additional energy-efficient equipment after participating in the program for which they did not receive an incentive (Table 4-33). Among the one-fifth of respondents (24) who indicated they had installed equipment or made improvements without receiving outside incentives, lighting was the most frequently installed (11 respondents), followed by HVAC (five respondents) and motor/pump upgrades (three respondents).

The survey asked the 24 participants to use a scale of 1 to 5 to rate how influential their participation in the Retrofit P4P Program had been on their decision to make the additional upgrades.[30] Nine respondents indicated that their experience with the program ranged from somewhat to very influential in their decision to make lighting improvements. Similarly, the program had somewhat of an influence on respondents' decisions to install lighting controls, ENERGY STAR® Appliances, and Motor/Pump Drive Improvements (VSD and Sync Belt). Program participation had less influence on participants who installed HVAC, motor/pump upgrades, and fans.

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[30] Scale is 1 to 5, where 1 means "not influential at all", 2 means "slightly influential", 3 means "somewhat influential", 4 means "very influential" and 5 means "extremely influential".

Table 4-33: Program Influence on Equipment Installed Outside the Program (n=24) (Rating of 3 or more on a scale of 1 to 5)

How much influence did your earlier involvement with the utility incentive program have on your decision to implement the following equipment?	Count of Respondents who Rated Influence of Program on their Upgrade Decision as a 3 or more
Lighting (n=11)	9
HVAC – Air conditioner replace, above code minimum (n=5)	2
Motor/Pump Upgrade (n=3)	2
Lighting – Controls (n=2)	2
Fan (n=2)	1
ENERGY STAR® Appliance (n=1)	1
Motor/Pump Drive Improvement (VSD and Sync Belt) (n=1)	1

The survey participants who indicated that they installed the program-influenced non-incentivized equipment were asked a series of follow-up questions (e.g. capacity, annual hours of operation, etc.). These detailed questions are not displayed here but are instead used within the NTG algorithm to attribute spillover savings to each equipment installation

4.4 Process Evaluation: Retrofit Pay for Performance

The following subsections outline the process evaluation results of the Retrofit P4P Program. Responses have been summarized and detailed observations are provided in Appendix I. Additional details regarding the process methodology can be found in Appendix F.

4.4.1 Retrofit Pay for Performance Program Participant Perspectives

The following subsections highlight the feedback received from the Retrofit P4P Program Participant survey. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

4.4.1.1 Key Observations

Key findings from participants' responses include the following:

- Most participants learned about the Retrofit P4P Program through a contractor or vendor (53%), followed by a representative from their LDC (13%).
- Participants were generally satisfied (79%) with the overall program with 92% of respondents saying they would recommend the program to others. Fewer respondents were satisfied with the dollar amount of the incentive (62%) and the time it took to receive the incentive (44%).
- Saving energy was the most cited non-program specific factor influencing respondents' decision to participate in the program; about three-fourths of respondents (74%) indicated they were satisfied with the savings achieved.

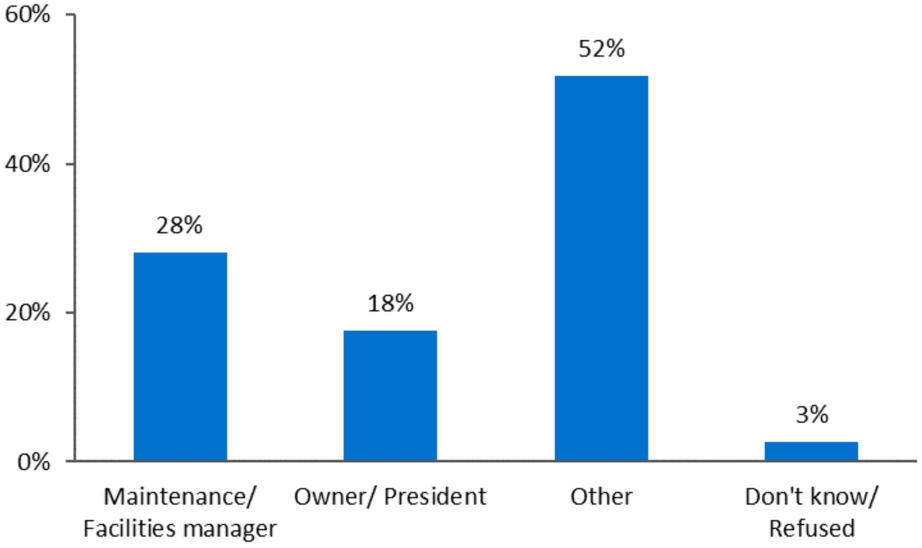
- Three-tenths of participants had an official policy in place that either encouraged or required demonstrated energy savings, with the most common being an annual target ranging from a 1% to 20% reduction.

4.4.1.2 Firmographics

The survey asked participants about their position in the company, ownership status, primary activities, chain or franchise status, size of labor force, and square footage of the facility where the upgrades were made.

Participants most frequently surveyed were maintenance/facility managers (28%), followed by owners or presidents (18%), as seen in Figure 4-70 Respondents who fell into the “other” categories were mainly in other management (34%), controller or financial management (5%), and administrative (4%) positions. Note that the survey allowed respondents to list more than one title.

Figure 4-70: Title of Respondent (multiple response allowed; n=114)

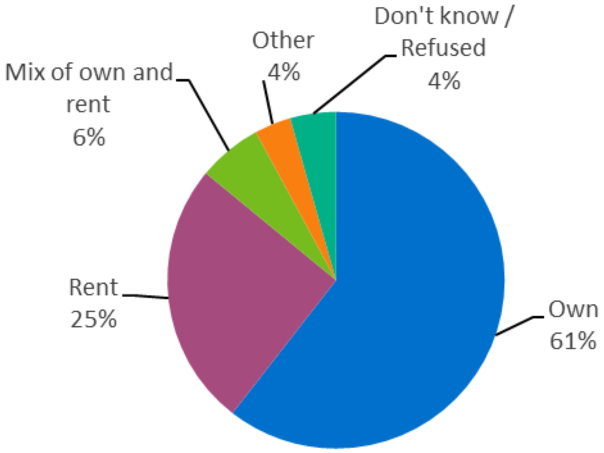


*Does not sum to 100% due to rounding.

Most participants had responsibility for the budget or expenditure for the upgrades or retrofits at their company, with 43% having primary responsibility, 50% having shared responsibility, 6% having no responsibility, and less than 1% reporting that they did not know.

The survey asked participants about the ownership status of the facility in which the upgrades were made. Three-fifths of respondents (61%) own, one-fourth (25%) rent and a few were a mix of own and rent (6%). Respondents who were neither owners nor renters make up 4% of respondents; these respondents are primarily made up of third-party managers/facility operators or have multiple owners or renters (e.g., condominiums consisting of separate units with multiple owners and renters).

Figure 4-71: Ownership Status (n=114)



The survey asked participants to describe the primary activities conducted at the facilities where the upgrades were made. Some respondents implemented upgrades in multiple facilities that conduct primary activities in different industries. Manufacturing (26%), warehouse and wholesale (17%), office or professional (14%), and real estate or property management (14%) were the most frequently mentioned primary activities.

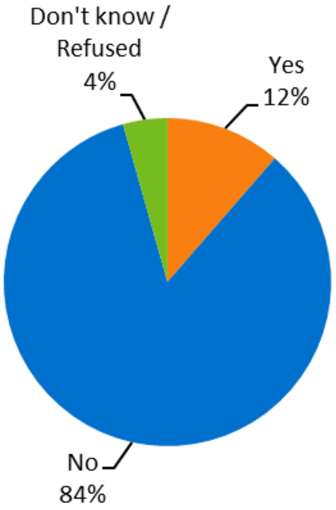
Table 4-34: Primary Activity at Facility(ies) (multiple responses allowed; n=114)*

What are the primary activities conducted at this/these facility(ies)?	Respondents
Manufacturing	26%
Warehouse/Wholesale	17%
Office/Professional	14%
Real estate/Property management	14%
Non-food retail	9%
Grocery or convenience store	5%
Education	5%
Food sales or service (restaurant, bar)	4%
Governance/Pubic administration	3%
Lodging	2%
Entertainment	1%
Religious	1%
Other	3%

*Does not sum to 100% due to multiple response.

The survey asked participants about their businesses' chain or franchise status. Over four-fifths of respondents (84%) reported that their business is not part of a chain or franchise, while 12% of respondents reported that their business is a chain or franchise.

Figure 4-72 Chain or Franchise Status (n=114)



The survey asked participants how many employees work at the facilities where the upgrades were made. More than one-half of the facilities (56%) were small businesses with 100 or fewer employees. A few were medium in size, with 15% having between 100 and 500 employees. Eight percent of businesses had more than 500 employees.

Table 4-35: Employment Count (n=114)*

How many employees are located in the facility(ies)?	Respondents
1-10	15%
11-50	24%
51-100	17%
101-250	12%
251-500	3%
500-1,000	4%
Greater than 1,000	4%
Don’t know / Refused	23%

*Does not sum to 100% due to rounding.

The survey asked participants to provide either the total square footage for all buildings or the average square footage per building. Within the participant group that provided total square footage for all buildings (60% of respondents), nearly one-half (47%) have facilities that are 25,000 square feet or less. Within the participant group that provided the average square footage per building (8% of respondents), two respondents indicated the average square footage is 5,000 square feet or less. One participant said their buildings are over 50,000 square feet. Approximately one-third of respondents (32%) did not know or refused to answer.

Figure 4-73 Total Square Footage for All Buildings (n=66)

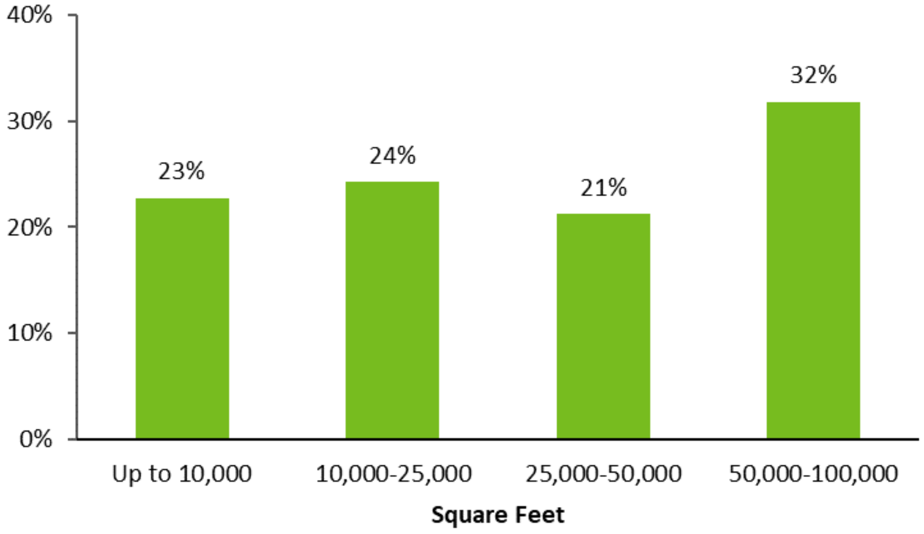
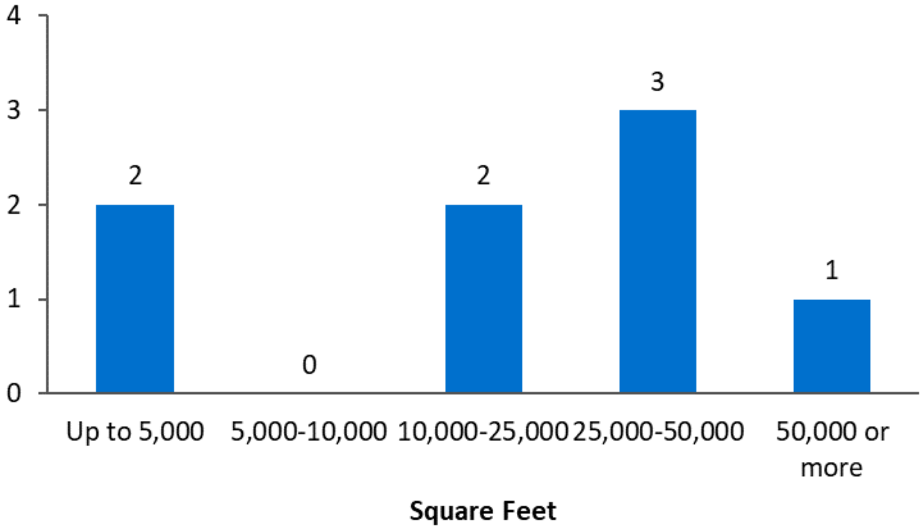
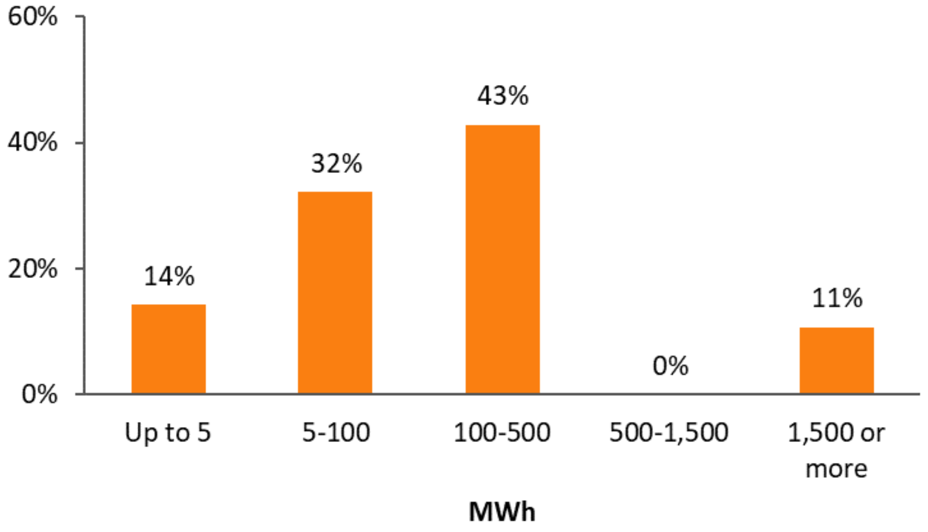


Figure 4-74: Average Square Footage Per Building (n=8)



The survey then asked participants to provide the average monthly electricity usage of their facility. Three-fourths (75%) did not know or refused to provide an answer. Of those who could provide an answer, almost one-half (46%) reported having an average monthly electricity usage below 100 MWh. Just over two-fifths (43%) had average monthly electricity usage between 100 and 500 MWh, and several facilities (11%) had an average monthly consumption greater than 1,500 MWh.

Figure 4-75: Average Monthly kWh Consumption at Facility(ies) (n=28)



4.4.1.3 Program Outreach and Marketing

Program contractors and equipment vendors (53% of respondents), LDC representatives (13% of respondents), and word of mouth through colleagues or competitors (8% if respondents) played the biggest roles in program outreach and marketing (Table 4-36). Of the participants who first heard about the program through their LDC representative, 14 respondents reported their LDC made the initial contact, four stated they made the first contact, and one did not know.

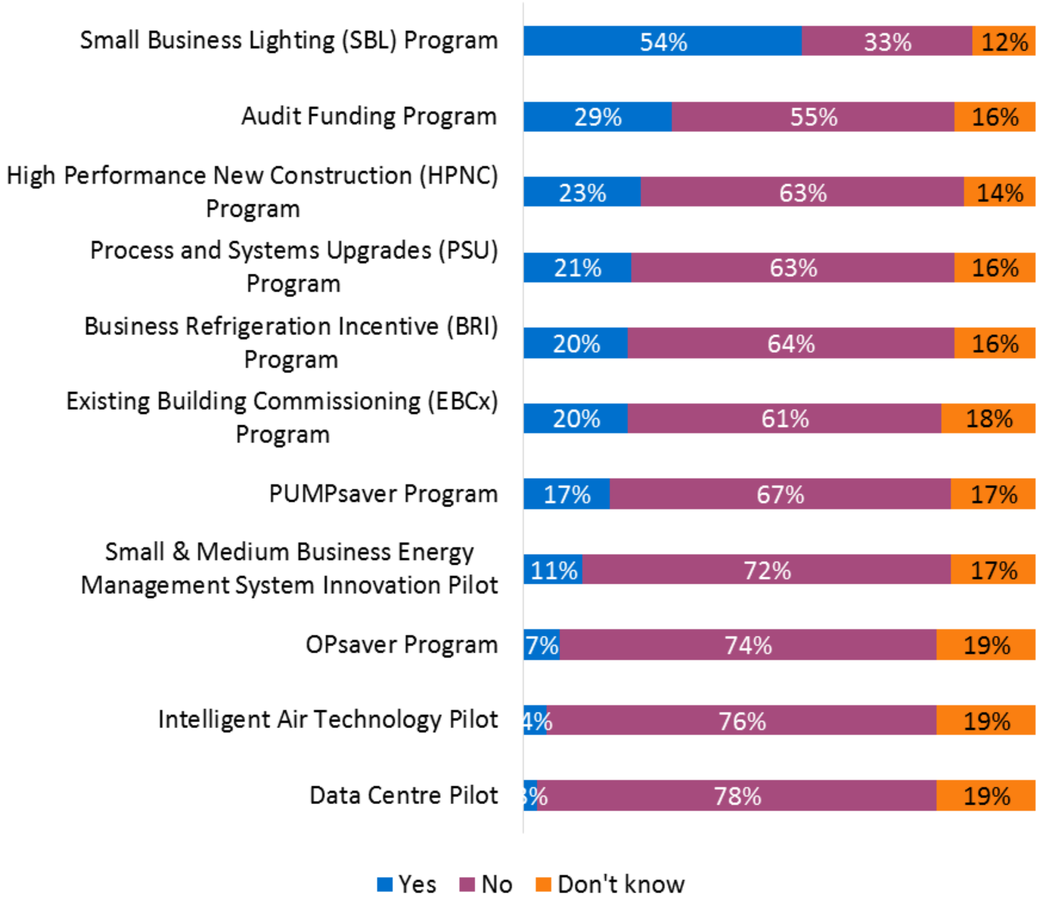
Table 4-36: How Participants First Heard about the Program (n=114)*

How did you first hear about the Retrofit P4P Program?	Respondents
A contractor or equipment vendor	53%
A representative from my LDC	13%
A colleague or competitor	8%
Other energy efficient advertising	5%
My property or energy management company	5%
Energy efficiency advertising from my LDC	4%
Energy efficiency advertising from Ontario's Independent Electric System Operator (IESO)	2%
Other	10%
Don't know/ Refused	1%

*Does not sum to 100% due to rounding.

The survey asked participants about their awareness of other programs offered through their LDC (Figure 4-76). The SBL Program was the most well-known program—over one-half of respondents (54%) indicated that they were aware of the program. Respondents were less aware of the Small & Medium Business Energy Management System Innovation Pilot (11%), OPsaver Program (7%), Intelligent Air Technology Pilot (4%), and Data Centre Pilot (3%).

Figure 4-76: Awareness of Other Business Programs (n=114)*



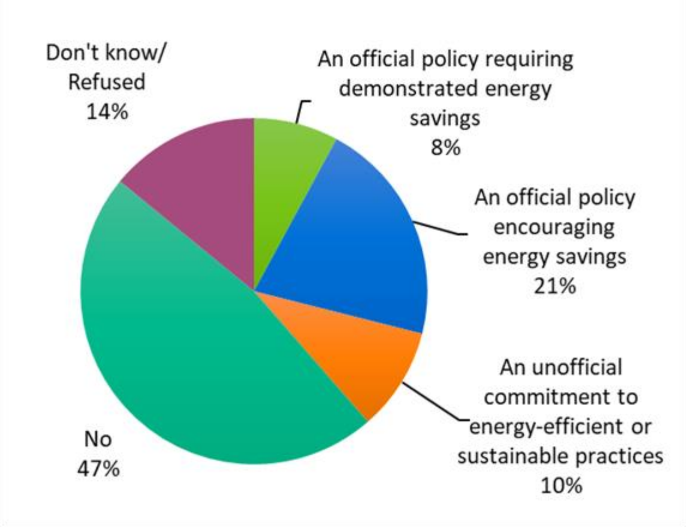
*Some responses do not sum to 100% due to rounding.

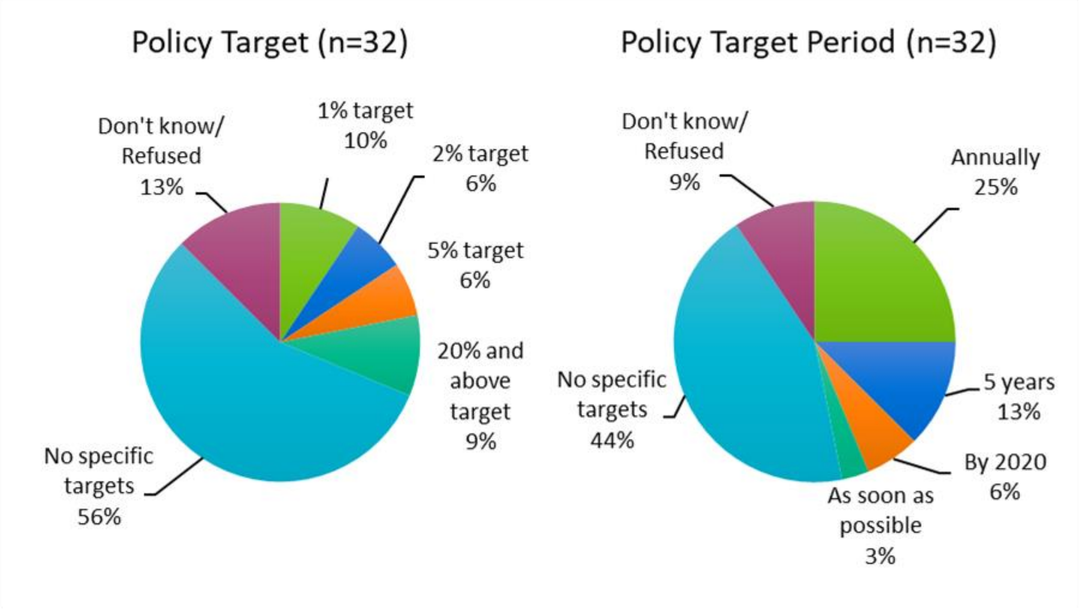
4.4.1.4 Participant Motives and Decision Making

The survey asked participants if they adhered to a sustainability or energy efficiency policy at their organization and the requirements of the policy (

Figure 4-77). Over two-fifths (47%) did not have a policy of this kind. Three-tenths (29%) had an official policy in place that either encouraged or required demonstrated energy savings. Of these respondents with policies, 31% had an established target ranging from a 1% to 20% energy reduction and 47% had a specific time period in which their company was required to meet their sustainability requirements. The most common time period to meet requirements was an annual target (25%), followed by a five-year target (13%).

Figure 4-77 Sustainability or Energy Efficiency Policy (n=114)





The survey asked participants to indicate how influential several reasons not directly related to the Retrofit P4P Program had on their organizations' decisions to do the energy efficient equipment upgrades. Respondents were asked to rate on a scale of 1 to 5 how influential the reasons were (Figure 4-78).[31]

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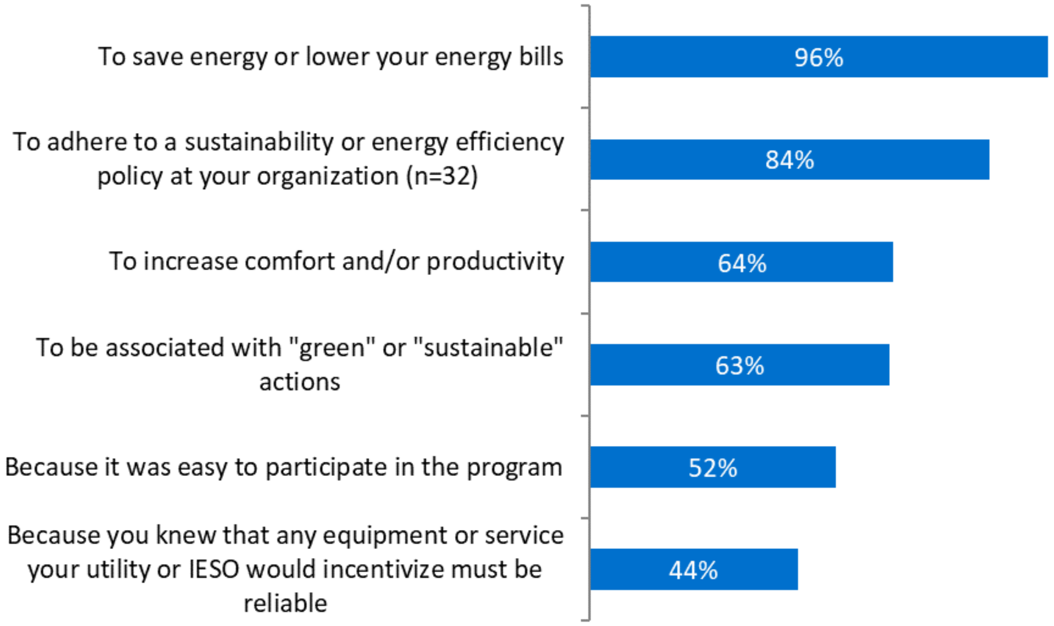
[31] Scale is 1 to 5, where 1 means "not influential at all", 2 means "slightly influential", 3 means "somewhat influential", 4 means "very influential" and 5 means "extremely influential".

Almost all the participants (96%) indicated that saving energy played the most significant role (4 or 5 rating) in their decision to participate in the program. Almost two-thirds of the respondents (64%) indicated that increasing comfort and/or productivity played a great role in their decision to participate in the Retrofit P4P Program, as did being associated with "green" or "sustainable" actions (63%) and ease of program participation (52%). The sustainability or energy-efficiency policy was very influential on over four-fifths (84%) of the respondents who reported having a policy.

Figure 4-78: Motives for Participating in the Program (n=114)
(Rating of 4 or 5 on a scale of 1 to 5)



The installer had an influential role in participants' selection of equipment installed or upgraded where almost three-fourths of participants (73%) installed the recommended equipment or chose from several recommendations made by the installer (Table 4-37). Less than one-fourth of respondents (23%) conducted their own research before deciding on the equipment.

Table 4-37: Equipment Selection (n=114)

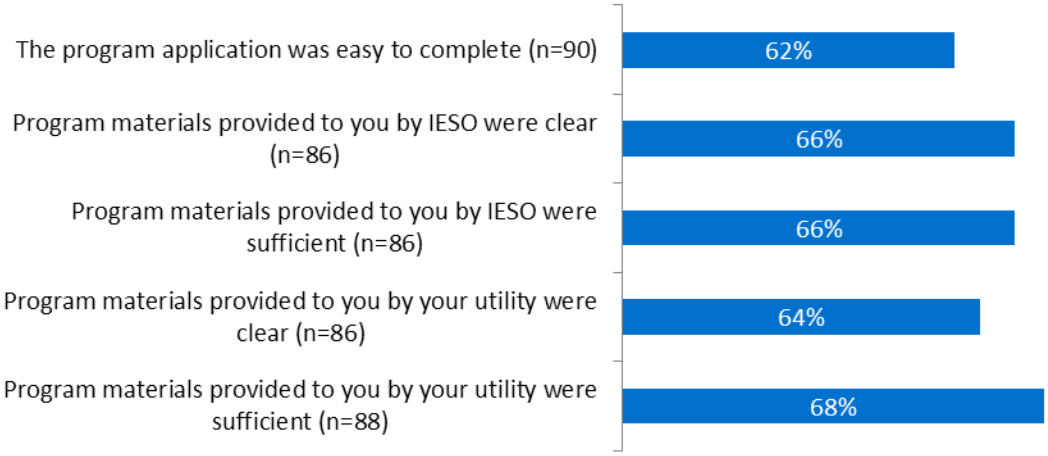
Which of the following describes how you made your selection of the equipment you installed or upgraded through the program?	Respondents
My installer suggested the particular equipment that was installed	44%
My installer suggested different models of the equipment and I chose	29%
I did some research on the equipment and made my own choice	23%
Don't know/ Refused	4%

4.4.1.5 Participant Satisfaction

The survey asked participants to use a scale of 1 to 5 to rate whether the program materials provided by their LDC or IESO were clear and sufficient and whether the program application was easy to complete

(Figure 4-79).[32] About two-thirds of respondents (64% to 68%) indicated that the program materials provided by their LDC and IESO were clear and sufficient. Slightly less than two-thirds of respondents (62%) indicated the program application was easy to complete. Respondents did not give overwhelmingly high ratings to any of these categories, which may suggest that an opportunity exists to better meet customers information and program participation decision needs.

Figure 4-79: Assessment of Program Materials and Application Process (Rating of 4 or 5 on a scale of 1 to 5)



Participants who provided low ratings (1 or 2) for the program materials or application were asked for suggestions on how to improve them. One respondent suggested providing simple and clear information on incentives in the program materials. Respondents suggested the following to improve and simplify the application process:

- Streamline the process to reduce repetition of application information (four respondents)
- Provide a clear step-by-step list of required documentation at the beginning of the process (two respondents)
- Improve website and increase web portal speed (two respondents)
- Allow LDC, contractors, energy solution companies, and suppliers to complete documentation/application, and ensure materials submitted by a third party are accurate (one respondent)
- Speed up approval process (one respondent)
- Allow for customer and contractor to have individual log-ins (one respondent)
- Incorporate an anticipated savings calculator into the application (one respondent)

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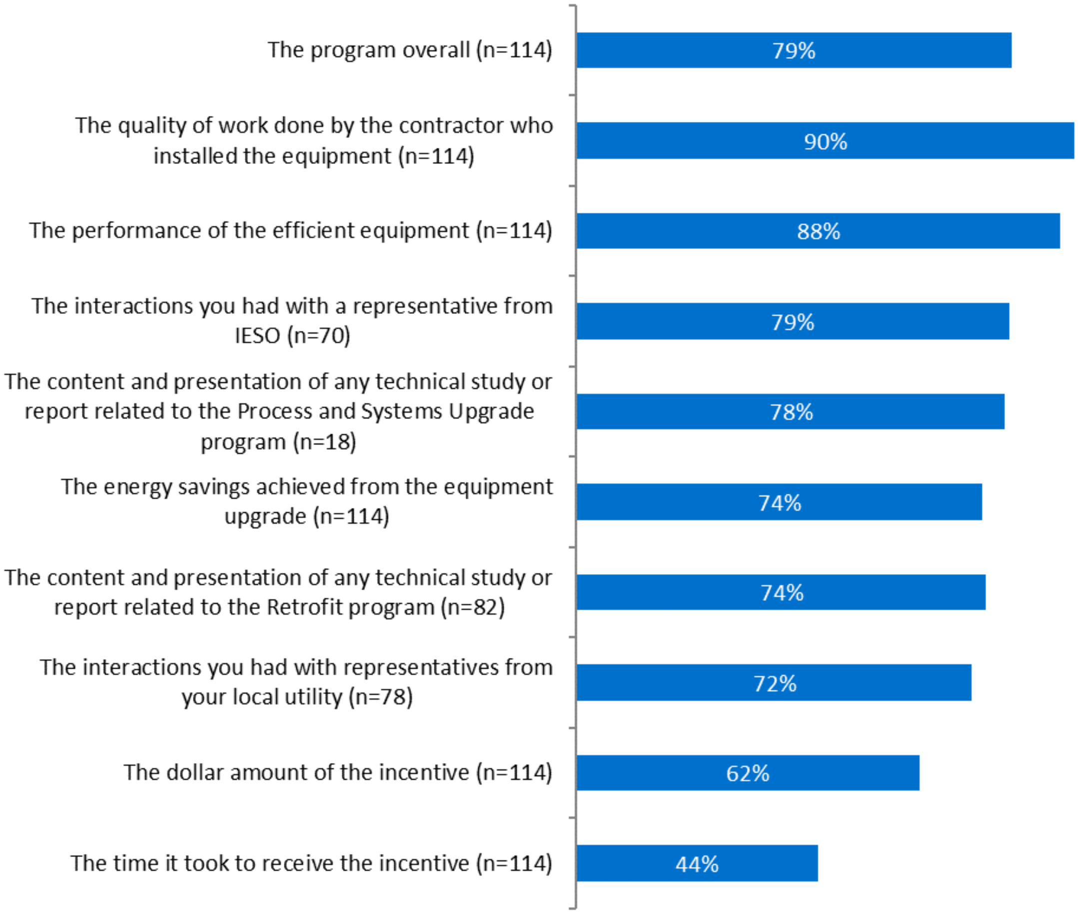
[32] Scale is 1 to 5, where 1 means “do not agree at all”, 2 means “somewhat disagree”, 3 means “neither agree nor disagree”, 4 means “somewhat agree” and 5 means “completely agree”.

The survey next asked participants to use a scale of 1 to 5 to rate their satisfaction with several other program factors (Figure 4-80).[33] Respondents were generally satisfied with the program overall (79% of respondents gave a 4 or 5 rating) and were most satisfied with the quality of work done by the contractor who installed the equipment (90%). A majority of respondents also provided a 4 or 5 rating to the equipment's performance (88%) and savings achieved (74%).

Fewer participants were satisfied with the dollar amount of the incentive (62%) and the time it took to receive the incentive (44%). The long wait time in receiving the incentive can potentially inhibit respondent participation in future programs.

Figure 4-80: Participant Satisfaction (Rating of 4 or 5 on a scale of 1 to 5)



The survey asked participants who gave a low a rating (1 or 2) to overall program satisfaction for suggestions to improve the program. Recommendations included the following:

- Improve customer service and follow-up (e.g., staff training) (two respondents)
- Speed up process overall (one respondent)

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[33] Scale is 1 to 5, where 1 means “not at all satisfied”, 2 means “somewhat dissatisfied”, 3 means “neither satisfied nor dissatisfied”, 4 means “somewhat satisfied” and 5 means “completely satisfied”.

- Increase incentive offerings and equipment types for projects (one respondent)
- Improve program marketing (one respondent)

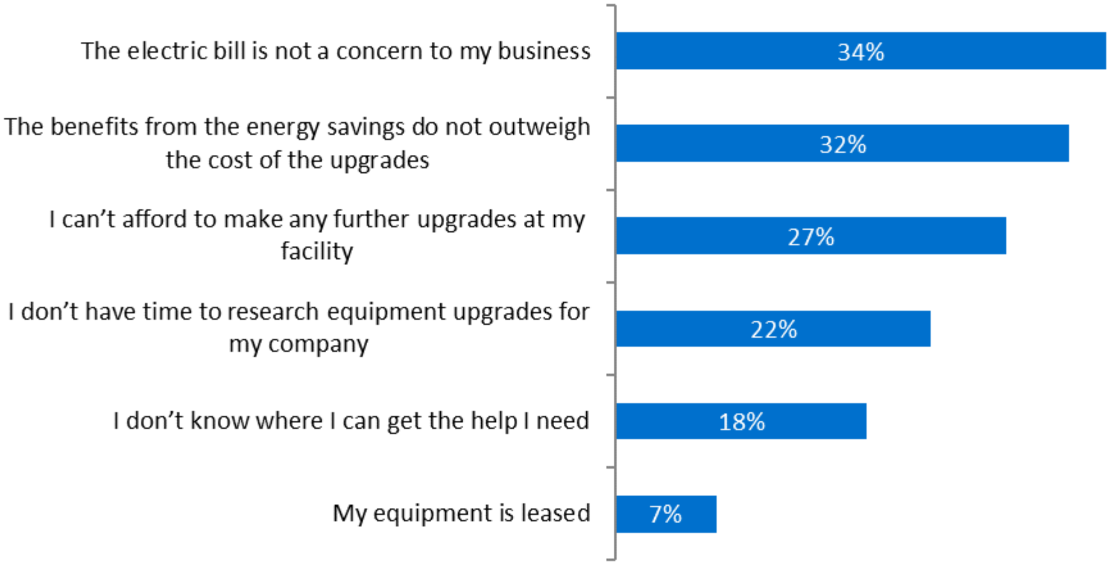
When asked how likely they would be to recommend the program to others on a scale of 1 to 5, the vast majority (92%) of respondents indicated that they would be very likely to do so and 5% were neutral.[34]

4.4.1.6 Barriers to Future Participation

The survey asked participants to rate their level of agreement with reasons why it could be difficult for their business to make future energy efficient upgrades. The survey asked respondents to provide their feedback about several barriers on a scale of 1 to 5 (Figure 4-81).[35]

Most participants indicated they can't or were unlikely to be able to afford to make future upgrades at their facility (59% provided a 3 rating or lower), have time to research equipment upgrades (72% provided a 3 rating or lower), and have access to help (79% provided a 3 rating or lower). Respondents' greatest barrier to future program participation is if energy savings benefits do not outweigh the cost of future upgrades (32% of respondents provided 4 or 5 rating). The cost of electricity is also taken into consideration approximately one-half of the time when respondents make decisions on future upgrades (54% of respondents provided 1 or 2 rating, meaning the electric bill is a concern). Few facilities had leased equipment; 86% indicated that leased equipment was either not at all relevant or not applicable.

Figure 4-81: Barriers to Future Participation (n=114)
(Rating of 4 or 5 on a scale of 1 to 5)



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[34] Scale is 1 to 5, where 1 means "extremely unlikely", 2 means "somewhat unlikely", 3 means "neither likely nor unlikely", 4 means "somewhat likely" and 5 means "extremely likely".

[35] Scale is 1 to 5, where 1 means "not at all relevant", 2 means "slightly relevant", 3 means "somewhat relevant", 4 means "very relevant" and 5 means "extremely relevant".

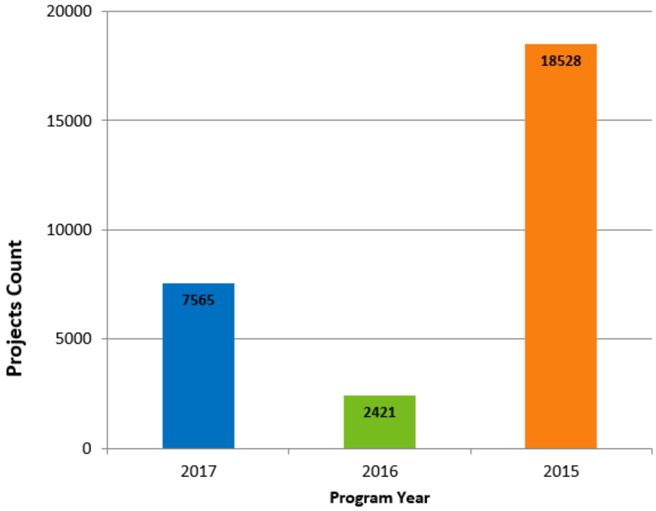
5 Small Business Lighting Program

5.1 Impact Evaluation

5.1.1 Participation

There were 7,565 projects completed under the SBL Program in 2017. This is a 212% increase from 2016 participation levels and a 59% decrease from 2015 participation levels. Figure 5-1 shows the number of SBL projects completed in 2017 compared to the previous two years. It is important to note that the SBL Program underwent program restructuring between program years 2015 and 2016. The 2017 population shows growth toward participation levels achieved by the previous version of the program in 2015. Of the 69 LDCs, 44 contributed savings to the 2017 SBL Program, an increase of 22% over the 2016 program which saw participation from just 36 LDCs. Participation is expected to continue to increase in the coming years.

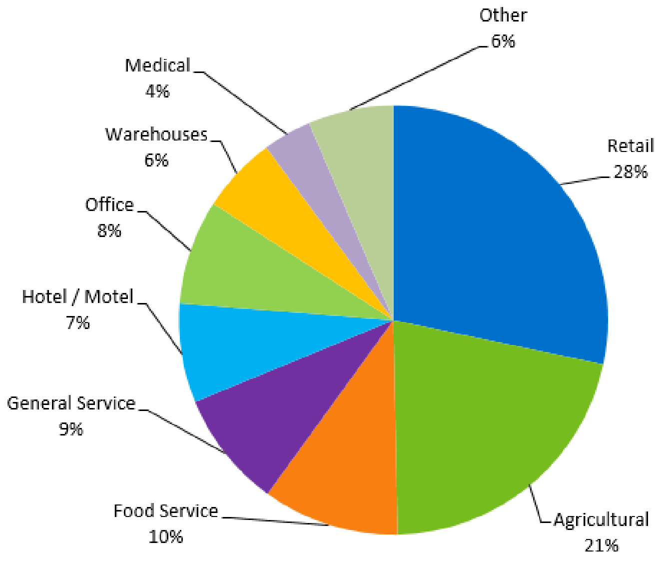
Figure 5-1: Number of Completed 2017 SBL Projects



5.1.1.1 Participation by Facility Type

In previous years, the facility-type field within the tracking database was limited to only five unique input choices. Similar to the 2016 tracking database, the facility type data in the 2017 tracking database did not have any data restrictions, and therefore includes various facility types across reporting LDCs and projects. Nexant categorized each unique entry into one of 12 possible facility types, matching those reported in previous program years as closely as possible. The composition of program participants by Nexant-defined facility type is presented in Figure 5-2.

Figure 5-2: 2017 SBL Program Facility Type Composition



The retail and agricultural sectors were again the largest contributors to 2017 SBL energy savings followed by the food service and general service sectors. This trend is consistent with 2016 participation as the agricultural sector maintained the same contribution, while the retail sector increased from 26% to 28%. The "other" portion describes savings from forty projects from unidentified sectors as well as from sectors contributing less than 4% each which includes education, government, religious, and manufacturing.

5.1.2 Impact Results

The province-wide net verified impact results of the 2017 SBL Program are shown in Table 5-1 and Table 5-2.

Table 5-1: 2017 SBL Program Impact Results: Energy

Reported Energy Savings (MWh)	Energy Realization Rate	Gross Verified Energy Savings (MWh)	Gross Verified Precision at 90% Confidence	Net-to-Gross Ratio	Net Verified Energy Savings (MWh)	Lifetime Net Verified Energy Savings (MWh)	Net Verified Energy Savings at 2020 (MWh)
62,962	87%	54,573	10%	94%	51,441	379,449	46,428

Table 5-2: 2017 SBL Program Impact Results: Summer Peak Demand

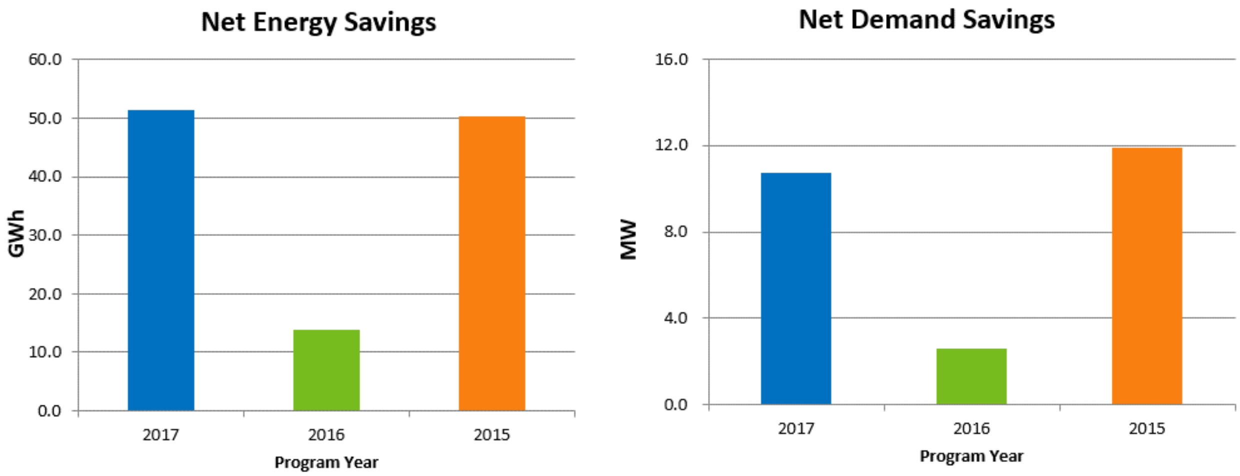
Reported Summer Demand Savings (MW)	Summer Demand Realization Rate	Gross Verified Summer Demand Savings (MW)	Gross Verified Precision at 90% Confidence	Net-to-Gross Ratio	Net Verified Summer Demand Savings (MW)	Net Verified Summer Demand Savings at 2020 (MW)
17.0	67%	11.5	12%	94%	10.7	10.2

Interactive effects and baseline adjustments that occurred in the first year were included in the program realization rates shown in Table 5-1 and Table 5-2. The calculation of the interactive effects is described in Section 3.1.6. The calculation of the NTG ratio is described in Section 3.1.8.

5.1.3 Results Comparison of 2017 with 2016 and 2015

The net verified energy and demand savings results from 2015, 2016, and 2017 are presented in Figure 5-3.

Figure 5-3: Comparison of Year-on-Year SBL Net Verified Energy and Demand Savings



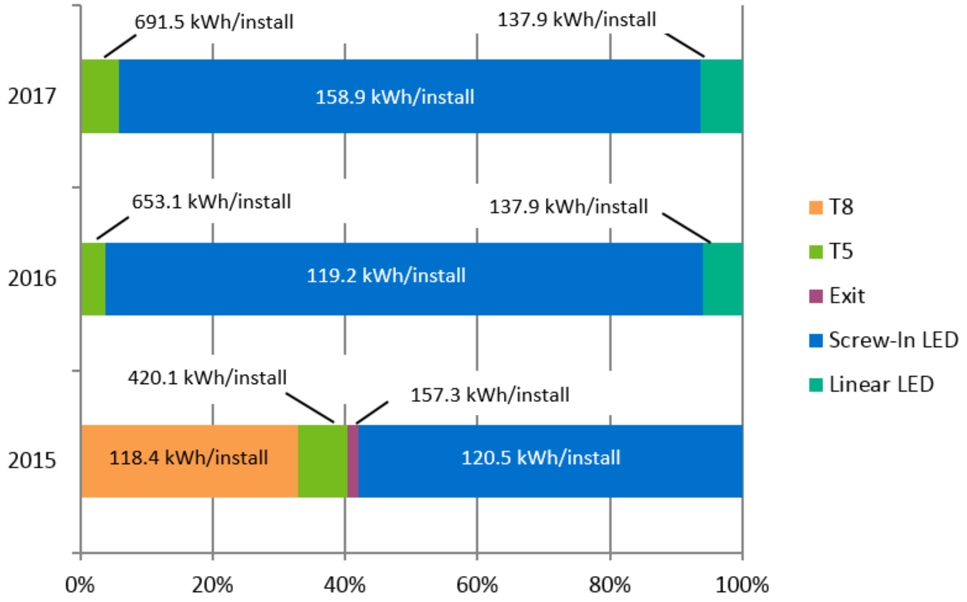
There was a 273% increase in net verified energy savings and a 308% increase in net verified demand savings between 2016 and 2017. The increase in net verified energy and demand savings is mainly due to the higher participation experienced as this is the second year for the re-designed program. Compared to 2015 results, net verified energy savings have increased by 2% while net verified demand savings have decreased by 10%.

The energy realization rate decreased 2.9 percentage points while demand realization rate increased 3.8 percentage points from the 2016 program. SBL program realization rates are stabilizing within the evaluation precision margins of the realization rate estimates. Compared to 2015, energy and demand realization rates increased 16.1 and 8.9 percentage points respectively from the 2015 program. The increase of realization rates in 2017 compared to 2015 is mainly due to the new structure of the SBL program. The reported savings of the re-designed SBL program are based on actual operating hours reported by applicants, while the previous version of the program was using deemed hours of operation based on the lighting application and business type. .

Per-project net verified energy and demand savings continue to improve, as both increased 19% and 30%, respectively since 2016. A breakdown of the savings contribution per measure between the 2015, 2016, and 2017 programs is provided in Figure 5-4.

As shown in Figure 5-4, a significant portion (33%) of the total 2015 net verified savings came from T8 measures whereas the 2016 and 2017 programs only provided incentives for LED and T5 measures. The average savings per LED measure in 2017 increased from 119.2 kWh to 158.9 kWh per measure, which contributed to the further increase in the per project energy savings in 2017 compared to 2016. T5 measures also saw an increase in average savings to 691.5 kWh per measure.

Figure 5-4: Comparison of Year-on-Year SBL Energy Savings Contributions



5.1.4 Lifetime Savings

The SBL Program achieved 379,449 MWh of lifetime net verified energy savings with 46,428 MWh of annual savings persisting until 2020. This was a 271% increase compared to 2016. Figure 5-5 and Figure 5-6 show the comparison for net verified energy savings at 2020 and lifetime net verified energy savings, respectively. The higher lifetime savings is mainly due to the higher participation experienced in 2017 compared to 2016. The lifetime savings of the SBL program was impacted by the effective useful lives (EULs) of the new SBL measures.

Figure 5-5: Comparison of Net Verified Energy Savings at 2020

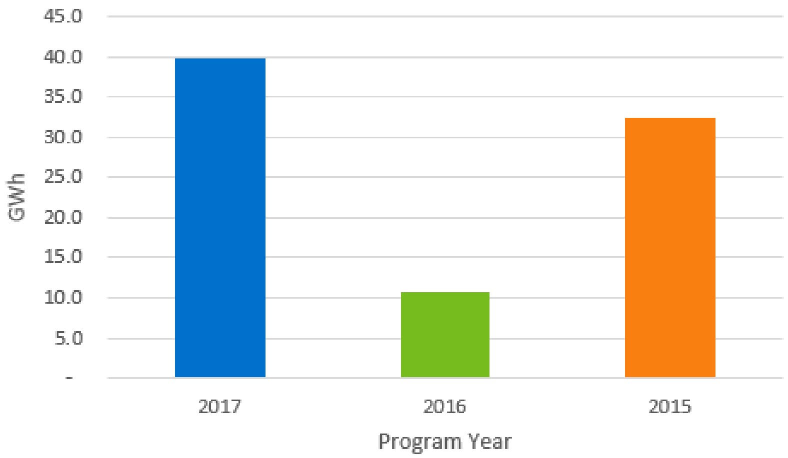
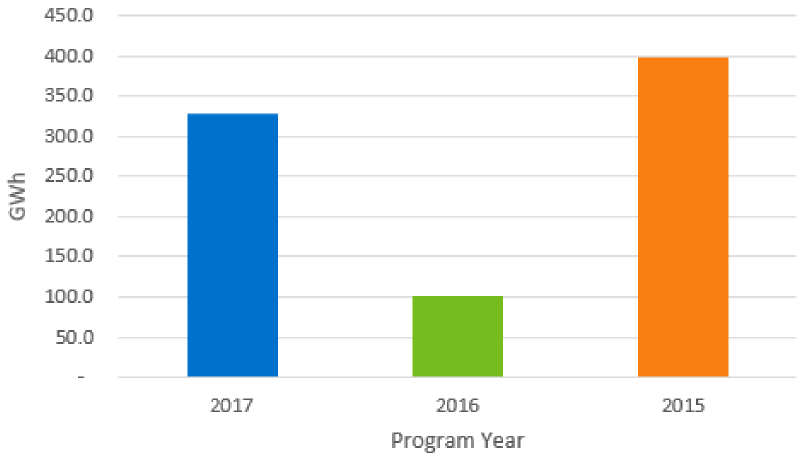


Figure 5-6: Comparison of Net Verified Lifetime Energy Savings



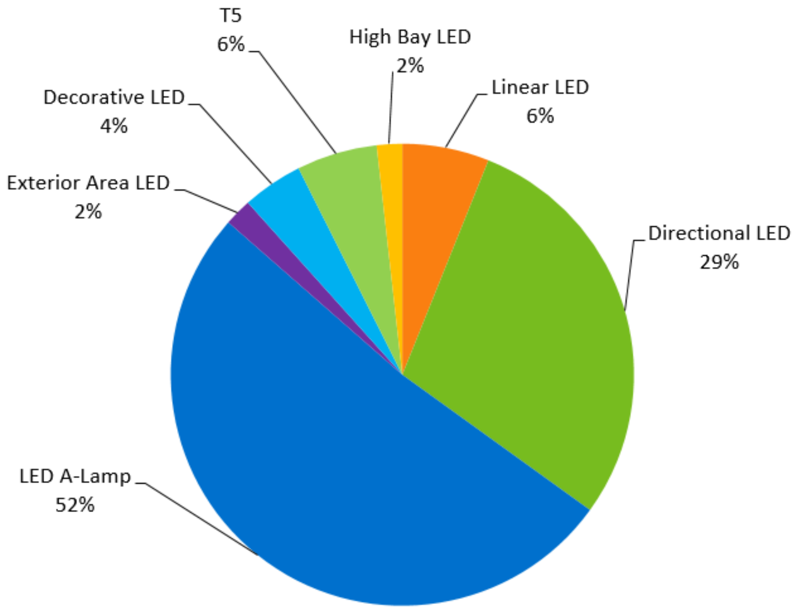
A measure's EUL describes how long the savings associated with the measure persist. The newly designed SBL program provides the EUL for each measure as a function of the lamp's rated life and each participant's reported annual hours of use. For example, the average rated life of a high-bay LED fixture is 70,000 hours. If a participant reports the fixtures will operate 5,182 hours annually, then the calculated EUL of a high-bay LED fixture is 70,000 divided by 5,182, or 13.5 years.

5.1.5 Impact Observations

5.1.5.1 SBL Measure Types

Similar to the results observed in 2016, the SBL energy savings in 2017 were largely contributed by screw-in LED measures, specifically directional LEDs and LED A-lamps. The two measures made up 82% and 81% of the total energy savings in 2016 and 2017, respectively. The full distribution of energy savings by measure type in the 2017 program is shown in Figure 5-7.

Figure 5-7: SBL Energy Savings Contributions by Measure Type



5.1.5.2 SBL Realization Rates

The standard equation for calculating energy savings due to lighting retrofits relies on three main inputs: hours of use, fixture wattages, and fixture counts. Any difference between verified and reported values across these three main inputs will lead to an adjustment in savings via a realization rate. Findings specific to each one of these parameters, as well as additional outside influences on the SBL Program realization rates are detailed in the following subsections.

Hours of Use (HOU)

Applicants to the SBL Program are required to fill out a “SBL Assessment Tool”. The assessment tool details the inventory of lighting installed and removed, and calculates the energy and demand savings accordingly. Applicants are required to input their facility’s lighting operating schedule, which determines the hours of use through which energy savings are calculated. The tool only accepts one schedule for the entire facility. Nexant found 17 instances in the sample of 77 projects where lighting equipment was installed in multiple spaces with varying schedules. Additionally, the tool accepts schedule inputs in terms of a weekly schedule, which is assumed to be constant over the entire year. Nexant found 4 instances within the sample where the facility, and therefore the installed lighting equipment, operated at varying schedules throughout the year. With only one input schedule, applicants tended to input the schedule that corresponded to the greatest amount of hours a lamp would operate if varying schedules were observed.

Hours of use discrepancies had a strong influence on the SBL energy realization rate. For instance, LED A-lamp measures, which contributed 52% of the reported energy savings had an energy realization rate of 81%. Although the LED A-lamp efficient measure wattages were generally verified to be lower than the values assumed by the program, the realization rate fell further below 100% due to lower verified operation hours. Average reported HOU for LED A-lamp is 3,919 hours, which is 374 hours more than the average verified schedules.

IESO’s SBL program does not rely on a deemed HOU assumption. However, for reference, Nexant found the average hours of use associated with the 77 sampled sites to be 3436 hours annually.

Fixture Wattages

Of the 77 sampled projects, 55 (71%) received adjustments to their reported savings due to inappropriate wattage assumptions on installed lamps. The SBL Assessment Tool allows for manual input of removed lamp wattages, from a list with sufficient choices of fixture types and wattages, but assigns assumed wattages to installed lighting fixtures.

Table 5-3 tabulates the results of 7 LED measures encountered in the evaluation sample where the assumed wattages differ from the installed wattages. For instance, linear LED fixtures had the highest energy realization rate of 167%. This is due to program over estimating the efficient case measure wattage. The program assumes linear LED efficiency measure wattage of 18W, however, evaluation team found that verified linear LED wattages in the range of 12-15 W for all sampled measures. This is in line with the 2016 program's findings, as verified installed measures wattages differed from wattages reported by the program.

Table 5-3: Verified and Reported Wattages of LED Fixtures in SBL Sample

Measure Code	Measure Description	Reported Installed Lamp Wattage (W)	2016 Average Verified Installed Lamp Wattage (W)	2017 Average Verified Installed Lamp Wattage(W)
SBL_03	2 Lamp LED Tube Re-Lamp ≤ 15W Min. 1500 Lumen Output	36	35	26
SBL_11	ENERGY STAR® LED PAR 38 ≤ 19W Min. 1100 Lumen Output	19	19	17
SBL_13	ENERGY STAR® LED A Shape ≤ 12W Min. 800 Lumen Output	12	11	10
SBL_14	ENERGY STAR® LED A Shape ≤ 16W Min. 1100 Lumen Output	16	13	14
SBL_18	ENERGY STAR® LED PAR 20 ≤ 12W Min. 600 Lumen Output	12	10	10
SBL_22	ENERGY STAR® LED PAR 30 ≤ 16W Min. 800 Lumen Output	16	15	15
SBL_40	ENERGY STAR® LED BR20 ≤ 12W Min. 600 Lumen Output	12	7	9

Fixture Counts

Nexant found twenty three instances within the sample where the reported fixture counts were determined to be inaccurate. In twenty one instances, the verified count was found to be lower than reported, and only two cases were found to have higher verified counts than reported. Generally, this discrepancy resulted in less verified savings than reported savings. Nexant calculated the realization rate of change in connected load across the twenty three measures with errors to be 79%, signifying that inaccurate fixture counts created artificially overestimated reported energy and demand savings.

5.1.5.3 SBL Assessment Tool

The new SBL Assessment Tool for the updated program is an improvement from the previous version. It collects important parameters necessary to calculate energy and demand savings and is relatively easy to use for contractors and implementers. Nexant understands that it is important that the tool is easy to use while at the same time addressing the issues identified above. The following recommendations address similar issues as the 2016 recommendations but with more specific and achievable actions that should improve the quality of the data that is collected.

- **Observations:** Many times the hours the business is open to the public are entered into the SBL Assessment Tool when in fact the lights are turned on before and after the business is open to the public. Another option is to clarify in the Assessment Tool instructions and in contractor trainings that in cases where multiple schedules exist, the schedule entered should be for the lights that are expected to generate most of the energy savings.

  Recommendation: *Provide clear instructions on what hours of operation should be entered in the SBL Assessment Tool. It should be clarified that the schedule entered in the Hours of Operation tab should be the hour the new efficient lamps are expected to operate and not the hours of operation of the business.*

- **Observations:** For certain SBL measures, a range of allowable wattages is allowed. These measures typically allow an LED lamps to have up to a certain maximum wattage, less than or equal to 15W, for example. The prescriptive savings calculations for these measures assume the maximum wattage allowed as the new efficiency wattage. A discrepancy exists when the verified wattage of the actual lamp is found to be less that this maximum wattage values. This discrepancy leads to the reported savings to be less than the gross verified savings.

  Recommendation: *Provide an optional field for contractors to enter the wattage of the new efficient lamp or fixture in the SBL Assessment Tool. This would only be necessary for measures that only specify a maximum wattage. The wattage value could be made to be optional in that if a value was not entered then the default lookup value could be used.*

- **Observations:** In PY 2017 SBL implementers submitted photos of the pre-existing baseline fixtures and lamps. These photos are important and helpful when verifying the in-situ baseline wattages. In many cases the photos were close up images of the lamps and contained make, model and wattage information. There were a few instances where the photos did not capture enough detail of the lamps or fixtures to definitely determine the baseline wattages. Several pictures collected by contractors are of light fixtures or lamps turned on from a few feet away which does not provide useful information about the lamp wattage or lamp type.

  Recommendation: *Specify what information should be captured in the pre-retrofit and post-retrofit pictures that are collected by the SBL contractors. Many pictures collected by contractors are of light fixtures or lamp turned on either from a few feet away. Specify that pictures of the replaced equipment should capture the wattage of the lamps and, if applicable, the type of ballast.*

5.1.6 Avoided Greenhouse Gas Emissions

The evaluation team used the IESO CDM Energy Efficiency Cost Effectiveness Tool to calculate avoided GHG emissions. Avoided GHG emissions were calculated for the first year or the 2017 program year and for the lifetime of the measures. Table 5-4 below presents the results of these calculations.

Table 5-4: SBL Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided (Tonnes CO_2 equivalent)		
	Electric	Gas*	Total	Electric	Gas*	Total
2017	11,883.38	(3,514.30)	8,369.07	139,433.21	(31,903.13)	107,530.07

*Interactive Effects savings

5.1.7 Cost Effectiveness

The evaluation team conducted a cost effectiveness analysis for the SBL program. Cost effectiveness results are presented in Table 5-5. The SBL program passed the TRC test and the PAC test with both benefits exceeding their respective costs. The program cost effectiveness is improved considerably compared to 2016 and 2015. In 2015, SBL program did not pass the TRC test with a benefit ratio of 0.77. In 2016, the program passed the TRC test with a benefit ratio of 1.07. Full cost effectiveness comparison is presented in Table 5-6.

Table 5-5: SBL Cost Effectiveness Results

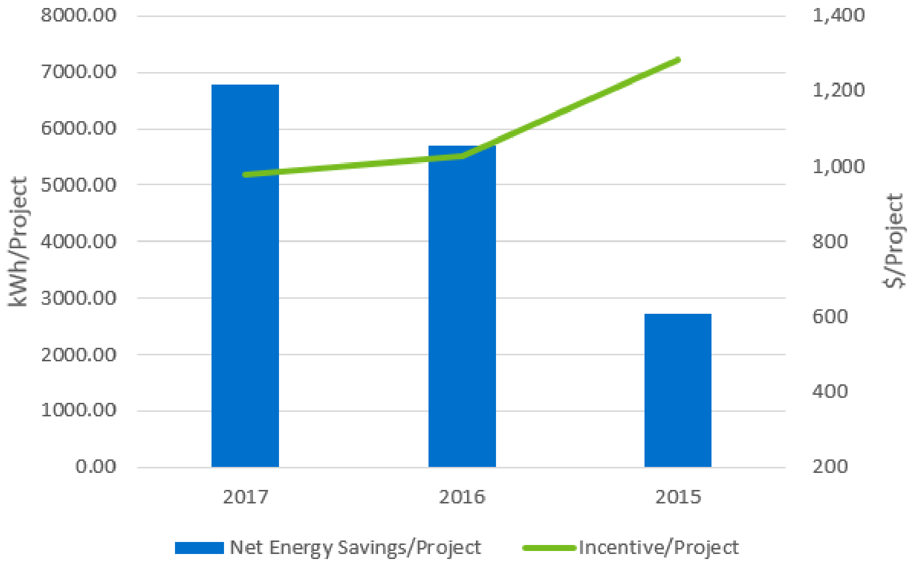
Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	$ 15,725,619
TRC Benefits ($)	$ 32,475,414
TRC Net Benefits ($)	$ 16,749,795
TRC Net Benefit (Ratio)	2.07
Program Administrator Cost (PAC)	
PAC Costs ($)	$ 13,622,901
PAC Benefits ($)	$ 31,956,040
PAC Net Benefits ($)	18,333,140
PAC Net Benefit (Ratio)	2.35
Levelized Unit Energy Cost (LUEC)	
$/MWh	$36.50
$/MW	$174,058

A key contributor to the improvement of SBL cost effectiveness ratio is the increase of the per project net verified energy savings throughout the project years. Additionally, SBL per project incentive is decreasing year-over-year; 2017 per project incentive has decreased by 24% and 5% compared to 2015 and 2016, respectively. The net verified energy savings and incentive paid per project are shown in Figure 5-8.

Table 5-6: Cost Effectiveness Comparison

Project Year	TRC Net Benefit (Ratio)	PAC Net Benefit (Ratio)	Demand LUEC ($/MW)	Energy LUEC ($/MWh)
2017	2.07	2.35	$174,058	$36.50
2016	1.06	1.11	$326,278	$71.30

Figure 5-8: Per Project Energy Savings and Incentive



5.1.8 Net-to-Gross (NTG)

NTG observations for the SBL Program are provided in the following subsections and detailed observations are provided in Appendix D. Additional details regarding the NTG methodology can be found in Appendix C.

5.1.8.1 Key Observations

Key observations from the net-to-gross analysis include the following:

- Participant feedback indicates mostly positive levels of free-ridership. When asked about their actions in the absence of program incentives, more than two-fifths (42%) of participants would have waited at least a year and almost one-fourth (24%) would have installed less expensive or less efficient lighting. However, just over one in 20 of all respondents would have installed the same lighting equipment and paid the full cost themselves (6%), which is indicative of some level of free-ridership.
- The program incentive was the greatest influence on the respondents' decisions (cited by about four out of five, or 79% of participants).
- Participation in the program resulted in moderate spillover—nearly one-fifth (18%) of survey respondents installed equipment (primarily lighting and appliances) with attributable savings. Savings were considered attributable to the program if the respondent's prior program involvement was very influential in the installation decision.

5.1.8.2 NTG Strata Level Results

Table 5-7 shows the results of the 2017 SBL Program NTG evaluation and NTG category (e.g., individual, regional, or provincial). The NTG values for the SBL Program were moderate to high, ranging between 82.9% and 119.4% depending on the LDC. The province-wide NTG score was also favorable at 99.9%. Free-ridership scores ranged from a low value of 0% to a more moderate value of 24.3%. For some LDCs, this was offset by spillover values of between 2.5% and 25.4%. The following subsections summarize the analyses performed to help understand the differences.

Table 5-7: NTG Assignments – SBL Program

NTG Assignment	Facility LDC	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Individual	Alectra Utilities Corporation	123	7.10%	7.00%	4.20%	99.90%	97.10%
Individual	Algoma Power Inc.	7	6.60%	0.00%	0.00%	93.40%	93.40%
Individual	Atikokan Hydro Inc.	2	6.20%	0.00%	0.00%	93.80%	93.80%
Individual	Brantford Power Inc.	5	3.90%	0.00%	0.00%	96.10%	96.10%
Individual	Canadian Niagara Power Inc.	6	2.00%	0.00%	0.00%	98.00%	98.00%
Individual	Centre Wellington Hydro Ltd.	4	4.20%	0.00%	0.00%	95.80%	95.80%
Individual	Entegrus Powerlines Inc.	15	4.50%	4.00%	5.10%	99.50%	100.60%
Individual	Erie Thames Powerlines Corporation	19	6.20%	6.90%	7.80%	100.70%	101.60%
Individual	Fort Frances Power Corporation	2	12.50%	0.00%	0.00%	87.50%	87.50%
Individual	Grimsby Power Incorporated	2	7.50%	0.00%	0.00%	92.50%	92.50%
Individual	Hydro One Networks Inc.	441	11.90%	3.60%	3.40%	91.70%	91.50%
Individual	Lakefront Utilities Inc.	5	5.90%	0.00%	0.00%	94.10%	94.10%
Individual	Lakeland Power Distribution Ltd.	14	6.00%	0.00%	0.00%	94.00%	94.00%
Individual	Midland Power Utility Corporation	5	9.00%	0.00%	0.00%	91.00%	91.00%
Individual	Niagara Peninsula Energy Inc.	7	0.90%	0.00%	0.00%	99.10%	99.10%
Individual	Niagara-on-the-Lake Hydro Inc.	10	17.10%	0.00%	0.00%	82.90%	82.90%
Individual	North Bay Hydro Distribution Limited	3	0.00%	0.00%	0.00%	100.00%	100.00%
Individual	Northern Ontario Wires Inc.	2	0.00%	2.80%	6.20%	102.80%	106.20%
Individual	Orillia Power Distribution Corporation	6	5.90%	2.70%	0.30%	96.80%	94.40%
Individual	Toronto Hydro-Electric	67	9.50%	2.50%	2.50%	92.90%	93.00%

NTG Assignment	Facility LDC	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
	System Limited						
Individual	Whitby Hydro Electric Corporation	3	4.00%	0.00%	0.00%	96.00%	96.00%
South	2 LDCs[36]	5	10.50%	0.00%	0.00%	89.50%	89.50%
GTA	3 LDCs[37]	26	6.00%	25.40%	29.90%	119.40%	123.90%
East	4 LDCs[38]	20	21.10%	10.30%	6.40%	89.20%	85.30%
West	5 LDCs[39]	23	24.30%	9.90%	2.40%	85.60%	78.10%
Province-wide	4 LDCs[40]	88	15.60%	15.47%	11.34%	99.9%	95.7%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net to gross.

5.1.8.3 Free-ridership

The evaluation team assessed the extent of free-ridership within the program by asking participants a series of questions about their experiences and plans before learning about the program, what they would have done in the absence of the program, and how influential the program was on the participant's decision to do the energy-efficient upgrades.

The survey first asked participants whether they had considered or had plans to do lighting upgrades before they learned they could receive energy-efficiency incentives through the SBL Program (Figure 5-9). Over three-fifths (62%) of survey respondents had considered replacing their lights before being contacted by the SBL Program, while over one-third (35%) had not.

Of the survey respondents who said that they had considered replacing their lights, two-fifths (40%) also already had plans to install new lighting before they were contacted by the program indicating potential free-ridership (Figure 5-9). However, nearly three-fifths (57%) of the survey respondents who had considered new lighting had not made plans to install any. While responses to these questions are not included in the estimation of the free-ridership score, they provide additional context for understanding the participants' decision-making. To further understand participant intentions, the survey asked additional questions about their actions and decision-making.

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[36] The two LDCs that received the South's regional score for the SBL Program include EnWin Utilities Ltd. and Essex Powerlines Corporation.

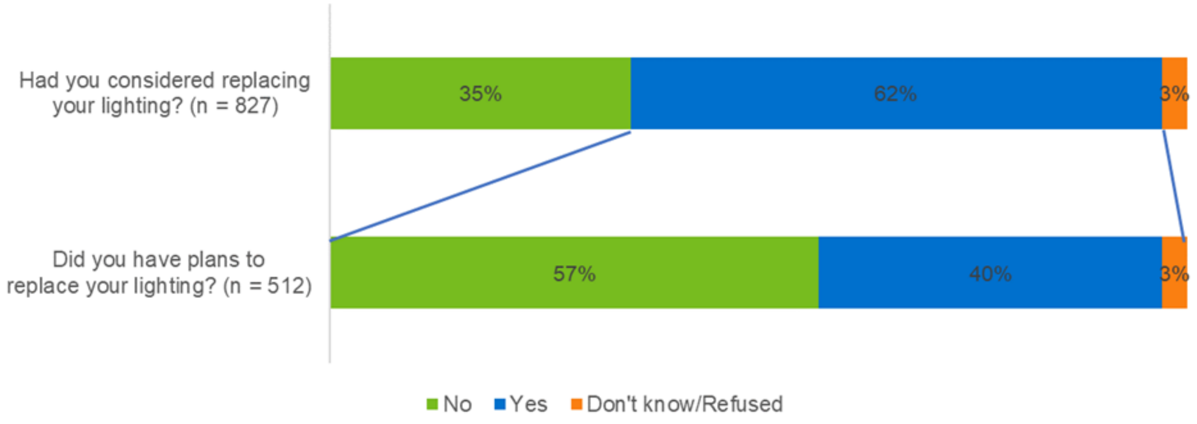
[37] The three LDCs that received the GTA's regional score for the SBL Program include Oakville Hydro Electricity Distribution Inc., Oshawa PUC Networks Inc., and Veridian Connections Inc.

[38] The four LDCs that received the East's regional score for the SBL Program include COLLUS PowerStream Corp., Hydro Ottawa Limited, InnPower Corporation, and Peterborough Distribution Incorporated.

[39] The five LDCs that received the West's regional score for the SBL Program include Energy+ Inc., Festival Hydro Inc., Orangeville Hydro Limited, West Coast Huron Energy Inc., and Westario Power Inc.

[40] The four LDCs that received the province-wide score for the SBL Program include Kenora Hydro Electric Corporation Ltd., Ottawa River Power Corporation, Sioux Lookout Hydro Inc., Thunder Bay Hydro Electricity Distribution Inc.

Figure 5-9 Actions Taken Prior to Applying to Program



The survey next asked participants about the timing of their application in relation to the start of their lighting upgrades. Table 5-8 summarizes their responses. Over three-fifths (63%) either submitted their application before upgrading their lights or after they had begun upgrades but before the upgrades were completed, which suggests that most participants are submitted their application to the program as intended. Less than one-tenth (7%) submitted the application after all lighting upgrades were complete. As with the prior two questions, participant responses to this question are not used to estimate the free-ridership score but are instead intended to provide additional context for understanding their decision processes.

Table 5-8 Timing of Application (n=425)

When did you submit your application to the Small Business Lighting Program?	Respondents*
Before your organization began implementing the energy efficiency upgrade	47%
After the energy efficiency upgrade began, but before the upgrade was complete	16%
After the energy efficiency upgrade was complete	7%
Don’t Know/Refused/Reason unclear	29%

*Does not sum to 100% due to rounding.

The survey next asked participants who had indicated that they submitted their SBL application after they had begun upgrading their lighting why they chose to proceed in that order (Table 5-9). Nearly one-fourth (22%) said that they had started their lighting upgrades before the application was complete because of the length of time needed to complete the application. Other common reasons included the need to find an immediate replacement for failed lighting (18%) and the need to stick to a tight internal deadline to complete the upgrades (16%). This feedback suggests that many of these participants likely had intended to apply to the program but submitted the application late either due to the application system or because of internal organizational drivers. Those that applied after completing emergency replacements may exhibits some free-ridership, though the extent is dependent on whether the program helped them complete more extensive upgrades than they could have on their own.

Table 5-9 Reasons for Beginning Installations Before Application (n=98)

Why did your organization move forward with the energy efficiency upgrade before submitting your application to the SBL Program?	Respondents*
Time needed to submit application through the program application system	22%
Needed to complete work for an unplanned replacement for recently failed existing equipment	18%
Needed to stick to an internal schedule to complete upgrade	16%
Time or resource constraints at your organization	16%
I wasn't yet aware of the SBL Program	6%
Don’t know/Refused/Reason unclear	20%

*Does not sum to 100% due to rounding.

The survey next asked the 2016 participants who said they had planned to upgrade lighting before applying to the SBL Program what their company would have done in the absence of the SBL Program’s free audit and installation of equipment (Table 5-10). Overall, their responses suggest relatively low free-ridership as seven out of ten participants (69%) would have put off, canceled, or installed less expensive or less efficient lighting without the support of the program. The remaining survey respondents would have either installed the same lighting equipment and paid the full cost themselves (23%) or were unsure of what they would have done (7%), which is indicative of partial or full free-ridership for these respondents. Responses to this participant intent question along with the later question on program influence are factored into the free-ridership analysis.

Table 5-10: Actions in Absence of Program (n=206)

If you had not been offered a free audit and installation of equipment, which of the following options best describes what your business would have done in 2017?	Respondents
Would have put off doing the lighting installation for at least one year	42%
Would have installed lighting that was less expensive or less energy efficient	24%
Would have installed the same lighting and paid the full cost yourself	23%
Would have cancelled the lighting installation altogether	3%
Don’t know/Refused	7%

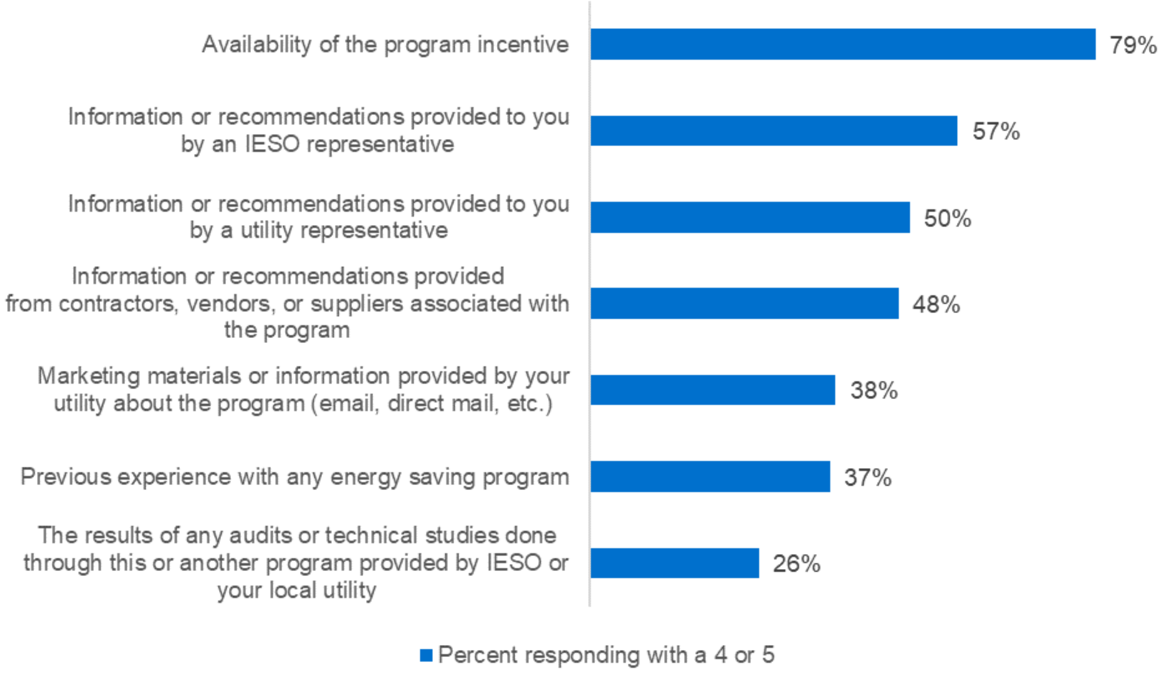
*Does not sum to 100% due to rounding.

The survey asked the 24% of survey respondents who indicated that they would have installed lighting that was less expensive or less energy efficient to describe how much they would have reduced the size, scope, or efficiency of the project. One-tenth (10%) would have decreased the scope of the project by a large amount and more than half (53%) would have reduced the scope by a moderate amount. However, about one-fourth (25%) would have reduced the scope only by a small amount, and about one-tenth (12%) did not know what they would have done. These responses indicate that the program likely helped more than one-half of these respondents to improve their projects in ways that they would not have been able to do otherwise. This question is not directly used to estimate free-ridership but is instead intended to provide additional context.

The survey asked the 23% of respondents who said they would have installed the same lighting in the absence of the program to confirm that they would have done so – and paid for it themselves – if they had not received the free lighting through the program. The large majority (92%) of these respondents confirmed that they would have done the same exact project and paid for it themselves. Note that while these responses are used to estimate free-ridership, these participants' scores constitute a small percentage of the total number of survey respondents and do not have a notable impact on the overall level of free-ridership for the program.

The survey next asked respondents to rate the influence that several SBL Program features had on their decision to complete the lighting upgrade. Figure 5-10 shows these program features and the percentage of survey respondents who rated each as influential (a score of 4 or 5 on a scale of 1 to 5).[41] Most notably, nearly four out of five (79%) survey respondents were influenced by the availability of the program incentives and over one-half were influenced by the information presented by an IESO representative (57%) or an LDC representative (50%).

Figure 5-10 Influence of Program Features on Participation (n=827)
(Rating of 4 or 5 on a scale of 1 to 5)



Finally, the survey asked participants if any other factor played a great role in influencing their company to complete the lighting upgrades (Table 5-11). Saving energy and avoiding high energy bills (50%), the appeal of better quality lighting (14%), and the lack of cost to participate (14%) were the most common other factors reported by survey respondents.

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[41] Scale is 1 to 5, where 1 means “not at all influential,” 2 means “slightly influential,” 3 means “somewhat influential,” 4 means “very influential,” and 5 means “completely influential

Table 5-11 Other Influential Factors on Upgrade Decision (multiple response allowed; n=151)

Is there anything else that played a great role in influencing your organization to do the energy efficient equipment upgrades?	Respondents
Saving money on the company electric bill	50%
Better quality lighting	14%
No cost to participate	14%
Out of concern for the environment	11%
Ease of participation in the program	10%
Recommendation from past program participants	4%
Bulbs need to be changed less frequently	2%
LEDs were safer/more appropriate for the company	2%
Outside grants	1%
The program covered both bulbs and fixtures	1%
There was more than one upgrade option provided	1%
There was no paperwork to fill out	1%

*Does not sum to 100% due to multiple responses.

In summary, the participant free-ridership results for the SBL Program were mostly positive. These responses show that the program is largely reaching the participants who would not have made lighting upgrades without the program.

5.1.8.4 Spillover

To estimate spillover, the survey first asked participants if they installed any energy efficient equipment that did not receive an incentive for (Table 5-12). Nearly one-fifth (18%) reported installing new equipment.

Table 5-12 Additional Upgrades Conducted after Program Participation (n=827)

In 2017, did you install or upgrade any energy efficient equipment after the upgrade project that did NOT receive an incentive?	Respondents
No	82%
Yes	18%

Table 5-13 displays the types of non-incentivized equipment installed by companies after their SBL project was complete. Some survey respondents installed multiple types of equipment. Non-incentivized lighting was the most common equipment type installed (92%).

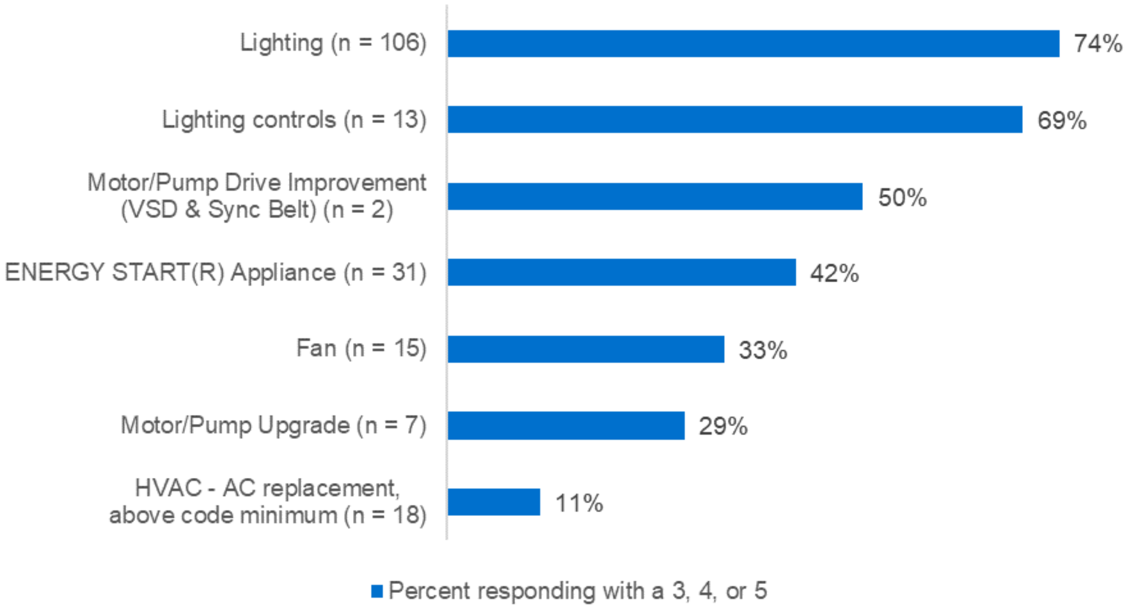
Table 5-13 Types of Upgrades Conducted After Program Participation (multiple response allowed; n=84)

What type of energy efficient improvements, products, or equipment did you install?	Equipment Installed
Lighting	92%
ENERGY STAR® Appliance	15%
Lighting – Controls	11%
Fan	6%
HVAC - Air conditioner replacement, above code minimum	2%
Motor/Pump Upgrade	1%
Motor/Pump Drive Improvement (VSD & Sync belt)	1%

The survey asked participants who installed non-incentivized equipment to use a 1 to 5 scale to rate how influential their participation in the SBL Program had been on their decision to install the new equipment.[42] The percent of survey respondents who were influenced by the program (a score of 3, 4, or 5) is shown in Figure 5-11 for each equipment type.

Most of the respondents reported being influenced by the SBL Program to install non-incentivized lighting and lighting controls.

Figure 5-11 Program Influence on Equipment Installed Outside the Program (Rating of 3, 4, or 5 on a scale of 1 to 5)



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[42] Scale is 1 to 5, where 1 means “not at all influential”, 2 means “slightly influential”, 3 means “somewhat influential”, 4 means “very influential”, and 5 means “extremely influential”.

The survey then asked participants who had indicated that they installed the program-influenced non-incentivized equipment a series of follow-up questions (e.g. capacity, annual hours of operation, etc.). These detailed questions are not displayed here but are instead used within the NTG algorithm to attribute spillover savings to each equipment installation.

5.2 Process Evaluation

The following subsections outline the process evaluation results of the SBL Program. Responses have been summarized and detailed observations are provided in Appendix I. Additional details regarding the process methodology can be found in Appendix F.

5.2.1 Program LDC Staff Perspectives

The following subsections highlight the feedback received from LDC staff about the design and implementation of the SBL Program in 2017.

5.2.1.1 Key Observations

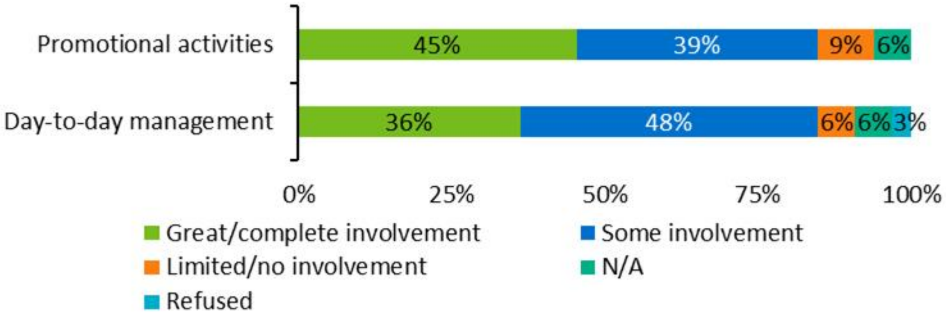
Key findings from LDC staff responses include the following:

- The SBL Program was allocated the second highest percent of total resources (9%) dedicated to CFF Business Programs. LDCs expect the program will achieve 7% of their total expected savings target.
- Most LDCs (58%) managed the SBL Program by using program delivery agents.
- Over one-half of LDCs (55%) engaged one contractor to conduct audits and/or installations in 2017.
- The largest barrier to increased customer participation in the SBL Program is cost of upgrades, which was mentioned by 45% of LDC staff respondents.

5.2.1.2 LDC Staff Involvement

Slightly over one-third of LDC staff (36%) indicated that they were greatly involved in the day-to-day management of the SBL Program and 45% were greatly involved in its promotional activities (Figure 5-12).

Figure 5-12 Level of LDC Staff Involvement in the SBL Program (n=33)

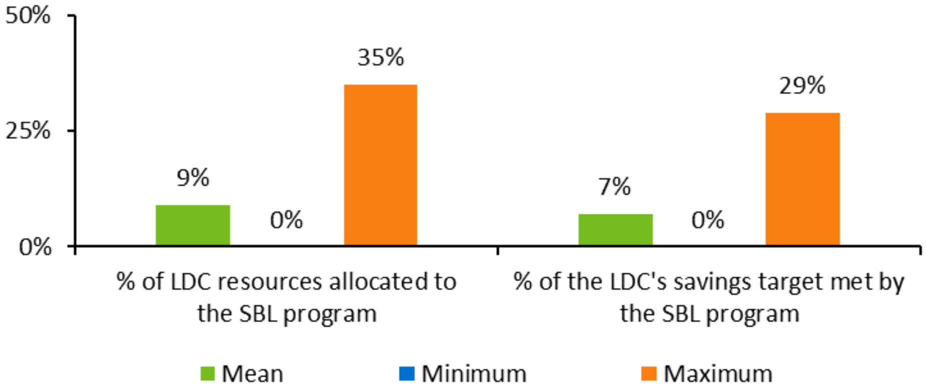


More than one-half (53%) of LDC staff (n=33) expect that in 2018 their LDC will increase its level of involvement and engagement in the SBL Program. Forty-four percent expect to maintain their current level of involvement and the remaining 3% anticipate being less involved.

5.2.1.3 Allocated Resources and Savings

The survey asked LDC staff to estimate the approximate percentage of total resources their LDC allocated to the SBL Program. On average, LDC staff estimated that 9% of their LDC's total resources were allocated to the SBL Program (Figure 5-13). Responses ranged from 0% to 35% of resources. When asked what percent of their LDC's 2017 savings target would be met by the SBL program, LDC staff estimated an average of 7% with a minimum answer of 0% and a maximum of 29%.

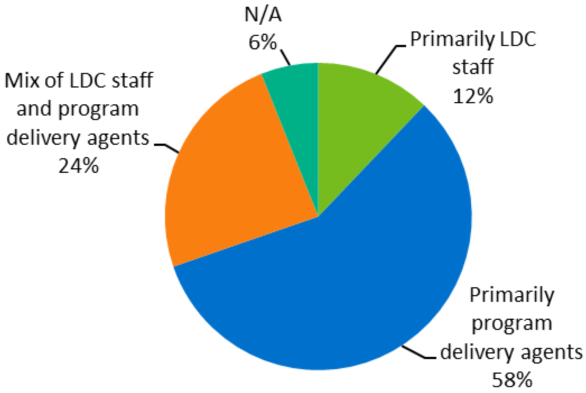
Figure 5-13 Allocated Resources and Expected Savings (n=29)



5.2.1.4 Program Management and Implementation

Most LDCs (58%) managed and delivered the SBL Program primarily through program delivery agent(s) (Figure 5-14). Twenty-four percent used a mixture of LDC staff and program delivery agents, and 12% used primarily in-house LDC staff.

Figure 5-14 Program Management and Delivery (n=33)

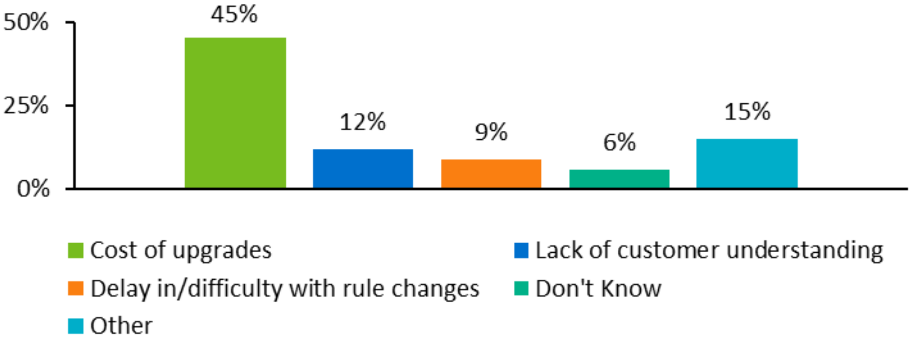


The survey asked LDC staff (n=33) how their LDC managed the contractors that conduct *audits and/or installations* for the SBL Program in 2017. Over one-half of LDCs (55%) indicated that a single contractor managed all aspects of the audit and/or installation management. Thirty percent stated that their LDC used one service provider (also referred to as a program delivery agent) to manage all contractors. As compared to 2016, there was a significant difference in LDCs in 2017 who were more frequently using one contractor to manage all aspects of audits and/or installations (55% and 23%, respectively) and no longer managing the logistics of multiple contractors on their own (0% and 9%, respectively). These results may indicate that LDCs prefer to have a single liaison communicating with and managing all contractors.

5.2.1.5 Barriers to Increased Participation

The survey asked LDC staff about the single largest barrier to greater customer participation for each program (Figure 5-15). For the SBL Program, the most common responses include the cost of upgrades (45%), lack of customer understanding (12%), and delay in/difficulty understanding rule changes (9%). “Other” barriers with single mentions include T-12 ineligibility, staffing issues, and “the program had run its course and should not have been offered”. As compared to 2016, the percentage of LDCs that mentioned the cost of upgrades in 2017 increased significantly (12% and 45%, respectively) and the percentage of respondents that mentioned market saturation decreased significantly (9% and 0%, respectively).[43]

Figure 5-15 Barriers to Customer Participation (multiple response allowed; n=33)



5.2.1.6 Expected Changes for 2018

Over one-half (59%) of survey LDC staff (n=29) indicated that their LDC’s approach to implementing the SBL Program in 2018 changed from 2017. The remaining 41% did not change the implementation process.

The most frequently mentioned changes to SBL implementation in 2018 were increased marketing and outreach efforts (35%) and initial launch of the program (24%) (Figure 5-16). LDCs also mentioned more aggressive customer targeting and new opportunities created by program changes (12% each). “Other” changes with single mentions include switching to a performance-based model, increasing the number of audits, reviewing program changes and their effects on current contracts, better use of joint plan partners, increased sensitivity to program costs, a new PDA, and a new staff member.

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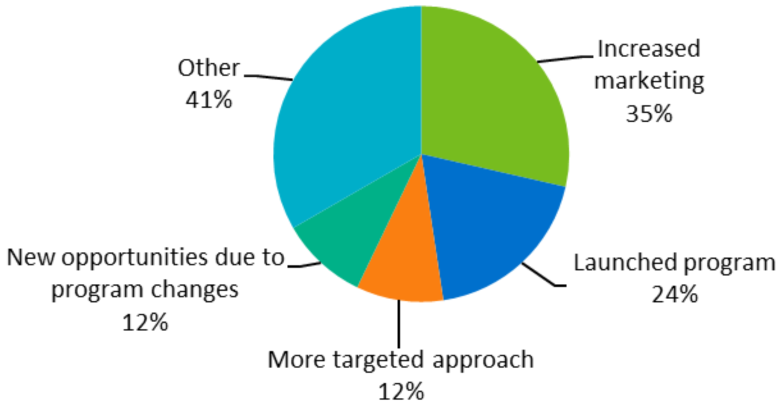
[43] The 2016 and 2017 percentages of respondents who mention the cost of upgrades and market saturation are significantly different at the 90% confidence level.

Figure 5-16 Changes to the SBL Program in 2018 (n=17)



5.2.2 PDA and TPE Staff Perspectives

The following subsections highlight the feedback received from the SBL PDA and TPE staff who provided support to the implementation of the SBL Program in 2017. Feedback was received through a web survey that was administered in April 2018. As the sample size of SBL PDAs and/or TPEs is small (2 respondents, 1 partial response), counts are reported instead of percentages. The partial respondent provided some useful feedback that was incorporated into the barriers and program improvement; however, the evaluation team was unable to use the remaining responses due to inconsistencies in the answers provided.

5.2.2.1 Key Observations

Key findings from PDA and TPE staff responses include the following:

- All three firms indicated the ability to save energy and lower their energy bills were extremely influential on their customer's decision to install the program-qualifying equipment.
- All three firms indicated that a primary barrier that customers face is high upfront costs, which are only partially offset by program incentives.
- One PDA/TPE firm stressed the importance of spreading the program to more LDCs; another PDA firm recommended expanding the program's coverage of T8 lighting, specifically, but in general to cover "what is predominantly seen in the market." This respondent also suggested the LDCs support a better, more comprehensive, marketing strategy to enhance customer confidence in the program.

5.2.2.2 Respondent Roles and LDCs Supported

The responding PDA and TPE firms supported multiple LDCs in the delivery of the SBL Program in 2017. One firm provided PDA and audit support while the other provided a comprehensive PDA, TPE, audit, installation and product procurement support to the SBL Program. Both firms reported there were no issues with having multiple roles on SBL projects.

The survey asked respondents what activities or duties were involved in providing PDA support to the SBL Program in 2017. Both firms indicated providing customer outreach, door-to-door marketing, and audit services (including scheduling) as part of their role as a PDA. One firm provided some additional services under their role as PDA and TPE, including coordination with installation contractors, installation of some types of measures, as well as product procurement.

5.2.2.3 Review of Customer Applications

One of the two responding PDA/TPE firms was responsible for reviewing customer applications for the 2017 SBL Program. Their process included an overall review to ensure that the application was complete and compliant with program rules as well as a detailed review of the energy savings calculations and verification of proper documentation of inputs to the calculations. The responding firm also conducted post-installation review to confirm installation of the proper equipment. Their application review did not include assessing if the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program; however, it is possible that the LDC or some other entity performs this level of review.

5.2.2.4 PDA and TPE Interactions with LDCs, IESO, and Customers

Interactions and Satisfaction with LDCs: The survey asked the PDA and TPE firms about the nature or purpose of their interactions with the LDCs when providing support services to the SBL Program in 2017. One PDA firm interacted with the LDCs for reporting purposes. The other PDA/TPE firm indicated interacting with the LDC for multiple reasons. The PDA/TPE respondent provided the following explanation:

"We [communicate] with the LDCs on projects we install, educate the LDCs on lighting, and [respond to requests] to talk to customers who need advice on lighting design. We are [also] helping to introduce the new changes to program delivery and evaluating the proposed changes to the program on energy (kWh) reductions."

Both firms experienced differences in their interactions with the LDCs in administering the SBL Program. One firm indicated that reporting details were different for the individual LDCs, while the other reported that the level of interaction depended on the customer engagement needs of the individual LDC.

The survey asked respondents to use a scale of 1 to 5 to rate their level of satisfaction with specific elements of communications with the LDCs.[44] Both firms indicated they were either somewhat satisfied or completely satisfied (rating of 4 or 5) with their overall interactions with the LDCs, clarity on coordination needs, and clarity on roles and responsibilities of the different organizations involved in administering the program. One firm was completely satisfied (rating of 5) with clarity on program goals and the level of communication and collaboration, while the other firm was neither satisfied nor dissatisfied (rating of 3) with these aspects of interacting with the LDCs.

Program Support Received from the LDCs: The survey asked PDA and TPE firms what support their firm received from the LDCs to help in their role as the PDA and/or TPE in 2017. Both firms reported receiving one-on-one in person support from LDC staff. One firm also received marketing support from the LDC staff.

The survey asked if the respondents had any suggestions for additional support they would recommend the LDCs provide to the PDAs and TPEs. Both firms did not have any specific suggestions for additional support.

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[44] Scale is 1 to 5, where 1 means "not at all satisfied," 2 means "somewhat dissatisfied," 3 means "neither satisfied nor dissatisfied," 4 means "somewhat satisfied," and 5 means "completely satisfied."

PDA and TPE Interactions with the IESO: The survey asked PDA and TPE firms about the nature or purpose of their interactions with the IESO when providing support services to the SBL Program in 2017. Both firms indicated they did not have any direct contact with the IESO regarding their support to the SBL Program.

PDA and TPE Interactions with Customers, Marketing, and Outreach: The survey asked PDA and TPE firms how frequently their firm interacted directly with customers. The respondents indicated they had frequent daily or weekly customer interactions. The survey asked the respondents to describe the nature of their interactions with customers. One firm reported contacting potential customers for sales and program promotion. The other firm indicated contacting customers for several different reasons including, clarification of application details, to provide assessments or installations, and to provide information on other programs that are available through the LDC.

The survey asked respondents what role their firm played in marketing the SBL Program. The PDA/TPE firms both indicated marketing the SBL Program through customer calls, door-to-door canvassing, and marketing through social media. One firm also reported marketing the SBL Program through advertisements on television or radio, as well as the release of targeted direct mailers prior to launching a door-to-door canvassing effort.

The survey asked respondents who marketed the program, how customers were identified. One firm indicated that customers were targeted based on their demand eligibility, which is likely provided by the LDC(s). The other firm reported that customers were targeted by postal codes, and areas deemed as “business improvement areas” were given priority.

5.2.2.5 Perspectives on Motivations, Barriers, and Suggestions for Program Improvement

The survey asked PDA and TPE firms to use a scale of 1 to 5 to rate how influential certain factors were on the customer’s decision to install the program-qualifying equipment.[45] All three firms indicated the ability to save energy and lower their energy bills were extremely influential on their customer’s decision to install the program-qualifying equipment. Two firms thought the ease of participating in the program was an extremely influential factor. One firm also thought that customer’s trust that equipment incentivized by the IESO must be reliable was a very influential factor, but that receiving the incentive was an extremely influential factor in the decision to install program-qualifying equipment.

The survey also asked respondents what they thought were the primary barriers to increased customer participation. All three firms indicated that customers face high upfront costs, which are only partially offset by program incentives. One firm also mentioned that customers' lack of confidence in the energy savings is another barrier that prevents increased customer participation. Another firm also thought the benefits from the energy savings do not outweigh the costs of the upgrades, customers do not know where to get the help they need, and in general do not trust that the program will help them.

The survey asked PDA and TPE firms if they had any suggestions for improvements to the SBL Program. One PDA/TPE firm stressed the importance of spreading the program to more LDCs but did not have any

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[45] Scale is 1 to 5, where 1 means the factor had “no influence at all,” 2 means it was “slightly influential,” 3 means it was “somewhat influential,” 4 means it was “very influential,” and 5 means it had a “extremely influential.”

specific suggestions for program improvements. One PDA firm recommended expanding the program's coverage of T8 lighting, specifically, but in general to cover "what is predominantly seen in the market." This respondent also suggested the LDCs support a better, more comprehensive, marketing strategy to enhance customer confidence in the program.

5.2.3 Program Assessor and Lighting Installation Contractor Perspectives

The following subsections highlight the feedback received from the SBL Program Assessor and Lighting Installation Contractor survey. Responses have been summarized and detailed findings are provided in Appendix I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

5.2.3.1 Key Observations

Key findings from assessors and lighting installation contractors' responses include the following:

- Of the 27 respondents, about three-fifths were lighting installation contractors (16 respondents), about one-tenth were assessors (three respondents), and three-tenths were both assessors and lighting installation contractors (eight respondents).
- Assessors and lighting installation contractors completed a somewhat similar number of projects, with an average of 38 SBL site assessments and 45 lighting installations completed in 2017. Companies that acted as both assessor and lighting installation contractors completed an average of 46 site assessments and lighting installations in 2017.
- Overall, an average of almost half (48%) of all small business sales by these responding assessors and lighting installation contractors went through the SBL Program.
- One-third (nine of 27) of SBL assessors and lighting installation contractors indicated that they had received some sort of training with formal group training sessions most commonly mentioned. Most trainings were comprehensive in their coverage of the SBL Program, though marketing and outreach techniques were absent from the discussion of two trainings, and the program rules and application process were missing from one training.
- Less than two-fifths (ten of 27) of SBL assessors and lighting installation contractors were satisfied with the program overall. They were less satisfied with the dollar amount of the incentives (six of 27), the number and types of equipment incentivized (six of 26), the program marketing and outreach (nine of 27), and the dollar cost caps associated with each upgrade (seven of 27).
- Lighting installation contractors and assessors who were dissatisfied with the program (seven of 27) reported that too few jobs were being assigned to lighting installation contractors (three respondents), requested a change to the incentives for certain bulb types to make them more appealing to customers (three respondents), requested that additional light products be covered by the program (two respondents), and added that lighting installation contractors had to cover the cost of additional visits and bulbs when assessors assigned incorrect bulb types (two respondents).

5.2.3.2 Firmographics

Over four-fifths (17 of 20) of the responding SBL assessors and lighting installation contractors were from small businesses with 15 full-time employees or fewer. Over two-fifths (nine of 21) of the responding SBL assessors and lighting installation contractors reported that their company employed part-time employees. Over three-fourths (18 of 23) of SBL assessors and lighting installation contractors said that their company had been in business for more than ten years.

Figure 5-17 Employee Count (n=20)

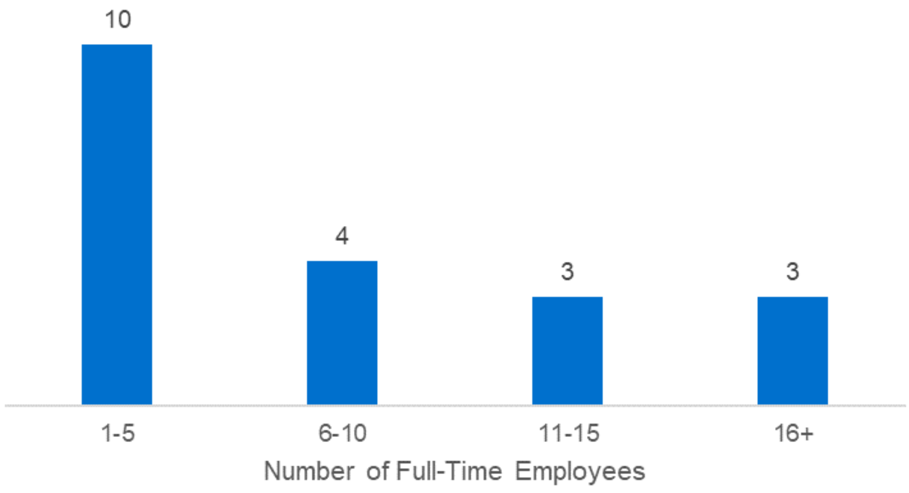
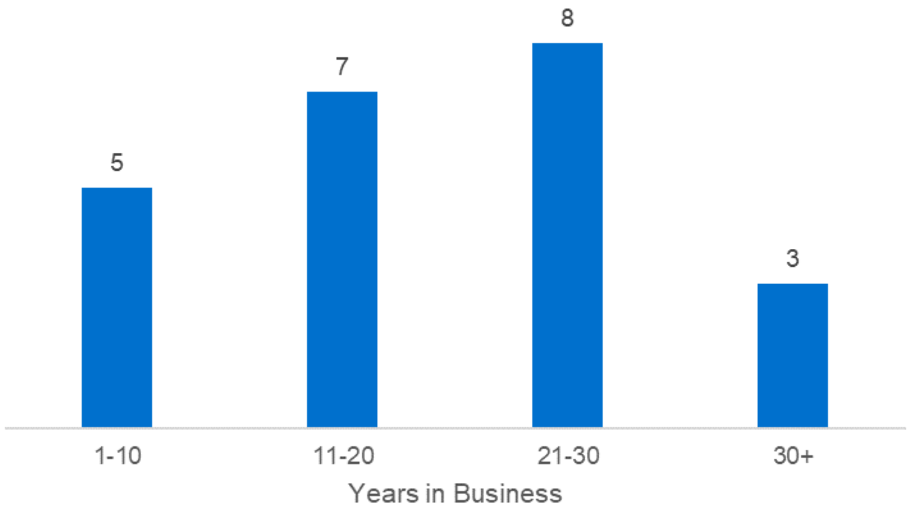


Figure 5-18 Company Years in Business (n=23)



5.2.3.3 Company Background and Participation in SBL Program

Table 5-14 shows the distribution of roles that responding assessors and lighting installation contractors played in the SBL Program with the largest group consisting of lighting installation contractors (16 respondents).

Table 5-14: SBL Program Role (n=27)

Roles Served by SBL Program	Respondents
Lighting Installation Contractor	16
SBL Assessor	3
Both an SBL Assessor and a Lighting Installation Contractor	8

Figure 5-19 depicts the average percentage of all projects completed by the respondent's businesses both inside and outside the SBL Program that come from the residential, small business, and medium/large business sectors. On average, over two-thirds (69%) of projects come from the small business sector, while the residential sector represented less than a fifth (15%).

Figure 5-19 Average Total Projects by Customer Type (multiple response allowed; n=27)

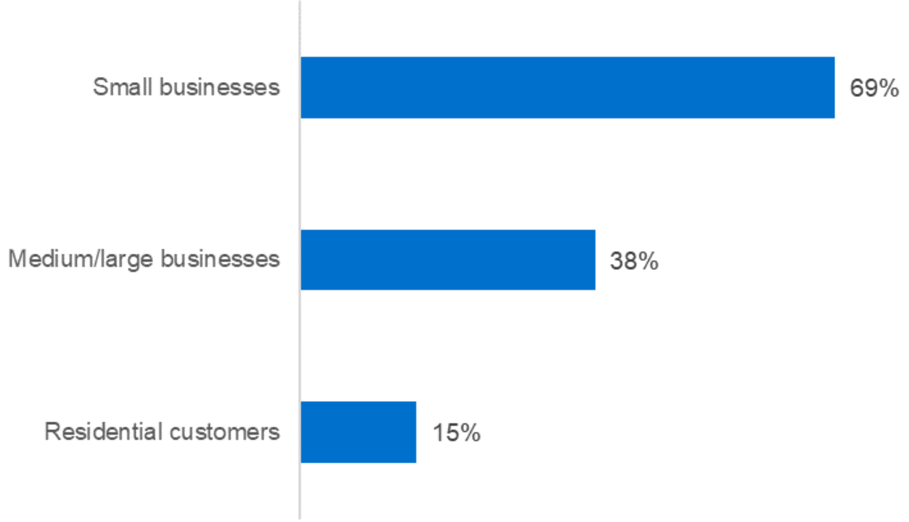
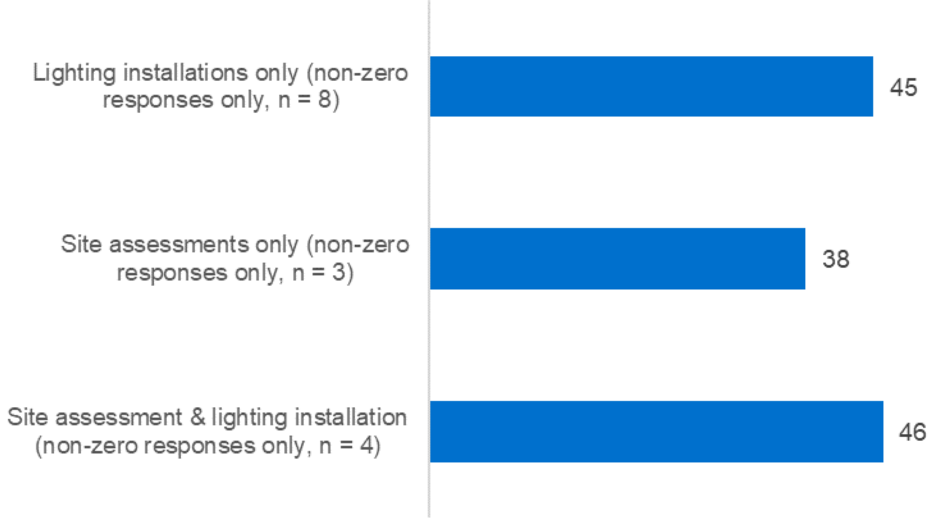


Figure 5-20 shows the average number of SBL projects completed in 2017 by project type—site assessment (average of 38 projects), lighting installation (average of 45 projects), or both (average of 46 projects) by the assessors and lighting installation contractors.

Figure 5-20: Average Number of SBL Projects in 2017



Respondents were asked to estimate the average percentage of total small business sales that came from the SBL Program in 2017. Overall, an average of almost half (48%) of all small business sales by these respondents went through the SBL Program.

The survey asked SBL assessors and lighting installation contractors about sales of different types of LED bulbs as a percentage of their total small business sales and *then asked them to report what percentage of those sales came through the SBL Program* (Table 5-15). ENERGY STAR® A-shape bulbs made up the largest average percentage of small business sales (30%), while refrigerated display case LEDs represented the smallest average percentage (2%). A-shape lamps and high bay LEDs represented the highest average proportion of sales through the SBL Program (53% and 30% respectively), while linear LEDs and refrigerated display case LEDs had the lowest proportion of sales through the SBL Program (12% and 0%, respectively). These data suggest that the program may have a further opportunities to increase its share of contractor sales particularly for ENERGY STAR® A-Shape bulbs, high bay LEDs, ENERGY STAR® Reflector Bulbs, and exterior area LEDs; program cost caps (see Section 5.2.3.7) may, however, be limiting these opportunities.

Table 5-15 Energy Efficient Lighting Sales (n=13)

SBL Program Eligible Efficient Equipment Type	Avg. % of SBL Sales	Avg. % of Lighting Type Sold through SBL Program
ENERGY STAR® A-Shape	30%	53%
ENERGY STAR® Decorative Bulb	8%	19%
ENERGY STAR® Reflector Bulb (BR, MR, PAR)	19%	21%
Exterior Area LEDs	18%	18%
High Bay LEDs	23%	30%
Linear LEDs	13%	12%
Refrigerated Display Case LEDs	2%	0%

When the evaluation team asked if any other types of lighting equipment made up a significant percentage of total 2017 small business sales, two of twenty-seven (7%) said yes. The other lighting equipment included canopy lamps, T8 lamps, exterior parking lamps, T12 lamps, and replacement magnetic ballasts. These lighting types represented between 2% and 35% of their total 2017 small business sales.

5.2.3.4 Program Outreach and Marketing

Table 5-16 shows how responding assessors and lighting installation contractors first heard about the SBL Program. About two-fifths (11 of 27) of assessors and lighting installation contractors first heard of the program through previous experience with an LDC or IESO energy efficiency initiative. Hearing of the program from an LDC representative was mentioned the next most frequently (3 of 27). Lighting installation contractors and assessors who said that they heard about the program through other means (four of 27) became aware of the program through a wholesaler, customer, engineering firm, or bidding process.

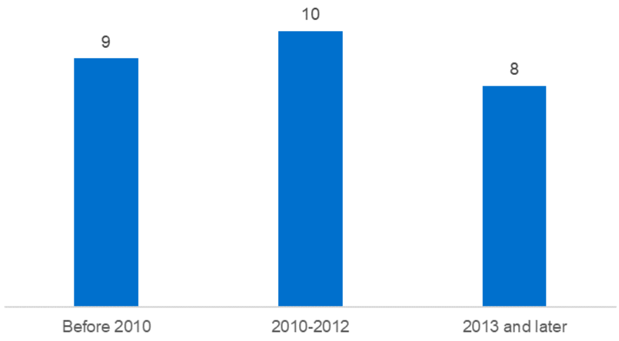
Table 5-16 SBL Assessor and Lighting Installation Contractor Outreach (n=27)

How did you first hear about the SBL Program?	Respondents
Previous experience with an LDC or IESO energy efficiency initiative	11
A representative from your LDC	3

How did you first hear about the SBL Program?	Respondents
A representative from IESO	2
Energy efficiency advertising from your LDC	2
Not applicable	2
A colleague or competitor	1
Other energy efficiency advertising	1
Through other means	4
Don't know	1

Figure 5-21 shows the year in which the surveyed company first participated in the SBL Program (or its predecessors, the Small Commercial Direct Install Program and the Small Business Lighting Initiative). Over two-thirds of companies (19 of 27) have been participating in the program since 2012 or earlier.

Figure 5-21 Year that Company First Participated in SBL Program (n=27)



The survey also asked assessors and lighting installation contractors whether they had received training from the SBL Program, and, if so, what type of training they had received. One-third (nine of 27) indicated that they had received some sort of training. Table 5-17 shows that they most frequently received formal group training sessions, mentioned by all of these survey respondents. Additionally, some respondents indicated that they received training in the form of answers to questions (four respondents), webinars (two respondents), and one-on-one in-person instruction (two respondents).

Table 5-17 Type of SBL Training Received (multiple response allowed; n=9)

What type of training or education did you receive?	Respondents
Formal group training session	9
Responses to questions	4
Webinar or other online instruction	2
One-on-one in-person instruction from LDC staff	2

The survey asked respondents if each of the following four topics were covered in the formal group trainings: the program offerings associated with the SBL Program, the program rules and application process for the SBL Program, installation procedures and practices, and marketing and outreach techniques to better upsell the program to customers. All four topics were covered in most SBL trainings, but marketing and outreach techniques were absent from two trainings, and the program rules and application process were missing from one training.

Table 5-18 shows the primary way in which respondents said their customers learned of the SBL Program. Nearly one-half (13) indicated that their customers most frequently learned of the program through actions their own company took. These actions included cold calling customers (five respondents), describing the program during client calls (five respondents), or marketing the program during customer contacts (three respondents).

Table 5-18: SBL Customer Outreach (multiple response allowed; n=27)

What is the primary way that your customers learned about the SBL Program in 2017?	Respondents
You made cold calls to potential customers	5
You described the SBL Program during client calls	5
Customer saw advertisement for program, contacted company	5
You marketed the SBL Program during audits and other customer contacts	3
Other	3
Don't know	6

The survey asked assessors and lighting installation contractors how often they promoted other Save on Energy initiatives to their customers. About three-fifths (16 of 27) indicated that they promoted other initiatives “frequently” or “very frequently.” Only two indicated that they “never” promoted the initiatives, one indicated that there was not much of a market in his small town and the other stated that he did not know very much about the other initiatives.

5.2.3.5 Assessor and Lighting Installation Contractor Satisfaction

Figure 5-22 shows lighting installation contractor and assessor satisfaction (4 or 5 on a scale of 1 to 5)[46] with various aspects of the SBL Program. Less than two-fifths (37%) of SBL assessors and lighting installation contractors were satisfied with the program overall.

The large majority (89%) of respondents who had completed a SBL training were satisfied with it. The majority (58%) of surveyed SBL assessors and lighting installation contractors were also satisfied with the interactions they had with SBL Program representatives from a LDC, but less than a third (27%) were satisfied with interactions they had with SBL Program representatives from IESO.

The respondents were less satisfied with the dollar amount of the incentives, the number and types of equipment incentivized through the, the program marketing and outreach, and the dollar cost caps associated with each upgrade.

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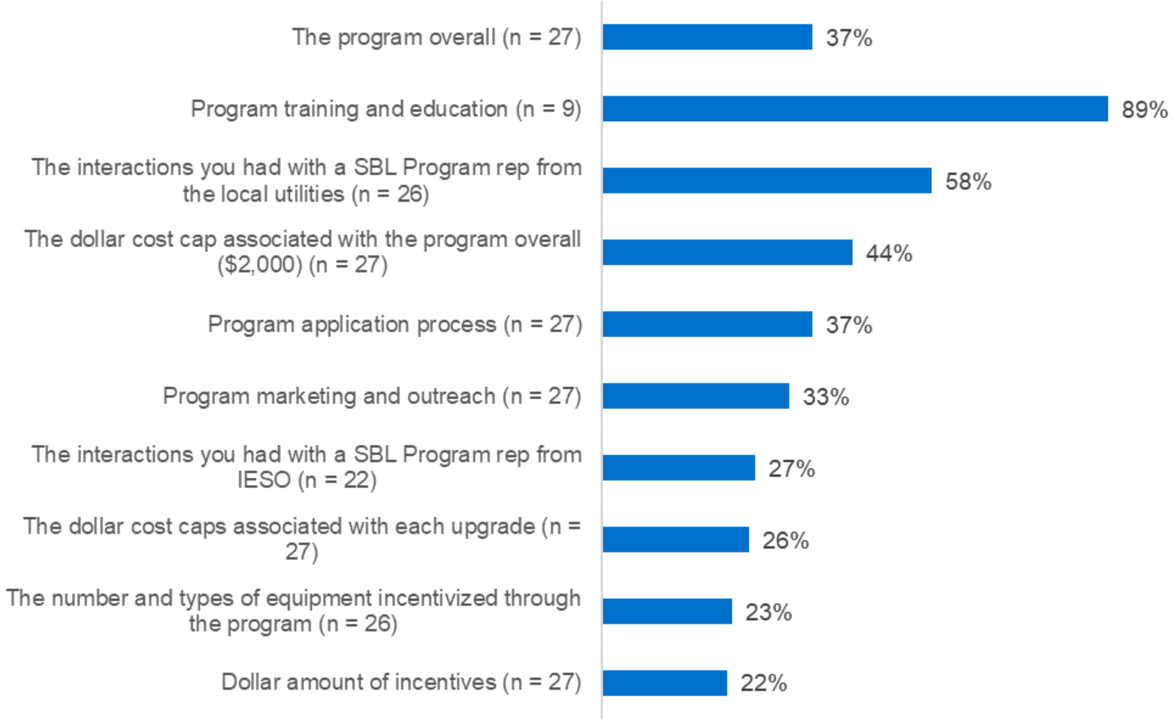
[46] Scale is 1 to 5, where 1 means “not at all satisfied,” 2 means “somewhat satisfied,” 3 means “satisfied,” 4 means “very satisfied,” and 5 means “completely satisfied.”

Figure 5-22 Lighting Installation Contractor and Assessor Satisfaction with Program Components



5.2.3.6 Dissatisfaction and Suggestions for Program Improvement

The survey asked lighting installation contractors and assessors who were dissatisfied (response of 1 or 2) with the cost caps associated with each upgrade, the overall cost cap, or the program overall why they were dissatisfied. Their reasons for dissatisfaction and recommendations for improvement are shown below.

The seven respondents[47] who were dissatisfied with the program overall suggested the following areas of improvement:

- There are too few SBL jobs assigned to lighting installation contractors. Ensure that assessors and program staff provide as many opportunities to contractors as possible (three respondents)
- Requested a change to the incentives for certain bulb types to make them more appealing to customers (three respondents)
- Requested that additional light products be covered by the program (two respondents)
- Increase assessors’ accuracy when assigning bulb types so that lighting installation contractors do not have to cover the cost when bulb types they are incorrectly listed by the assessors (two respondents)
- Re-introduce no charge lighting up to $2000 (one respondent)
- Set minimum service, so lighting installation contractors are not travelling for extremely small jobs (one respondent)
- IESO and the LDCs should do more to promote program to customers (one respondent)

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[47] Note that suggestions from a respondent to the PDA/TPE survey were included here as that respondent provided PDA services as well as installation services to the SBL Program.

The nine lighting installation contractors and assessors who were dissatisfied with the dollar cost caps associated with each upgrade reported the following areas of dissatisfaction:

- Certain bulb conversions were low due to low incentives (three respondents)
- Cost caps associated with each upgrade restrict the ability to upgrade an entire facility (three respondents).
- Cost caps don't allow contractor to make a profit (two respondents)
- Customers were dissatisfied with the dollar cost caps of each upgrade (two respondents)
- Customers were dissatisfied with copay, having received no charge lighting in the past (one respondent)

The nine lighting installation contractors and assessors who were dissatisfied with the overall program cost cap of $2,000 reported the following areas of dissatisfaction:

- The overall cost cap should be increased so customers will take full advantage of program (four respondents)
- The overall cost cap prevents contractors from making a profit (two respondents)
- Customers confuse the $2,000 cost cap with $2,000 of free lighting (one respondent)
- The overall cost cap works well only if there is no copay (one respondent)
- Program is hard to sell to customers with its current structure and products covered (one respondent)

The survey asked respondents for suggestions on additional equipment types to include in the SBL Program in future program years. Responses to this question are shown in Table 5-19. The most common responses were T12 lamps, exterior lighting, reimbursing contractors for the use of scissor lifts, and T8 lamps.

Table 5-19 Lighting installation contractors and Assessor Recommendations for Additional Program-Covered Equipment (open end response; n=14)

Recommendation for Additional Equipment	Respondents
T12 lamps	6
Exterior lighting: pole lights, flood lights, soffit lights, parking lights, sign lighting	4
Scissor lifts for contractors*	4
T8 lamps	4
Ballasts	2
A19 base chandelier bulbs	1
Exit signs	1
Full fixture replacement options for troffers	1
LED kits (1x4, 2x4, 8', etc.)	1
U lamps	1
Wider range of lamp colours	1

*Suggested as a reimbursable cost for lighting installation contractors

5.2.3.7 Customers Maximizing the Program Cost Cap

Based on feedback from the respondents, on average, over one-half (52%) of all completed SBL projects maximized the overall program cost cap of $2,000.[48] The survey asked lighting installation contractors and assessors why some of their projects did not maximize the overall program cost cap. Their responses are shown in Table 5-20.

Table 5-20 Reasons Project May Not Maximize Cost Cap (open end response; n=20)

Reasons $2.000 Cost Cap Not Met	Respondents
Small job, not enough lights	8
Remainder of lighting was not covered by the program	5
Cost was too high for customer	3
Customer unwilling to co-pay to retrofit a fixture	3
Incentives were low, so it was difficult to use up to $2000	3
Assessor error/lack of explanation to customer	2
Cost-sharing	2

About four-fifths (81%) of lighting installation contractors and assessors said more program-qualifying lighting equipment would have been installed if the overall cost cap had not existed. The survey asked respondents who said that more lighting could have been installed if not for the overall cost cap the same question for each lighting type. They were also asked to estimate the quantity of the lighting type that could have been installed in 2017 without the overall cost cap. These responses are shown in Table 5-21. Survey respondents reported that additional high bay LEDs (83% of respondents) or exterior area LEDs

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[48] In comparison, a review of the SBL project database shows that, on average, 7.3% of customers received the maximum incentive of $2000; 18.2% of customers received incentives of $1,900, and 20.1% received incentives of $1,800.

(76% of respondents) would have most commonly been installed. Survey respondents indicated that the greatest savings opportunity would have likely still come from A-Shape bulbs, as they indicated that they would have replaced an average additional quantity of 2,000 A-Shape bulbs in 2017. They suggest that reflector bulbs would have followed (average additional quantity of 375 in 2017).

Table 5-21 Energy Efficient Lighting Sales Without Overall Cost Cap (n=22)

SBL Program Eligible Efficient Equipment Type	Percent of respondents indicating that more of the bulb type could have been installed without cost cap	Avg. additional quantity that would have been installed
ENERGY STAR® A-Shape	64%	2,000
ENERGY STAR® Decorative Bulb	36%	250
ENERGY STAR® Reflector Bulb (BR, MR, PAR)	54%	375
Exterior Area LEDs	76%	118
High Bay LEDs	83%	65
Linear LEDs	69%	250
Refrigerated Display Case LEDs	22%	50

5.2.4 Program Participant Perspectives

The following subsections highlight the feedback received from the SBL Program participant survey. Responses have been summarized and detailed findings are provided in Appendix I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

5.2.4.1 Key Observations

Key findings from participants' responses include the following:

- About one-fourth (26%) heard about the program through a representative from their LDC and nearly one-fourth (23%) heard about the program through a representative of IESO.
- While nearly one-half (47%) were aware of the Retrofit Program, less than one- tenth were aware of every other program. These results point to an opportunity for additional outreach to small businesses to increase program awareness across a broader range of programs
- Nearly all survey respondents (95%) said that saving energy and lowering energy bills was the primary motivating factor in their decision to participate in the program, and more than four-fifths (82%) said that ease of participation was a major motivating factor.
- About three-fourths (74%) accepted the suggestions of their installer and did not directly choose their own lighting equipment.
- A majority of survey respondents were satisfied with all aspects of the program. Over four-fifths said that they were satisfied with the performance of the efficient equipment (85%), the work done by the assessor and/or installer (84%), and the program overall (83%).
- The most common reasons for dissatisfaction were that the quality of the upgrades needed to be improved (22%), the number of equipment types covered needed to be increased (20%), and that the performance of the dimmable LEDs installed was poor (14%).

- More than four-fifths (85%) agreed that program materials provided by their LDC were sufficient; while about two-thirds (68%) agreed that the program application was easy to complete.
- Two-fifths (40%) agreed that they did not have time to research equipment upgrades for their company, with about the same percentage (39%) reporting that they could not afford further upgrades.

5.2.4.2 Firmographics

The survey asked responding SBL participants questions about their title, the ownership of the project buildings, the primary use of the project buildings, the employee count of the company, and the square footage of the facilities. Nearly two-thirds of survey respondents (63%) were the owner or president of their company. About three-fifths (61%) were the primary employee responsible for the SBL lighting upgrades, and one-third (33%) had shared responsibility. Nearly nine out of ten (88%) respondents said their company was not part of a franchise or chain.

Many respondents received incentivized lighting for more than one facility. Participants more frequently worked in the agricultural or farming sector (30%) as seen in Table 5-22. The next most common sectors were non-food retail (19%), office or professional (12%), and lodging (10%).

Table 5-22 Primary Activity at Facility(ies) (multiple responses allowed; n=827)

What are the primary activities conducted at this / these facility(ies)?	Respondents
Agriculture, farming	30%
Non-food retail	19%
Office/Professional	12%
Lodging	10%
Religious	8%
Food sales or service (restaurant, bar)	7%
Healthcare	3%
Warehouse, storage	3%
Entertainment	3%
Grocery or convenience store	2%
Government/public administration	1%
Other	1%
Education	1%

Table 5-23 describes the number of employees at the facilities that received upgrades. Over four-fifths (83%) were small facilities with 12 or fewer employees.

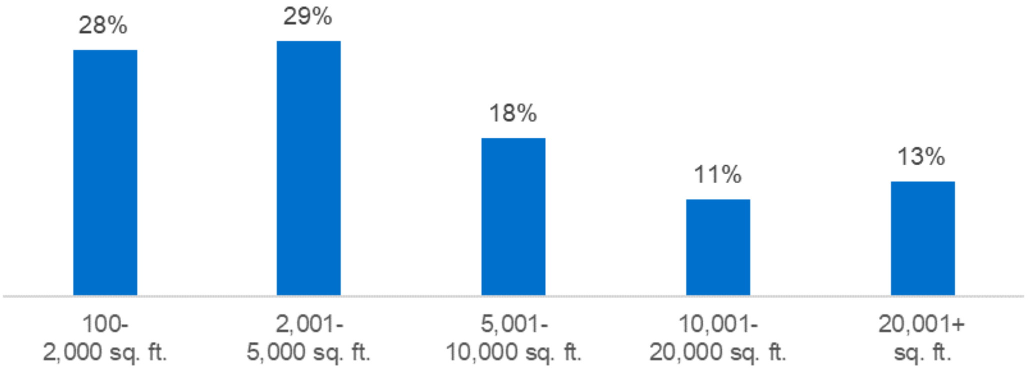
Table 5-23: Employment Count (n=756)*

How many employees are located in the facility(ies)?	Respondents
1	15%
2	18%
3	12%
4-5	16%
6-12	22%
13+	16%

*Does not sum to 100% due to rounding.

The survey asked participants to provide the square footage of the project facilities. If multiple facilities received lighting upgrades, the evaluation team survey asked survey asked participants to either supply the total square footage for all buildings or an average square footage per building. The majority of survey respondents provided the total square footage (for one or multiple facilities); their responses are shown in Figure 5-23 nearly one-third (29%) said that the total square footage of the facility was between 2,001 and 5,000 square feet. The responses from the few that supplied average square footage are provided inAppendix I.

Figure 5-23: Total Square Footage for All Buildings (n=451)*



*Does not sum to 100% due to rounding.

The survey asked participants the average monthly kWh usage of their facility(ies) about three-fourths of survey respondents (74%) did not know or did not want to answer the question. The remaining one-fourth who provided valid responses (178 respondents) were almost equally split between those with facilities that used under 1,400 kWh (33%), 1,400-5,000 kWh (33%), and 5,001-100,000 kWh (31%); only 3% of these respondents reported their average monthly consumption to be greater than 100,000 kWh.

5.2.4.3 Program Outreach and Marketing

Table 5-24 reports how participants first heard about the SBL Program. About one-fourth (26%) heard about the program through a representative from their LDC, and nearly one-fourth (23%) heard about the program through a representative of IESO. Of those who heard about the SBL Program from an LDC representative, 89% reported that they were contacted by the LDC, while 9% reported contacting the LDC themselves.

Table 5-24 How Participants First Heard about the Program (multiple response allowed; n=827)*

How did you first hear about the SBL Program?	Respondents
A representative from your LDC	26%
A representative from Ontario's Independent Electric System Operator (IESO)	23%
Energy efficiency advertising from your LDC	19%
A contractor or equipment vendor	9%
A colleague or competitor	5%
Other word of mouth	4%
Energy efficiency advertising from Ontario's Independent Electric System Operator	3%
Other energy efficiency advertising	3%
I researched the program	<1%
My property or energy management company	<1%
Don't know/Refused	8%

*Does not sum to 100% due to multiple response.

Table 5-25 reports survey respondents' awareness of other business programs offered through their LDC. While nearly one-half (47%) were aware of the Retrofit Program, less than one in ten were aware of every other program. These results point to an opportunity for increased outreach to small businesses to increase program awareness across a broader range of programs.

Table 5-25: Awareness of Other Business Programs (n=827)

What other business programs offered through your LDC are you aware of?	Percent Aware
Retrofit Program	47%
BRI Program	8%
Audit Funding Program	6%
HPNC Program	5%
Small & Medium Business Energy Management System Innovation Pilot	5%
Process and Systems Upgrades (PSU) Program	4%
EBCx (EBCx) Program	3%
OPsaver Program	2%
PUMPsaver Program	2%
Data Centre Pilot	1%
Intelligent Air Technology Pilot	1%
Other Program	<1%

5.2.4.4 Participation Motives and Decision Making

The survey asked the 827 SBL participant survey respondents if their organization had a corporate policy related to energy efficiency or sustainability; 15% indicated that they did, 75% indicated that they did not, and 11% were unsure. These results were an increase from 2016 where only 5% of participants reported having a corporate policy related to energy efficiency or sustainability.

Of the 15% (120 respondents) who indicated they had a corporate policy, more than one-half (55%) said that they had an unofficial commitment to energy efficiency or sustainable practices, while about one-third (31%) reported having an official policy *encouraging* energy savings and more than one-tenth (13%) reported that their company's policy *required* demonstrated energy savings.

The survey asked the 51 survey respondents who indicated that they had an official company policy either *requiring* or *encouraging* energy savings about the targets and timespan of that policy. Nearly one-third (29%) reported that their company had specific energy efficiency targets. These targets included a reduction in energy consumption, a reduction in the dollar amount of their electric bill, a goal to reduce energy consumption each year, and a goal to reduce energy consumption to shorten the payback period of the lighting upgrades.

About two-fifths (39%) of these 51 participants said that their company had a specific time period in which they were required to meet their energy efficiency target. One-half of these respondents (10 of 20) indicated that their energy efficiency target was required to be met annually, with a five-year target being the next most common. Note that having internal efficiency or sustainability policies does not necessarily suggest that the participant is a free-rider of the program; these goals could be reached in several ways, such as more efficient heating upgrades instead of lighting. Respondents' intentions are more fully assessed in the free-ridership section above.

The survey next asked participants to use a 1 to 5 scale to rate how influential non-program specific factors were in motivating their participation in the SBL Program (Figure 5-24).[49] Nearly all survey respondents (95%) said that saving energy or lowering energy bills was the primary motivating factor, and more than four-fifths (82%) said that ease of participation was a major motivating factor. These findings are similar to those in 2016 where 98% said saving energy and lowering energy bills was a major motivating factor. The survey asked the 51 survey respondents who indicated that their company had an official sustainability policy to rate the policy as a motivating factor and three-fourths (75%) said that adhering to a sustainability policy was a significant motivation for participating in the program.

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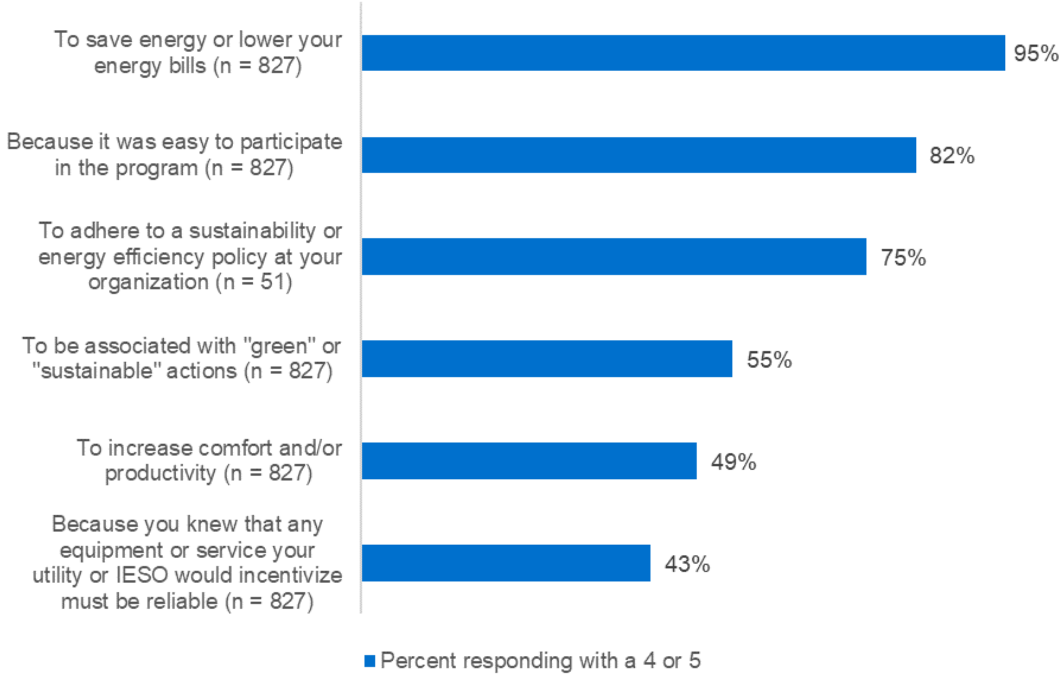
[49] Scale is 1 to 5, where 1 means "not at all influential," 2 means "somewhat influential," 3 means "influential," 4 means "very influential," and 5 means "completely influential."

Figure 5-24 Motives for Participating in the Program (Rating of 4 or 5 on a scale of 1 to 5)



The survey asked participants to explain how they made their lighting equipment selection (Table 5-26). Nearly three-fourths (74%) of survey respondents accepted the suggestions of their installer and did not directly choose their own lighting equipment.

Table 5-26 Equipment Selection (n=827)

Which of the following describes how you made your selection of the equipment you installed through the program?	Respondents
My installer suggested the equipment that was installed	74%
My installer suggested different equipment models and I chose one	8%
I did some research on the equipment and made my own choice	12%
Don't know	6%

5.2.4.5 Participant Satisfaction

The survey asked SBL participants to use a 1 to 5 scale to rate whether the program materials provided by their LDC and IESO were clear and sufficient and whether the program application was easy to complete (Figure 5-25).[50] More than four-fifths (86%) agreed that the program application was easy to complete, while only about two-thirds (68%) agreed that the program materials provided by the utility were sufficient, which suggests there may be an opportunity to provide participants with more comprehensive materials.

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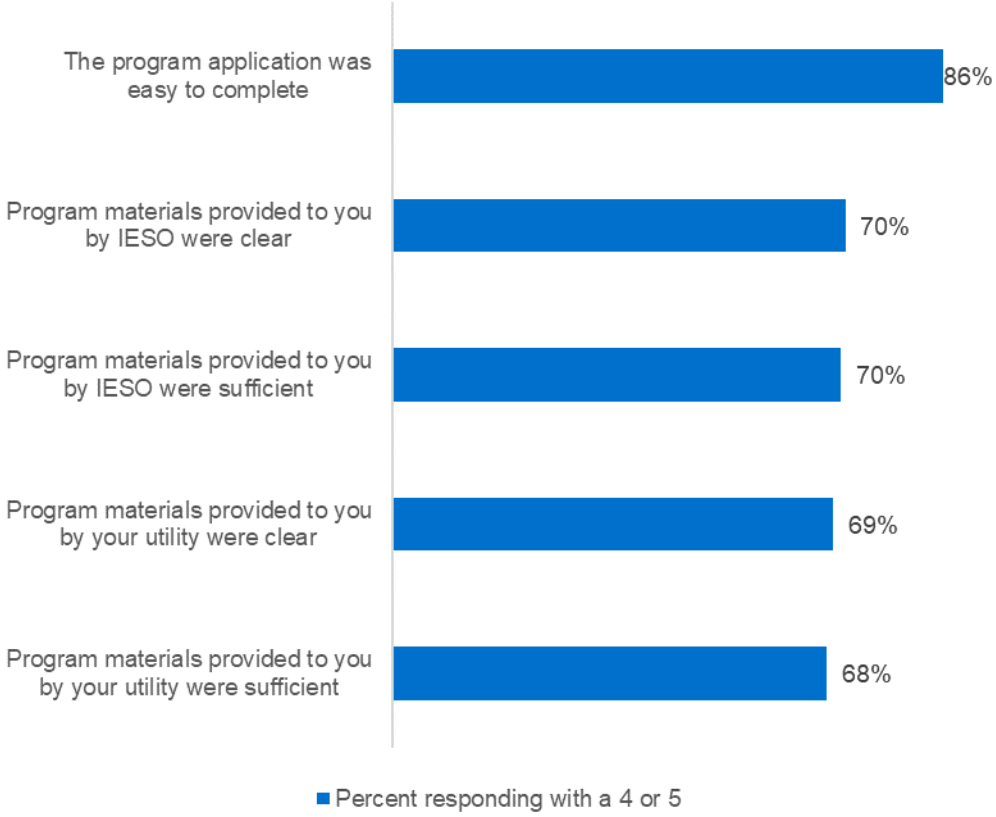
[50] Scale is 1 to 5, where 1 means “do not agree at all,” 2 means “somewhat disagree,” 3 means “neither agree nor disagree,” 4 means “somewhat agree,” and 5 means “completely agree.”

Figure 5-25 Assessment of Program Materials and Application Process (n=827) (Rating of 4 or 5 on a scale of 1 to 5)



The survey asked participants who were dissatisfied with the SBL Program materials to provide suggestions on how to improve the materials (Table 5-27). Over two-thirds (70%) did not have any suggestions. Of those who did have suggestions, over one-third (35%) had not received any or enough materials and almost one-fifth (22%) requested more upfront detail on eligible products and participant eligibility.

Table 5-27 Program Material Recommendations (open end response; n=18)

Do you have any suggestions on how to improve the program materials?	Respondents
Ensure delivery of materials	35%
More upfront detail on eligible products and participant eligibility	22%
Simplify material language	13%
Would prefer in-person meeting to mailed materials	13%
Include materials with mailed LDC bill	6%
Include the actual equipment installed and the installation timeline in the materials	6%
Materials should include FAQs	6%

The survey asked participants who were dissatisfied with the SBL Program application process to provide suggestions on how to improve the application (Table 5-28). Two-thirds (66%) did not have any suggestions. Of those that did have suggestions, close to one-fourth (23%) requested greater clarity on amount, type, and cost of equipment to be installed.

Table 5-28: Program Application Process Recommendations (open end response; n=19)*

Do you have any suggestions on how to improve the program application process?	Respondents
Greater clarity on amount, type, and cost of equipment to be installed	23%
More upgrade options would be helpful	19%
Multiple calls required to set up initial assessment	12%
Reduce waiting periods during application process	12%
Would prefer to work through LDC rather than a contractor	12%
Add follow-up after application is completed	8%
Easier user interface	8%
Errors were made during application process	8%

*Does not sum to 100% due to rounding.

Figure 5-26 shows the percentage of participants who said that they were satisfied (4 or 5 rating on a scale of 1 to 5)[51] with various elements of the SBL Program. Overall, most of participants were satisfied with all elements of the program. Over four-fifths of participants were satisfied with the program overall (83%), the performance of the efficient equipment (85%), and with the work done by the assessor and/or installer (84%). These results are comparable to 2016 where the same percentage were satisfied with the program overall and with the performance of the efficiency equipment (83% and 85%, respectively) and slightly more respondents were satisfied with the work of their assessor or installer (89%).

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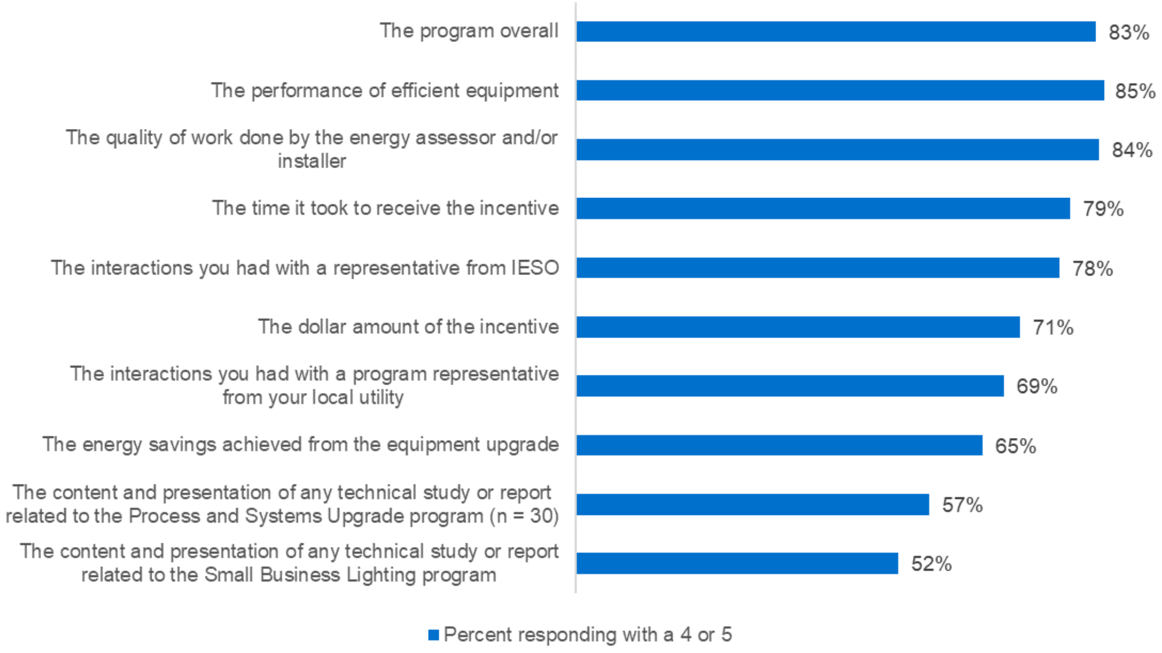
[51] Scale is 1 to 5, where 1 means “not at all satisfied,” 2 means “somewhat satisfied,” 3 means “satisfied,” 4 means “very satisfied,” and 5 means “completely satisfied.”

Figure 5-26 Participant Satisfaction (n=827, except where noted)
(Rating of 4 or 5 on a scale of 1 to 5)



The survey asked participants who were dissatisfied with the SBL Program overall (1 or 2 rating) to provide suggestions on how to improve the program (Table 5-29). The most common responses given were that the quality of the upgrades needed to be improved (22%), the number of equipment types covered needed to be increased (20%), and that the performance of the dimmable LEDs installed was poor (14%).

Table 5-29 Suggestions for Program Improvement (open end response; n=51)*

Do you have any suggestions on how to improve the program?	Respondents
Upgrades received were of low quality	22%
Offer incentives for more equipment types	20%
I have continued problems with dimming LEDs	14%
I did not receive all the bulbs I needed, some were missing	8%
Improve overall process	8%
Increase transparency of expected project costs	8%
Improve initial assessment, it was inaccurate or slow	6%
Improve installation process	4%
Advertise program more widely	2%
I did not see a reduction in my electricity bill	2%
I found the initial process confusing	2%
Increase allotment of products available per business to ensure enough are provided	2%
Offer more light bulb colour temperatures	2%
Provide follow up information about the savings in dollars	2%

*Does not sum to 100% due to rounding.

When asked if they would recommend the SBL Program to others, nearly nine out of ten (86%) survey respondents said that they were very likely or extremely likely to recommend the program to others.[52] Though results are quite similar to results from 2016, no definitive conclusions can be made because sample sizes are inadequate for statistical comparison.

5.2.4.6 Barriers to Future Participation

Figure 5-27 shows the percentage of SBL participants who said that various barriers to future energy-efficient upgrades were relevant (4 or 5 rating on a scale of 1 to 5)[53] to their business. Two-fifths (40%) of survey respondents agreed that they did not have time to research equipment upgrades for their company, with a similar percentage (39%) reporting that they could not afford further upgrades. Over one-third (34%) said both that they were not sure where to get the help they needed and that the energy savings from additional upgrades were not expected to outweigh the costs.

The respondents who said there was “some other reason” it would be difficult to make efficient upgrades reported the following reasons: the landlord is responsible for the remainder of equipment (two respondents), fluctuating municipal budget (one respondent), newer equipment is less reliable than what it is replacing (one respondent), the programs are too difficult to access (two respondents), and that the company would like to replace equipment that is not covered by a program (two respondents).

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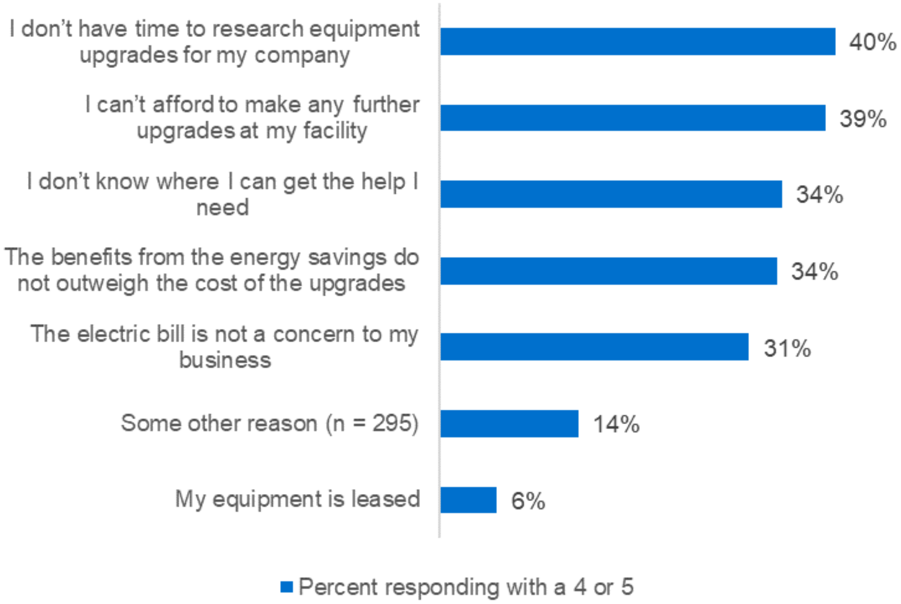
[52] Scale is 1 to 5, where 1 means “extremely unlikely”, 2 means “somewhat unlikely”, 3 means “neither likely nor unlikely”, 4 means “somewhat likely” and 5 means “extremely likely”.

[53] Scale is 1 to 5, where 1 means “not at all relevant,” 2 means “slightly relevant,” 3 means “somewhat relevant,” 4 means “very satisfied,” and 5 means “extremely satisfied.”

Figure 5-27 Barriers to Future Participation
(n=827, unless otherwise noted; Rating of 4 or 5 on a scale of 1 to 5)



6 Business Refrigeration Incentive Program

6.1 Impact Evaluation

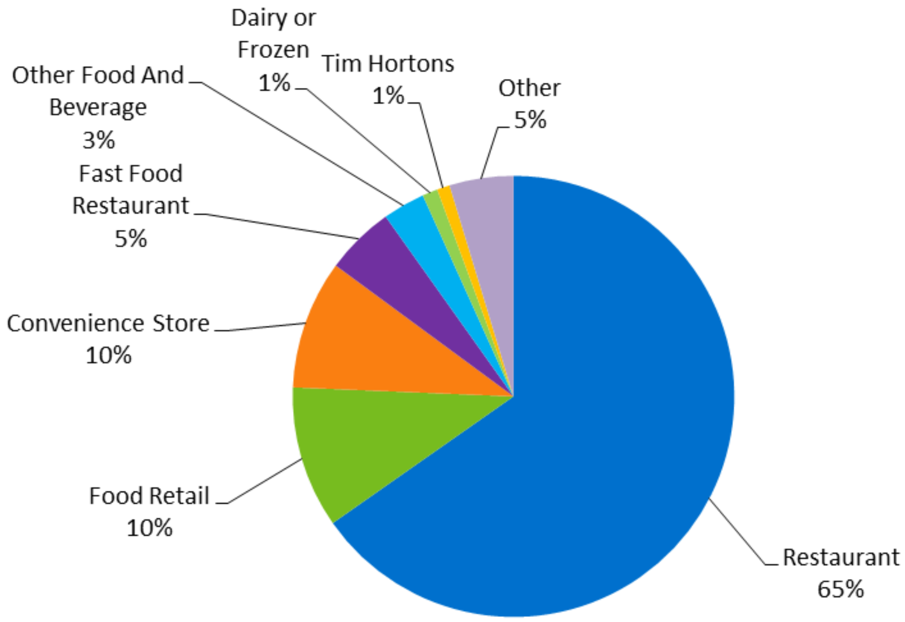
6.1.1 Participation

The 2017 BRI data contained both local and provincial participants, as there was no significant difference between how the programs were implemented.

The initial list of projects provided to the evaluation team by the IESO included 1,189 projects that met the provincial program criteria. After removing invalid entries, the total project count in the BRI provincial program became 1,077.

The BRI data provided business types for each project. Figure 6-1 presents the relative frequency of each type of business contained in the 2017 population. The majority of the projects (70%) were classified as either restaurant or fast food restaurant.

Figure 6-1: BRI Program Business Type Composition



6.1.2 Impact Results

The impact results of the 2017 BRI provincial program are shown in Table 6-1 and Table 6-2.

Table 6-1: 2017 BRI Program Impact Results: Energy

Reported Energy Savings (MWh)	Energy Realization Rate	Gross Verified Energy Savings (MWh)	Gross Verified Precision at 90% Confidence	Net-to-Gross Ratio	Net Verified Energy Savings (MWh)	Net Verified Precision at 90% Confidence	Net Verified Energy Savings at 2020 (MWh)
7,534.30	69%	5,193.71	12.1%	101%	5,219.68	21.4%	4,715.10

Table 6-2 : 2017 BRI Program Impact Results: Demand

Reported Demand Savings (MW)	Demand Realization Rate	Gross Verified Demand Savings (MW)	Gross Verified Precision at 90% Confidence	Net-to-Gross Ratio	Net Verified Demand Savings (MW)	Net Verified Precision at 90% Confidence	Net Verified Demand Savings at 2020 (MW)
0.974	63%	0.616	11.2%	119%	0.734	39.8%	0.643

6.1.3 Lifetime Savings

Each measure in the program was given a EUL based on the IESO's *Measures and Assumptions List* (MAL)[54] or the California Database for Energy Efficiency Resources (DEER)[55]. Table 6-3 presents each of these estimated measure EULs.

Table 6-3: Measure EULs

Measure Type	EUL (years)	Data Source
ECM Fan Motor	15	MAL
A19 LED	11	MAL
LED Case Lighting	10	MAL
Night Curtains	5	DEER
Strip Curtains	4	DEER
Condenser Coil Cleaning	3	DEER
Door Auto Closers	8	DEER

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[54] IESO Prescriptive Measures and Assumptions List, October 2015, http://www.ieso.ca/-/media/files/ieso/document-library/conservation/measures-and-assumptions/ieso-prescriptive-measures-assumptions-list-october-2015.pdf?la=en

[55] California Database for Energy Efficiency Resources, version 2014, http://www.deeresources.com/

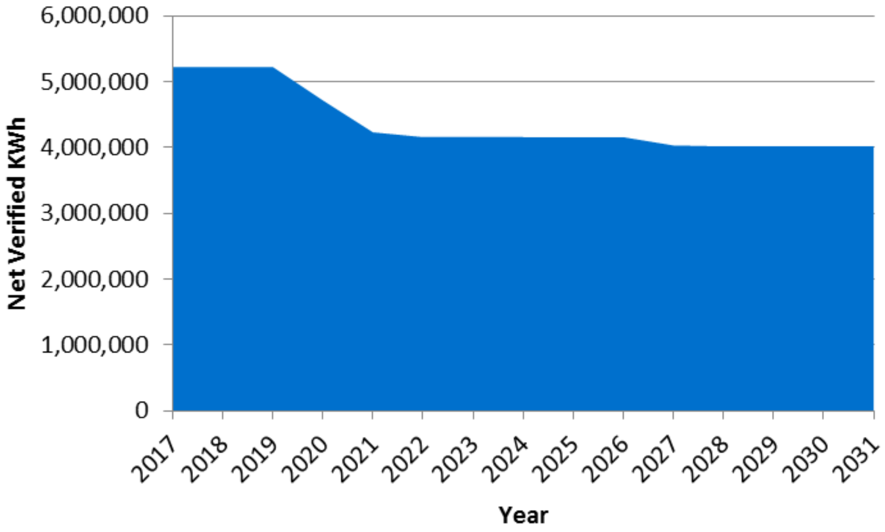
Table 6-4 displays the estimated savings at both 2017 and 2020. The difference in the two savings amounts is due to condenser coil cleaning measures reaching the end of their expected lives before 2020.

Table 6-4: Net Verified Savings Persistence

Savings	2017	2020
MWh	5,220	4,715
MW	0.734	0.643

Figure 6-2 shows the estimated annual savings over a 15 year horizon, which is the length of the longest measure life (ECM fan motors) in the program. Seventy-seven percent of the first year (2017) savings are expected to persist through year 15 (2032), mainly due to the strong influence of the ECM fan motor measure on the program's overall savings.

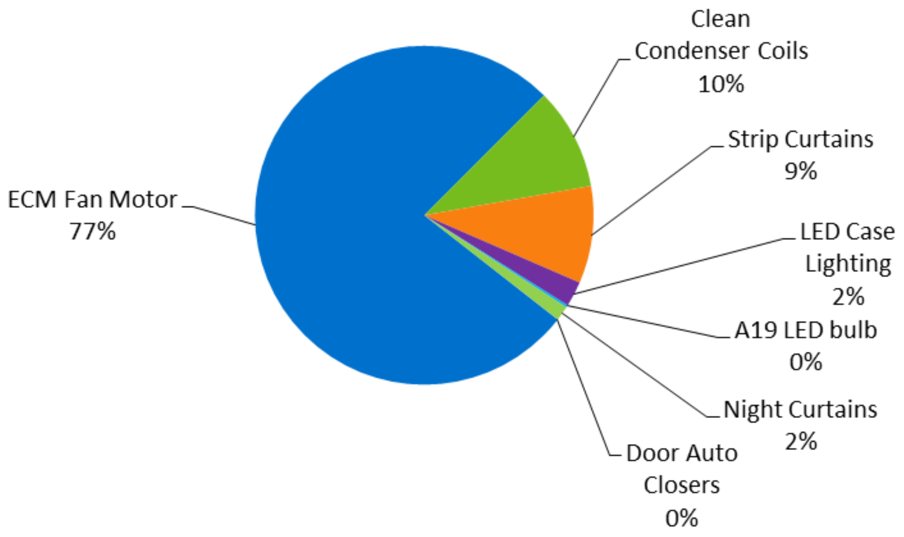
Figure 6-2: Estimated Net Verified Energy Savings by Year



6.1.4 Impact Observations

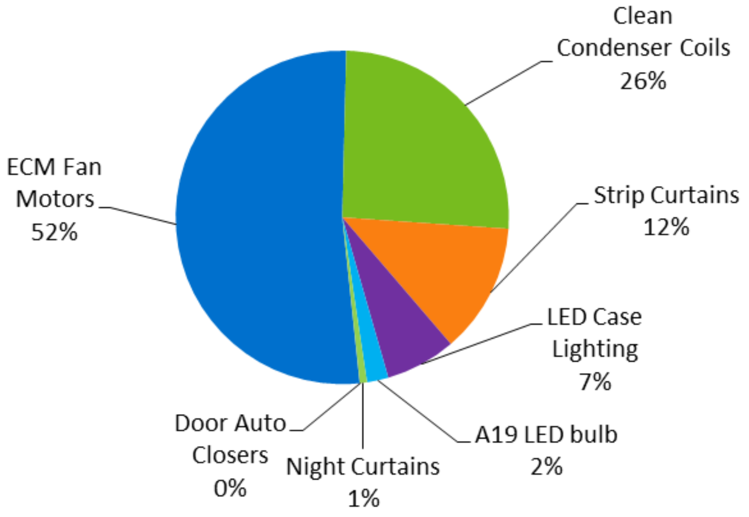
Three measures accounted for 96% of the programs verified energy savings: ECM fan motors (77%), condenser coil cleaning (10%), and strip curtains (9%). Figure 6-3 graphically shows the net verified energy savings contribution of each measure type in the program.

Figure 6-3 Percent of Program Total Net Verified Energy Savings by Measure Type



Similar to their energy savings contribution in the program, the same three top measures—ECM fan motors, condenser coil cleaning, and strip curtains—account for 90% of the overall program's implemented measure quantity. Figure 6-4 shows the relative quantity of each measure type in the program.

Figure 6-4: BRI Program Measure Type Composition by Quantity



Measure Level Realization Rates

Table 6-5 shows the average reported and gross verified energy savings per measure type. ECM fan motors and strip curtains had the highest verified savings per measure while the LED lighting measures and condenser coil cleaning had the lowest verified savings per measure. The program's business case adopted the reported savings values from a previous PowerStream BRI evaluation report;[56] however, the previous BRI evaluation report did not provide measure-specific details regarding how these savings estimates were derived (e.g. average spot measurements, estimated equipment run hours from meter data), such that the presented savings estimates could be updated with supplemental new data in the future. To ensure consistent and transparent savings calculations, it is recommended that the program adopt standard savings algorithms for each offered measure or defined and supported deemed savings values for common measure sub-types (e.g. ECM fan motor horsepower, case lighting by foot length).

Table 6-5: Reported and Gross Verified Savings by Measure Type[1]

Measures	Reported kWh/Measure	Gross Verified kWh /Measure	Realization Rate
ECM Fan Motor	1,007	508	50%
Condenser Coil Cleaning	273[2]	105	38%
Strip Curtains	500[3]	1308	261%
LED Case Lights	190	103	54%
LED A19 Lights	133	111	84%

[1] No night curtain or automatic door closer measures were captured in the evaluation sample

[2] Includes both freezer and cooler applications, with reported kWh savings of 243 and 289, respectively.

[3] Includes both freezer and cooler applications, with reported kWh savings of 480 and 548, respectively.

The realization rates shown in Table 6-5 are a result of the total gross verified savings divided by the total reported savings for each measure type in the sample. However, within each measure type are measure sub-types that more granularly define the measure – i.e. motor HP, case lighting length, lighting baseline type. Table 6-6 breaks out realization rates by measure sub-types and reveals two trends.

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[56] *Evaluation of the Business Refrigeration Incentives Program*, IndEco Strategic Consulting, April 14, 2015.

Table 6-6: Measure Sub-Type Realization Rate Comparison for Measures in Evaluation Sample

Measure Type	Measure Sub-Type	Measure Quantity	Average Savings / Measure				Realization Rate	
			Energy (kWh)		Demand (kW)			
			Reported	Gross Verified	Reported	Gross Verified	kWh	kW
ECM Fan Motor	1/15 HP ECM Fan PSC Motor Replacement	39	1007	517	0.12	0.06	51%	52%
	1/15 HP ECM Fan SP Motor Replacement	66	1007	1304	0.12	0.16	130%	130%
	1/15 HP ECM Fan Motor - Unspecified Baseline	28	1007	880	0.12	0.11	87%	90%
	1/20 HP ECM Fan PSC Motor Replacement	2	1007	378	0.10	0.04	37%	43%
	1/20 HP ECM Fan Motor - Unspecified Baseline	13	1007	630	0.12	0.14	63%	112%
	24 Watt ECM Fan Motor - Unspecified Baseline	2	1007	134	0.10	0.02	13%	17%
	16 Watt ECM Fan Motor - Unspecified Baseline	6	1007	247	0.10	0.03	25%	34%
	9 Watt ECM Fan Motor - Unspecified Baseline	189	1007	177	0.12	0.02	18%	20%
LED A19 Bulb	12 Watt LED A19 Bulb – CFL	24	133	46	0.00	0.01	35%	260%
	12 Watt LED A19 Bulb - Incandescent	15	133	216	0.01	0.05	162%	802%
LED Case Lighting	36" LED Case Lighting - Canopy - (T8)	17	190	55	0.06	0.02	29%	23%
	48" LED Case Lighting - Canopy - (T8)	55	190	85	0.05	0.01	45%	26%
	48" LED Case Lighting - Center - (T8)	31	190	114	0.05	0.02	60%	35%
	48" LED Case Lighting - Left - (T8)	6	190	95	0.07	0.02	50%	25%
	48" LED Case Lighting - Right - (T8)	8	190	86	0.05	0.02	45%	34%
	48" LED Case Lighting - Shelf - (T8)	2	190	86	0.10	0.02	45%	17%
	60" LED Case Lighting - Center - (T8)	21	190	113	0.05	0.02	59%	36%
	72" LED Case Lighting - Center - (T12)	9	190	264	0.06	0.06	139%	108%

Measure Type	Measure Sub-Type	Measure Quantity	Average Savings / Measure				Realization Rate	
			Energy (kWh)		Demand (kW)			
			Reported	Gross Verified	Reported	Gross Verified	kWh	kW
Clean Condenser Coils	Clean condenser coils – Cooler	140	274	83	0.05	0.01	30%	27%
	Clean condenser coils - Freezer	17	265	282	0.05	0.05	107%	87%
Strip Curtains	Strip Curtains - Walk-in Cooler	58	480	802	0.10	0.09	167%	92%
	Strip Curtains - Walk-in Freezer	25	548	2482	0.10	0.29	453%	286%

Note that the single deemed reported savings for each measure is generally within the range of verified savings estimates. This indicates that reported savings, at a minimum, broadly align with the range of verified savings, or are “in the same ballpark.”

Looking at measures with the same baseline type (e.g. PSC fan motor), the larger the equipment (HP, light length) that is included in the measure, the higher the realization rate. This trend can be explained, if the savings algorithms that are used assume a single defined percent savings per measure type. Larger equipment that uses more energy would therefore save more energy. For example, comparing 1/15 HP ECM Fan PSC Motor Replacement with 1/20 HP ECM Fan PSC Motor Replacement, it is observed that both energy and demand realization rates increases with motor size. Similarly, comparing 36” case lighting to 48” and 60” case lighting, with all measures having a T8 baseline, the realization rate generally increases with increased length of lamp length. It is also important to note that for the vast majority of measures, the baseline equipment was not verified due to the original equipment being already removed from the site and no evidence supporting the reported baseline was included with the program documentation. It is recommended that LDCs consistently track the baseline equipment type for each measure. In the reported 2017 program data, baseline type was included in some reported measure descriptions, but was not consistently included for all measures. Program administrators should consider requiring equipment installers to submit proof (e.g. photos) of baseline equipment for each measure at the time it is removed from service, and provide these files to IESO. This would ensure the baseline is accurate and consistent between reported and verified savings estimates.

Table 6-6 includes the measure quantity within the evaluation sample. For the ECM fan motor measure, the reported energy savings value for ECM fan motors was 1,007 kWh and the range of verified kWh values were 134 to 1,304 kWh. Since the reported savings value is closer to the maximum of the verified savings value range, one would expect to see a higher measure quantity for the larger ECM fan motor sizes. Thirty nine percent (39%) of the sampled motors were the largest size - 1/15 HP. The remainder of the ECM fan motors sampled were not equally distributed, with over half (55%) of the total sampled ECM fan motors being the smallest size – 9 watts. This distribution of fan motor sizes indicates that the single assumed reported savings value is overstating savings for the motors in the program.

Coil Cleaning Measure Persistence

During on-site visits, the evaluation team checked the condition of the condenser coils that were cleaned as part of the BRI program. In an effort to mitigate subjectivity in quantifying cleanliness by field engineer, field engineers were asked to rate the coil's level of cleanliness using the following scale:

1. Clean – very little to no visible dirt or debris present
2. Moderately dirty – light or spotty dirt or debris present
3. Very dirty – visible heavy dirt or debris present

Table 6-7 below presents the results for all coil cleaning measures for which data was collected. The results presented in Table 6-7 support a coil cleaning measure life of one year. In that all condenser coil cleanings sampled in the evaluation were performed between May and December of 2017 and the evaluation site visits were conducted in March and April of 2018, meaning there was between three to ten months elapsed when the coils were cleaned and the evaluation team's observation. The average time elapsed between coil cleaning and evaluation site visit was 233 days, or just under 8 months. Assuming a measure life of one year, one would expect the highest proportion of coils to be moderately dirty after this timeframe, with smaller, but still non-zero, proportions observed as very dirty or still clean.

Table 6-7: Coil Cleaning Measure Observations

Cleanliness Level	BRI Local Quantity Observed	BRI Provincial Quantity Observed	Total Quantity Observed	% of Total Quantity Observed
1 – Clean	4	16	20	36%
2 – Moderately dirty	16	14	30	54%
3 – Very dirty	5	1	6	10%
Total	25	31	56	100%

The impact evaluation identified the following observations and recommendations:

- **Observations:** Measure descriptions, such as ECM fan horsepower and LED case lighting length, were captured in the program's tracking database; however, the measure savings were not reflective of differences within the broader measure type.

  In particular, the ECM fan motor measure has a very large influence on the program (77% of verified energy savings) yet only used a single deemed value for reported savings. Verified savings varied substantially per ECM fan motor measure depending on the motor's application and size.

  Recommendation: *The currently used broad measure types (e.g. ECM fan motor or LED case lighting) should be broken out into measure sub-types (e.g. 1/20 Horsepower ECM evaporator fan motor, 48 inch LED strip light) to appropriate capture unique savings estimates. By way of using more granular measure savings will allow for improved precision in savings estimates.*

Recommendation: *It is recommended to prioritize disaggregating the single ECM fan motor measure to distinguish sub-measure type key characteristics, as these variations have a significant influence on the measure's savings. The most influential characteristics on the savings are the application of the motor (evaporator vs. condenser) and the size of the motor (Watts or HP).*

- **Observations:** Assumed baseline types impact measure savings significantly, specifically for ECM fan motor and lighting measure types. However, baseline information was inconsistently captured in the BRI program's tracking database and project files. Some measures were listed in the program tracking database with no reference to a baseline type while other measures included a baseline description.

  Recommendation: *Standardizing a menu of measures for program implementers to select from when entering project data (such as Microsoft Excel's data validation feature) will help ensure baseline information is included in the program tracking data, as well as standardize measure names used across LDCs.*

  Recommendation: *Consider requiring equipment installers submit proof (e.g. photos) of baseline equipment at the time it is removed from service for all equipment, and provide these files to IESO. This would ensure the baseline is accurate and consistent between reported and verified savings estimates.*

- **Observations:** Project file organization and available data supporting reported savings estimates was inconsistent between LDCs.

  Recommendation**:** Across all LDCs, standardize how project files are collected, stored, and provided to IESO. It is recommended to have one main file folder for each project, with all supporting documents for the project contained within that folder, such as work orders and photos. Similarly, standardizing file naming conventions for different file types (e.g. work orders, photos) may prove to help program staff and evaluators alike quickly navigate project files.

6.1.5 Avoided Greenhouse Gas Emissions

The evaluation team used the IESO Conservation and Demand Management (CDM) Energy Efficiency Cost Effectiveness Tool[57] to calculate avoided GHG emissions. Avoided GHG emissions were calculated for the first year or the 2017 program year and for the lifetime of the measures. Table 6-8 below presents the results of these calculations.

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[57] http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/LDC-toolkit/IESO-CDM-EE-Cost-Effectiveness-Tool-Update-2016-Jan-04.xlsm?la=en

Table 6-8: BRI Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided (Tonnes CO_2 equivalent)		
	Electric	Gas[1]	Total	Electric	Gas[1]	Total
2017	843.50	-	843.50	14,988.50	-	14,988.50

[1] Gas interactive effects were not evaluated

6.1.6 Cost Effectiveness

The evaluation team conducted a cost effectiveness analysis for the BRI program. Cost effectiveness results are presented in Table 6-9. The BRI program passed the TRC test and the PAC test with both benefits exceeding their respective costs.

Table 6-9: BRI Cost Effectiveness Results

Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	$2,243,172
TRC Benefits ($)	$3,793,072
TRC Net Benefits ($)	$1,549,900
TRC Net Benefit (Ratio)	1.69
Program Administrator Cost (PAC)	
PAC Costs ($)	$2,249,216
PAC Benefits ($)	$3,298,324
PAC Net Benefits ($)	1,049,108
PAC Net Benefit (Ratio)	1.47
Levelized Unit Energy Cost (LUEC)	
$/MWh	$49.56
$/MW	$367,163

Cost effectiveness was analyzed at the measure level. It is important to note that, when considering measure level cost effectiveness results, program-level administrative costs are not taken into account in the calculations. However, it is still useful to present measure-level cost effectiveness results side by side for comparison purposes. Table 6-10 below shows the minimum, average, and maximum TRC ratios observed by measure type.

ECM fan motors tended to have the highest TRC ratios, suggesting LDCs should continue their already strong effort in implementing this measure through this program. Also, analogous to what is generally found in other programs, the two lighting measures (A19 bulb and case/strip) showed strong TRCs as well. There were only two door auto close measures in this year's population so the measure wasn't studied; however, the average calculated TRC for this measure indicates this measure has good potential to be a strong contributor to the program in the future. All other measures' average TRC were close to 1.0 indicating that each of them is generally considered cost effective.

Table 6-10 Observed TRC Ratios by Measure Type

Measure	Minimum TRC Ratio	Average TRC Ratio	Maximum TRC Ratio
A19 LED bulb	1.95	2.81	4.39
Clean Condenser Coils	0.83	0.95	1.02
Door Auto Closers	2.24	2.32	2.41
ECM Fan Motor	1.73	3.40	4.71
LED Case Lighting	1.13	2.56	3.64
Night Curtains	0.86	0.99	1.13
Strip Curtains	0.96	1.08	1.31

6.1.7 Net-to-Gross (NTG)

NTG observations for the BRI Program are provided in the following subsections and detailed observations are provided in Appendix D. Additional details regarding the NTG methodology can be found in Appendix C.

6.1.7.1 Key Observations

- Participant feedback indicates moderate levels of free-ridership (21.3%).
- The high Energy NTG score that was achieved in 2017 (100.5%) can largely be attributed to the amount of Spillover achieved (21.7%).
- The responses reveal that the program helped nearly one-half of these participants (48%) with upgrades they otherwise would not have been able to implement (23%) or would have had to postpone (25%). However, some instances of free-ridership exist as close to one-tenth (8%) would have done the same project but scaled back and over one-tenth (15%) would have done the exact same upgrade anyway.
- The program incentive was the greatest influence on the respondents' participation decisions (cited by about 70% of participants).

6.1.7.2 NTG Strata Level Results

Table 6-11 shows the results of the 2017 BRI Program NTG evaluation. The following subsections summarize the analyses done to help interpret those differences. All LDCs included in the BRI Program were assigned the province-wide NTG values. The following subsections summarize the analyses done to help interpret these values.

Table 6-11: BRI Province-Wide Program Strata Level Net-to-Gross Results

NTG Assignment	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG *%	Demand Savings Weighted NTG* %
Province-wide	60	21.3%	21.7%	40.5%	100.5%	119.2%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net to gross.

6.1.7.3 Free-ridership

The evaluation team assessed the extent of free-ridership within the program by asking BRI participants a series of questions about their experiences and plans before learning about the program, what they would have done in the absence of the program, and how influential the program was on the participant's decision to do the energy-efficient upgrades.

The evaluation team asked participant survey respondents when they first learned that they could get energy efficiency incentives through the BRI Program (Table 6-12). Just under one-half (46%) of respondents said they learned about the incentives before they started making plans to upgrade, and one-tenth (10%) learned about the incentives after they had started planning but before they started implementing the upgrades. While this feedback is suggestive of relatively low levels of overall program free-ridership, over two-fifths (44%) either of had already started implementing their project (6%), had already completed it (3%), or did not know when they first learned about the project (35%), which may be indicative of some level of free-ridership. ,While responses to this question do not directly impact the free-ridership score, they provide additional context for understanding the participants' decision-making.

Table 6-12: When Participants Heard about the Program (n=62)*

When did you first learn you could get energy efficiency incentives through your LDC?	Respondents
Before you started planning this upgrade	47%
After you started planning, but before you started implementing this upgrade	10%
After you started implementing but before you completed this project	6%
After you completed this upgrade	3%
Don't know/ Refused	35%

The survey next asked participants about the timing of their BRI application (also known as a participant agreement) in relation to the beginning of their upgrades (Table 6-13). Nearly two-thirds (65%) submitted their application before their organization began implementing the energy efficiency upgrades. Those who submitted the application after the project had begun (5%) or after the upgrade was complete (3%) said that they did not submit their applications earlier because of the time needed to submit the application through the program application system (3 respondents), time or resource constraints at their organization (1 respondent), or they did not know the reason (1 respondent). This feedback suggests that many of these participants likely would have applied earlier if it had been feasible. Like the previous question, this question is not used to calculate free-ridership but is intended to provide additional context around participant intentions.

Table 6-13: Timing of Application (n=61)

When did you submit your application to the BRI Program?	Respondents
Before your organization began implementing the energy efficiency upgrade	62%
After the energy efficiency upgrade began, but before the upgrade was complete	5%
After the energy efficiency upgrade was complete	3%
Don’t Know/Refused/Reason unclear	30%

The survey asked participants what they would have done in the absence of the program. Responses suggest that the program helped over one-half of these participants (57%) with upgrades they otherwise would not have been able to implement (23%) or would have had to postpone (25%) or scale back (8%) (Table 6-14). Some instances of free-ridership exist, as less than one-fifth (15%) would have done the exact same upgrade anyway. Responses to this participant intent question along with the later question on program influence are factored into the free-ridership analysis.

Table 6-14: Actions in Absence of Program Incentives (n=60)*

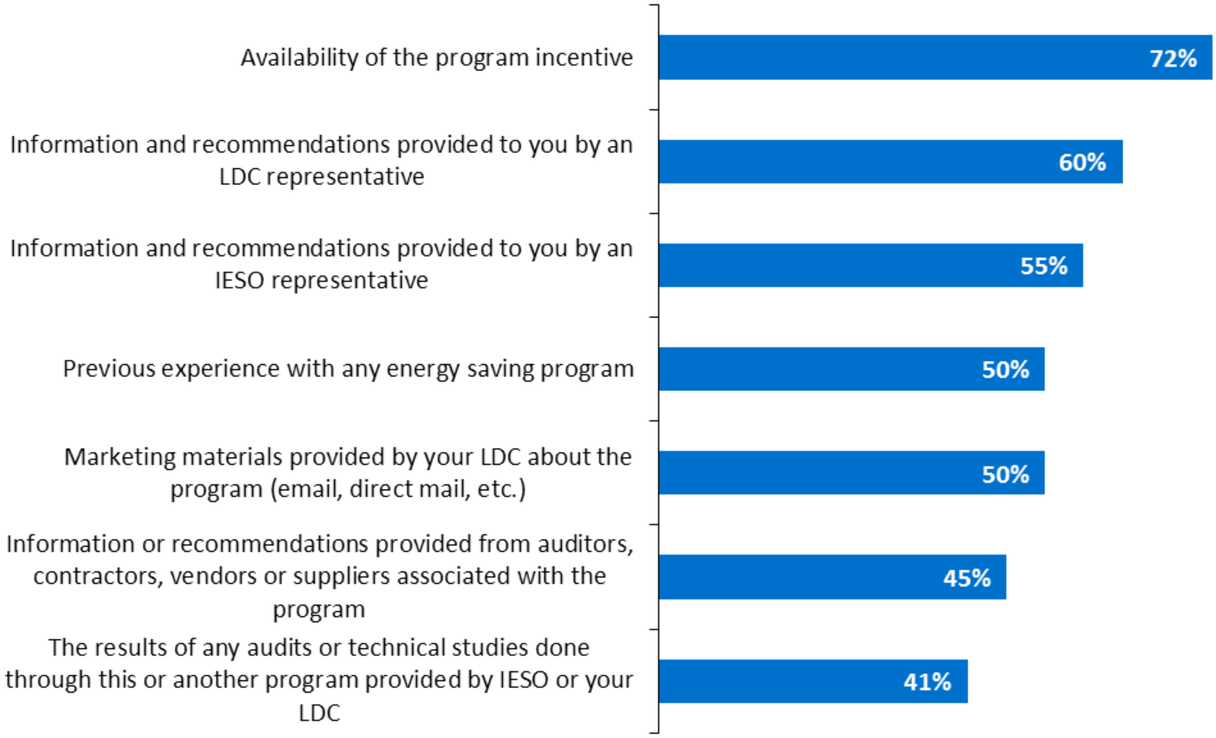
If you had never learned you could get incentives from your LDC, which of the following best describes what your business would have done?	**Respondents**
Put off doing the upgrade for a least one year	25%
Cancelled the upgrade altogether	23%
Done the upgrade, but scaled back the size or extent of the upgrade	8%
Done the exact same upgrade anyway	15%
Don’t know/Refused	28%

The survey asked the 8% of respondents who said they would have scaled back the project how much they would have scaled it back (five respondents in total). Two respondents would have scaled back by a moderate amount, and one would have scaled back by a large amount which suggests that the program was likely able to help these customers increase the size or extent of their project in significant ways. Of the other two respondents, one would have scaled back by a small amount, and one did not know. This question is not directly used to estimate free-ridership but is instead intended to provide additional context regarding their decision processes and intentions.

Of the 15% (nine respondents) who reported they would have done the exact same upgrade without the program, two reported that they would have definitely had the funds to cover the entire cost of the project, which is indicative of a high free-ridership intention score for these respondents. One reported that they might have had the funds, three reported that they definitely would not have had the funds to cover the project, and three did not know. This suggests that the program may have helped these respondents in some way. This question is used in the estimate of free-ridership, though customers who reported definitely having the funds to do the work without the program received a higher free-ridership score compared to those who were not sure about the funding.

The evaluators also asked respondents how program features influenced their decision to make upgrades (Figure 6-5). Respondents indicated that the availability of the program incentive and the information or recommendations from an LDC representative were most influential on their decision to do the energy efficient upgrades (72% and 60%, respectively). However, information or recommendations from program-affiliated auditors, refrigeration technicians, or suppliers were somewhat less influential as were audits and technical studies. This suggest there may be a need for the program delivery agents to assess whether the audit reports, technical studies, and other information or recommendations they provide are resonating with customers.

Figure 6-5: Influence of Program Features on Participation (n=60)
(Rating of 4 or 5 on a scale of 1 to 5)



Finally, the survey asked whether there were any other factors that influenced the organization to install the energy-efficient equipment. Participants provided the following factors:

- Ease of applying to the program/no cost option (4 respondents)
- Overall energy savings/saving money on energy bills (4 respondents)
- Replacing/updating old or failing equipment (2 respondents)

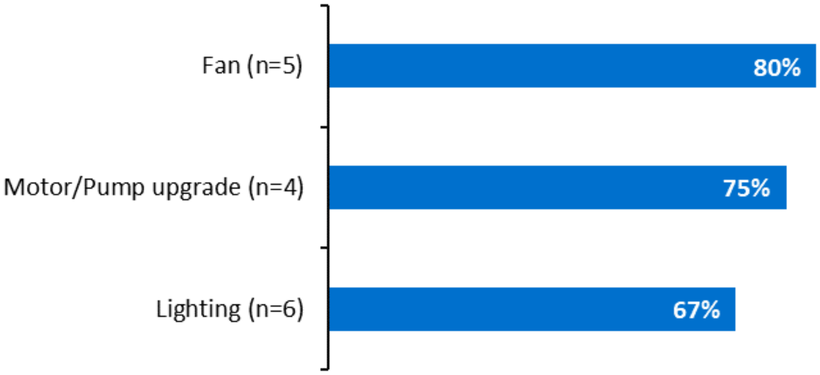
In summary, participant feedback indicates moderate levels of free-ridership. The program helped nearly one-half of these participants (48%) with upgrades they otherwise would not have been able to implement or would have had to postpone. Room for improvement still exists, though, as some respondents would have done a scaled back version of the same project (8%) or would have done the same exact upgrade without the program (15%).

6.1.7.4 Spillover

Fourteen out of fifty-six (25%) of participant survey respondents reported installing or upgrading additional energy efficiency equipment without an incentive after they participated in the BRI Program. These 14 respondents implemented a total of 17 equipment installations, with lighting equipment mentioned most often by six respondents.

The survey asked respondents what level of influence their prior participation in the BRI Program had on their decision to install this additional energy efficiency equipment (Figure 6-6). Participants rated the influence of the BRI Program on their decision using a 1 to 5 scale.[58] Participants generally reported that the program had some influence (3 rating or higher) on their decision.[59] Hence, the program has evidence of spillover, which ultimately resulted in a NTG of greater than 100%. The survey asked participants who indicated that they installed the program-influenced non-incentivized equipment a series of follow-up questions (e.g. capacity, annual hours of operation, etc.). These detailed questions are not displayed here but are instead used within the NTG algorithm to attribute spillover savings to each equipment installation.

Figure 6-6 Program Influence on Equipment Installed Outside the Program (n=14) (Rating of 3, 4, or 5 on a scale of 1 to 5)



6.2 Process Evaluation

The following subsections outline the process evaluation results of the BRI Program. Responses have been summarized and detailed observations are provided in Appendix I. Additional details regarding the process methodology can be found in Appendix F.

6.2.1 Program Staff and Program Delivery Agent Perspectives

The evaluation team interviewed LDC program staff (two LDC staff covering a total of three LDCs) and program delivery agents (two firms) to obtain their perspectives regarding design and implementation of the BRI Program. Feedback from these interviews is summarized below.

6.2.1.1 Key Observations

- In general, LDC staff and the program delivery agents thought that the program has been successful and has had a positive impact on the market.

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[58] Scale is 1 to 5, where 1 means “not influential at all”, 2 means “slightly influential”, 3 means “somewhat influential”, 4 means “very influential” and 5 means “extremely influential”.

[59] For the spillover calculation, if a respondent gives a rating of three or higher, which indicates their experience with the program had at least some influence on their equipment installation, spillover savings is calculated for their un-incentivized equipment (half savings for a rating of 3, full savings for a rating of 4 or 5).

- Program delivery agents indicated the program needs to reach past the “low hanging fruit” to the harder-to-reach customers. A lack of proper education on potential savings and the challenges with proving long-term savings were the main barriers mentioned by program delivery agents, as well as the program refrigeration technician and the motor supplier.
- Program delivery agents suggested streamlining the assessment and installation process by implementing a more “turn-key” type service, whereby the program delivery agents are responsible for lead generation, assessments, and in some instances installations.

6.2.1.2 Background

The LDC staff interviewed were responsible for the administration and oversite of the BRI Program in 2017. Of the two program delivery agents interviewed, one was responsible for delivering the program for one LDC, and another was responsible for delivering the program for two LDCs. The program delivery agents’ responsibilities include many aspects of implementation, such as some or all of the lead generation (depending on the LDC served), scheduling and performing the initial site assessment/audit, making recommendations on what to install during the audit, and scheduling the site visits of the refrigeration technician who ultimately installs the upgrades.

6.2.1.3 Barriers to Implementation

The LDC program staff and program delivery agents discussed some of the barriers to the delivery of the BRI Program. In general, they thought that the program has been successful and has had a positive impact on the market. However, program delivery agents stressed the need to increase efforts to get past the “low hanging fruit” and achieve deeper savings.

The main barrier mentioned by the program delivery agents was the challenge of providing proof of the long-term savings, an essential component to client education. One program delivery agent mentioned this was particularly a barrier to increasing the uptake of additional energy-efficient equipment beyond the $2,500 program incentive cap. One suggestion was to perform in situ (onsite) metering to get a better estimate of “the real savings.” Another suggestion was to streamline the assessment and installation process, or to create a more “turn-key” type service, whereby the program delivery agent is responsible for some installations in addition to the work they do with lead generation and audits. They suggested that this approach could alleviate the amount of time small business customers need to dedicate to participating in the program.

LDC program staff also noted that technicians need special refrigeration-technician training to install most program-supported equipment, which limits the scope of who can install many of these measures.

6.2.1.4 Success of the Program to Date

The evaluation team asked the LDC program staff and program delivery agents for their perspectives on the success of the program to date; both mentioned their satisfaction with program participation, as well as with their projections for program participation in the future. One program delivery agent mentioned they expect to take on program delivery for additional LDCs soon. Program staff also mentioned satisfaction with the sole refrigeration technician working with the program.

6.2.2 Supplier and Technician

The evaluation team interviewed BRI Program’s delivery partners--the supplier (1 ECM motor supplier) and technicians (1 refrigeration technician)—to better understand how the program was implemented in 2017. Feedback from these interviews is summarized below.

6.2.2.1 Key Observations

- The refrigeration technician and motor supplier stressed the importance of both customer and contractor education about the savings and payback period of equipment to ensure the acceptance of new technologies and products (such as ECM motors).
- The motor supplier and refrigeration technician appear to have contradictory perspectives on equipment availability. The motor supplier reported “no product or supply-related issues.” However, the refrigeration technician reported that shortage of program qualifying ECMs was growing into a “consistent issue.”

6.2.2.2 Firmographics

The refrigeration technician interviewed was the sole BRI Program refrigeration technician in charge of performing installations and working with the suppliers. Both respondents from the motor supplier and the refrigeration technician are the president of their company. The motor supplier’s company consisted of eight full-time employees and had been in operation for over 20 years.

6.2.2.3 Background

The refrigeration technician was responsible for most of the installation work performed for the BRI Program in 2017, and the supplier interviewed was the primary supplier of electronically commutated motors (ECMs)—one of the programs most commonly installed equipment type. These two interviews elucidate the impact of the program on market diffusion of ECMs among non-residential customers, such as grocery stores, restaurants, convenience stores, and similar businesses. While many more efficient refrigeration technologies are covered by the BRI Program, interviews with the program delivery partners largely focused on the impact of the program on ECMs because ECMs account for a large percentage of the program’s savings.

The motor supplier works with the BRI Program to develop specifications and supply ECMs to the refrigeration technician. The refrigeration technician works closely with the program delivery agents to update program supported measures, including ECMs. The refrigeration technician’s site visits are scheduled by the program delivery agents; they are responsible for installing the technology but do not make recommendations on what to install as those recommendations are made during the initial audit. In 2017, the refrigeration technician’s firm had started providing refrigeration training to the program delivery agents who perform the audits; the purpose of the training was to help improve the audit and equipment recommendation process.

6.2.2.4 Sales and Market Adoption

The ECM motor supplier did not report any issues with the program. The motor supplier reported there were “no issues with communications” and “no product or supply-related issues.” The motor supplier believes he sold approximately 10,000 motors to an unknown number of sites in 2017, and stocks roughly 2,500 to 3,000 motors at any given time in large part due to demand associated with the program.

The refrigeration technician also reported no issues with program communications but did mention that the shortage of program-qualifying ECM motors was growing into a “consistent issue.” The motor supplier and refrigeration technician appear to have contradictory perspectives on availability of ECM motors. Program delivery agents, or the IESO, may have an opportunity to clarify program needs between the supplier and refrigeration technician. The refrigeration technician reported installing motors in roughly 2,500 individual sites in 2017. The refrigeration technician installs motors both within and outside the BRI Program.

The motor supplier thought that the number of motor sales would decline if the program was discontinued. However, he also expects sales of ECMs will continue to increase by 10% to 15% over the next year or two. While incentive programs play a role in market demand and product acceptance, he points out that they are not the only driver of ECM demand. He states, “the BRI program affects a certain portion of the market, but there is a lot more happening outside [the small commercial sector]. He also pointed out that ECM technology is improving, and more customers are confident in the product.

The evaluation team asked whether some commercial customers or contractors were more receptive to purchasing ECMs than others. The motor supplier said that it “depends on the size of the business, and if they have someone designated to address equipment upgrades.” The smaller businesses “just don’t have the time.”

The motor supplier indicated that the main barriers to adoption he faced when selling ECMs were price and customer unfamiliarity with the product. He explained that there is usually a premium on ECMs, resulting in a large price differential between ECMs and conventional motors. He thought that installers are not providing the proper information on energy savings for the customer to make an informed decision, which leaves business owners “wary” to install ECMs due to lack of education.

The refrigeration technician said projects that participated in the BRI Program represented about 35% of their total sales in 2017. They also have a separate division in charge of providing service and installation for existing customers. The motor supplier said BRI motor upgrades accounted for approximately 95% of their total sales in 2017.

The evaluation team asked the refrigeration technician if customers decided not to install any specific program-qualifying technologies due to the technology increasing the project cost beyond what was covered under the program funding threshold. He indicated that participants often decided not to install anti-sweat heater controls, as they are “more expensive and customers are a bit afraid of installing [them]” as “[they] don’t want display cases to fog up and/or malfunction.”

When evaluators asked the refrigeration technician for recommendations on how the program can motivate customers to install recommended technologies, he said that customers need “targeted education on the program and the *[savings] potential* of the equipment. If they understood, then why would they say no?” The refrigeration technician monitors the savings for a few of their larger customers. “It is very exciting to see what is actually saved.” There may be an opportunity for the program to use testimonials, such as these, to help spread the word and educate other businesses on the potential energy savings.

6.2.2.5 Program Outreach and Marketing

The evaluation team asked the refrigeration technician to identify the primary way that his customers would have learned about or come to participate in the BRI Program. The refrigeration technician said the most successful outreach was going door-to-door and talking with customers directly. Cold calling and explaining the program over the phone was also working, but not proving as successful as the face-to-face interactions.

The motor supplier said his company did not play a direct role in marketing the program, but he does encourage the specification of ECMs to customers.

6.2.2.6 Program Delivery Partner Influence

The refrigeration technician thought that auditors were extremely influential in recommending and explaining upgrades to the customers. Auditors are responsible for making recommendations to customers on what equipment to install. The refrigeration technician emphasized the importance for auditors to be able to effectively explain the benefits of the equipment upgrades to the customer, which the program is now supporting by having the refrigeration technician provide training to the program delivery agents audit staff.

The refrigeration technician said he had first heard of the BRI Program through a program representative. He started participating in 2014 while the program was in its early stages (a pilot at the time).Besides early collaboration, the technician said his only role was to install the equipment. The motor supplier first heard about the BRI Program when a customer inquired about the program, and he became involved with the program in 2015. The motor supplier stated his role was primarily to provide technical and product support.

6.2.2.7 Program Delivery Partner Satisfaction

The evaluation team asked the refrigeration technician and motor supplier to rate their satisfaction with the program overall, their interactions with the LDC, program delivery agent, and IESO representatives; and aspects specific to the program and equipment (Table 6-15).[60]

The refrigeration technician and the motor supplier were completely satisfied with the program overall. They also indicated complete satisfaction with the value of the program incentivized equipment and their interactions with the program delivery agents and the LDC's program representatives.

Table 6-15 Refrigeration Technician and Supplier Satisfaction (n=2)

Satisfaction	Refrigeration Technician Rating	Motor Supplier Rating
The program overall	5	5
The value that the equipment covered by the program provides to customers	5	5
The interactions you had with Program Delivery Agent at firm A	5	N/A
The interactions you had with Program Delivery Agent at firm B	5	5
The interactions you had with a BRI Program representative from the LDCs	5	5
Program worksheets	5	N/A
Number and types of equipment incentivized through the program	4	5
Program marketing and outreach	4	5
Program application process	4	N/A
The interactions you had with a BRI Program Technician	N/A	5
The interactions you had with a BRI Program representative from IESO	N/A	5

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[60] Scale is 1 to 5, where 1 means "not at all satisfied", 2 means "somewhat dissatisfied", 3 means "neither satisfied nor dissatisfied", 4 means "somewhat satisfied" and 5 means "completely satisfied".

When asked how valuable the program is to the buyers of the incentivized motor upgrades, the motor supplier felt the program was “extremely valuable” because of the cost savings. He also indicated that the buyers and end users were completely satisfied with the equipment and did not have additional products for the BRI Program to consider offering in future program years.

6.2.2.8 Suggestions for Program Improvement

The refrigeration technician stressed the importance of customer education on energy savings and payback for the ECMs, but also recommended that the program delivery agent staff who are responsible for conducting the audits receive thorough training so they are equipped to educate the customer. The refrigeration technician’s firm “is helping out with that process,” so he thought this issue had been addressed, but still felt the LDCs could do more to educate end use customers on the benefits of participating in the program, specifically the potential for energy savings.

The motor supplier stressed that the program could do more to “reach out to [other] contractors” and educate them on the ECM technology and potential savings. He thought there may be some skepticism coming from the other refrigeration contractors that install the original equipment, on the benefits of ECMs, which is likely translated to the customer. When asked if certain contractors were more likely to install ECMs, the motor supplier stated:

“Some are satisfied with the old fashioned and some like the newer equipment. Some are keener, [more] exposed to lots of products; some are more receptive to energy efficiency. The contractor should give the customer the knowledge to make the right decision, but they don’t all do it and are not versed in why it’s more efficient.”

6.2.3 Program Participant Perspectives

The following subsections highlight the feedback received from the BRI Program participant survey. Responses have been summarized and detailed findings are provided in Appendix I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

6.2.3.1 Key Observations

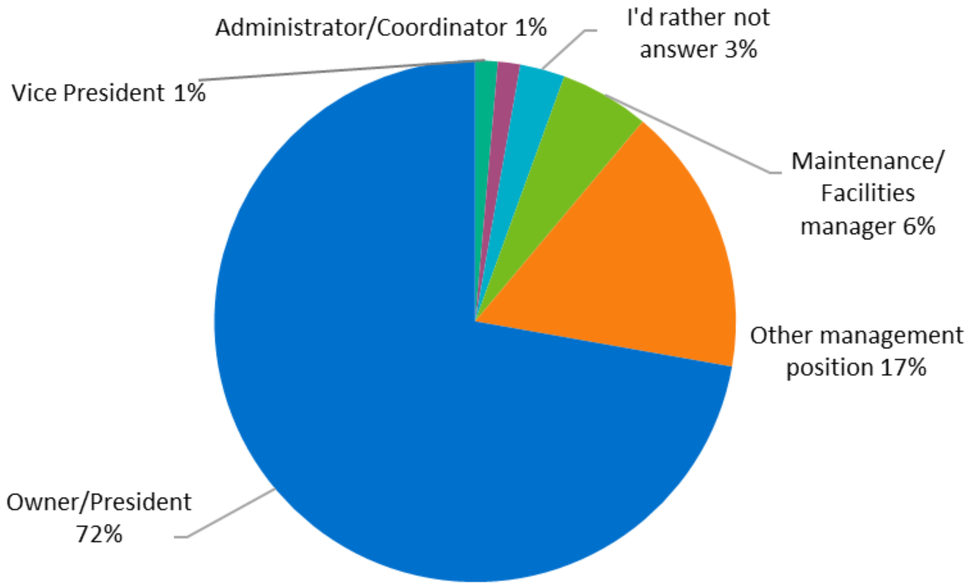
- Most surveyed participants (79%) were either somewhat satisfied or completely satisfied with the program overall and the majority (84%) would likely recommend the program to others.
- One-eighth (12%) of participants did not agree or somewhat disagreed that the program materials provided by the LDC were sufficient.
- Some of the surveyed participants were less satisfied with the savings achieved by the upgrades (12% somewhat dissatisfied or not at all satisfied) and/or the level of the incentive (15% somewhat dissatisfied or not at all satisfied).
- Three surveyed participants indicated frustrations with the technician and/or equipment options offered by the technician, and two of these surveyed participants suggested expanding the equipment options covered by the program incentive.

6.2.3.2 Firmographics

The survey asked BRI participants questions about their position in the company, ownership status, primary activities, chain or franchise status, size of labor force, and square footage of the facility where the upgrades were made. Companies that received the BRI incentive tend to be small to moderate independent businesses operating in the food sales or service industry. Almost all (96%) of these businesses have fewer than 100 employees on staff.

Just under three-fourths of respondents (72%) stated that their title was the owner/president. General management, and maintenance/facility managers made up nearly one-fourth (23%) of the respondents. Close to all (93%) had responsibility for the budget or expenditure for the upgrades or retrofits at their company, with 68% having primary responsibility and 25% having shared responsibility.

Figure 6-7 Title of Respondent (n=72)



About two-fifths of respondents (41%) rent their facility, and a similar percentage (39%) own their facility; with the remaining 15% both own and rent their facility.

Table 6-16 Ownership Status (n=55)*

Do you own or rent the facility(ies) where the program upgrades were made for this project in 2017?	Respondents
Own all	39%
Rent all	41%
Mix of own and rent	15%
Don't know/Refused	6%

*Does not sum to 100% due to rounding.

A large portion of the respondents (89%) operate in the food sales or service industry.

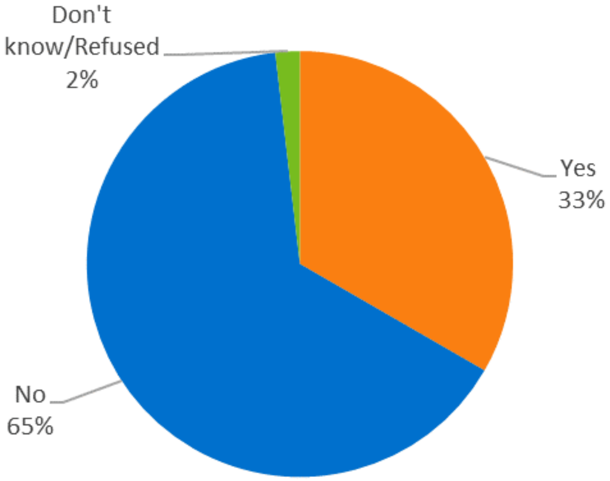
Table 6-17 Primary Activity at Facility(ies) (multiple response allowed; n=72)

What are the primary activities conducted at this/these facility(ies)?	Respondents
Food production, sales, or service	89%
Grocery or convenience store	6%
Warehouse	1%
Hotel	1%
Legion	1%
Nursing Home	1%

*Does not sum to 100% due to rounding.

The survey asked participants whether their company was part of a chain or franchise (Figure 6-8). About two-thirds of respondents (65%) reported that their business is not part of a chain or franchise, compared to one-third of respondents (33%) who reported that their business is part of a chain or franchise.

Figure 6-8 Chain or Franchise Status (n=54)



The survey asked participants how many employees work at the facilities where the upgrades were made (Table 6-18). Just under one-half of the facilities (48%) were small businesses with ten or fewer employees. Just under one-tenth of the facilities (9%) had 51 to 100 employees, and only 4% (two out of fifty-four) had 9,997 employees or more.

Table 6-18 Employment Count (n=54)

How many employees are located in the facility(ies)?	Respondents
1 to 10	48%
11 to 30	30%
31 to 50	9%
51 to 100	9%
Don’t know/Refused	4%

The survey asked participants what the square footage was of the facility(ies) where the program upgrades were made. They provided either the total square footage for all buildings, or an average square footage per building. As seen in Table 6-19 just over three-fifths of these participants (67%) reported that the total square footage of the facility where the upgrades were made is 5,000 square feet or less. A similar trend was seen in Table 6-20 with 17 of 18 respondents indicating the average square footage per building was 5,000 square feet or less.

Table 6-19 Total Square Footage for All Buildings (n=24)

Total Square Footage for All Buildings	Respondents
Up to 1,000 square feet	25%
1,000 up to 5,000 square feet	42%
5,000 up to 10,000 square feet	17%
10,000 up to 25,000 square feet	8%
25,000 up to 50,000 square feet	4%
500,000 square feet or more	4%

Table 6-20 Average Square Footage Per Building (n=18)

Average Square Footage Per Building	Counts
Up to 1,000 square feet	2
1,000 up to 5,000 square feet	15
5,000 up to 10,000 square feet	1

The survey asked participants the average monthly kWh usage of their facility(ies) (Table 6-21). About three-fourths of survey respondents (76%) did not know or did not want to answer the question. The remaining one-fourth provided a range of responses, with 13% reporting their facility(ies) used under 5,000 kWh per month.

Table 6-21 Average Monthly kWh Consumption at Facility(ies) (n=72)

What is the average monthly electricity consumption in kilowatt-hours (kWh) at the facility(ies) where the program upgrades were made for this project in 2017?	Respondents	Average kWh
Under 5,000	13%	2,472
5,000 - 10,000	4%	7,833
10,000 - 15,000	3%	11,500
15,000 - 20,000	--	--
20,000 - 25,000	1%	24,000
25,000 - 30,000	1%	27,000
30,000 and above	1%	1,200,000
Don't know/Refused	76%	N/A

6.2.3.3 Program Outreach and Marketing

Just over one-third of BRI participants (36%) stated that they first heard about the BRI Program through a representative from their LDC (Table 6-21). Just over three-fourths (77%) reported that the LDC made the initial contact with their company about the program. Approximately one-fifth (21%) of the respondents heard about the BRI Program through energy efficiency advertising from their LDC, and just under one-sixth (14%) of the respondents heard about the BRI Program through a representative from the IESO. This suggests that the program is doing a good job of reaching customers through multiple channels.

Table 6-22 How Participants First Heard about the Program (n=72)*

How did you first hear about the Business Refigeration Incentive (BRI) Program?	Respondents
A representative from your LDC	36%
Energy efficiency advertising from your LDC	21%
A representative from Ontario's Independent Electric System Operator (IESO)	14%
A contractor or equipment vendor	7%
A colleague or competitor	7%
Upper level management	4%
Energy efficiency advertising from Ontario's Independent Electric System Operator	1%
Other energy efficiency advertising	1%
Friends/family/community	1%
Don’t know	7%

*Does not sum to 100% due to rounding.

The survey asked respondents about their knowledge of other Business Programs offered through their LDC (Table 6-23). About two-thirds of respondents (65%) were aware of the SBL Program, and about one-fourth of respondents (24%) were aware of the Retrofit Program. These BRI Program participants had low awareness (<10%) of all other Save on Energy programs, with only one respondent reporting being aware of these other programs.

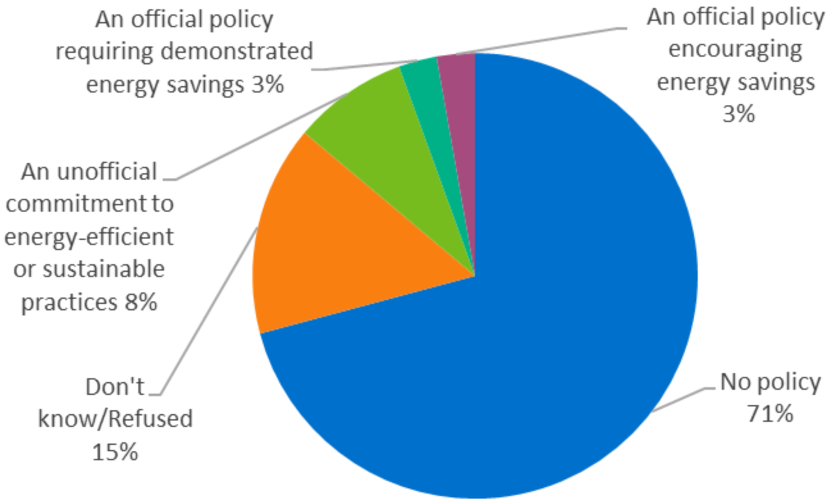
Table 6-23 Awareness of Other Business Programs (n=72)

What other business programs offered through your LDC are you aware of?	Percent Aware
SBL Program	65%
Retrofit Program	24%
Small & Medium Business Energy Management System Innovation Pilot	7%
HPNC Program	3%
Audit Funding Program	3%
EBCx Program	3%
Process and Systems Upgrades (PSU) Program	3%
PUMPsaver Program	3%
OPsaver Program	3%
RTUsaver Pilot (rooftop units)	3%
Intelligent Air Technology Pilot	1%
Data Centre Pilot	1%

6.2.3.4 Participation Motives and Decision Making

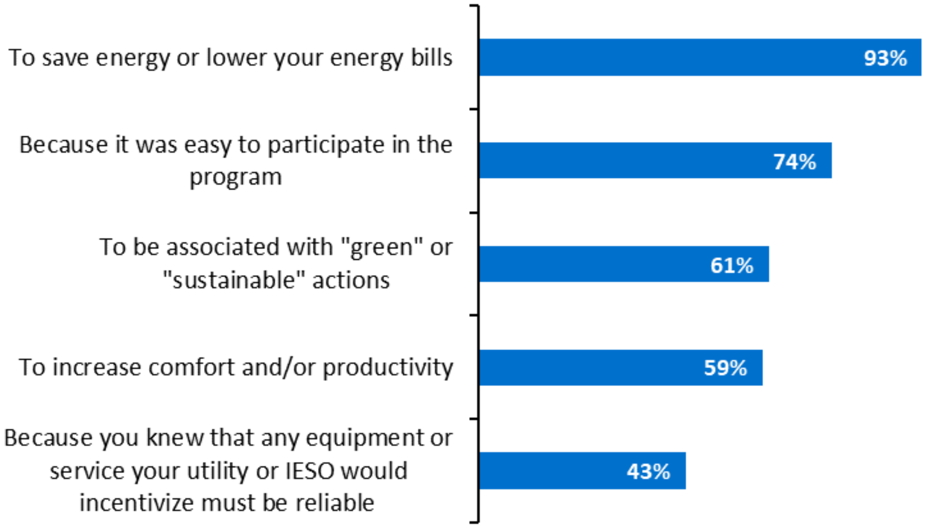
The survey asked BRI participants if their organization has a corporate policy related to energy efficiency or sustainability (Figure 6-9). Just under one-sixth of respondents (14%) had a corporate energy efficiency policy at the time of the survey, while nearly three-fourths (71%) reported they did not. Among the 14% (10 respondents) who reported having a corporate policy, two (3%) had an official policy that *encouraged energy savings*, and a similar percentage (3%) had an official policy that *required demonstrated* energy savings. Of the corporations that required demonstrated energy savings, only one respondent reported a specific target of reduced energy saving over a specific period. This respondent reported their corporation’s policy targeted a 2.5% energy reduction on an annual basis. Note that having internal efficiency or sustainability policies does not necessarily suggest that the participant is a free-rider of the program; these goals could be reached in several ways, such as more efficient heating upgrades instead of refrigeration. Respondents’ intentions are more fully assessed in the free-ridership section above.

Figure 6-9 Sustainability or Energy Efficiency Policy (n=72)



The survey asked participants to rate the influence of certain non-program specific factors on their decision to participate in the program on a scale of 1 to 5 (Figure 6-10).[61] Saving energy or lowering their energy bills (93%) and the ease of participating in the program (74%) were very or extremely influential in many 'participants' decisions to participate in the program. Three of the four respondents who indicated that their company has an official energy-efficiency policy indicated that adhering to their policy was very or extremely influential in their company's decision to participate in the BRI Program.

Figure 6-10 Motives for Participating in the Program (n=69)
(Rating of 4 or 5 on a scale of 1 to 5)



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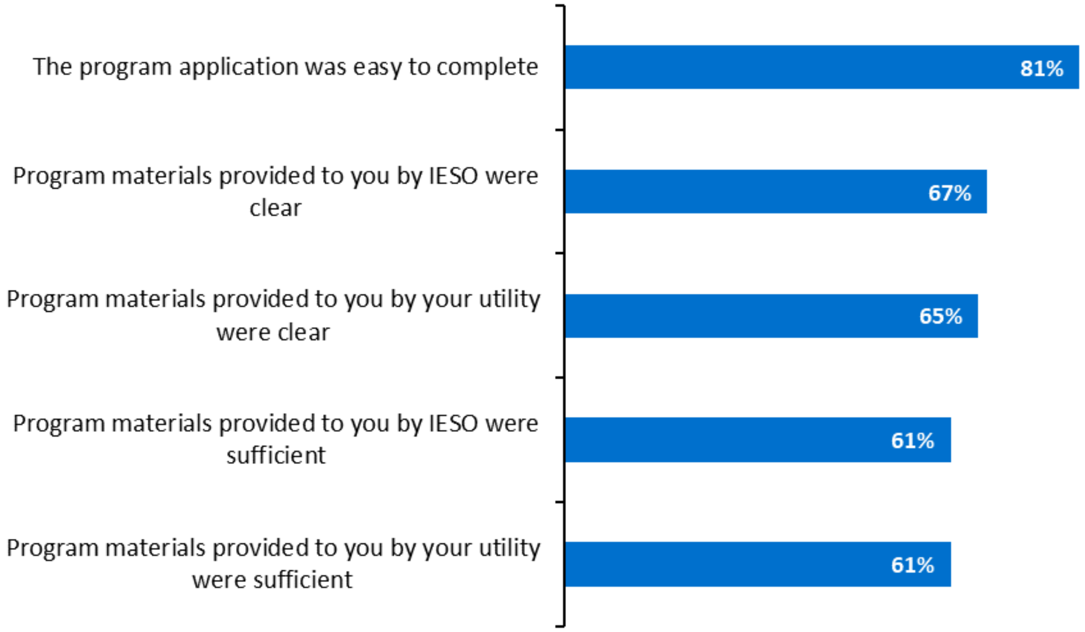
[61] Scale is 1 to 5, where 1 means "not influential at all", 2 means "slightly influential", 3 means "somewhat influential", 4 means "very influential" and 5 means "extremely influential".

6.2.3.5 Participant Satisfaction

The survey asked participants to rate whether the program materials provided by their LDC and the IESO were clear and sufficient and whether the program application was easy to complete (Figure 6-11).[62] The majority of respondents (81%) somewhat agreed or completely agreed that the program application was easy to complete (4 or 5 rating). Lower levels of agreement were seen with the clarity of the program materials from the IESO (67%) or the LDC (65%),) and the sufficiency of the program materials from the IESO (61%) or the LDC(61%) , which suggests there may be an opportunity to provide participants with more comprehensive materials.

The survey asked participants who had low satisfaction (1 or 2 rating) with program materials and the application process for any suggestions on how to improve them. One respondent suggested that participants be provided paper versions of program materials, when requested, and have the option to complete the application in writing.

Figure 6-11 Assessment of Program Materials and Application Process (n=69) (Rating of 4 or 5 on a scale of 1 to 5)



The survey asked participants to rate their satisfaction with several other aspects of the program on a scale of 1 to 5 (Figure 6-12).[63] A majority of the respondents (79%) were somewhat satisfied or completely satisfied (4 or 5 rating) with the program overall. When asked about their satisfaction with aspects of the participation process, most respondents somewhat or completely satisfied with the quality of the work performed by the contractor (85%), the interactions with LDC representatives (82%) or IESO representatives (77%), and the time it took to receive the incentive (80%). The two respondents who had previously indicated they were aware of the Process and Systems Upgrade Program were somewhat

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[62] Scale is 1 to 5, where 1 means “do not agree at all”, 2 means “somewhat disagree”, 3 means “neither agree nor disagree”, 4 means “somewhat agree” and 5 means “completely agree”.

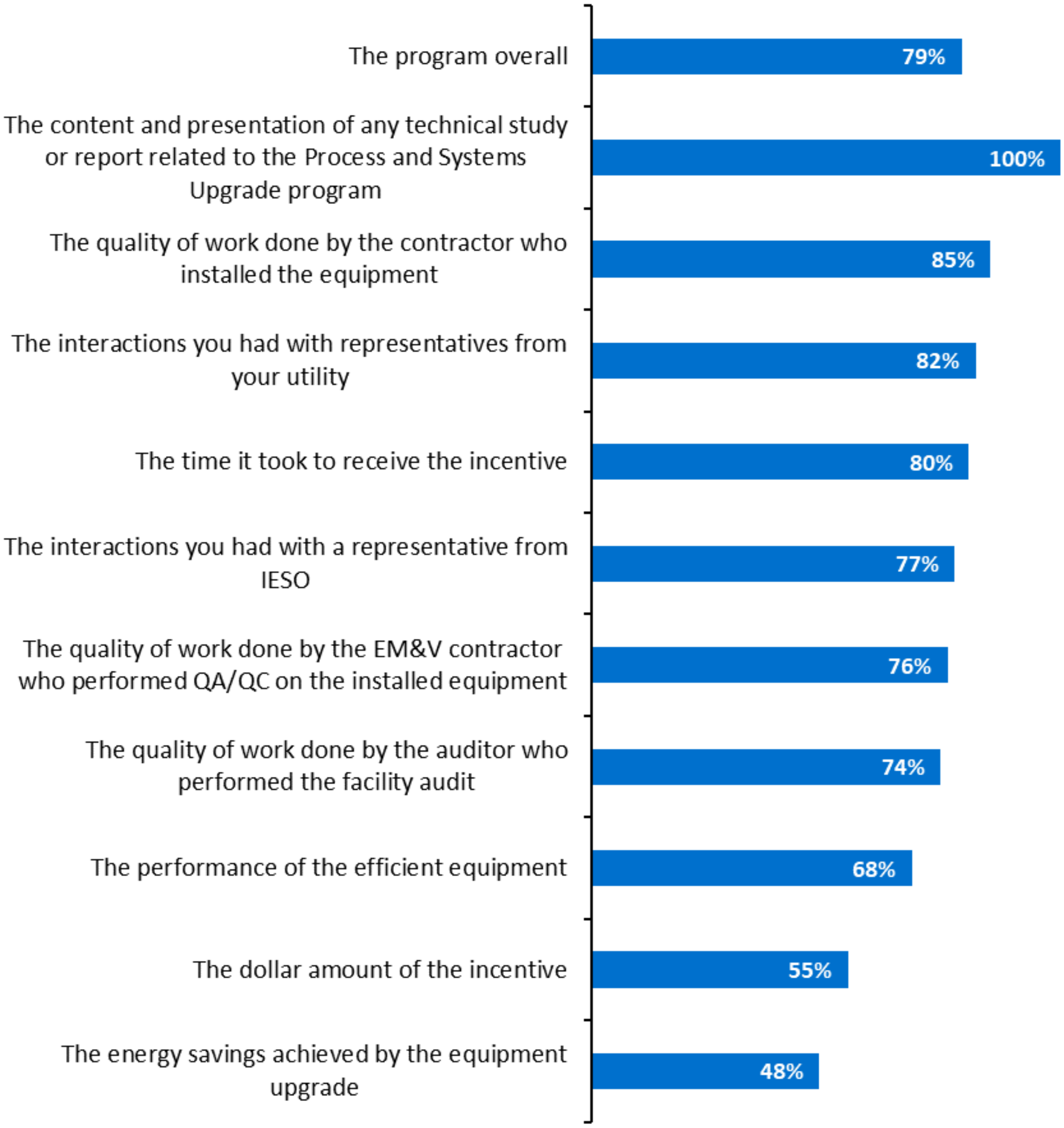
[63] Scale is 1 to 5, where 1 means “not at all satisfied”, 2 means “somewhat dissatisfied”, 3 means “neither satisfied nor dissatisfied”, 4 means “somewhat satisfied” and 5 means “completely satisfied”.

satisfied or completely satisfied with the content and presentation of any technical study or report related to the program.

The team also asked respondents about their satisfaction with the quality of work completed by the program auditors and EM&V contractors who performed the QA/QC on the installed equipment. About three-fourths indicated they were somewhat satisfied or completely satisfied (4 or 5 rating) with the quality of work done by the auditor (74%). A similar percentage of respondents (76%) were somewhat satisfied or completely satisfied with the quality of work conducted by the EM&V contractor and over two-thirds (68%) were somewhat satisfied or completely satisfied with the performance of the efficient equipment.

Respondents indicated somewhat lower levels of satisfaction with the energy savings achieved by the upgrades, as well as the dollar amount of the incentive. Just over one-half of respondents (55%) said they were somewhat satisfied or completely satisfied (4 or 5 rating) with the level of the incentive; and just under one-sixth of respondents (15%) reported they were either not at all satisfied or somewhat dissatisfied (1 or 2 rating). Less than one-half of respondents (48%) said they were somewhat satisfied or completely satisfied (4 or 5 rating) with the energy savings achieved; and about one-eighth (12%) were either not at all satisfied or somewhat dissatisfied (1 or 2 rating). This suggests that opportunities may exist to review incentive levels where possible and to better help customers interpret or monitor their savings.

Figure 6-12 Participant Satisfaction (n=66)
(Rating of 4 or 5 on a scale of 1 to 5)



The survey asked participants who had low satisfaction (1 or 2 rating) with the program overall for suggestions on improvements in these areas. Two respondents suggested expanding coverage of the program incentive by raising the cap to cover more of the project costs. Three respondents indicated frustrations with the technician and/or equipment options offered by the technician, and two of these respondents suggested expanding the equipment options covered by the program incentive.

When the evaluators asked how likely respondents would be to recommend the program to others, 84% of the participants surveyed indicated they would be somewhat likely or extremely likely to do so (4 or 5 rating).64

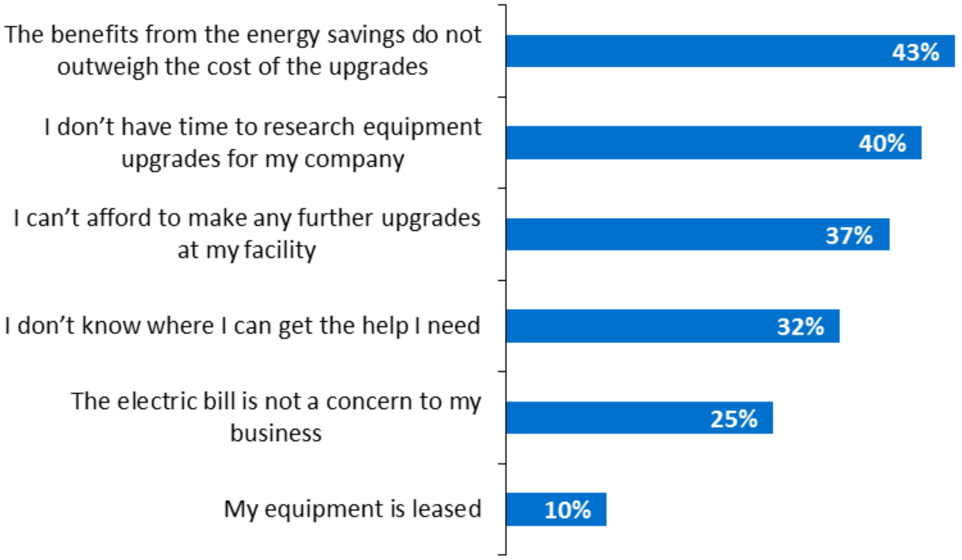
6.2.3.6 Barriers to Future Participation

Figure 6-13 shows the responses when asked about why it could be difficult for BRI participants to make future energy-efficient equipment upgrades. Using a scale of 1 to 5 to rate the extent to which they agreed with a statement, respondents reported that the primary barriers to future efficient upgrades were the benefits not outweighing the costs (43%) and not having the time to research equipment upgrades (40%).[65] Other common challenges mentioned were not being able to afford the upgrades (37%) and being unaware of where to get the necessary help (32%).

Very few respondents said that leased equipment would be a potential barrier, implying that the respondents typically owned all their equipment. One respondent added that they had already upgraded all their equipment as a reason they would not be making future upgrades.

Although one-fourth (25%) of respondents gave 4 or 5 ratings to the electric bill not being a concern, this statement also received ratings of 1 or 2 from close to one-half of respondents (48%), suggesting that the electric bill was a substantial concern to many respondents when considering future upgrades.

Figure 6-13 Barriers to Future Participation (n=63)
(Rating of 4 or 5 on a scale of 1 to 5)



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[64] Scale is 1 to 5, where 1 means "extremely unlikely", 2 means "somewhat unlikely", 3 means "neither likely nor unlikely", 4 means "somewhat likely" and 5 means "extremely likely".

[65] Scale is 1 to 5, where 1 means "not at all relevant", 2 means "slightly relevant", 3 means "somewhat relevant", 4 means "very relevant" and 5 means "extremely relevant".

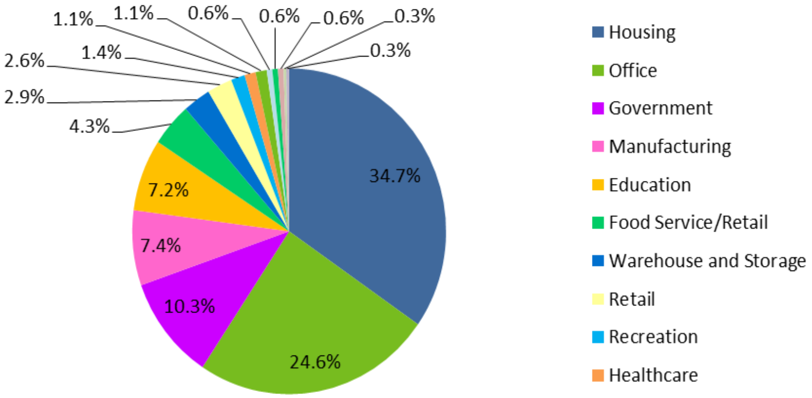
7 Audit Funding Program

7.1 Impact Evaluation

7.1.1 Participation

There were a total of 349 audits completed in 2017 across 19 contributing LDCs for a growth of 64% over the 2016 audit count of 213 (without true ups). The make-up of the types of facilities in the 2017 Audit Funding population is shown in Figure 7-1.[66]

Figure 7-1: Audit Funding Program Facility Type Composition



The change in percentage share for a given facility types from 2016 to 2017 was between -3 and +1%, except for Offices which increased from 12% in 2016 to 25% in 2017. The four sectors that contributed the most projects were Housing, Offices, Government, and Manufacturing. The full composition of the 2016 and 2017 Audit Funding Programs is shown in Figure 7-2.

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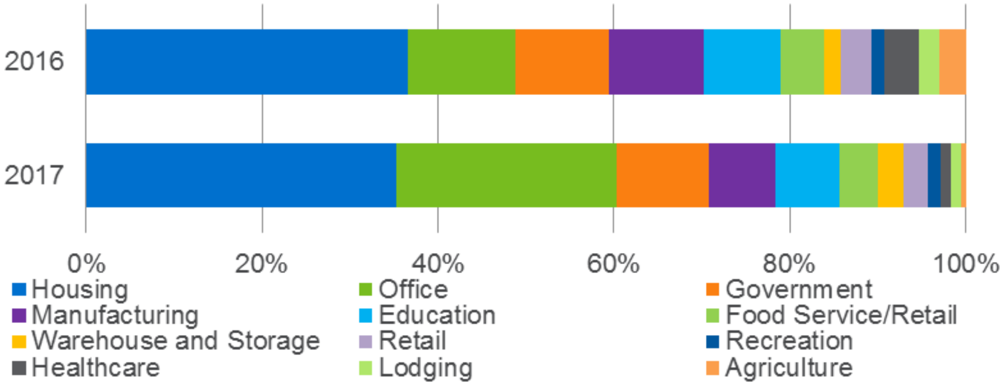
[66] Note that the tracking database did not provide a consistent naming convention for facility type. Nexant reclassified customer-supplied inputs into 14 common building types.

Figure 7-2: Audit Funding Facility Type Composition



7.1.2 Impact Results

The average annual electric consumption of the 2017 sample was 1,999,283 kWh across 17 facilities[67]. The average gross verified energy and demand savings attributable to the Audit Funding Program were estimated to be 65.33 MWh and 2.9 kW on a per-audit basis. Table 7-1 shows the total estimated net savings for the 2017 Audit Funding Program.

Table 7-1: 2017 Audit Funding Program Impact Results - Energy and Demand

Program Year	Completed Projects	Estimated Net Energy Savings (GWh)	Net Precision at 90% Confidence (Energy)	Estimated Net Energy Savings at 2020 (GWh)	Estimated Net Demand Savings (MW)	Net Precision at 90% Confidence (Demand)
2017	349	22.8	4%	22.8	1.0	4%

7.1.3 Results Comparison of 2017 with Previous Program Years

The net energy and demand savings results from 2017 compared to those verified in 2016 and 2015 are presented in

Figure 7-3. Note that 2016 and 2015 values include true-up projects shaded in orange. The program observed a 715% increase in net first-year energy savings and a 178% increase in net first-year demand savings between 2016 (not including true ups) and 2017. This increase in net first-year savings is due to a large increase in per audit energy savings and the program's participation.

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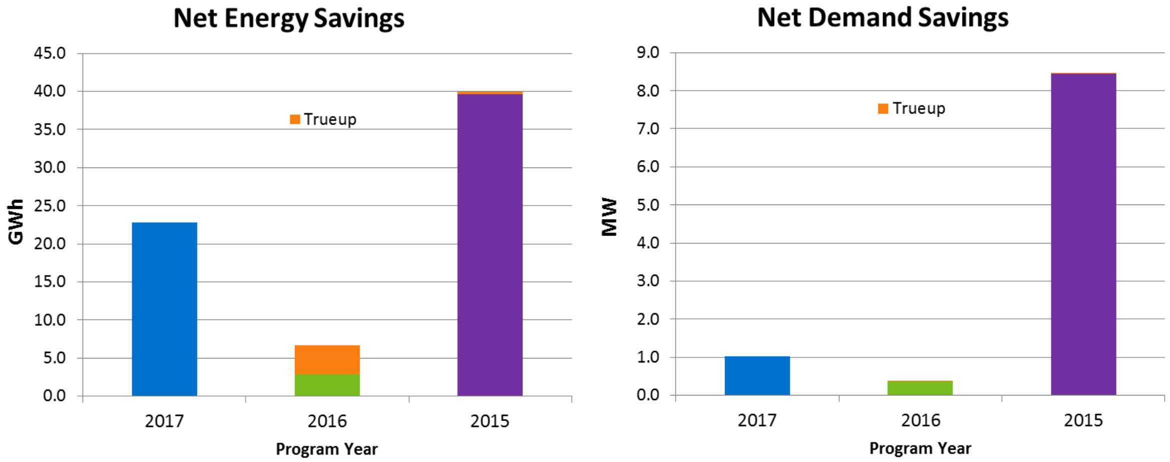
[67] n=17 (the sample consisted of 18 sites, of which one did not report their annual energy consumption)

Figure 7-3: Comparison of Annual Audit Funding Net Energy and Demand Savings



As shown in Table 7-2, the per-audit energy savings increased significantly by 240% from 19.2 MWh in 2016 to 65.3 MWh in 2017. Demand savings increased modestly from 2.5 kW to 2.9 kW. Participation also grew by 64% over the same period while the per audit average annual electricity consumption grew 17%. The large increase in per-audit energy savings was due to several factors including an increase in the Measure Adoption Rate, which is the ratio of the number of measures installed (net of the measures that were installed with an incentive or rebate) to the total number of recommended measures.

Table 7-2: Key Differences in 2016 and 2017 Per-Audit Impact Results

Program Year	Participation (Audits)	Average Per Audit Annual Electric Consumption (kWh)	Per-Audit Energy Savings (MWh)	Per-Audit Demand Savings (kW)
2016	213	1,706,314	19.2	2.5
2017	349	1,999,283	65.3	2.9
Δ	↑ 64%	↑ 17%	↑ 240%	↑ 16%

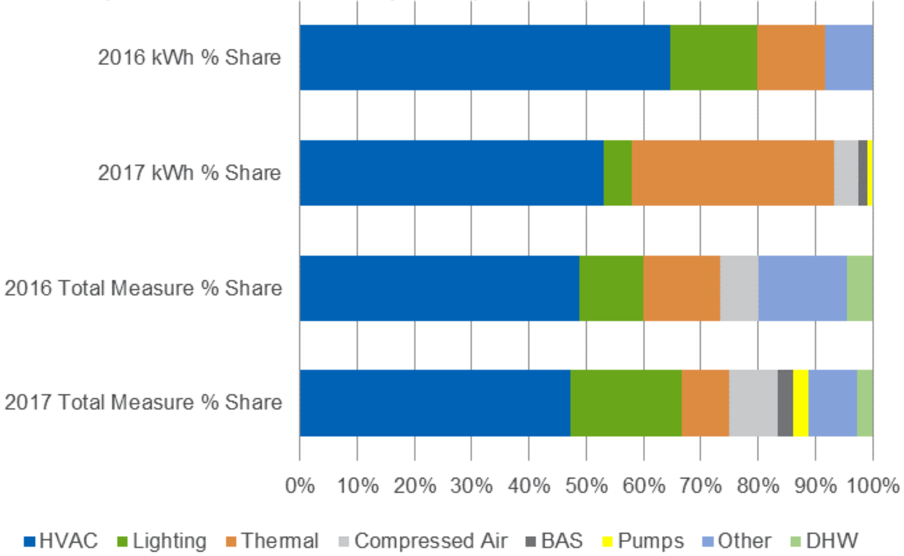
When looking at the annual samples independently, the Measure Adoption Rate increased from 12.9% to 28.8% from 2016 to 2017, as shown in Table 7-3. The number of measures that were installed but were not attributed to the Audit Funding program fell significantly from 55% in 2016 to 20% in 2017, while the proportion of implemented measures to recommended measures attributable to the Audit Funding program increased from 20% in 2016, to 36.0% in 2017. The savings adoption rate, which is a function of the measure adoption rate and the magnitude of attributable savings, increased dramatically from 5.1% in 2016 to 39.7% in 2017. In the 2017 sample program participants implemented many more measures as a share of the total that were recommended, and also implemented measures that had larger savings, on average, than in 2016.

Table 7-3: Audit Funding Influenced Implemented Measures and Savings by Year

Program Year	No. of Recommended Measures within Sample	No. of Implemented Measures within Sample	Measure Adoption Rate	Total Recommended MWh within Sample	Total Implemented MWh within Sample	Savings Adoption Rate
2016	350	45	**12.9%**	12,123.8	615.5	**5.1%**
2017	125	36	**28.8%**	9,748.2	3,867.9	**39.7%**
	↓ 64%	↓ 20%	↑ 124%	↓ 20%	↑ 528%	↑ 682%

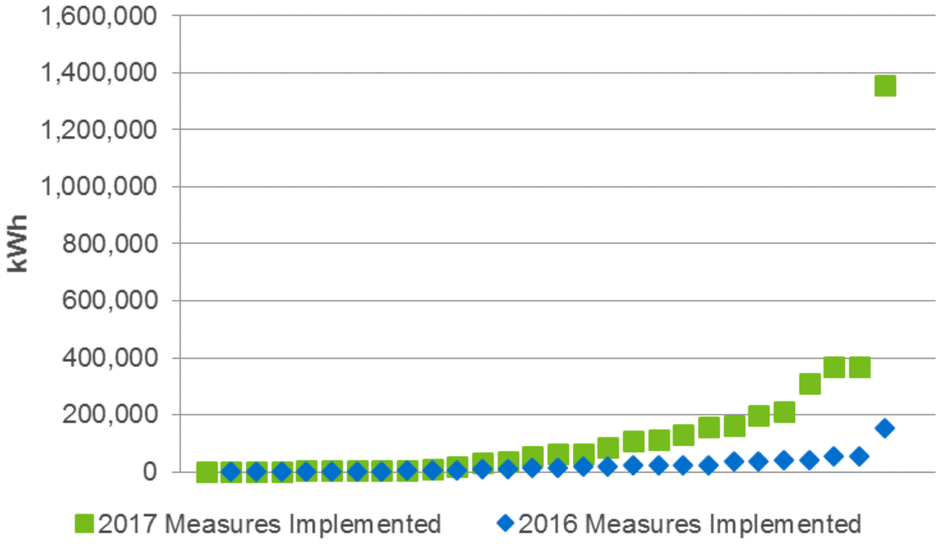
The Nexant team categorized implemented measures into eight end use categories which included: BAS, Compressed Air, Domestic Hot Water (DHW), HVAC, Lighting, Pumps, Thermal, and Other measures. Across all end use categories the average savings per implemented measure (or the total savings achieved in the sample divided by the total number of implemented measures in the sample) grew from 21.23 MWh in 2016 to 138.14 MWh in the 2017, a five-fold increase. Specifically the end-use with the largest year over year growth was thermal measures, growing from 72.2 MW in 2016 to 1,360 MW in 2017. As shown in Figure 7-4 HVAC measures continue to provide the largest share of savings. A comparison of the savings contributions among end-uses in the Audit Funding between the 2016 and 2017 programs is presented in Figure 7-4. Considering the breakdown of the measure count by end-use in Figure 7-4 it is apparent that there were very large thermal projects in 2017 as they disproportionately make up the 2017 energy savings.

Figure 7-4: Audit Funding Energy Savings Contributions



Measures implemented in 2016 and 2017 are displayed in Figure 7-5. Only measures with non-zero savings and an energy savings estimate are included. Measures are sorted by savings and it is apparent that measures implemented in 2017 had much higher savings, and one thermal project had savings of almost 1.6 GWh.

Figure 7-5: 2016 and 2017 Implemented Measure



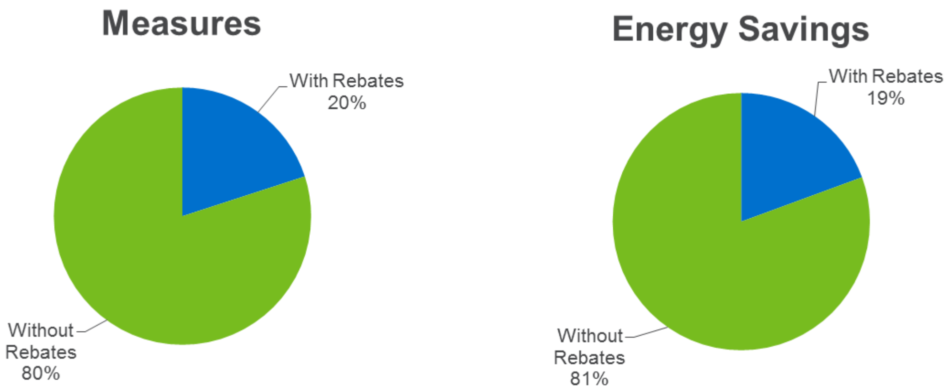
7.1.4 Lifetime Savings

The Audit Funding Program achieved 224,906 GWh of net lifetime energy savings and persistence of 22.8 GWh net annual savings at 2020. The lifetime energy savings are based on a weighted average EUL of all measures contributing to the savings achieved by the Audit Funding Program. Measures contributing to the program savings include all measures recommended in an audit report and implemented without any form of financial incentive. The EUL for the 2017 program year was calculated based on the measure level EULs of the measures that were attributable to the program. The assigned EUL for each attributable measure ranged from one to twenty years with a weighted average of 9.86 years.

7.1.5 Impact Observations

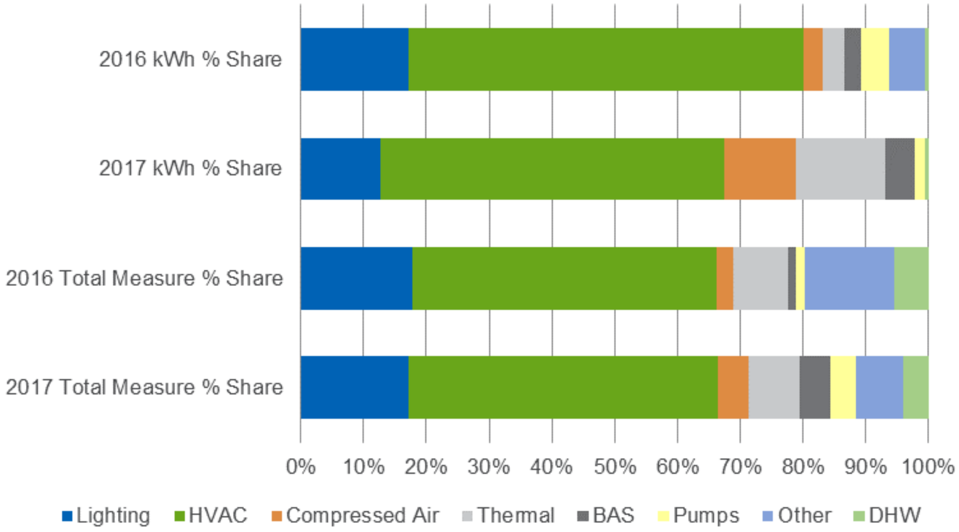
A total of 125 measures were recommended to participants by their auditors within the annual 2017 Audit Funding Program sample of 19 projects. Only measures installed that were not incentivized were included in the 2017 Audit Funding Program savings. Figure 7-6 shows the breakdown of the 36 implemented measures in the sample with respect to whether or not they received rebates through another program. The no. of measures and their associated energy savings represented in green are installed measures that contribute to the Audit Funding savings.

Figure 7-6: Comparison of Rebated and Non-Rebated Measures



As compared to PY 2016, PY 2017 saw many more measures implemented due to the Audit Funding program but not incentivized through another Save On Energy program. In light of this, an analysis was completed to determine whether or not the measures recommended in 2017 were systematically different than those in 2016. As can be seen in Figure 7-7, many of the end-use categories had both similar kWh savings and measure proportions year over year. The notable stand out was compressed air, which saw the total number of measures grow modestly and the energy savings grow significantly. Further, thermal measures actually had a decrease year over year in terms of the number of measures but the total energy savings increased dramatically.

Figure 7-7: All Recommended Measures Program Years 2016 and 2017



To further investigate why fewer recommended measures were installed with Save On Energy incentives in 2017, the measures themselves were considered to determine whether they were likely eligible for incentive. Of the 36 total measures implemented, it was estimated that 16 (44%) were likely eligible for incentives in 2017; this figure was 38% in 2016. It was not determined if the participants were aware these recommended measures would likely qualify for incentives.

The impact evaluation identified the following observations and recommendations:

- **Observations:** In order to further increase the number of measures implemented as a result of the Audit Funding program the audit reports should clearly state which recommended measures may qualify for incentives through other CDM programs.

  Recommendation: *Provide clear information on all available incentives for measures that are recommended in audit reports including contact information and instructions on how to apply for them.*

7.1.6 Avoided Greenhouse Gas Emissions

The evaluation team used the IESO Conservation and Demand Management (CDM) Energy Efficiency Cost Effectiveness Tool to calculate avoided greenhouse gas (GHG) emissions. Avoided GHG emissions were calculated for the first year or the 2017 program year and for the lifetime of the measures. Table 7-4 below presents the results of these calculations.

Table 7-4: Audit Funding Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided (Tonnes CO_2 equivalent)		
	Electric	Gas	Total	Electric	Gas	Total
2017	4,386.83	53,609.46	57,996.29	62,173.79	536,094.61	598,268.39

7.1.7 Cost Effectiveness

The evaluation team conducted a cost effectiveness analysis for the Audit Funding program. Cost effectiveness results are presented in Table 7-5. The Audit Funding program passed the TRC test and the PAC test with both benefits exceeding their respective costs. The program cost effectiveness is improved compared to 2016. In 2016 the program passed the TRC test with a benefit ratio of 2.04 and a PAC of 0.59.

The improvement in the TRC and PAC test is due primarily to the increased average per audit energy savings which increased 262% between 2016 and 2017. The average amount of natural gas savings per audit also increase from 1,933 MMBtu in 2016 to 2,739 MMBtu on 2017. For the TRC test, this increase in savings overcame the effect of a 42% increase in average per audit incremental costs. The average per audit incentives was similar between the 2016 and 2017 with values of $4,383 and $4,180, respectively.

Table 7-5: Audit Funding Cost Effectiveness Results

Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	$33,407,009
TRC Benefits ($)	$81,526,367
TRC Net Benefits ($)	$48,119,358
TRC Net Benefit (Ratio)	2.44
Program Administrator Cost (PAC)	
PAC Costs ($)	$2,849,605
PAC Benefits ($)	$9,185,137
PAC Net Benefits ($)	$6,335,531
PAC Net Benefit (Ratio)	3.22
Levelized Unit Energy Cost	
$/MWh	$16.22
$/MW	$365,171

The changes in the CE results between the 2015 and 2017 program years are shown in Table 7-6. These changes are primarily effected by the changes in the average savings per audit found in the annual impact evaluations.

Table 7-6: Cost Effectiveness Comparison

Evaluation Year	TRC Test	PAC Test	Demand LUEC ($/MW)	Energy LUEC ($/MWh)
2017	2.44	3.22	$365,171	$16.22
2016	2.01	0.55	$913,152	$119.16
2015	1.15	1.78	$147,394	$31.42

7.1.8 Net-to-Gross (NTG)

NTG observations for the Audit Funding Program are provided in the following subsections and detailed observations are provided in Appendix D. Additional details regarding the NTG methodology can be found in Appendix C.

7.1.8.1 Key Observations

Key observations from the NTG analysis include the following:

- Eight of 33 (24%) participants installed energy efficient equipment recommended by the program-funded audit without any incentive.
- Participants installed 12 different efficient equipment types, and in the absence of the program-funded audit, three of the exact same equipment types would have been installed anyway, six would have been postponed or canceled, and one respondent chose not to describe what they would have done in the absence of the program-funded audit.[68]
- These eight participants also rated the influence of the program-funded audit on their decision to install efficient equipment. Four respondents rated the program audit as influential, three said the audit was somewhat influential, one reported that the program audit had little to no influence on their installation decision, and one did not know whether the program audit had an influence on their installation decision.[69]
- These responses indicate varying degrees of free-ridership, which in turn indicates the program did a good job in many—but not all—instances of helping customers who needed the program's support in identifying efficient upgrades.
- Participation in the Audit Funding Program did not result in any measurable spillover.

7.1.8.2 NTG Strata Level Results

Table 7-7 summarizes the results of the 2017 Audit Funding Program NTG evaluation. All LDCs included in the Audit Funding Program were assigned the province-wide NTG values. The following subsections summarize the analyses done to help interpret these values.

Table 7-7: NTG Assignments – Audit Funding Program

NTG Assignment	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG *%	Demand Savings Weighted NTG* %
Province-wide	33	5.9%	0%	0%	94.1%	94.1%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net to gross.

7.1.8.3 Non-Incentivized Energy Efficient Equipment Background

The survey of Audit Funding Program participants asked a series of questions to assess free-ridership and spillover associated with the program. Due to the small sample size, the evaluation team presents counts in all tables and figures throughout this section, rather than percentage values.

The survey asked all 33 responding participants if they had installed or upgraded energy efficient equipment *without any program-funded incentives* at their properties where the program-funded audit was performed in 2017 (Table 7-8). Eleven participants reported installing 19 different equipment types that met these criteria, while 22 participants said they had not. Of these 11 respondents, eight confirmed they had either partially or fully installed a total of 12 different equipment types that were specifically recommended in the program-funded audit report.

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[68] In some instances, respondents installed multiple equipment types; therefore, they provide program influence ratings specific to each equipment type. Given this, the responses to this question do not add up to the total number of respondents.

[69] Ibid.

Table 7-8: Completion Status of Recommended Equipment Upgrade (n=8; multiple response allowed)

Type of Equipment Installed without Incentive After Audit Completed	Recommended Upgrade(s) Completed?		
	All	Some	None
ENERGY STAR® Appliance	--	--	--
Fan	--	--	--
HVAC - Air conditioner replacement, above code minimum	2	1	--
Lighting	--	5	--
Lighting - Controls	--	--	--
Motor/Pump Upgrade	1	1	--
Motor/Pump Drive Improvement (VSD and Sync Belt)	--	1	--
Other	1	--	--
TOTAL	**4**	**8**	**0**

The survey asked the five participants who said they only completed "some" of the recommended upgrades if there were *any other* upgrades recommended in their audit *that they did not install* (Table 7-9). Four respondents said they did not install HVAC, chiller, or lighting equipment upgrades. The same four respondents indicated that they did not plan to install the equipment due to budget constraints, though one respondent does have plans to complete an HVAC upgrade within a year.

Table 7-9: Recommended Equipment Upgrade Uncompleted (n=5; multiple response allowed)

Type of Equipment Not Installed After Audit Completed	Recommended Upgrade(s) Not Completed but will Complete within Year	Recommended Upgrade(s) Not Completed for Budget Reasons
HVAC	1	2
Chiller	--	1
Lighting	--	1
Other (compressor; boiler)	--	2
TOTAL	**1**	**6**

All four respondents who said they did not make the recommended upgrades due to budget concerns reported that they received incentive-level information within their Audit Report for each recommended measure, though it was presented in various ways, as follows:

- Cost of the measure after the incentive was presented in the Audit Report (one respondent)
- Incentive amount was listed in addition to measure cost in the Audit Report (two respondents)
- Payback with and without incentive was presented in the Audit Report (one respondent)

These same four respondents stated that the cost of the recommended equipment would have to be reduced by 11% to 23% for them to implement it, with an average required reduction of 19.5%.

7.1.8.4 Free-ridership

To estimate free-ridership, participants who confirmed installing audit-recommended equipment were first asked about what their *intentions* would have been regarding the installed efficient equipment if they had not had the program-funded audit performed. The responses from these eight participants regarding the twelve equipment types they identified as installing are summarized below and in Table 7-10:

- Six participants said they would have delayed seven of their upgrades by at least one year or cancelled the work altogether (three HVAC projects, one lighting project, two motor/pump upgrades, and one other upgrade).
- Three participants said they would have done the exact same upgrade anyway for the four upgrades they reported (three lighting upgrades and one Motor/Pump Drive Improvement).
- One participant chose not to explain whether they would have installed their lighting upgrade if the audit had not recommended it.

Table 7-10: Respondent Action on Recommended Equipment Upgrades in the Absence of the Funded Audit (multiple response allowed; n=8)

Type of Equipment Installed without Incentive after Audit Completed	Likely Respondent Action on Recommended Equipment Upgrades in Absence of Audit (if upgrade partially or fully completed)			
	Put off doing the upgrade for at least one year or cancelled it altogether	Done the upgrade, but scaled back the size or extent of the upgrade	Done the exact same upgrade anyway	Don't know/ Refused
ENERGY STAR® Appliance	--	--	--	--
Fan	--	--	--	--
HVAC - Air conditioner replacement, above code minimum	3	--	--	--
Lighting	1	--	3	1
Lighting - Controls	--	--	--	--
Motor/Pump Upgrade	2	--	--	--
Motor/Pump Drive Improvement (VSD and Sync Belt)	--	--	1	--
Other	1	--	--	--
TOTAL	**7**	**0**	**4**	**1**

To estimate free-ridership, participants were also asked to use a 1 to 5 scale to rate the audit's *influence* on the decision to install the non-incentivized equipment after having the audit performed (Table 7-11).[70]

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[70] Scale is 1 to 5, where 1 means "not influential at all", 2 means "slightly influential", 3 means "somewhat influential", 4 means "very influential" and 5 means "extremely influential".

A summary of program influence ratings provided by each of the eight participants for the 12 technology types[71] that they provided ratings for is shown below:

- The audit had little influence (2 rating) over one respondent's decision to install the motor/pump drive improvement. Given this, the respondent exhibited some likelihood of free-ridership for this equipment type.
- The audit had a moderate influence (3 rating) on one respondent who made a recommended HVAC upgrade and three respondents who made recommended lighting upgrades. These scores indicate a moderate level of free-ridership for these equipment types.
- The audit was very influential or extremely influential (4 or 5 rating) on two respondents who installed recommended HVAC measures, one respondent who installed lighting measures, two respondents who installed motor/pump upgrades, and one respondent who installed another type of upgrade. These scores are associated with moderate to low levels of free-ridership.
- The audit was somewhat influential (3 rating) on one respondent who made a recommended HVAC upgrade and three respondents who made recommended lighting upgrades. These scores indicate a moderate level of free-ridership for these equipment types.
- The audit was slightly influential (2 rating) on one respondent's decision to install the motor/pump drive improvement. Given this, the respondent exhibited higher likelihood of free-ridership for this equipment type.
- One respondent said they did not know how much influence the audit had on their decision to install recommended lighting upgrades.
- Overall, the mean influence rating of the audit given by participants, with each upgrade being rated separately, was 3.4 out of 5

Table 7-11: Influence of LDC-Funded Audit on Respondent Organizations' Decision to Undertake Recommended Upgrades (multiple response allowed; n=8)

Type of Equipment Installed without Incentive after Audit Completed	Influence of Program-Funded Audit on Upgrade					
	1 (no influence)	2	3	4	5 (great influence)	Average Rating
ENERGY STAR® Appliance	--	--	--	--	--	--
Fan	--	--	--	--	--	--
HVAC - Air conditioner replacement, above code minimum	--	--	1	2	--	3.7
Lighting	--	--	3	1	--	3.3
Lighting - Controls	--	--	--	--	--	--
Motor/Pump Upgrade	--	--	--	2	--	4
Motor/Pump Drive Improvement (VSD and Sync Belt)	--	1	--	--	--	2

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[71] As a reminder, the 12 equipment types that respondents reported installing included HVAC (three respondents), lighting (five respondents), motor/pump upgrade (two respondents), motor/pump drive improvement (one respondent)

Type of Equipment Installed without Incentive after Audit Completed	Influence of Program-Funded Audit on Upgrade					
	1 (no influence)	2	3	4	5 (great influence)	Average Rating
Other	--	--	--	--	1	5
TOTAL	**--**	**1**	**4**	**5**	**1**	**3.4**

7.1.8.5 Spillover

Participation in the Audit Funding Program did not result in any measurable spillover.

7.2 Process Evaluation

The following subsections outline the process evaluation results of the Audit Funding Program. Responses have been summarized and detailed observations are provided in Appendix I Additional details regarding the process methodology can be found in Appendix F.

7.2.1 LDC Staff Perspectives

The following subsections highlight the feedback received from LDC staff about the design and implementation of the Audit Funding Program in 2017.

7.2.1.1 Key Observations

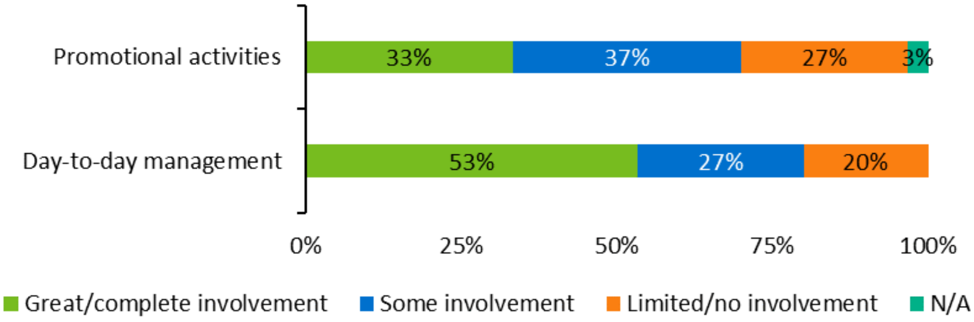
Key observations from LDC staff responses include the following:

- Most LDCs (51%) managed the Audit Funding Program by using primarily in-house staff.
- Nearly one-quarter (23%) of LDCs managed the logistics of multiple contractors on their own.
- The single largest barrier to increased customer participation in the Audit Funding Program is the lack of customer understanding (mentioned by 12% of LDC staff).

7.2.1.2 LDC Staff Involvement

More than half of LDC staff (53%) said they were greatly involved in the day-to-day management of the Audit Funding Program and 33% were greatly involved in its promotional activities (Figure 7-8).

Figure 7-8: Level of LDC Staff Involvement in the Audit Funding Program (n=30)

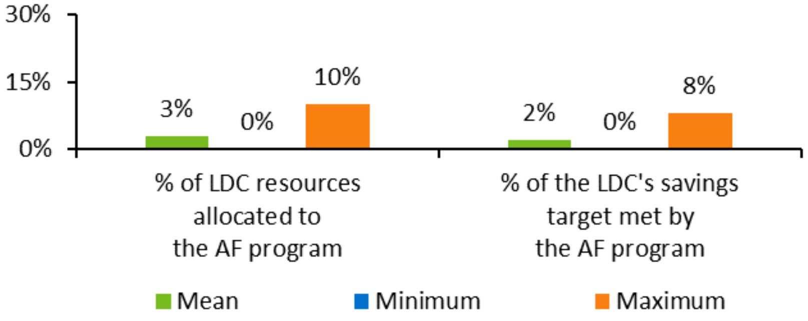


The majority (83%) of LDC staff expect that in 2018 their LDC will maintain its same level of involvement and engagement in the Audit Funding Program. Only 13% expect their LDC will increase its level of involvement and 3% indicated this is not applicable to them. As compared to 2016, the 2017 predicted level of involvement in the Audit Funding Program has shifted significantly away from expectations of less involvement (11% and 0%, respectively) and towards maintaining the current level of involvement (64% and 83%, respectively). These results may indicate that LDCs have started to find an optimal balance of involvement level and expected savings.

7.2.1.3 Allocated Resources and Expected Savings

The survey asked LDC staff to estimate the approximate percentage of total resources their LDC allocated to the Audit Funding Program. On average, LDC staff estimated that 3% of their LDC's total resources were allocated to the Audit Funding Program (Figure 7-9). Responses ranged from 0% to 10% of resources (please refer to in Table 10-1 in Section 10.1.1).

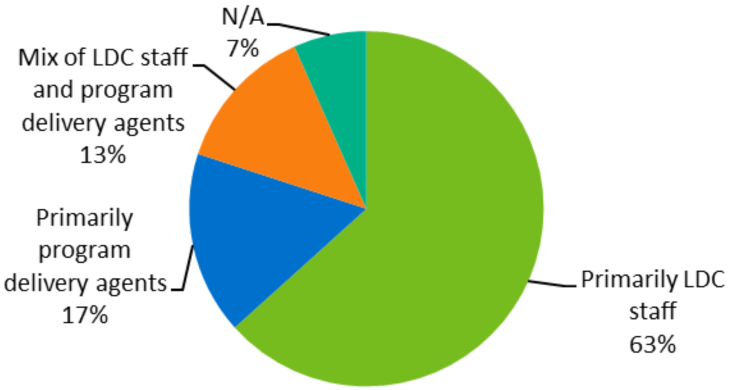
Figure 7-9 Allocated Resources and Expected Savings (n=29)



7.2.1.4 Program Management and Implementation

Sixty-three percent of LDCs (n=30) managed and delivered the Audit Funding Program by primarily using in-house LDC staff (Figure 7-10).

Figure 7-10 Program Management and Delivery (n=30)

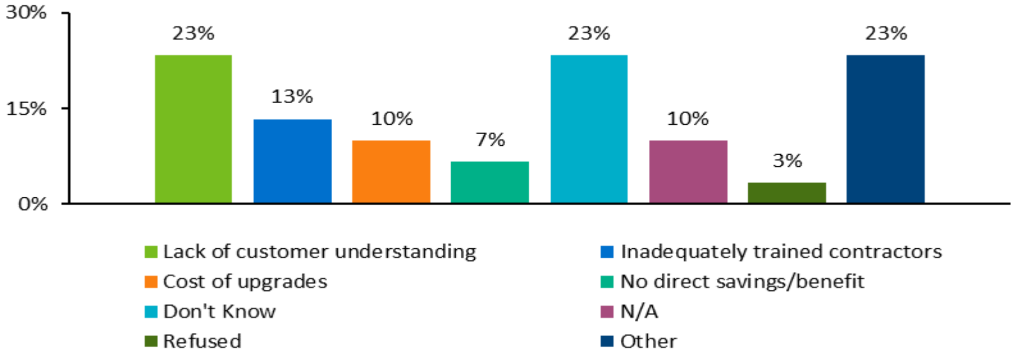


The survey asked LDC staff (n=30) how their LDC managed the contractors that were necessary to conduct any audits for the Audit Funding Program in 2017. Most commonly, LDC staff indicated that one contractor managed all aspects of the program's audits (20%). As compared to 2016, there was a significant difference in LDCs in 2017 who no longer manage the logistics of multiple contractors on their own (23% and 0%, respectively). These results may indicate that LDCs prefer to have a single liaison communicating with and managing all auditors.

7.2.1.5 Barriers to Increased Customer Participation

The survey asked LDC staff about the single largest barrier to greater customer participation for each program (Figure 7-11). For the Audit Funding Program, the most common responses include lack of customer understanding (23%) and inadequately trained contractors (13%). The percentage of respondents that mentioned audit costs saw a significant decrease in 2017 compared to 2016 (0% and 9%, respectively).

Figure 7-11: Barriers to Customer Participation (multiple response allowed; n=30)



7.2.1.6 Expected Changes for 2018

The majority (93%) of survey LDC staff indicated that their LDC's approach to implementing the Audit Funding Program in 2018 did not change from 2017. One LDC (4%) indicated having changed the process this year by more actively marketing and promoting the program. The remaining LDC (4%) stated this was not applicable to their LDC

7.2.2 PDA and TPE Staff Perspectives

The following subsections highlight the feedback received from the PDA and/or TPE staff that provided support to the implementation of the Audit Funding Program in 2017. Feedback was received through a web survey that was administered in April 2018. As the sample size of Audit Funding PDAs and/or TPEs is small (3 respondents), counts are reported instead of percentages.

7.2.2.1 Key Observations Key Observations

Key observations from the PDA and TPE staff responses include the following:

- One PDA/TPE firm thought the primary barriers to increased customer participation are the high upfront costs and not having the time to research the appropriate equipment upgrades.
- One firm who interacted directly with customers in marketing the Audit Funding Program said that their firm made direct calls to customers, sent out flyers, advertised through TV and other mediums, and marketed the program audits on social media. The other firm indicated they did not actively market the Audit Funding Program.

7.2.2.2 Respondent Roles and LDCs Supported

One of the three responding PDA and TPE firms supported multiple LDCs in the delivery of the Audit Funding Program. This firm served five different LDCs in support of the 2017 Audit Funding Program. The other two firms served one LDC each (Table 7-12). All three responding firms provided TPE support to the Audit Funding Program in 2017, and one provided PDA support as well. This firm reported there were no issues with having multiple roles on Audit Funding projects.

Table 7-12 Roles of PDA and TPE Responding Firms (n=3)

PDA/TPE Respondents	Firm Roles		LDCs Served
	PDA	TPE	
Firm 1	✓	✓	5
Firm 2	--	✓	1
Firm 3	--	✓	1

The survey asked the respondent who provided PDA services what activities or duties were involved in supporting the Audit Funding Program in 2017. The firm indicated providing budgeting, program management, and management of audit applications as part of their role as a PDA for the Audit Funding Program in 2017.

The survey asked the three respondents who provided TPE services to describe the activities or duties that were involved in supporting the Audit Funding Program in 2017. Two firms indicated reviewing customer audit applications for completeness. One of these firms also provided program-related recommendations to LDCs. The third firm was contracted to provide technical review, calculations of potential energy savings, and project reporting (Table 7-13).

Table 7-13 Roles of TPE Firms (n=3)

TPE Roles	Firm 1	Firm 2	Firm 3
Review applications for completeness	✓	✓	--
Provide recommendations to LDC	✓	--	
Reporting	--	--	✓
Data collection	--	--	✓
Calculation of potential project savings	--	--	✓

7.2.2.3 PDA and TPE Interactions with LDCs, IESO, and Customers

PDA and TPE Interactions and Satisfaction with LDCs: The survey asked PDA and TPE respondents about the nature or purpose of their interactions with the LDCs when providing support services to the Audit Funding Program in 2017. The timing and amount of interaction with the LDCs varied depending on the LDC. One firm communicated with the LDC on technical aspects of the audit review, and the other two indicated communicating with the LDC throughout the application review process. One TPE respondent provided the following context:

"The LDC's send [the] applicant documentation. [Our firm] would issue recommendation documents to [the] LDC, based on which they would approve or otherwise."

The survey asked respondents to use a scale of 1 to 5 to rate their level of satisfaction with specific elements of communications with the LDCs.[72] All three firms were either somewhat or completely satisfied with their overall interactions with the LDCs, as well as clarity on program goals, clarity on coordination needs, level of communication and collaboration, and the clarity on roles and responsibilities of the different organizations involved in administering the program.

The firm that served multiple LDCs indicated that interactions were varied across the LDCs served. The respondent indicated that some LDCs were "*very good with communications, and others were not*."

Program Support Received from the LDCs: The survey asked PDA and TPE respondents what support their firm received from the LDC(s) to help in their role as the PDA and/or TPE in 2017. All firms indicated receiving responses to their questions as a general form of support provided by the LDCs. Two out of the three firms indicated receiving one-on-one, in-person support from LDC staff.

The survey asked respondents if they had any suggestions for additional support they would recommend the LDCs provide to the PDAs and TPEs. None of the respondents had any specific suggestions for additional support.

PDA and TPE Interactions with Customers: The survey asked PDA and TPE respondents how frequently their firm interacted directly with customers. The level of direct customer interaction was different for each of the three firms. One of the TPE firms reported having moderately frequent biweekly interactions with customers, one PDA/TPE firm reported having infrequent interactions with customers, and the third TPE respondent did not interact directly with customers.

The survey asked respondents to describe the nature of their interactions with customers. One of the TPE firms who had direct interactions with the customer, reported they typically provided customers with application support when applying for the audit, or reached out to customers to gather documentation in support of the audit application. The other respondent preferred not to answer this question.

PDA and TPE Marketing and Customer Outreach: The survey asked the two PDA and TPE respondents who interacted directly with customers what role their companies played in marketing the Audit Funding Program. One firm made direct calls to customers, sent out flyers, advertised through TV, radio, and through other means, and marketed the program on social media. This firm targeted customers at industrial events and conferences. The other firm indicated they did not actively market the Audit Funding Program.

7.2.3 Auditor Perspectives

The following subsections describe the results of interviews of auditors in the Audit Funding program and address firmographic information, their company's firmographics and involvement in the program; customers and the audit process; auditor perceptions of customer barriers to participation, and auditor satisfaction with program elements.

7.2.3.1 Key Observations

Key observations from auditors' responses include the following:

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[72] Scale is 1 to 5, where 1 means "not at all satisfied," 2 means "somewhat dissatisfied," 3 means "neither satisfied nor dissatisfied," 4 means "somewhat satisfied," and 5 means "completely satisfied."

- Auditors reported high levels of satisfaction with the program overall, as well as with a number of aspects of it, including: the program form submission process, LDC staff interactions, and the dollar amount of the incentive.
- According to respondents, the review process for program applications and reports tends to slow project completion. Auditors reported that in some instances the reviews are inconsistent, overly critical, and that requirements for these reports and incentive rebates are too inflexible.
- Auditors could use supplementary material from the program that could help them encourage customers to pursue retrofits. These could include program flowcharts, case study materials, and resources regarding how to pursue financing the recommended upgrades.

7.2.3.2 Firmographics

The evaluation team gathered survey data for 10 auditors with experience in the Audit Funding program. The companies the 10 auditors work for vary greatly in size, ranging from 1 employee to over 8000 employees, and the average number of staff working on Audit Funding program projects was 5. Finally, while 3 firms had existed for less than 10 years, the other respondent’s firms have existed for more than 25 years.

7.2.3.3 Firm Participation in the Audit Funding Program

Most respondents’ companies have been doing audits outside of the program, on average, for about 9 years, while having worked about 5 years within it. For the most part, respondent’s companies had done less than 10 audits in 2017, though one had done more than 20, and one had done more than 100. Six respondents noted that they had done audits at multi-residential properties, and four noted the same for commercial properties. Finally, for most respondents, regardless of firm size, audits through the program resulted in a significant amount of their workload and were, on average, responsible for 49% of it.

7.2.3.4 The Audit Process and Paperwork

Nine of ten auditors reported that they had informed customers of the Audit Funding Program; they recommend the audit based on the customers’ needs and describe the incentives they may be eligible to receive. Lighting was the most common efficiency upgrades for which customers requested evaluation, though many auditors reported that they evaluated everything.

Once the audits are complete, auditors most typically communicate audit findings via the required reports and do so via meetings or presentations in order to clarify the details of their findings and recommendations. This is done mainly because the auditors want clients to understand the importance of the energy savings potential that they have found, so as to encourage them to install energy efficient equipment, but also because if that firm offers follow-on services, such as project management or measurement and verification, that customers will hire the auditor’s firm to do it.

Auditors reported that the audit reports themselves were a “very” influential part of customers’ decision making process regarding implementing their recommendations. Respondents noted that a large majority of customers who receive audits go on to install at least some of the recommended measures. Five auditors reported that more than 75% would go on to do so, while the remainder said that at least 50% or “most” customers would do so.

Additionally, though some customers had actually filed audit invoices to their LDC for reimbursement, auditors reported that they had done the large majority of the paperwork required for the program in order to serve their customers and keep projects moving.

7.2.3.5 Auditor Perceptions of Customer Barriers to Equipment Upgrades

However, auditors believe the review process for audits and required reports can delay job completion, mainly because it is not flexible enough in its requirements for reporting, specifically when additional information is, or needs to be, included in reports. Auditors see this additional information as important for clients in terms of their decision-making process regarding how to address recommended equipment upgrades. Two auditors also thought that energy use practices should be included in evaluating equipment needs and savings. Specifically, one thought that there should be allowances for control equipment, and the other thought that systems should be fully evaluated in what he called a “systems approach,” as opposed to an “equipment replacement approach.” In the case of the latter, this meant to the auditor that systems should first be optimized, then evaluated for equipment retrofits.

Auditors also thought that they could use more support from the program in a number of respects to help encourage customers to pursue retrofits. Some respondents suggested that they would benefit from having resources available online that help customers navigate the audit and retrofit processes. These resources might include program flowcharts or resources that demonstrate benchmark data for audits, such as typical payback periods. This could include case studies, or a summarization or compendium of past audit data. This would make selling the benefits of audits easier and would also help to, as one auditor put it: “combat the skepticism” that customers have about the legitimacy of auditors’ savings estimates.

Two auditors also found the program’s guidelines for refunds (specifically the 10% maximum margin granted for incentives based on pre- and post-audit energy savings estimates) somewhat inflexible. One long-time auditor noted that the inflexibility and complexity of the process dissuades both customers and auditors from getting involved in projects.

For those customers that did not choose to pursue all or some of the recommended upgrades, auditors thought that this was primarily an upfront cost issue, as well as one of long-term financing and project payback. They also cited turnover in energy manager positions in explaining a lack of buy in for installing recommended measures, but many said that they encouraged low-cost measures first.

One suggested incentivizing recommended equipment retrofits and installations on the front end so that customers would have to bear less of the initial financial burden, especially because recommended equipment installation costs may exceed $1,000,000 CAD. Two others suggested that the program applications and reports could be processed more quickly.

7.2.3.6 Auditor Satisfaction

On a scale of 1 to 5, nine of ten auditors rated the overall program highly (by responding with a 4 or 5). [73] Further, respondents generally rated most program aspects highly. For example, respondents were highly satisfied with the program form submission process, LDC staff interactions, and the dollar amount of the incentive. Respondents were least satisfied with “ease of website use”, and reported portal crashes, slow and failed uploads, and difficulty finding appropriate forms. One respondent noted that some LDC portals crash, but other LDCs have updated their portals. This variation across LDCs, which also manifests itself in “interactions with LDC staff”, “ease of program incentive submission”, and “speed of incentive

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[73] Scale is 1 to 5, where 1 means “not at all satisfied”, 2 means “somewhat unsatisfied”, 3 means “neither satisfied or unsatisfied”, 4 means “somewhat satisfied”, and 5 means “completely satisfied”.

processing", can negatively impact completion speed. Investigating and addressing the cause of this variation could help speed up projection completion times, reduce application errors, and increase trade ally and participant satisfaction.

Finally, though auditors thought that the program could use some improvement, they generally expressed strong support for it, which is exemplified in comments such as "it's a great program" and "I am 100% behind it."

7.2.3.7 Suggestions for Program Improvement

Auditors found the audit process complicated, but also found it, and the program's guidelines for refunds, somewhat inflexible. Evaluating the program standards and review process for audit and retrofit expediency could encourage more auditor, contractor, and customer engagement.

Finally, some auditors encouraged the IESO and LDCs to make supplementary materials available. These materials could include case studies of successful projects or tips on getting energy efficient retrofit and upgrade projects financed, among other things.

7.2.4 Participant Perspectives

The following subsections highlight the feedback received from the Audit Funding participant survey. The findings discussed below address firmographic information, program outreach and marketing, participation motives, decision making, and program satisfaction.

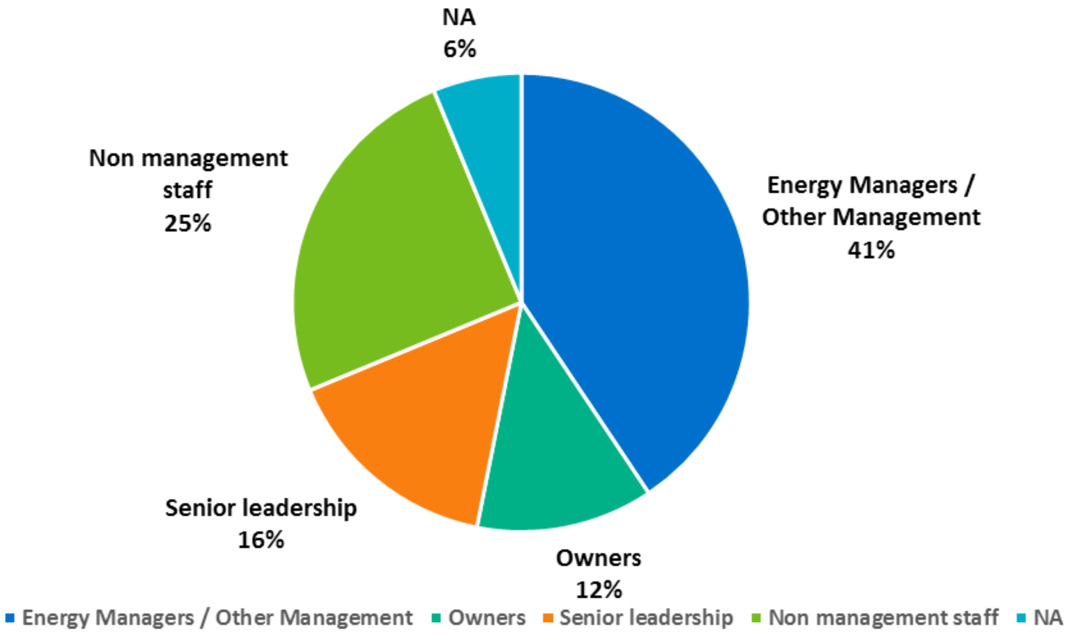
Key observations from participants' responses include the following:

- The majority of Audit Funding participants are satisfied with the program (69%), though this level has dropped since the 2016 cycle (89%).
- Participants' levels of awareness of other energy efficiency programs offered by their LDC varied widely, though more than two-thirds were aware of both the Retrofit (79%) and the SBL (67%) programs.
- Customers were most motivated to participate in the program by the ability to save energy or lower energy bills, and to be able to take advantage of equipment at a reduced cost.

7.2.4.1 Firmographics

Participants were asked about their position in the company, ownership status, primary business activities, chain or franchise status, size of labor force, and square footage of the facility where the upgrades were made. Respondents reported a wide range of business types, facility size, and number of employees as described in this section. The respondents' job titles are summarized in Figure 7-12.

Figure 7-12: Respondent Position (n=33)



Respondents reported high levels of ownership of their facilities, and most were not part of a chain or franchise. Further firmographic information is summarized in Table 7-14. Average electricity usage for the those who answered this question was 2,431,139 kWh (n=21), and the most common types of business endeavors reported by respondents were manufacturing (24%), office/professional (18%), government/public administration (18%), warehouse/storage (15%), and food sales or service (15%).

Table 7-14: Firmographics

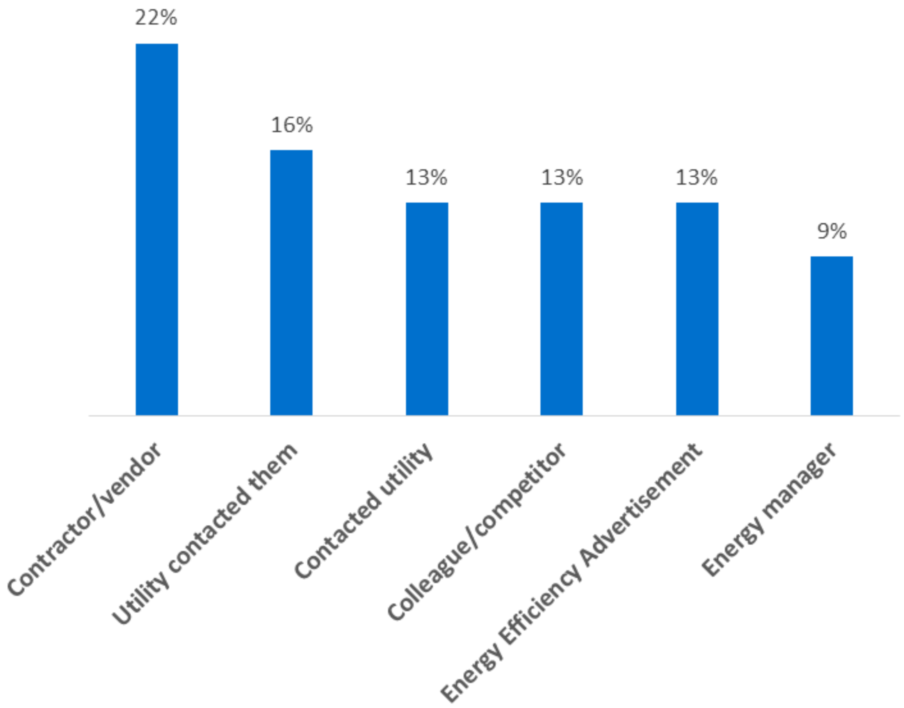
Do you own or rent the facility(ies) where the program/pilot upgrades were made for this project in 2016? (n=32)	
Own	91%
Rent	6%
Is your business part of a chain or franchise? (n=33)	
No	91%
Yes	6%
How many employees are located in the facility(ies) where the program upgrades were made for this project in 2017? (n=27)	
1 to 50	37%
51 to 200	41%
201+	22%

Note: “Don’t know” and “refused” answer choices are not listed.

7.2.4.2 Program Outreach and Marketing

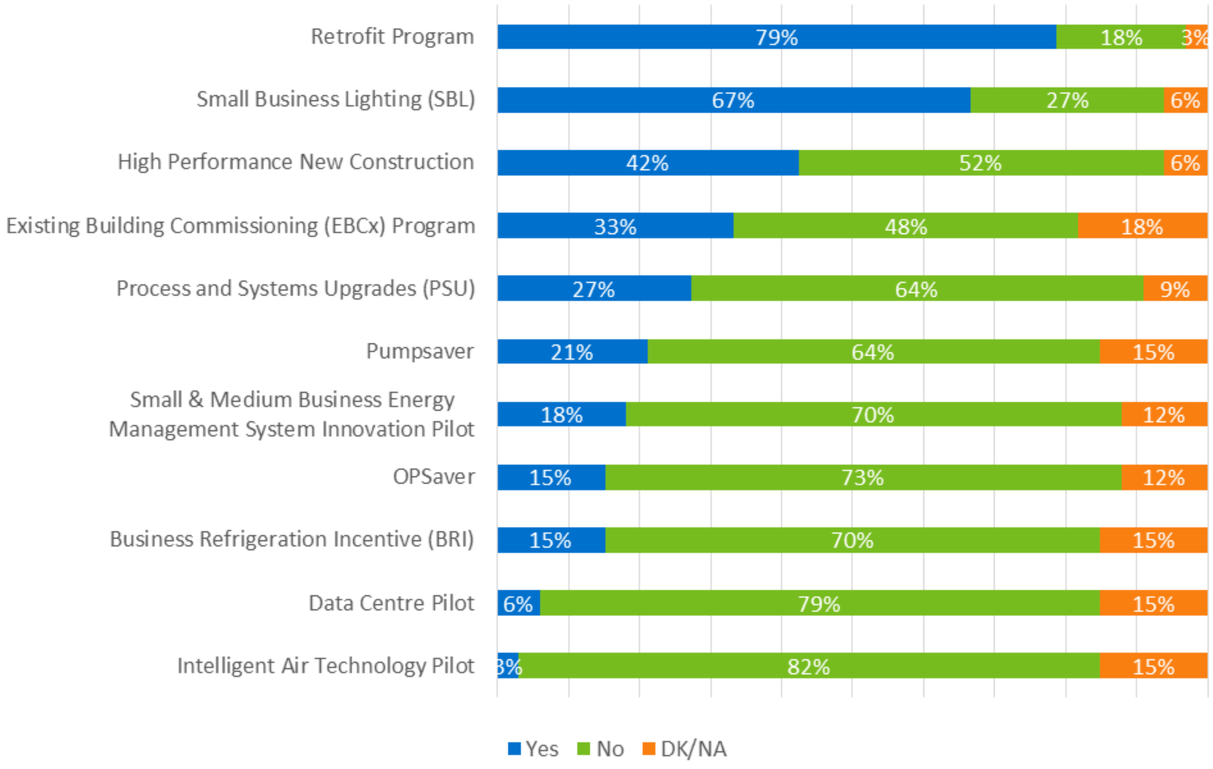
To assess how word of the Audit Funding Program is reaching potential participants, respondents were asked how they had heard about it (Figure 7-13). Results demonstrate that participants tend to hear about the program from a variety of sources in roughly similar proportions. Though results are quite similar to results from 2016, no strong conclusions can be made because sample sizes are inadequate for statistical comparison.

Figure 7-13: Participant Sources of Awareness (n=32)



Respondents were also asked whether they had heard of other efficiency programs offered through their LDC. As seen in Figure 7-14, awareness of other programs varied greatly, but many respondents had heard about both the Retrofit (79%) and the SBL programs (67%).

Figure 7-14: Participant Awareness of Other Energy Efficiency Programs (n=33)



7.2.4.3 Participation Motives and Decision Making

The survey asked participants to rate on a 1 to 5 scale what non-program specific factors influenced their decision to participate in the program.[74] Most commonly, as indicated in Figure 7-15, respondents reported that saving energy or lowering energy bills played an important role, as 100% recorded a 4 or a 5 on this scale. Overall, the results are quite similar to those of 2016, where respondents also showed a strong tendency to be motivated by savings in terms of energy, energy bills, and efficiency equipment costs.

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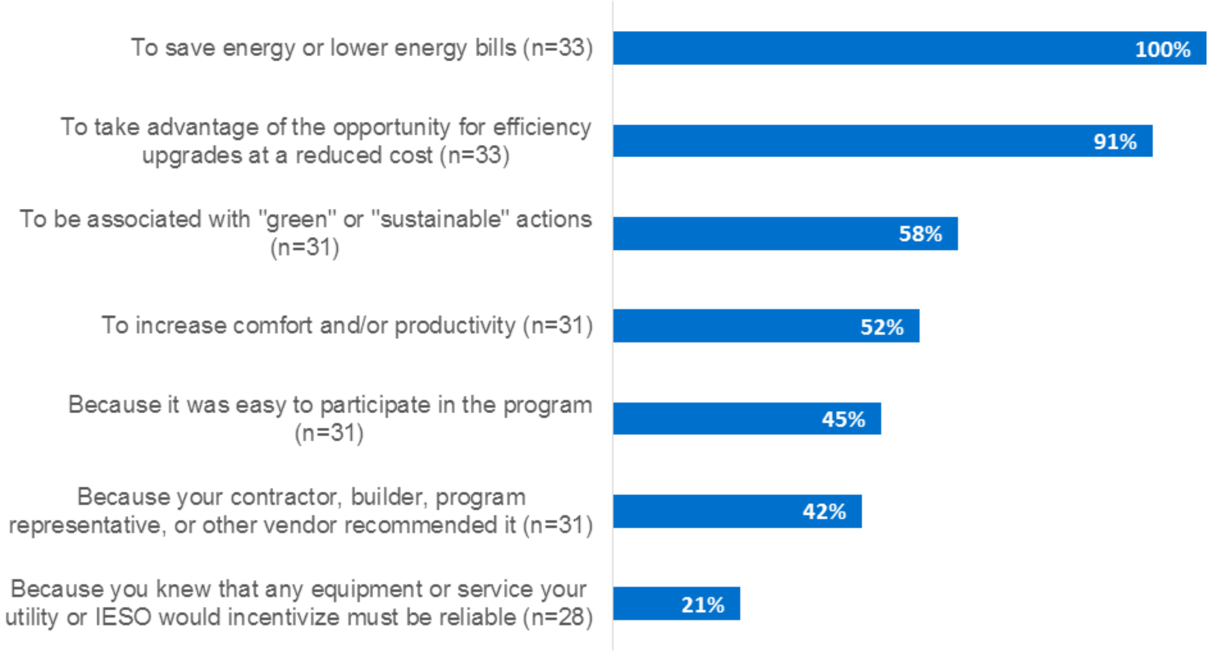
[74] Scale is 1 to 5, where 1 means “not influential at all”, 2 means “slightly influential”, 3 means “somewhat influential”, 4 means “very influential” and 5 means “extremely influential”.

Figure 7-15: Motives for Participating in the Program
(Rating of 4 or 5 on a scale of 1 to 5)



7.2.4.4 Participant Barriers

The survey asked respondents to rate on a 1 to 5 scale their level of agreement with several statements about reasons why it could be difficult for their company to make future energy efficient equipment upgrades.[75]

Overall, respondents did not feel that the issues the survey asked about were significant barriers to program participation. Most respondents reported that neither the amount of their utility bills (65%), access to assistance regarding the program (88%), nor leased equipment (97%) represented a barrier for them. Though only reported by 28% and 30%, respectively, some respondents did see the cost of their energy bill and the cost benefits of efficiency not outweighing the upfront expenditures as relevant barriers. Because several of these barriers did not generally appear to be relevant to participants in 2017, the next evaluation should continue to include self-report barrier questions, so as to discover nascent barriers and maximize program performance.

7.2.4.5 Participant Satisfaction

To assess satisfaction with program components, participants were asked to rate satisfaction with given program-related factors on a 5-point scale[76]. Highly rated program components, as indicated by respondent ratings of 4 and 5, were the interactions with LDC staff, the dollar amount of the incentive,

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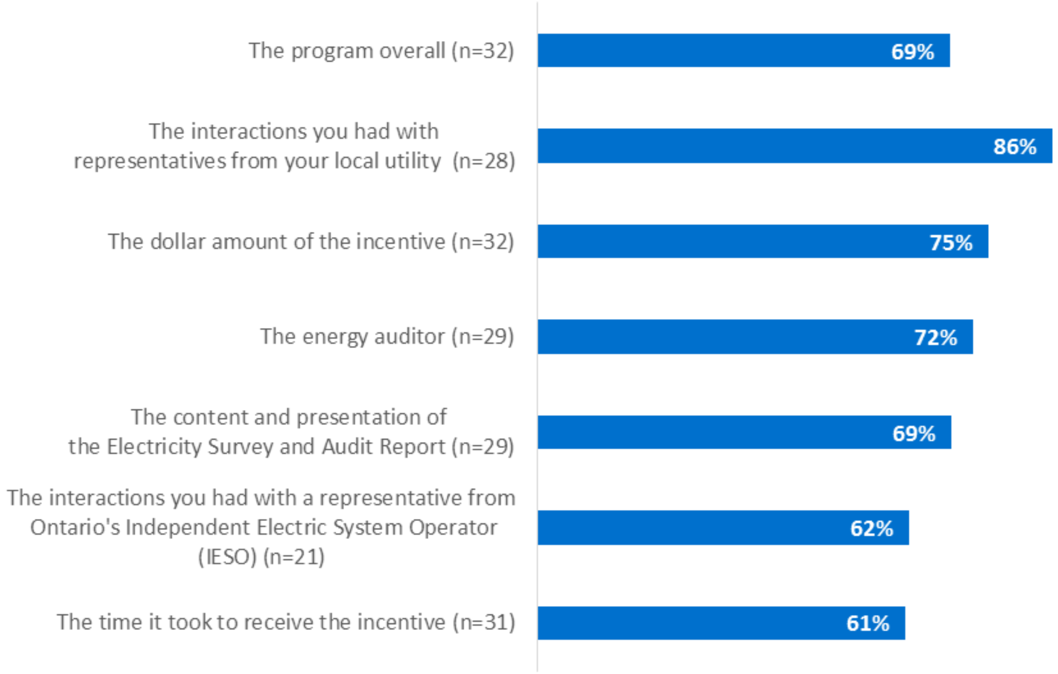
[75] Scale is 1 to 5, where 1 means “not at all relevant”, 2 means “slightly relevant”, 3 means “somewhat relevant”, 4 means “very relevant” and 5 means “extremely relevant”.

[76] On this scale, 1 means “not at all satisfied”, 2 somewhat unsatisfied, 3 means “neither satisfied or unsatisfied”, 4 means “somewhat satisfied”, and 5 means “completely satisfied”.

and the energy auditor, each of which received this rating from more than 70% of respondents. Results are shown in Figure 7-16.

Figure 7-16: Satisfaction Ratings for Program and Program Components (Rating of 4 or 5 on a scale of 1 to 5)



The program overall received a high rating from 69% of respondents, which is lower than the 90% reported in 2016. Though the current overall program rating is lower than for some components of the program, the evaluation team also asked respondents if they would recommend the program to others. Ninety-seven percent reported with high likelihood (having responded with a 4 or 5 on a scale of 1 to 5)[77] that they would. Along with validating the results of satisfaction questions, the results from this question indicate that, though respondents harbor some dissatisfaction with some of the program components, their dissatisfaction is not significant enough to stop them from recommending the program. This is very similar to 2016, where respondents also reported a high likelihood of recommending the program. Additionally, high satisfaction ratings (4 or 5) for “interaction with representatives from your local utility” are higher in this cycle than 2016, where 13 of 19 rated these interactions highly. However, “the dollar amount of the incentive” garnered lower ratings than 2016, where 18 of 19 rated this facet of the program highly.

Finally, respondents were asked about their satisfaction levels regarding the application process and program materials, using a scale ranging from 1 to 5[78] (Figure 7-17). Respondents were highly satisfied

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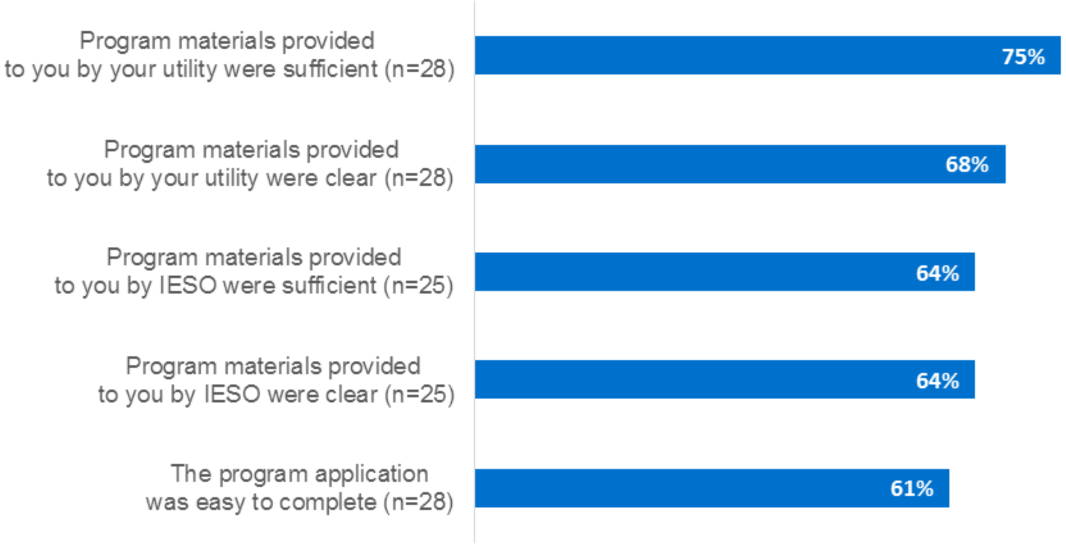
[77] Scale is 1 to 5, where 1 means “extremely unlikely”, 2 means “somewhat unlikely”, 3 means “neither likely nor unlikely”, 4 means “somewhat likely” and 5 means “extremely likely”.

[78] Scale is 1 to 5, where 1 means “do not agree at all”, 2 means “somewhat disagree”, 3 means “neither agree nor disagree”, 4 means “somewhat agree” and 5 means “completely agree”.

with these aspects of the program, most so with program materials from LDCs, with 75% of respondents rating them as a 4 or 5. This generally indicates that participants do not find the content of program materials or the application itself as barriers to participation in the program, though 14% of respondents disagreed with the statement that “the program materials were easy to complete”. This latter result was most likely an important factor in pulling overall satisfaction ratings down, along with “the time it took to receive the incentive”, from Figure 7-16.

Figure 7-17 Satisfaction with Program Materials and Application Process (Rating of 4 or 5 on a scale of 1 to 5)



7.2.4.6 Suggestions for Program Improvement

For the most part, program participants were highly satisfied with the program, though there were six who commented that the application process should be “streamlined,” “simplified,” or “less cumbersome.” Two other participants also noted that the program was too complicated; one of whom said: “put instructions in plain English. We hired an engineering firm to help us with this.”

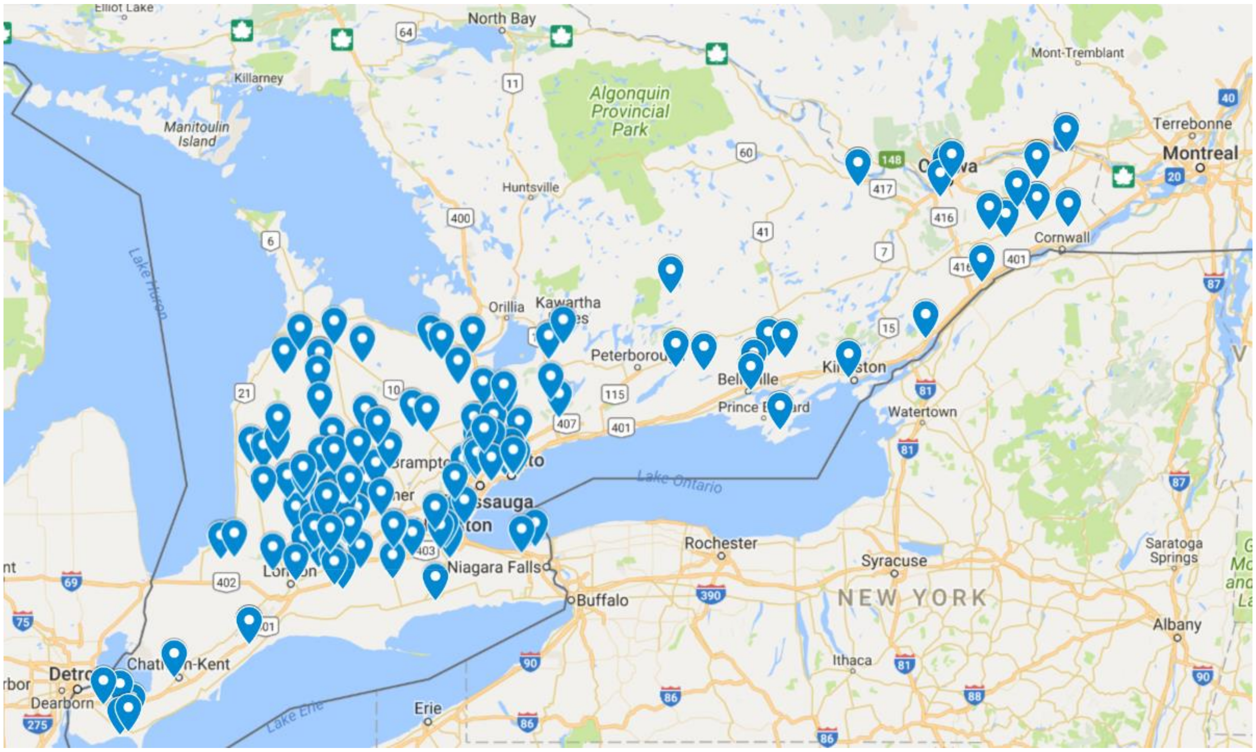
8 High Performance New Construction Program

8.1 Impact Evaluation

8.1.1 Participation

There were 172 reported projects[79] completed at approximately 152 buildings under the HPNC Program in 2017. This is a 9% increase at the building level compared to 2016. Twenty LDCs contributed savings to the 2017 HPNC Program. The geographical distribution of participating sites is presented in Figure 8-1.

Figure 8-1: Geographical Distribution of 2017 HPNC Participants



The distribution of participants by track is depicted in Figure 8-2, and by facility type in Figure 8-3.

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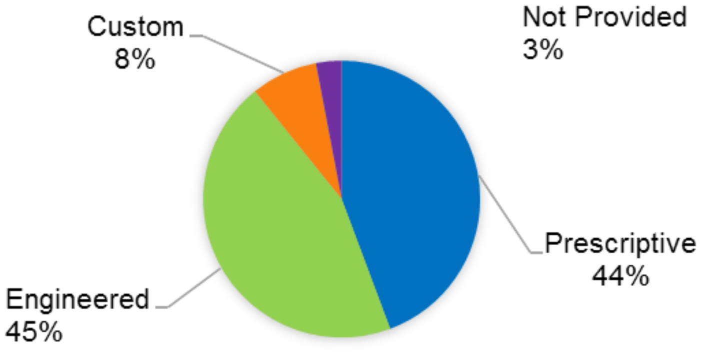
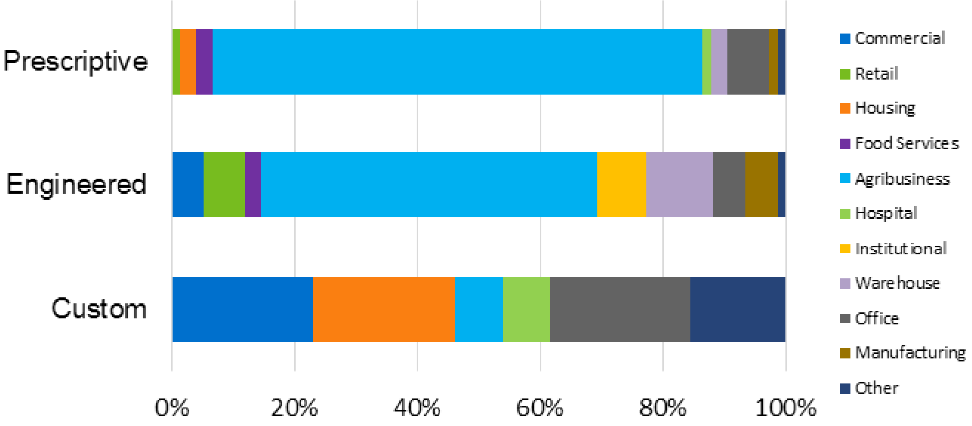
[79] One project is considered to be all measures within one track at one address. As there are three tracks in the HPNC program, one address can be associated with up to three projects.

Figure 8-2: 2017 HPNC Participation by Track



In comparison to the 2016 distribution of projects by track, the engineered track participation increased by 6% while the prescriptive track participation decreased by 3%. The custom track participation has not changed in comparison to 2016.

Figure 8-3: 2017 HPNC Participation by Track and Facility Type



The prescriptive and engineered tracks were dominated by the agricultural sector. The custom track was dominated by housing, commercial (including data centers), and office sectors.

8.1.2 Impact Results

The track-level and province-wide impact results of the 2017 HPNC Program are shown in Table 8-1 and Table 8-2.

Table 8-1: 2017 HPNC Program Impact Results: Energy

Track	Reported Energy Savings (GWh)	Energy RR	Gross Verified Energy Savings (GWh)	Gross Verified Precision at 90% Conf.	Net-to-Gross Ratio	Net Verified Energy Savings (GWh)	Lifetime Net Verified Energy Savings (GWh)	Net Verified Energy Precision at 90% Conf.	Net Verified Energy Savings at 2020 (GWh)
Prescriptive	9.58	139%	13.33	11%	57%	7.54	117.29	-	7.54
Engineered	26.59	114%	30.35	17%	57%	17.18	297.86	-	17.186
Custom	39.04	100%	39.04	0%	57%	22.10	596.49	-	22.10
Total	**75.22**	**110%**	**82.72**	**2.5%**	**57%**	**46.84**	**1,011.64**	**13%**	**46.84**

Table 8-2: 2017 HPNC Program Impact Results: Summer Demand

Track	Reported Demand Savings (MW)	Demand RR	Gross Verified Demand Savings (MW)	Gross Verified Precision at 90% Conf.	Net-to-Gross Ratio	Net Verified Demand Savings (MW)	Net Verified Precision at 90% Conf.	Net Verified Demand Savings at 2020 (MW)
Prescriptive	3.0	120%	3.6	8%	57%	2.0	-	2.0
Engineered	1.3	114%	1.5	14%	46%	0.8	-	0.8
Custom	8.7	100%	8.7	0%	57%	4.9	-	4.9
Total	**13.1**	**106%**	**13.9**	**1.4%**	**57%**	**7.7**	**16%**	**7.7**

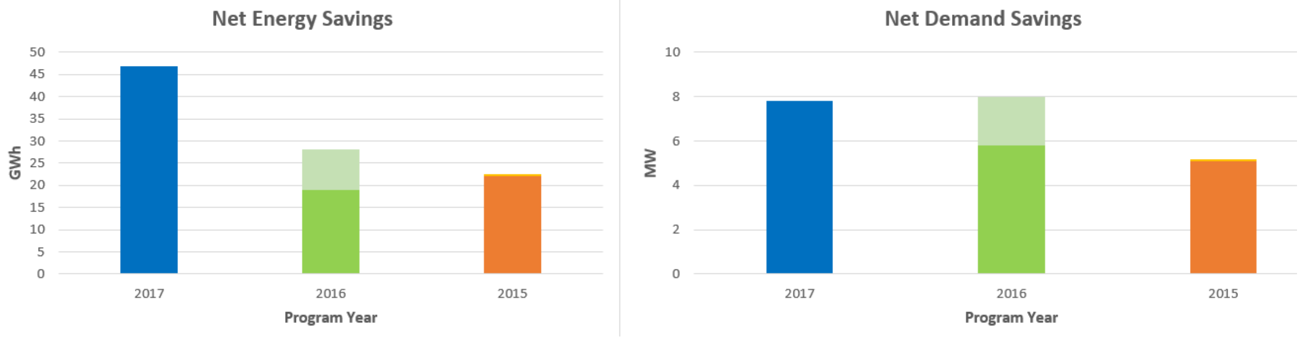
Total net verified energy and demand savings significantly increase compare to 2016 program year from 18.77GWh and 5.69 MW to 46.8 GWh and 7.7 MW in 2017 respectively. This increase is mainly from significant increase in Custom track savings.

Interactive effects for lighting measures were included in the program realization rates shown in Table 8-1 and Table 8-2. The calculation of the interactive effects is described in Section 3.1.6.

8.1.3 Comparison of 2017 with 2016 and 2015

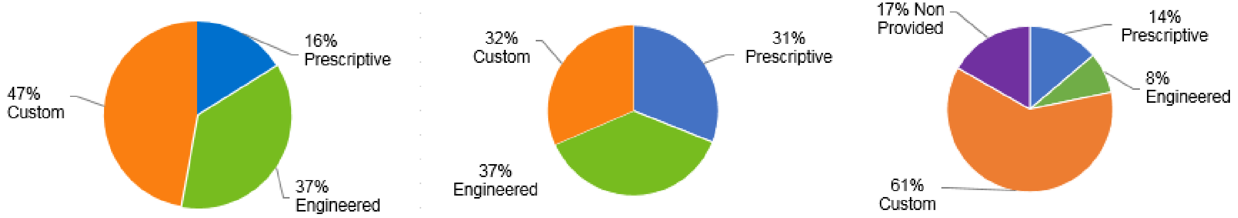
Total net verified energy and demand savings for program years 2015, 2016, and 2017 are presented below in Figure 8-4. True-up net verified energy and demand savings are also include in Figure 8-4.

Figure 8-4 Comparison of Year-on-Year HPNC Net Verified Savings and Participation



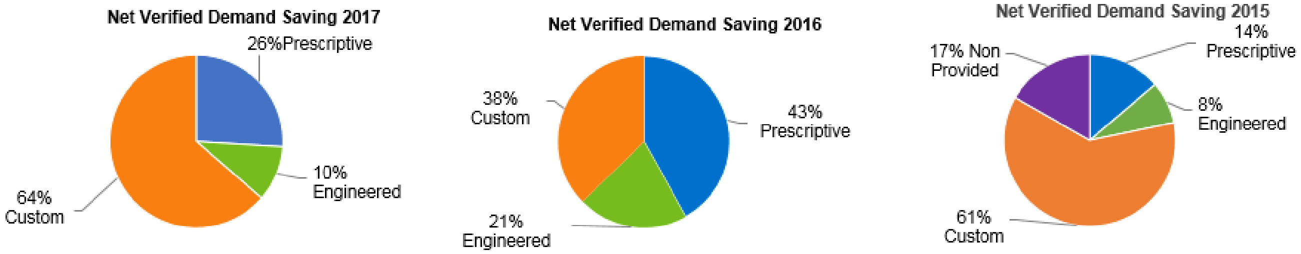
Track-level net verified energy savings is heavily dominated by the Custom track in 2017 with 15% increase from 2016. A comparison of net verified energy savings contribution by track from 2015 through 2017 is presented in Figure 8-5.

Figure 8-5 Comparison of Year-on-Year HPNC Net Verified Energy Savings



Net verified demand saving is also heavily dominated by the Custom track in 2017 with an increase of 26% compared to 2016. A comparison of net verified demand savings contribution by track from 2015 through 2017 is presented in Figure 8-6.

Figure 8-6 Comparison of Year-on-Year HPNC Net Verified Demand Savings



Realization rates were applied to the HPNC population based on each project's track. A comparison of track-level and program-wide realization rates between the 2016 and 2017 program years is presented in Table 8-3.

Table 8-3: Comparison of 2016 and 2017 HPNC Realization Rates by Track

Track	2016 Energy Realization Rate	2017 Energy Realization Rate	2016 Demand Realization Rate	2017 Demand Realization Rate
Prescriptive	125%	139%	119%	120%
Engineered	123%	114%	122%	114%
Custom	100%	100%	100%	100%
HPNC Program	**115%**	**110%**	**111%**	**106%**

8.1.3.1 Prescriptive Track

Prescriptive track participation decreased by 3% in 2017 although net verified energy savings increased from 5,903 MWh in 2016 to 7,549 MWh, an increase of 16%. This is primarily due to the energy and demand realization rates increasing from 125.4% and 118.9% in 2016 to 139% and 120% in 2017. The average net verified energy savings achieved by Prescriptive track per project is 86.77 MWh in 2017 which is similar to 2016. A comparison of the net verified energy savings contributions among the reported end-uses in the Prescriptive track between the 2016 and 2017 programs is presented in Table 8-4.

Table 8-4: Prescriptive Track Net Verified Savings Contributions by End Use

End Use	2016 Net Verified Energy Savings Contribution	2017 Net Verified Energy Savings Contribution
HVLS Fan	53.1%	72.9%
Natural Ventilation	2.9%	1.2%
Appliances	0.2%	0.5%
HVAC	0.9%	0.7%
Interior Lighting	16.0%	8.2%
High Bay Lighting	0.1%	5.4%
Lighting Controls	2.2%	1.6%
Belts, Motors, & VFDs	0.7%	0.9%
Unspecified	23.8%	8.6%

The Prescriptive track saw a large shift towards agricultural measures in 2017. Agriculture businesses made up 80% of the 2017 Prescriptive track participation compared to 48% in 2016. High Volume Low Speed (HVLS) fans savings increased from 53% in 2016 to 73% in 2017 as a result of an increase in the number of these measures being implemented. This increase in the HVLS savings also contributed to an increase in the Prescriptive track realization rate as these measures have a realization rate greater than 100% due to the verified hours of use being higher than the assumed hours used by Prescriptive worksheet.

Other factors contributing to high realization rates include different verified fan voltages and amperages than reported or larger fans being installed.

Prescriptive lighting measures also contributed to the high Prescriptive track realization rate due to 1) higher verified hours of use, particularly in manufacturing and retail-warehouses, and 2) higher baseline wattages than assumed due to the maximum allowable Lighting Power Density (LPD), which will be discussed in more detail in Section 8.1.5.2. A majority (66%) of projects that included prescriptive lighting measures implemented T5 Medium and High Bay fixtures.

The amount of savings from prescriptive measures without a specified end use decreased from 24% in 2016 to only 9% in 2017. This is a significant improvement of the quality of data collected on the types of end uses. However it should be noted that inconsistencies were found with the reported track of some prescriptive measures. For example one project in the 2017 HPNC sample that was reported t in the Prescriptive track was verified in the Engineered track. Nexant was not able to verify the track of all measures within the 2017 HPNC population therefore precise shifts in track savings contribution by end use cannot be fully explained.

8.1.3.2 Engineered Track

Engineered track participation increased slightly from 70 projects in 2016 to 75 projects in 2017 with an average of 108.7 MWh of net verified energy savings per project. Although total Engineered track net verified energy savings increased from 7,128 MWh in 2016 to 17,187 MWh in 2017, the percentage of total net verified energy savings across the program (37%) did not change from 2016 due to the overall increase in HPNC savings.

Engineered track net verified demand savings decreased from 1.2 MW in 2016 to 0.8 MW in 2017 due to fewer projects with large net verified demand savings. In the 2016 population there were two large projects with 365kW and 102kW net verified demand savings. These two projects contributed to the 2016 average net verified demand savings of Engineered track being 233 kW while the largest project in 2017 had 70 kW of net verified demand savings.

A comparison of net verified energy savings contributions among end-uses in the Engineered track between the 2016 and 2017 programs is presented in Table 8-5.

Table 8-5: Engineered Track Net Verified Savings Contribution by End Use

End Use	2016 Energy Savings Contribution	2017 Energy Savings Contribution
Interior Lighting	27%	16%
High Bay Lighting	54%	81%
Exterior Lighting	3%	2%
HVAC	1%	<1%
Unspecified	15%	1%

While the energy realization rate of the Engineered track decreased from 122.5% in 2016 to 114% in 2017, it is still well above 100%. Lighting measures make up 99% of net verified energy savings in Engineered track and therefor have a significant influence on the track realization rate. The main reason for decreasing realization rate in 2017 is that lower hours of use were observed in lighting sample population compare to 2016.

High Bay Lighting contributes 81% of Engineered track savings in 2017 which is a significant increase from 54% in 2016. Like in the Prescriptive track, Nexant calculated verified lighting savings using Lighting Power Density (LPD)-based calculations. Maximum allowable LPD allowances were found to be higher than the installed wattages which led to realization rates higher than 100%. Another reason for the higher realization rate was verified hours of use being found to be greater than reported hours for lighting measures.

As mentioned above, inconsistencies were found in the tracks of measures in the program data therefore observed shifts in track savings contribution by end use cannot be fully explained.

The engineered track had only 3 projects with unspecified measures projects in 2017 which is an improvement from 2016 with 12 projects.

8.1.3.3 Custom Track

Total HPNC net verified energy and demand savings are primarily (47%) from the Custom track. Although the number of Custom track participants decreased slightly from 15 projects in 2016 to 13 projects in 2017, the average net verified energy and demand savings per project significantly increased from 5,995 MWh and 2.15 MW in 2016 to 22,104 MWh and 4.9 MW in 2017. This increase is primarily due to two very large projects in the 2017 population with gross reported energy savings greater than 10 GWh each. The largest project in the 2016 Custom population was 3.2 GWh.

The realization rate for Custom track is 100% due to the higher level of rigor associated with utilizing simulation modeling software to estimate gross reported energy savings. Accurate model inputs and methodologies result in utilizing appropriate baseline conditions and accurate savings estimates. The Nexant team verified consistency between modeled design parameters and the implemented design and found no discrepancies.

8.1.4 Lifetime Savings

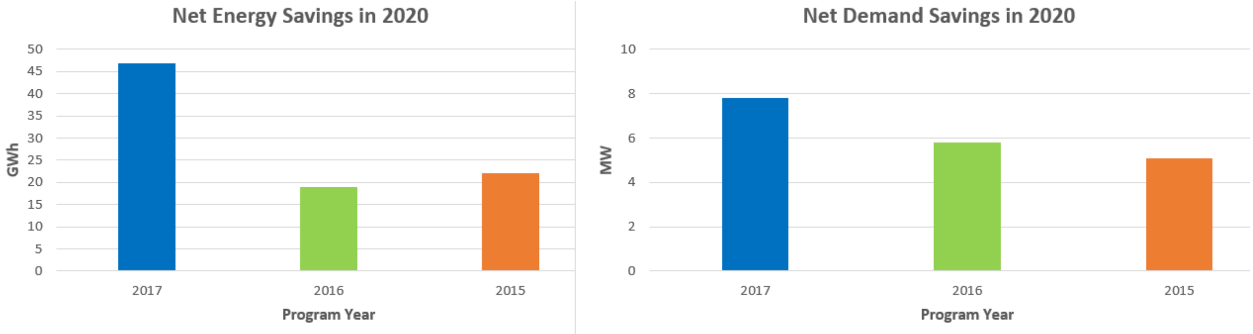
Lifetime savings are defined as the annual savings multiplied by the equipment’s EUL. For example, if the equipment saved 100 kWh and it has an EUL of 5 years, the lifetime savings would be 500 kWh. Nexant attempted to calculate the lifetime savings for the HPNC program at the measure-level using the measure’s annual savings and the measure-specific EUL when the measure’s equipment type or end use was known. There were only 9 reported EUL values for 258 measures in the 2017 HPNC population. This represents only 3.1% of the measures. Since measure descriptions are typically not specific enough to correctly apply a deemed EUL Nexant applied the average EUL by track from the 2016 population to the 2017 HPNC population. These calculated track-specific EULs are shown in Table 8-6.

Table 8-6: HPNC Program Track-Level EULs

Track	EUL
Prescriptive	15.4
Engineered	17.3
Custom	26.0

The HPNC Program achieved 1,011.65 GWh of net verified lifetime energy savings with a persistence of 6,840 MWh at 2020. Unlike the Retrofit program, the HPNC program does not observe any baseline adjustments. Figure 8-7 shows a comparison of annual net verified energy and demand savings that persists in 2020.

Figure 8-7 Comparison of Year-on-Year HPNC Net Verified Energy and Demand Savings in 2020



8.1.5 Impact Observations

8.1.5.1 Program Tracking Data

Many gaps existed within the reporting database in previous program years. Improvements in both the type of data that is tracked and the quality of the data continue to be made. The reported savings for 8 projects in Prescriptive and Engineered track could not be appropriately allocated to a specific end use due to lack of specific information about the measures' end use in the program database or project files. However this number has significantly improved compare to 2016 wherein the number of projects with unspecified measures was 53.

As mentioned in the Prescriptive and Engineered track sections, inaccuracy on both 2016 and 2017 reported tracks were found (e.g., incorrect project track, measure counts, etc.) which introduces some uncertainty when determining the exact amount of savings in each track or shifts in savings between tracks year-over-year.

8.1.5.2 Lighting Measures

The 2015 National Energy Code of Canada for Buildings provides Lighting Power Density Baseline (LPD) allowances per building and space type. An LPD allowance specifies the maximum amount of wattage of lighting a particular building can utilize per square foot. Code-based LPD values are set based on how much light (in lumens) is needed at the work-space level for different building types (e.g., for safety reasons a manufacturing facility is allotted a greater LPD allowance than an office).

In order to calculate savings for a measure where the baseline is theoretical[80] (as is the case in new construction), program administrators and evaluators are forced to make educated estimates as to what equipment the customer might have installed. In the case of new construction the baseline equipment should at least be assumed to be code-compliant as a non-compliant piece of equipment is not a realistic alternative. As the code specifies lighting compliance in terms of LPD calculations, it follows that energy savings should also be calculated via this method.

Reported lighting savings within the HPNC Program were calculated as retrofit measures where the consumption of the installed piece of equipment is compared to a hypothetical baseline fixture of an alternate type and wattage in a one-for-one replacement strategy. For example, if a customer installed twenty (20) 123-watt high bay LED measures, calculations typically relied on an assumed baseline of twenty (20) 400-watt high intensity discharge lamps. The baseline and retrofit cases in this instance however do not translate to the same amount of usable light for the customer, which is the primary driver of lighting design when no existing system is already in place. Lighting design calculations for the high-bay example above are tabulated below:

- 20 132-Watt LEDs @ 122 lumens/watt[81] = 322,080 total lumens installed, 2,640 watts used
- 20 400-Watt Metal Halides @ 65 lumens/watt[82] = 520,000 available lumens, 9,160 watts used
- 13 400-Watt Metal Halides @ 65 lumens/watt[83] = 338,000 available lumens, 5,954 watts used
- 20 250-Watt Metal Halides @ 65 lumens/watt[84] = 325,000 available lumens, 5,900 watts used

If 322,080 was the desired amount of lumens in a space, the customer would only have needed to install approximately thirteen (13) 400-watt metal halide fixtures or approximately twenty (20) 250-watt metal halide fixtures. The wattage implications of either of the second two options are closer to 5,900 watts of consumption, whereas the applicant assumed baseline uses 9,160 watts, leading to an overinflated amount of savings. The use of LPD calculations in new construction programs alleviates the need to perform lighting design calculations such as this in order to estimate an appropriate baseline.

Nexant calculated gross-verified lighting savings using LPD-based calculations where enough information was known. In instances where facility square footage was not available and an LPD could not be

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[80] Since existing baseline fixtures do not exist in new buildings the baseline consumption needs to be estimated based on what the minimum code requirements.

[81] Taken from Design Lights Consortium Qualified Products List, listing for Sylvania LED/135/HIDR/15000/830

[82] Taken from OSRAM SYLVANIA's 2014 - 2015 Lamp & Ballast Catalog, http://assets.sylvania.com/assets/onlinemedia/ihdp/Lamp-and-Ballast-Catalog/#?page=144

[83] ibid

[84] ibid

calculated, Nexant used the assumed baseline detailed in the application, with adjustments to wattage and quantity as needed to create an equivalent lighting design. The difference in baselines created by a lumen-equivalent lighting design strategy (such as an LPD-based calculation) and a one-for-one retrofit strategy led to large variations in realization rates, both positive and negative.

Lighting measures had an overall energy realization rate of 125% and a demand realization rate of 124% across the 41 projects within the sample. This shows that both energy and demand realization rate increased by 8% and 16% for lighting measures compared to 2016. The bulk of this increase in lighting realization rates is the difference in LPD-based calculations versus retrofit-style calculations.

The lower total wattage of lighting installed in the building area resulted in more savings when compared to the maximum LPD allowance. The reason for the higher realization rate compared to 2016 is that Nexant was able to collect square footage information in more cases.

- **Observations:** In the case of new construction the baseline equipment should at least be assumed to be code-compliant as a non-compliant piece of equipment is not a realistic alternative. As the code specifies lighting compliance in terms of LPD calculations, it follows that energy savings should also be calculated via this method. Nexant recommends IESO to update the prescriptive worksheet assumptions and make the allowable lighting baseline for engineered worksheets be based on LDP requirements of the code for the space or building type.

  ***Recommendation**: Switch to a Lighting Power Density methodology when calculating new construction lighting measures.*

Other factors minimally contributing to high and low lighting realization rates are summarised below.

- Reported baseline lamp wattage doesn't include the ballast factor.
- Differences between reported and verified hours of use.
- Differences in reported and verified measure quantities.
- Differences in the average assumed load as a result of not taking the dimming and control factors into consideration.

Twelve exterior lighting measures were sampled. Nexant’s exterior lighting calculator was used in order to calculate dusk to dawn hours of operation for these measures. The realization rate for exterior lighting measures was found to be 78%. This low realization is due to verified lower hours of use by the measure as some exterior lights are controlled by switches not photocell and are being used less hours.

8.1.5.3 High-Volume Low-Speed Fans

High-volume low-speed (HVLS) fan measures had an average energy realization rate of 126% and 113% demand realization rate across the 33 sampled sites. This measure contributes 73% of Prescriptive track savings which is higher than 2016 with 53%.

An HVLS fan is a highly weather dependent measure where its annual hours of use varies depending on the outdoor temperature. The primary driver of high realization rate is a lower assumed hours of use (HOU) in the reported energy savings. The Measures and Assumptions List (MAL) specifies 2,900 hours of operation per fan; however, Nexant calculated the average HOU among the sampled sites to be 3,743 hours.

This measure is primarily being used by the Agribusiness sector with various control systems. It was verified that, on average, fans operate only when the outdoor temperature is above 12.7°C and varies the speed based on temperature for the rest of year.

- **Observations:** Based on this average set point temperature Nexant completed an analysis using Canadian Weather year for Energy Calculations (CWEC) data for four different regions in Ontario. The resulting HOU values are presented in Table 8-7. Nexant recommends the IESO adopt these values associated with the CWEC data into their MAL.

  ***Recommendation**: Update the annual hours of use assumptions for HVLS fans to regional values based on the Canadian Weather year for Energy Calculations (CWEC) data and an average set point of 12.7°C.*

Table 8-7: High-Volume Low-Speed Fan Annual Hours of Use by Region

Eastern Ontario - (Ottawa)	Northern Ontario - (Sault Ste Marie)	Southern Ontario - (Toronto)	Southern Ontario - West (Windsor)
3,059	2,536	3,191	3,740

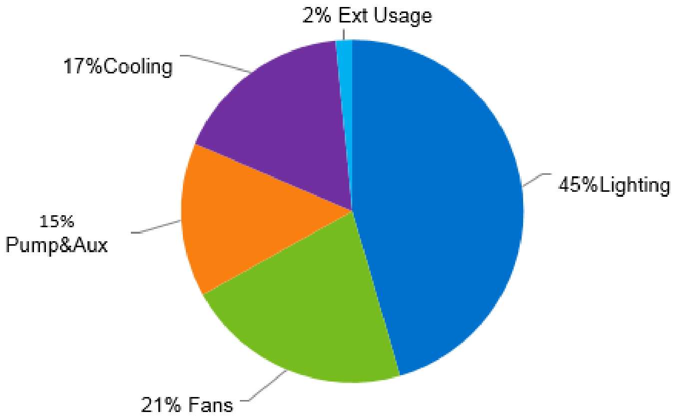
8.1.5.4 Custom Projects

Custom track savings increased significantly from the 2016 results. This increase is primarily due to two very large projects in the 2017 population with reported energy savings greater than 10 GWh each. The largest project in the 2016 custom population was 3.2 GWh.

Nexant sampled 9 custom projects. The HPNC program database does not specify the end use of custom track measures (i.e. lighting vs non-lighting, or specific equipment type). Realization rate for custom track is found to be 100% due to the use of a simulation modeling software to estimate energy savings.

Within the 9 sampled custom projects, savings were attributed to upgraded lighting and fans, followed by pumps and cooling measures after a review of project documentation was completed. The savings contributions from the sample projects in the custom track are shown in Figure 8-8. Common measures contributing to these savings include VFD controlled equipment, energy recovery mechanisms, improved envelope materials, higher efficiency heating and cooling equipment, premium motors, and use of daylighting controls.

Figure 8-8: Custom Projects Savings Contributions by End Use



8.1.5.5 Program Changes

Program year 2017 was a year of transition for the HPNC Program as updates took effect in September, 2017 to adapt to the Ontario Building Code (OBC) changes (SB-10) which were implemented in January 2017. During this program year, there were projects managed under both the expired and the updated versions of the Program in parallel. Projects that were approved under the expired OBC were eligible to participate through the expired version of the HPNC rules while projects approved under the 2017 OBC were only eligible to participate when the updated rules which took effect on September 1, 2017. Therefore in 2017 PY LCDs were managing projects submitted prior to September 1st using the older version of worksheets in parallel with the projects submitted after September 1st using the new version of program worksheets. After reviewing project documentation for all the projects in 2017 sample it was found that they all utilized the old version of worksheets since they were all approved before the September 1 milestone.

8.1.6 Avoided Greenhouse Gas Emissions

The evaluation team used the IESO CDM Energy Efficiency Cost Effectiveness Tool to calculate avoided GHG emissions. Avoided GHG emissions were calculated for the first year or the 2017 program year and for the lifetime of the measures. Table 8-8 below presents the results of these calculations.

Table 8-8: HPNC Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided (Tonnes CO_2 equivalent)		
	Electric	Gas	Total	Electric	Gas	Total
2017	9,021.57	-	9,021.57	281,535.59	-	281,535.59

8.1.7 Cost Effectiveness

The evaluation team conducted a cost effectiveness analysis for the HPNC program. Cost effectiveness results are presented in Table 8-9. The HPNC program passed the TRC test and the PAC test with both benefits exceeding their respective costs. The program cost effectiveness is improved considerably compared to 2016. In 2016 the program passed the TRC test with a benefit-cost ratio of 2.54 and PAC ratio of 3.56.

Table 8-9: HPNC Cost Effectiveness Results

Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	$18,297,443
TRC Benefits ($)	$56,204,586
TRC Net Benefits ($)	$37,907,144
TRC Net Benefit (Ratio)	3.07
Program Administrator Cost (PAC)	
PAC Costs ($)	$8,226,291
PAC Benefits ($)	$48,873,553
PAC Net Benefits ($)	$40,647,262
PAC Net Benefit (Ratio)	5.94
Levelized Unit Energy Cost (HPNC)	
$/MWh	$14.43
$/MW	$83,422

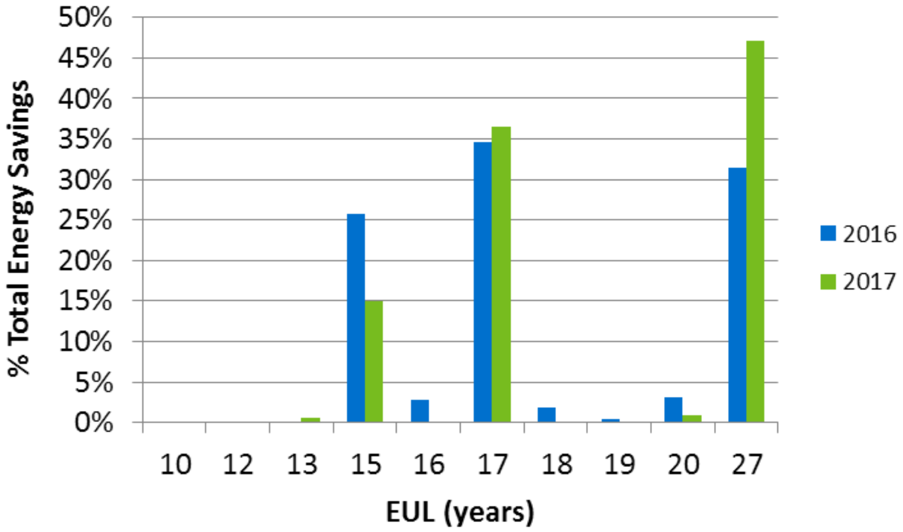
The changes in the CE results between the 2015 and 2017 program years are shown in Table 8-10.

Table 8-10: Cost Effectiveness Comparison

Evaluation Year	TRC Test	PAC Test	Demand LUEC ($/MW)	Energy LUEC ($/MWh)
2017	3.07	5.94	$83,422	$14.43
2016	4.83	3.39	$102,616	$31.30
2015	2.27	2.51	$154,557	$36.73

The main driver for the improved cost effectiveness of the 2017 HPNC program is an increase in savings from custom projects that have longer effective useful lives (EUL). Not only did the overall amount of savings increase between 2016 and 2017, as described above, but more of these savings persists for longer periods of time. Figure 8-9 shows the distribution of total energy savings across the different measure EULs. All of the savings with a EUL of 27 years are from Custom projects. This shift in savings creates persistent savings that deliver benefits for a longer period of time.

Figure 8-9: Comparison of the Distribution of Energy savings by Measure EUL



8.1.8 Net-to-Gross (NTG)

NTG observations for the HPNC Program are provided in the following subsections and detailed observations are provided in Appendix D. Additional details regarding the NTG methodology can be found in Appendix C.

8.1.8.1 Key Observations

- Most HPNC participants reported that they would have done the same project, or a scaled back version had they not been aware of the program incentive, however, when pressed on the subject, several participants revealed they were uncertain that they would have had sufficient funding and may have scaled back the upgrades. These findings suggest a moderate to moderately high levels of free-ridership.
- Eight of seventeen (47%) participants would have done the exact same project, although four were unsure if they would have had the full funds in the absence of the incentive.
- Six participants would have scaled back the project, with five reporting they would have needed to scale back a moderate amount.
- Information or recommendations from program contractors or vendors and the program incentives were the most influential factors in the program participation decision.
- Ten of seventeen participants (59%) gave high ratings to the influence of both factors.
- Participation in the HPNC Program did not result in any significant spillover.

8.1.8.2 NTG Strata Level Results

Table 8-11 shows the results of the 2017 HPNC program NTG evaluation. All LDCs included in the HPNC program were assigned the province-wide NTG values. The following subsections summarize the analyses completed to help interpret these values.

Table 8-11: NTG Assignments – HPNC Program

NTG Assignment	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG *%	Demand Savings Weighted NTG* %
Province-wide	17	43.4%	0%	0%	56.6%	56.6%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net to gross.

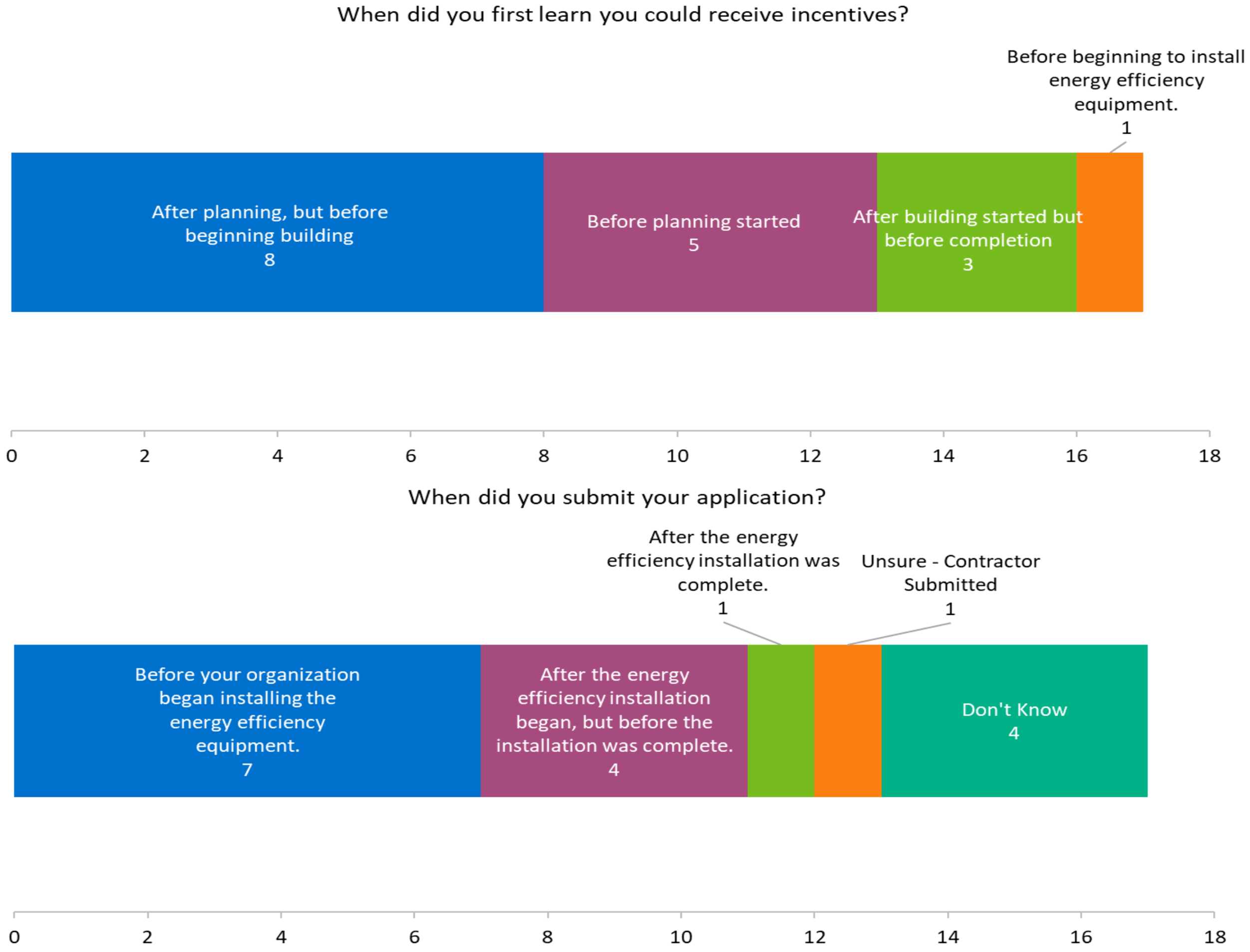
8.1.8.3 Free-Ridership

To gauge free-ridership, the team asked the HPNC participants when they first learned about the program (relative to the timeline for planning the project), if they would have scaled back the project or had sufficient funding without the incentive, and to rate the influence of several program-related factors on their decision to ultimately build a project up to HPNC standards.

Figure 8-10 shows that most participants learned about the incentive prior to beginning their project(s). Eight of 17 respondents became aware of the incentive after starting to plan but prior to beginning construction, while five were aware of the incentive prior to planning. The remaining respondents became aware of the incentive after construction began; three before completion of the project, and one just before beginning to install the energy efficient equipment. These findings may be suggestive of moderate free-ridership since some learned about the program only after planning had begun or even after building had started. However, to further determine participant intentions, the evaluation asked participants additional questions about their actions and decision-making. While responses to this and the following question do not directly impact the free-ridership score, they are intended to provide additional context regarding the participant decision processes.

Participants typically submitted their applications early in the process of installing the efficient equipment. Seven submitted the application before their organization began installing the equipment, while four submitted applications during the installation but prior to its completion. Just one participant reported that they submitted their application after the equipment was fully installed, which may be indicative of free-ridership. Those who began or completed their upgrade before submitting the application were asked what their reasons were for doing so—two said they needed to stick to an internal schedule to complete the upgrade, one said it was because of time or resource constraints at their organization, and one did not know.

Figure 8-10: When HPNC Participants Learned About the Program and Submitted Applications (n=17)



Eight of 17 respondents reported that they would have done the exact same project in the absence of the incentive, six would have done the project but scaled back the size or scope, and four did not know what they would have done in the absence of the program (Figure 8-11). Of the eight who would have done the exact same project, four reported that they maybe would have had the funds, internally or from other sources, to cover the entire cost of the project. Three reported that they definitely would have had the funds, which is indicative of free-ridership for these respondents. Among the six participants who would have scaled back the size of the project without an HPNC incentive, five reported that they would have had to scale back a moderate amount, while one reported they would have needed to scale back a small amount, which is also indicative of free-ridership. Responses to this participant intent question are factored into the free-ridership analysis.

Figure 8-11: Actions in Absence of Program Incentives (n=17)

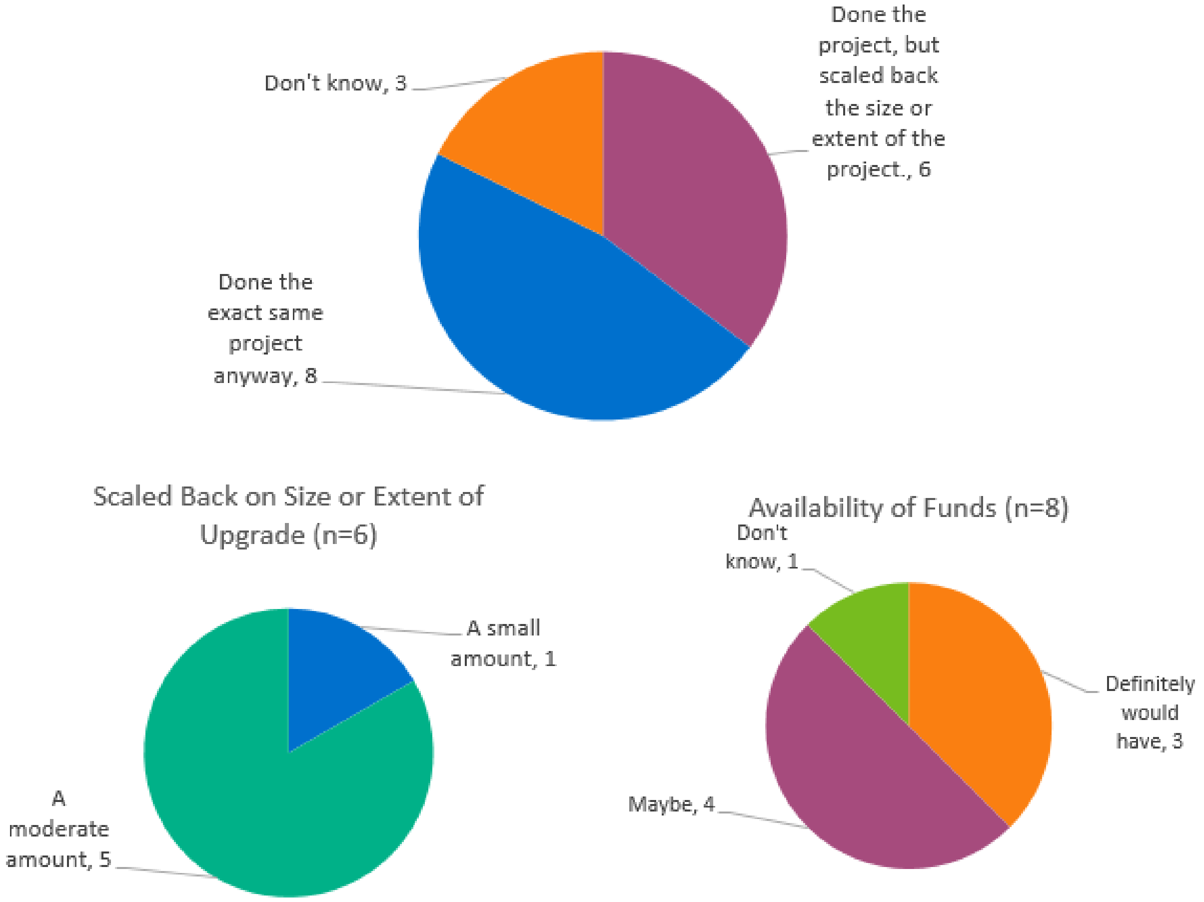


Figure 8-12 shows participant responses on a 1 to 5 scale regarding the influence of specific program features on their decision to build a project up to HPNC standards.[85] Participants most frequently gave high ratings to the influence of auditors, contractors, or vendors associated with the program, and to the availability of the program incentive (10 ratings of 4 or 5, respectively). Eight respondents gave ratings of 4 or 5 to a previous experience with an energy saving program. The fourth most influential element on participant decisions to build up to HPNC standards, the availability of an incentive for modeling, was rated as a 4 or 5 by seven participants. Most participants reported that marketing materials were the least influential factor on their decision to participate; though three respondents rated their influence as a 4 or 5. The fact that marketing materials were not an influence on many respondents may suggest that there could be opportunities to reach more participants through marketing efforts. Responses to these program influence questions are factored into the free-ridership analysis along with the participant intent questions. Three respondents rated their influence as a 4 or 5.

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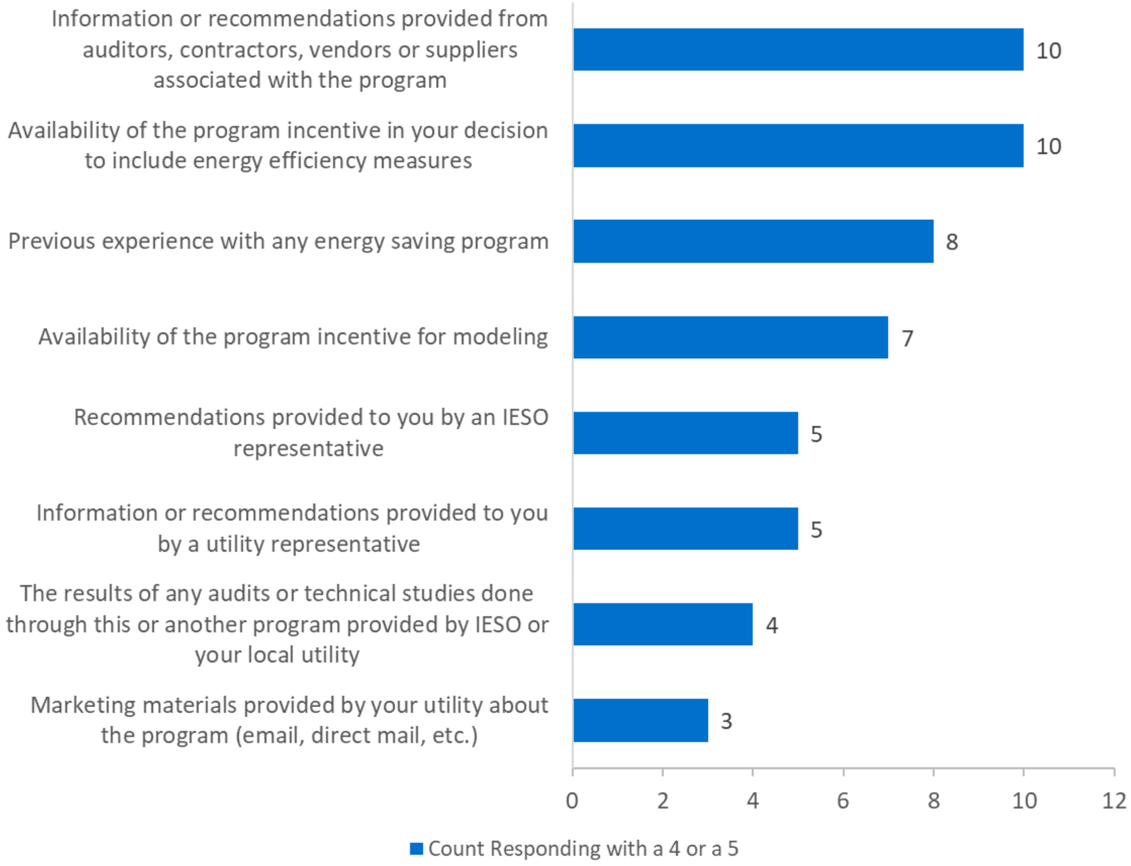
[85] Scale is 1 to 5, where 1 means “not influential at all”, 2 means “slightly influential”, 3 means “somewhat influential”, 4 means “very influential” and 5 means “extremely influential”.

Figure 8-12: Influence of Program Features on Participation (n=17)



8.1.8.4 Spillover

The team asked participants if they installed or upgraded any energy efficient equipment in 2017 after they had participated in the program and for which they did not receive an incentive. Three of 17 participants reported that they had done so. One installed new lighting and an ENERGY STAR appliance, one a fan and lighting, and the third had an energy efficient motor/pump upgrade. Of these three participants, two rated the influence of their participation in the HPNC program on making these energy efficient upgrades as a 1 (using a 1 to 5 scale where).[86] The respondent who installed the motor/pump upgrade rated the program's influence as a 3 on their decision to upgrade two standard pumps, but the respondent reported that the equipment installed was standard efficiency rather than premium. Given this, the HPNC program did not result in any measurable spillover.

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[86] Scale is 1 to 5, where 1 means "not influential at all", 2 means "slightly influential", 3 means "somewhat influential", 4 means "very influential" and 5 means "extremely influential".

8.2 Process Evaluation

The following subsections outline the process evaluation results of the HPNC program. Responses have been summarized and detailed observations are provided in Appendix I. Additional details regarding the process methodology can be found in Appendix F.

8.2.1 LDC Staff Perspectives

The following subsections highlight the feedback received from LDC staff about the design and implementation of the HPNC program in 2017.

8.2.1.1 Key Observations

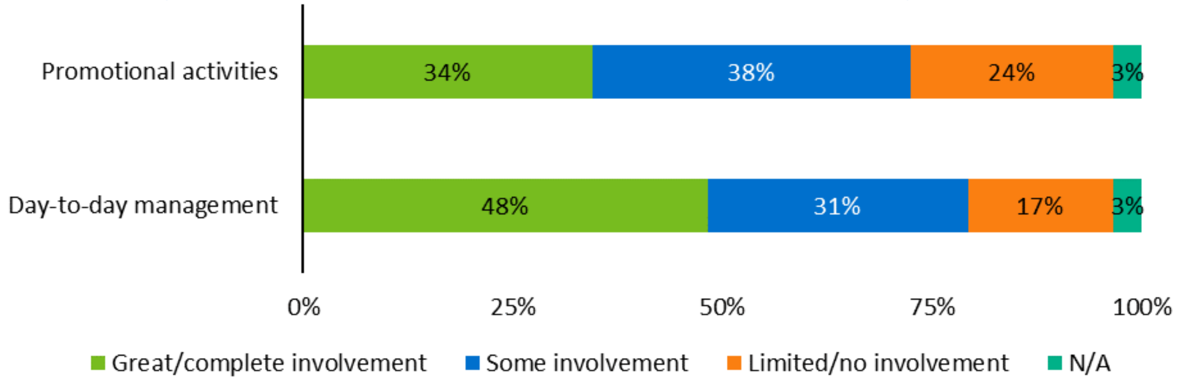
Key observations from LDC staff responses include the following:

- Most LDCs (55%) managed the HPNC Program by using primarily in-house staff.
- Twenty-one percent of LDC engaged one contractor to manage all aspects of the program.
- Most LDCs (92%) have not changed the way the program was implemented from program year 2016.

8.2.1.2 LDC Staff Involvement

Nearly half of LDC staff (48%) responded that they were greatly involved in the day-to-day management of the HPNC Program of the HPNC Program and about one-third (34%) were greatly involved in its promotional activities (Figure 8-13).

Figure 8-13: Level of LDC Staff Involvement in the HPNC Program (n=29)

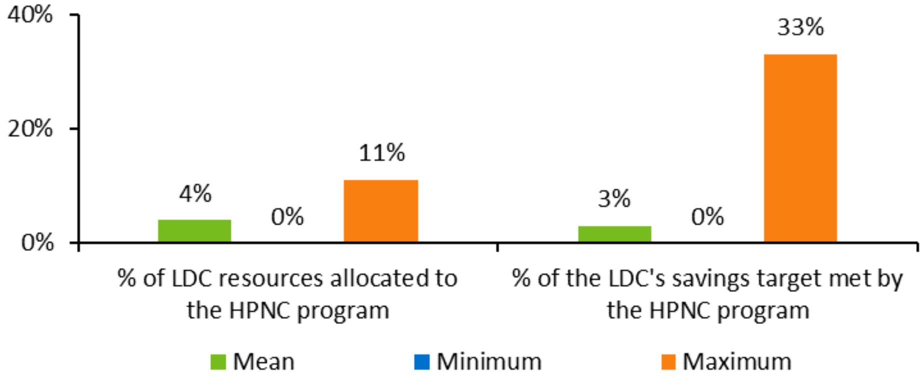


Over two-thirds (69%) of LDC staff %) expect that in 2018 their LDC will maintain its same level of involvement and engagement in the HPNC Program. Less than a quarter (21%) expect their LDC will increase its level of involvement, 7% expect to be less involved, and 3% indicated this is not applicable to them.

8.2.1.3 Allocated Resources and Expected Savings

The survey asked LDC staff to estimate the approximate percentage of total resources their LDC allocated to the HPNC Program. On average, LDC staff estimated that 4% of their LDC's total resources were allocated to the HPNC Program (Figure 8-14). Responses ranged from 0% to 11% of resources. When asked what percent of their LDC's 2017 savings target would be met by the HPNC Program, LDC staff estimated an average of 3% with a minimum answer of 0% and a maximum of 33%.

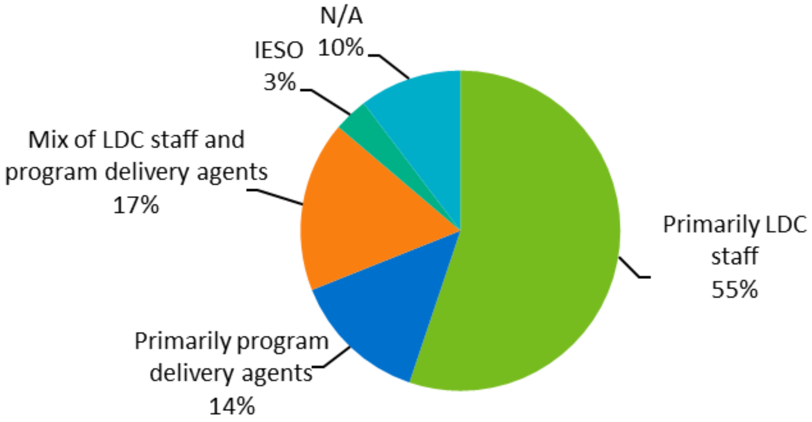
Figure 8-14 Allocated Resources and Expected Savings (n=31)



8.2.1.4 Program Management and Implementation

Most LDCs (55%) managed and delivered the HPNC Program to market by primarily using in-house LDC staff (Figure 8-15). Seventeen percent used a mixture of LDC staff and program delivery agents, 14% used primarily program delivery agents, and 3% delivered the program through IESO.

Figure 8-15 Program Management and Delivery (n=29)

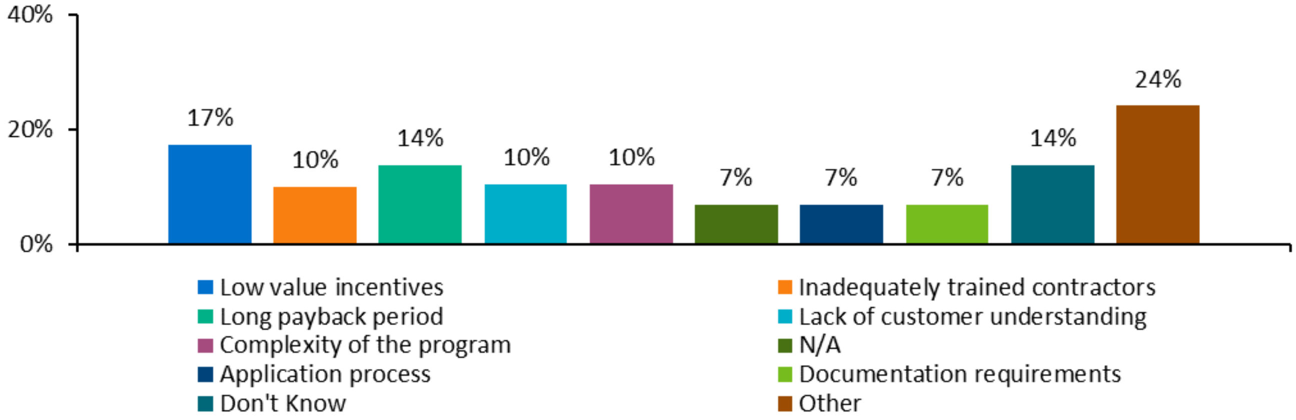


The survey asked LDC staff (n=29) how their LDC managed the builders and contractors that were necessary to conduct any installations for the HPNC Program in 2017. Most commonly, LDC staff indicated that their LDC used a single contractor (also referred to as program delivery agents) to manage all aspects of the program (21%). Only 7% used a single service provider to manage the logistics of all contractors. As compared to 2016, LDCs in 2017 no longer manage the logistics of multiple contractors on their own (20% and 0%, respectively). These statistically significant results may indicate that LDCs prefer to have a single liaison communicating with and managing all builders and contractors.

8.2.1.5 Barriers to Increased Customer Participation

The survey asked LDC staff about the single largest barrier to greater customer participation for each program (Figure 8-16). For the HPNC Program, the most common response includes the low value incentives (mentioned by 17% of LDC staff). The percentage of respondents that mentioned lack of new construction significantly decreased in 2017 as compared to 2016 (0% and 16%, respectively) and the percentage that mentioned the long payback period significantly increased (14% and 0%, respectively).

Figure 8-16 Barriers to Customer Participation (multiple response allowed; n=29)



8.2.1.6 Expected Changes for 2018

The majority (92%) of surveyed LDC staff indicated that their LDC's approach to implementing the HPNC Program in 2018 did not change from 2017. One LDC (4%) indicated they made changes by more actively marketing and promoting the program. As compared to 2016, a significant increase in 2017 respondents reported no change to their implementation approach (75% and 92%, respectively). This may indicate that LDCs are more satisfied with the current program and see fewer reasons to make changes to its implementation.

8.2.2 PDA and TPE Staff Perspectives

The following subsections highlight the feedback received from the PDA and TPE staff who supported the implementation of the HPNC program in 2017. Feedback was received through a web survey that was administered in April 2018. Feedback was received through a web survey that was administered in April 2018. Detailed findings are provided in Appendix I. As the sample size of HPNC PDAs and/or TPEs is small (five respondents), counts are reported instead of percentages.

8.2.2.1 Key Observations

Key observations from PDA and TPE staff responses include the following:

- Three out of five PDA/TPE firms indicated their application review included assessing if the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program.
- Three out of five firms that marketed the HPNC program either made direct calls or reached out via email to potential program participants. Only one firm was engaged in promoting the program on social media or other advertising venues, and one firm did not indicate any specific form of marketing as the company only interacted with customers when directed to do so by the LDC. This indicates that few firms engage with customers face to face when promoting the HPNC program.
- One PDA/TPE firm suggested the consideration of more frequent updates to the measures covered under the HPNC program as the technologies in the market are evolving at a faster pace than the worksheets capture.
- One PDA/TPE firm suggested it would be beneficial to have an online portal for the submission and management of applications, including letting customers know when the incentive has been sent.

8.2.2.2 Respondent Roles and LDCs Supported

Four out of the five responding PDA and TPE firms supported multiple LDCs in the delivery of the HPNC Program (Table 8-12). The number of LDCs served by each firm ranged from one to seven different LDCs. On average, the respondents served 3.8 LDCs. Three out of the five responding firms provided TPE support to the HPNC program in 2017, and two provided PDA support.

Table 8-12 Roles of PDA and TPE Firms (n=5)

PDA/TPE Respondents	Firm Roles		LDCs Served
	PDA	TPE	
Firm 1	==	✓	7
Firm 2	✓	==	5
Firm 3	==	✓	3
Firm 4	==	✓	3
Firm 5	✓	==	1

The survey asked the two respondents who provided PDA services what activities or duties were involved in supporting the HPNC program in 2017. Both firms indicated providing customer outreach services as part of their role as a PDA. One of the firms provided additional services, including scheduling and completing audits at the client location, reviewing applications for completeness, and communicating with the customer to process and approve applications.

The survey asked the three respondents who provided TPE services to describe the activities or duties that were involved in supporting the HPNC program in 2017. All three firms indicated providing a mix of services as part of their role as a TPE, which included reviewing customer applications for completeness, ensuring applications were compliant with program rules, and conducting a detailed review of M&V calculations.

Table 8-13 Roles of TPE Firms (n=3)

TPE Roles	Firm 1	Firm 2	Firm 3
Conducted a detailed review of M&V calculations	✓	✓	✓
Ensured that applicants followed program rules	✓	✓	✓
Reviewed customer applications for completeness	✓	✓	✓
Post installation review	✓	✓	✓
Pre-approved applications	==	✓	✓
Coordinated site visits	==	==	✓

8.2.2.3 Review of Customer Applications

All five PDA and TPE respondents were responsible for reviewing customer applications for the 2017 HPNC program. The survey asked respondents if their application review included assessing if the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program. Three out of the five respondents indicated making this type of assessment as part of their application review process.

The survey asked the three respondents to briefly describe how their firm went about assessing the customer's decision-making process. All three firms indicated verifying that the dates on quotes and/or work invoices were in fact after the project was pre-approved, or the application was submitted to the LDC. If this was not the case, the LDC was notified. One TPE firm gave the following context:

"For prescriptive/engineering reviews: [we] verified the submitted building permits and equipment invoices and compared against signed participant agreements. For custom projects, if the participant agreement was signed after a building permit was 'issued,' I would notify the LDC."

8.2.2.4 PDA and TPE Interactions with LDCs, IESO, and Customers

PDA and TPE Interactions with LDCs: The survey asked PDA and TPE respondents about the nature or purpose of their interactions with the LDCs when providing support services to the HPNC program in 2017. The timing and amount of interaction with the LDCs varied depending on the LDC, as well as the specific role of the responding firm. Some firms communicated with the LDC on technical aspects of the project review, while others coordinated with the LDCs on marketing efforts and customer outreach. Two of the TPE firms closely communicated with the LDCs throughout the application process. One TPE respondent provided the following description:

"From the time the review for the application is assigned, until the application has been approved (or rejected), any and all questions for the applicant are typically passed through the LDC. Requests for documentation, clarification, and edits to ensure a complete and accurate review are the most common causes for communication."

PDA and TPE Satisfaction with LDC Interactions: The survey asked PDA and TPE respondents to use a scale of 1 to 5 to rate their level of satisfaction with specific elements of communications with the LDCs (Figure 8-17).87 All five firms were either somewhat satisfied or completely satisfied with the clarity on roles and responsibilities of the different organizations involved in administering the program. Four out of the five firms were completely satisfied with their overall interactions with the LDCs. Slightly fewer respondents, two out of five, were completely satisfied with clarity on program goals.

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[87] Scale is 1 to 5, where 1 means "not at all satisfied," 2 means "somewhat dissatisfied," 3 means "neither satisfied nor dissatisfied," 4 means "somewhat satisfied," and 5 means "completely satisfied."

Figure 8-17 PDA and TPE Satisfaction with LDC Interactions (n=5) (Rating of 4 or 5 on a scale of 1 to 5)

Of the four firms that served multiple LDCs, three indicated that interactions were similar across the different LDCs they served, and one respondent declined to answer.

Program Support Received from the LDCs: The survey asked PDA and TPE respondents what support their firm received from the LDC(s) to help in their role as the PDA or TPE in 2017 (Table 8-14). All firms indicated receiving responses to their questions as a general form of support provided by the LDCs. Two out of the five firms indicated receiving one-on-one in-person support from the LDC staff and/or marketing and outreach support.

Table 8-14 HPNC Program Support Received from LDCs (multiple responses allowed; n=5)

Type of Support	Respondents
Responses to questions	5
One-on-one in-person support from LDC staff	2
Marketing and outreach support	2
Coordination with applicants to gather responses to questions or schedule a site visit	1

The survey asked respondents if they had any suggestions for additional support they would recommend the LDCs provide to the PDAs and TPEs. One PDA respondent suggested:

“[The LDCs could] *provide in-depth training on the application process, how to deal with both common and specific scenarios, and clarity on when to conduct site visits.”*

This type of support would be particularly helpful after any program changes have been made.

PDA and TPE Interactions with the IESO: The survey asked PDA and TPE respondents about the nature or purpose of their interactions with the IESO when providing support services to the HPNC program in 2017. Three of the five PDA and TPE firms indicated having direct contact with the IESO regarding their support of the program. The nature of these interactions was for clarification on program rules and building codes and providing project documentation when requested.

The survey asked respondents to use a scale of 1 to 5 to rate their level of satisfaction with specific elements of communications with the IESO (Figure 8-18).[88] All three firms reported being either somewhat satisfied or completely satisfied with communication and collaboration with the IESO, and two firms reported being somewhat satisfied or completely satisfied with overall interactions with the IESO. However, only one firm was completely satisfied with clarity on coordination needs, roles and responsibilities of different organizations, and clarity on program goals. This result indicates there may be an opportunity for the IESO to clarify program goals and the individual roles of the different parties involved with administering the HPNC program.

Figure 8-18: PDA and TPE Satisfaction with Interactions with the IESO (n=3) (Rating of 4 or 5 on a scale of 1 to 5)

PDA and TPE Interactions with Customers: The survey asked PDA and TPE respondents how frequently their firm interacted directly with customers. The level of direct customer interaction was different for each of the five PDA and TPE firms, ranging from no interactions to frequent interactions. This result suggests that the process for delivering the HPNC program is different across the firms that are responsible for implementation.

The survey asked respondents to describe the nature of their interactions with customers. All four of the PDA and TPE firms who indicated direct interactions with the customer reported they typically interacted with customers to provide application support in applying to the HPNC program. Other ways in which the respondents reported interacting with customers included performing customer outreach, communications to document technical review of the project, and coordinating site visits.

PDA and TPE Marketing and Customer Outreach: The survey asked PDA and TPE respondents what role their companies played in marketing the HPNC program (Table 8-15). Three of the firms either made direct calls or reached out via email to potential program participants. Only one firm promoted the

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[88] Scale is 1 to 5, where 1 means "not at all satisfied," 2 means "somewhat dissatisfied," 3 means "neither satisfied nor dissatisfied," 4 means "somewhat satisfied," and 5 means "completely satisfied."

program on social media or other advertising venues, and one firm did not select any specific form of marketing as the company only interacted with customers when directed to do so by the LDC.

Table 8-15 PDA and TPE HPNC Program Marketing Activities (n=4)

PDA/TPE Respondents	Customer calls	**Customer emails**	Social media marketing	Advertisements via TV, radio, internet, etc.
Firm 1	✓	-	-	✓
Firm 2	✓	✓	-	-
Firm 3	✓	✓	-	-
Firm 4	-	-	-	-

The survey asked the three firms who indicated providing some form of program marketing how customers were targeted as potential program participants. One firm said the LDC would suggest potential customers, but the firm would also meet and interact with customers at local Chamber of Commerce events. Another firm mentioned targeting customers through local trade ally and industry events, and the third firm reported that customers were self-identified.

8.2.2.5 Perspectives on Motivations, Barriers, and Suggestions for Program Improvement

The survey asked PDA and TPE firms to use a scale of 1 to 5 to rate how influential certain factors were on the customer's decision to install the program-qualifying equipment (Figure 8-19).[89] All of the responding PDA and TPE firms indicated the program incentive and ability to be associated with "green" or "sustainable" actions were very influential or extremely influential factors on the customer's decision. Three out of the four respondents indicated that being able to save energy and lower their energy bills was very influential or extremely influential on their customer's decision to install the program-qualifying equipment.

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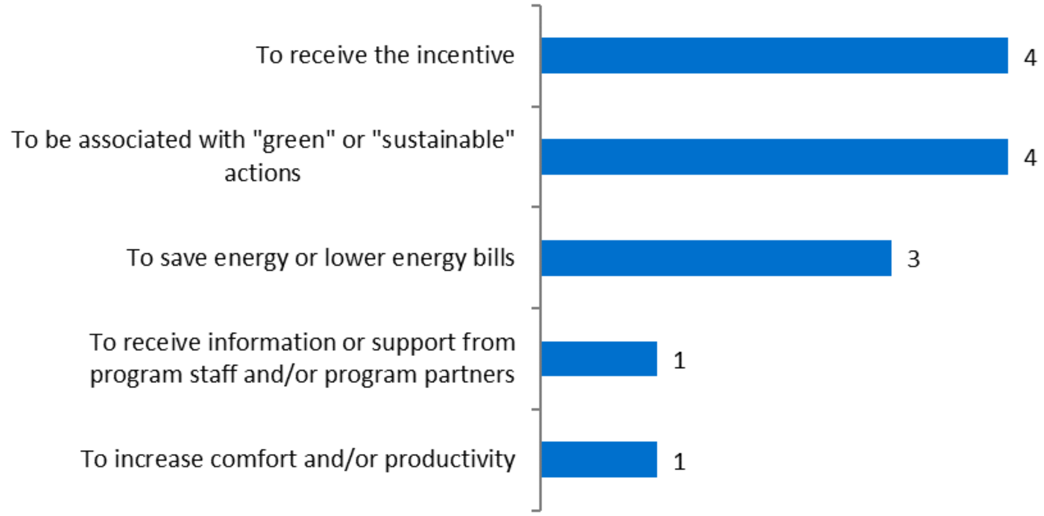
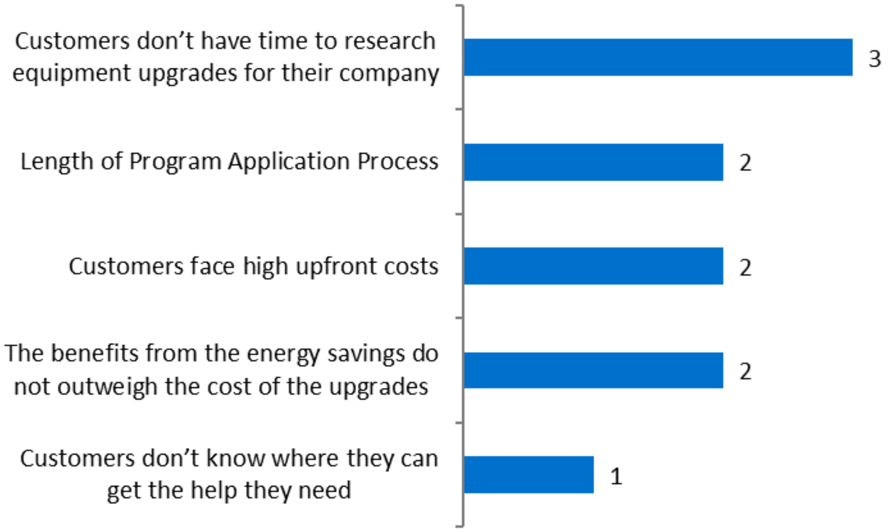
[89] Scale is 1 to 5, where 1 means the factor had "no influence at all," 2 means it was "slightly influential," 3 means it was "somewhat influential," 4 means it was "very influential," and 5 means it had a "extremely influential."

Figure 8-19: PDA and TPE Perspective on Customer Motivation to Install Program-Qualifying Equipment (n=4)
(Rating of 4 or 5 on a scale of 1 to 5)



The survey also asked PDA and TPE respondents what they thought were the primary barriers to increased customer participation (Figure 8-20). Three of the four PDA and TPE respondents thought that customers do not have the time to research the appropriate equipment upgrades.

Figure 8-20: PDA and TPE Perspectives on Barriers to Increased Customer Participation (multiple responses allowed; n=4)



The survey asked PDA and TPE firms if they had any suggestions for improvements to the HPNC program. These suggestions are as follows:

- Continue the program past 2020, as the program is making energy efficiency a priority at the start of the project (one respondent).

- Consider more frequent update of the measures, as the technology in the market is evolving at a greater pace than the worksheets capture (one respondent).
- Since the program has a manual, paper application and administration process, it would be beneficial to have an online portal for the submission and management of applications, including letting customers know when the incentive has been sent to the customer (one respondent).

8.2.3 Builder and Developer Perspectives

The following subsections highlight the feedback received from the HPNC Builder and Developer survey. Responses have been summarized and detailed findings are provided in Appendix I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size. Four out of seven interviewees were with developers and three were with builders.

8.2.3.1 Key Observations

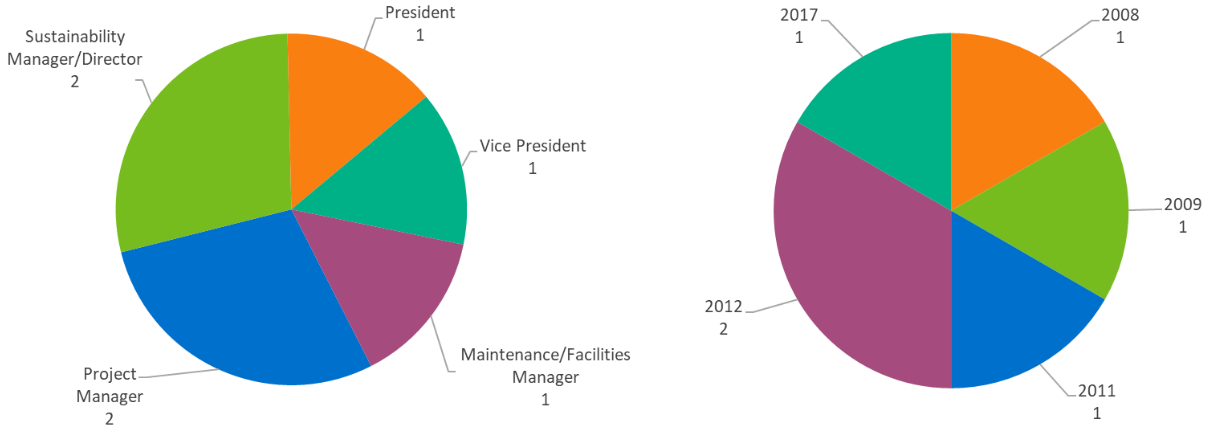
Key observations from builders' and developers' responses include the following:

- Builders were moderately satisfied with the program.
    - Builders gave an average satisfaction rating of 3 to the HPNC program overall using a 1 (not at all satisfied) to 5 (completely satisfied) scale.
    - The average rating given for every program aspect was a 3 or better. Builders attributed their highest levels of satisfaction to their interactions with LDC representatives (4.2 rating).
- A large majority of builder's sales were outside the program.
    - One builder reported that 35% of their 2017 sales went through the HPNC program, while no other builder reported more than 5% of their total sales going through the program.
- Builders most commonly learned about the program through an architect or engineer (three of seven). While many respondents to the participant survey recounted that they learned about the program through builders or other vendors, the surveyed builders reported being largely unaware of the influence that their recommendations had on customers. This top-down flow of information suggests that outreach to builders and other program vendors can increase the awareness of and participation in the HPNC program.

8.2.3.2 Firmographics

Figure 8-21 shows the job title of the builder or developer and their first year of participation in the HPNC Program. These responses mostly varied across participants. Two respondents were project managers, while two had specific positions overseeing sustainability. The 2017 program year was the first year of participation for one respondent's organization, while the other six all completed their first HPNC projects five or more years ago.

Figure 8-21: Job Title and First Year of Participation of HPNC Survey Respondents (n=7)

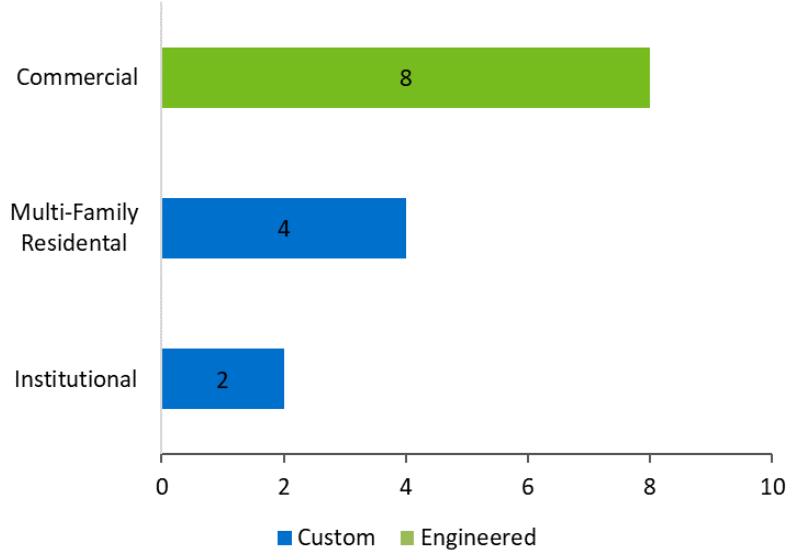


Three companies were independent, two were part of larger companies, and two declined to respond. The sizes of the respondents' organizations varied widely. The largest company had roughly 30,000 employees, which had a specific position(s) dedicated to sustainability. Another organization with 300 employees also had a dedicated sustainability position. The other companies had 3,000, 800, and 60 employees, respectively; two respondents declined to give their company size. When asked about their role in working with the HPNC program in 2017, four stated that they did projects as developers, two did projects for specific customers, and one did the HPNC projects for their own portfolio of multi-unit residential buildings.

8.2.3.3 Market Information

Five of the seven builders and developers provided information on the project tracks for a total of 15 projects that they completed in 2017. Three builders and developers completed projects in the multi-residential sector, one worked in the commercial space, and one worked in the institutional space. One respondent reported that their organization completed a high number of single-family residential projects (700) that did not go through the program. Otherwise, 14 of the 15 projects that respondents reported went through the HPNC program. Just one project in the institutional sector did not receive an HPNC incentive. Figure 8-22 shows the project tracks and sectors of respondent's 2017 HPNC projects. All eight commercial projects went through the engineered-track, while the four multifamily residential projects and two institutional projects were all custom-track. There were no agribusiness projects in the 2017 sample, which had been the most common track in surveyed 2016 participants.

Figure 8-22: Program Participation and Project Tracks of Respondents' 2016 Projects (multiple response allowed; n=5)



Respondents generally reported that HPNC-qualified sales made up a small percentage of their total sales. Of the five respondents who reported their HPNC qualified sales, one respondent said 35% were through the program, followed by reported levels of 5%, 4%, 1%, and 0%. This was a notable difference from 2016 when most builders reported a majority of sales were through the program.

8.2.3.4 Program Awareness

The team asked the builders and developers how they first heard of the HPNC program. They most commonly learned about the program through their architect or engineer (three of seven). Two respondents learned about HPNC through an LDC representative, while the other two respondents learned from online advertising and from experience with the program at a prior company. Of the two builders and developers who learned about the program from an LDC representative, one contacted the LDC directly and one was contacted by an LDC representative.

The survey asked builders and developers if they or anyone in their company had received any training or education on topics related to the HPNC program. One respondent said he had received responses from a program representative with regard to questions about the specific offerings available through the program but had not received any more formal training. None of the other seven respondents reported receiving training, although two stated that they did not know if anyone at their company had received HPNC training in 2017.

One respondent reported that their customers had contacted them about building a project up to HPNC program specifications, while the rest reported that they did not know how their customers first became aware of the program. The survey asked this respondent the level of influence their advice had on the customer's decision to build the project to HPNC standards and they provided a 3-rating using a scale from 1 to 5.[90]When asked about their specific role with the customer, this respondent reported 75% of

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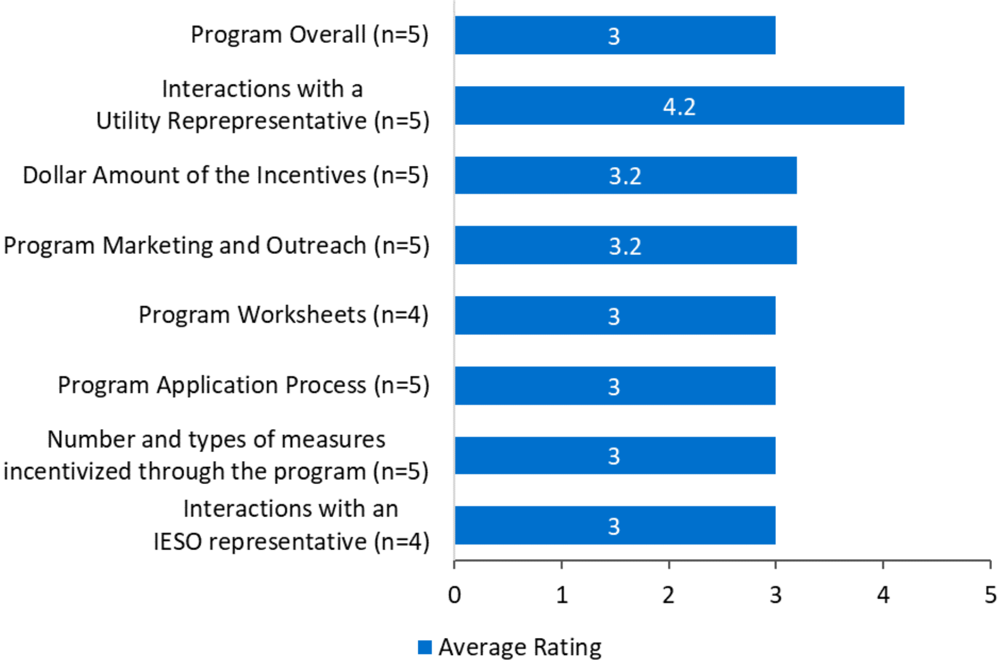
[90] Scale is 1 to 5, where 1 means "not influential at all", 2 means "slightly influential", 3 means "somewhat influential", 4 means "very influential" and 5 means "extremely influential".

their role was making recommendations that changed client projects, while 25% was defining, selling, and implementing the projects. This is a noteworthy finding as this indicates participants are often following builder advice. This may suggest that builders and developers do not completely understand the influence of their recommendations when it comes to building a project to HPNC standards.

8.2.3.5 Builder and Developer Satisfaction

Overall, builders and developers indicated that they were moderately satisfied with the HPNC program, giving an average rating of 3 to their overall satisfaction on a 1 to 5 scale.[91] Figure 8-23 shows that builders and developers provided similar satisfaction ratings to nearly every program factor. This was true for the dollar amount of the incentives, program marketing and outreach, program worksheets, the number and type of measures incentivized through the program, and interactions with an IESO representative, all of which received an average satisfaction rating between 3.0 and 3.2. Builders and developers were most satisfied with interactions that they had with an LDC representative (4.2 average rating), the dollar amount of the incentives (3.2 rating), and program marketing and outreach (3.2 rating). There were no program aspects for which builders and developers indicated notable dissatisfaction. The survey asked respondents who gave a rating of less than 3 to the program overall how to improve the HPNC program. Only one participant fell into this category, having given a 2 rating. Their suggestion was that final financial incentives be based on “actual demand savings to the system, based on LDC billings.”

Figure 8-23: Builder and Developer Satisfaction with HPNC Program Factors



8.2.4 Architect and Engineer Perspectives

The following subsections highlight the feedback received from the HPNC architect and engineer telephone interviews. Responses have been summarized and detailed findings can be found in Appendix

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[91] Scale is 1 to 5, where 1 means “not at all satisfied”, 2 means “somewhat dissatisfied”, 3 means “neither satisfied nor dissatisfied”, 4 means “somewhat satisfied” and 5 means “completely satisfied”.

I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

8.2.4.1 Key Observations

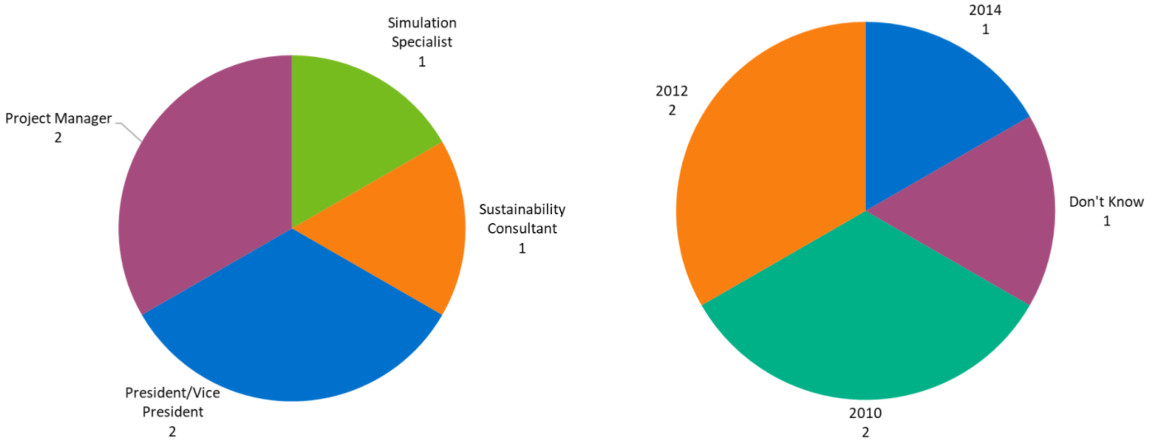
Key observations from architect and engineer responses include the following:

- Architects and engineers were mostly satisfied with program elements, although their overall satisfaction ratings were notably lower than the ratings they gave to specific factors.
  - The average overall satisfaction rating of 3.2 is lower than the average ratings given to program training and education (5 rating), the number and types of measures incentivized (4 rating), program marketing and outreach (4 rating), program worksheets (3.8 rating), and interactions with LDC representatives (3.7 rating). The average overall satisfaction rating is equal to the average rating for application process (3.2).
- Most architects (four out of five) learned about the program through energy efficiency advertising. One learned about it through a colleague or competitor. This further confirms the top-down flow of program awareness where participants mostly learned about the HPNC program from builders who mostly learned about it from architects.
- Architects and engineers reported that they find building owners to be most driven by the payback and the energy savings available when they choose to complete a project up to the HPNC program standards (mentioned by three respondents). They considered the amount of paperwork the biggest challenge facing potential applicants (also mentioned by three respondents).

8.2.4.2 Firmographics

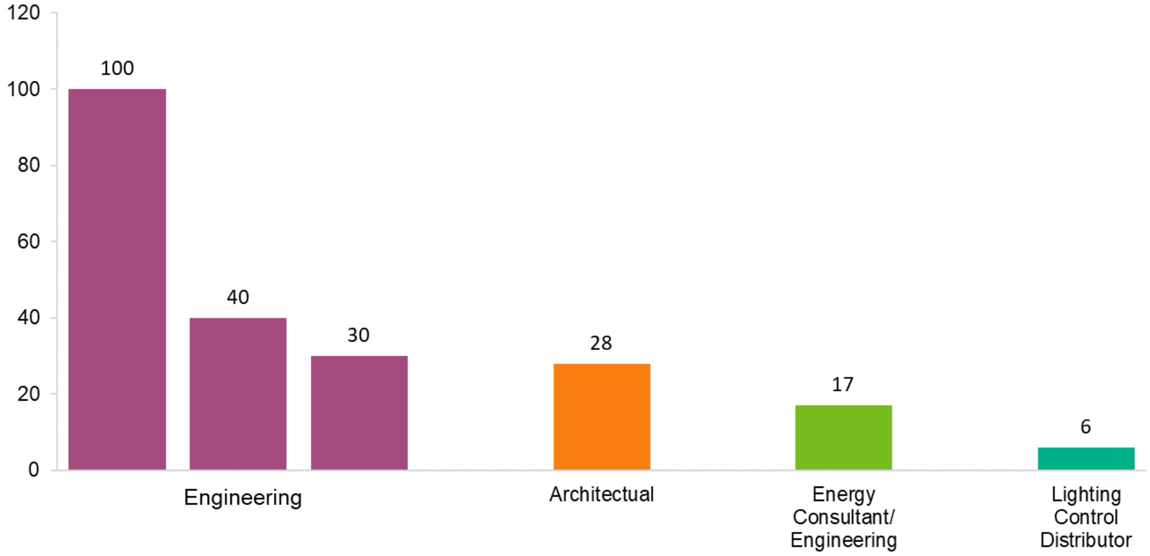
The evaluation team completed six architect or engineer interviews. Figure 8-22 shows respondents' job titles, as well as their organization's first year of participation in the HPNC program. Two respondents were project managers; one was a President; one was Vice President, as well as a simulation specialist; and one was a sustainability consultant. Most organizations had been involved with HPNC for several years, with two organizations having first participated in 2010, two in 2012, and one in 2014. One respondent was unsure when their company first participated in the program.

Figure 8-24: Job Title and First Year of Participation of HPNC Engineers and Architects (n=6)



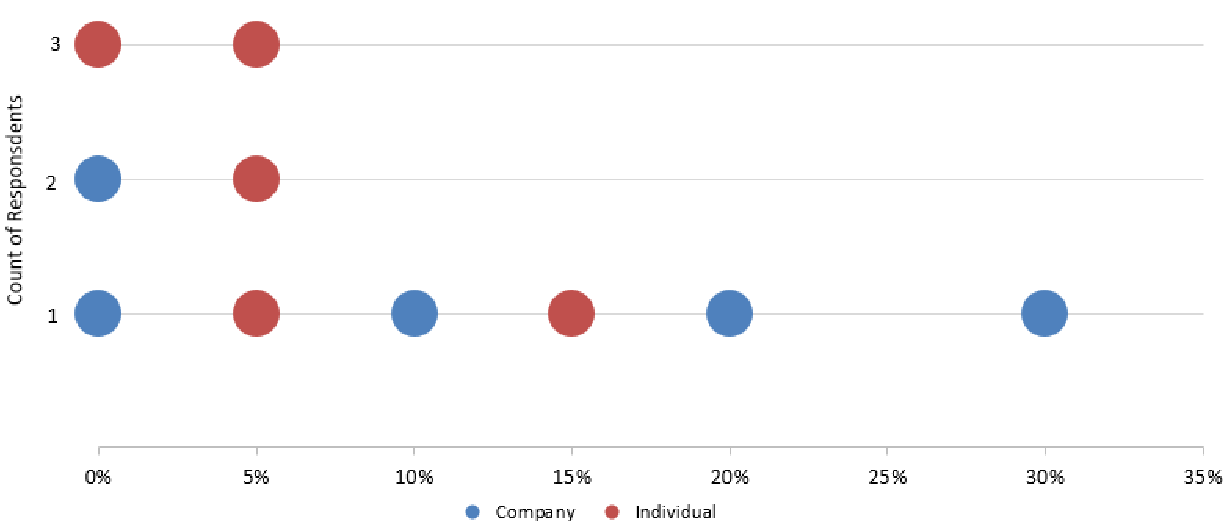
Three out of six interviewees worked for engineering companies, one worked for an architectural firm, one worked for an energy consulting/engineering firm, and one was a lighting control distributor. These companies were all small to medium-sized, ranging from six to 100 employees. The three engineering firms were the largest with 30, 40, and 100 employees. Figure 8-25 shows these company sizes split out by business type. All six companies were independent and not part of a larger chain.

Figure 8-25: Company Size and Primary Business of HPNC Engineer/Architect Respondents (n=6)



The evaluation team asked engineers and architects to approximate the percentage of their and their organization’s time spent on the HPNC program. Figure 8-25 displays these responses. Most individuals estimated that they spent 5% of their own time on the program (three respondents), while one reported spending 15% of their own time on the program and one reported spending 0%. Despite all these organizations working on projects that went through the HPNC program, two respondents suggested that their companies did not spend time on the program because all the specific work and applications were handled by builders, contractors, and/or building owners. Two respondents believed their companies spent at least 20% of their time working on the HPNC program: one estimated 20% and one (from the energy consulting firm) estimated 30% of company time spent.

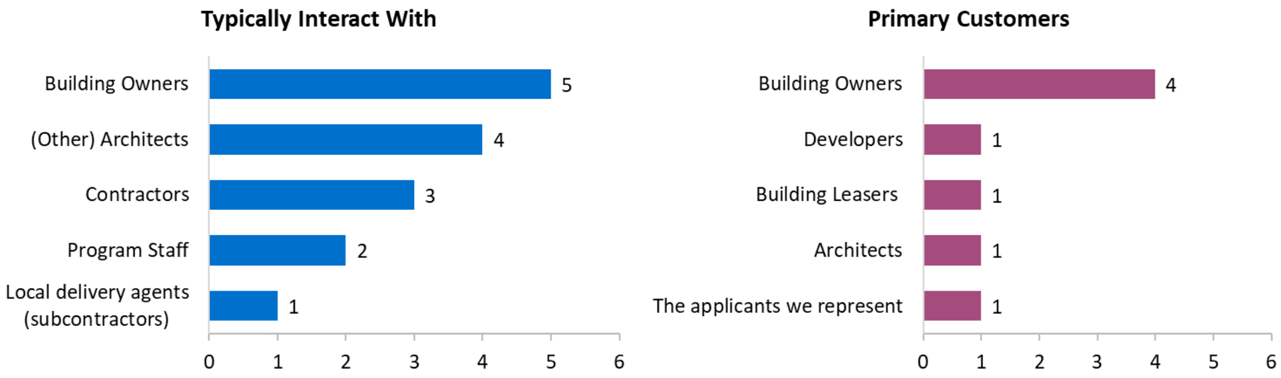
Figure 8-26: Respondents' Percentage of Time Spent on the HPNC Program (n=5)



8.2.4.3 Market Information

The evaluation team asked the engineers and architects who they typically interact with when working on the HPNC program and who they think are their primary customers. Figure 8-27 shows that all five respondents reported that they typically interact with building owners while going through the program. Four reported often having interactions with architects, followed by contractors (three), HPNC program staff (two), and local delivery agents/subcontractors (one). Most interviewees stated that building owners were their primary customers, as reported by four out of five respondents. Developers, building leasers, architects, and "the applicants we represent," all received one response as primary customers.

Figure 8-27: Typical Interactions and Primary Customers of HPNC Builders/Architects (multiple response allowed; n=5)



8.2.4.4 Engineer/Architect Roles in the HPNC Program

Table 8-16 shows the full range of answers provided by engineers and architects when asked about the specific services that they provided as a program delivery partner for HPNC in 2017. As the table shows, there was a balance between providing services, expertise, and planning and support with applications. All five who chose to respond also reported having positive relationships with both their clients and program staff and representatives.

Table 8-16 Specific Services Provided as an HPNC Partner (open end response; n=5)*

Services Provided	Company Type
“Mechanical and electrical engineering design”	Engineering
“Administration, submission and completion of energy model, forms and supplemental documentation”	Engineering
“We provide the services to cover all the application work and the modeling. Any involvement with paperwork, filling out calculations and any energy modeling we do. Building owner just has to review and sign off.”	Energy Consultant / Engineering
“Provide lighting retrofits”	Lighting Control Manufacturer / Distributor

*One architect reported that his company does not currently provide services for the program but was involved with an HPNC program project in 2017

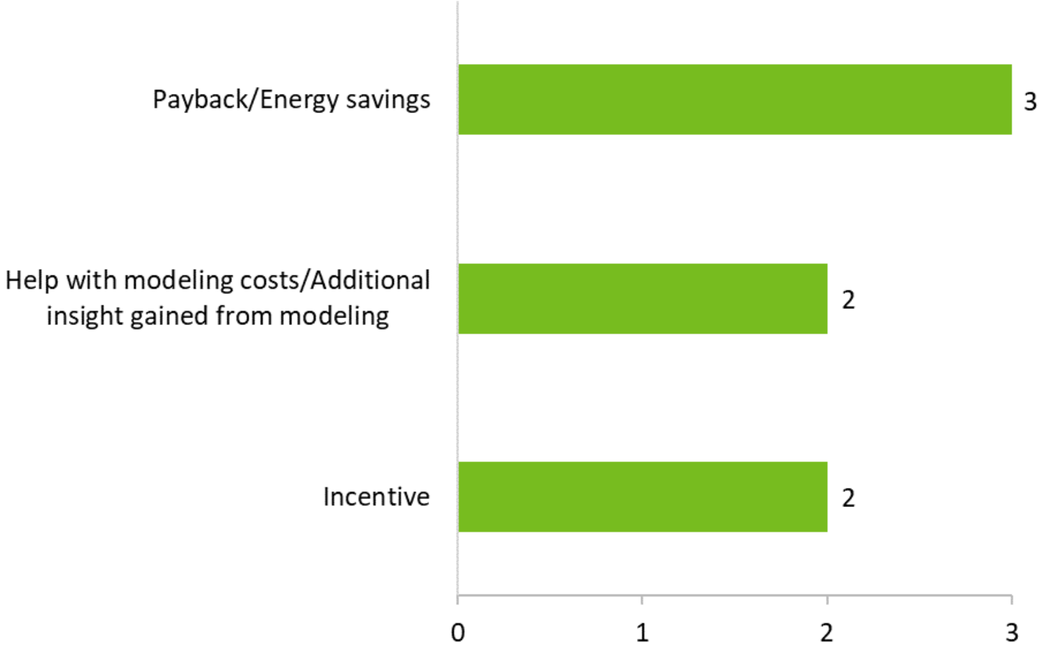
8.2.4.5 Program Awareness

Most engineers and architects learned about the HPNC program through LDC energy efficiency advertising, while one learned about it through a colleague or competitor. Three respondents were already familiar with the company from a former position prior to joining their current organization.

8.2.4.6 Perceptions of why Building Owners and Developers Participate in HPNC

The evaluation team asked the engineers and architects what they thought were the primary motivations behind why building owners and developers participate in the HPNC program. Figure 8-28 shows that three interviewees believed that the energy savings and payback or ROI was the greatest motivator for participating. One respondent said that “energy savings [are the biggest factor]. The last job we did was a 1.5-year payback so it’s a no-brainer at that point.” Another added, “owners are already trying to make their buildings more efficient, if they do it from the design they catch the incentive right up front.” Two respondents thought the incentive was the biggest factor, while two believed that the incentive for modeling was what led building owners and developers to participate in the program. One engineer explained that owners and developers participated “for assurance on what sort of energy targets the building could achieve,” something which they may not get without using the incentive to model expected energy outputs.

Figure 8-28: Perceived Primary Motivations for HPNC Participation (multiple response allowed; n=5)*

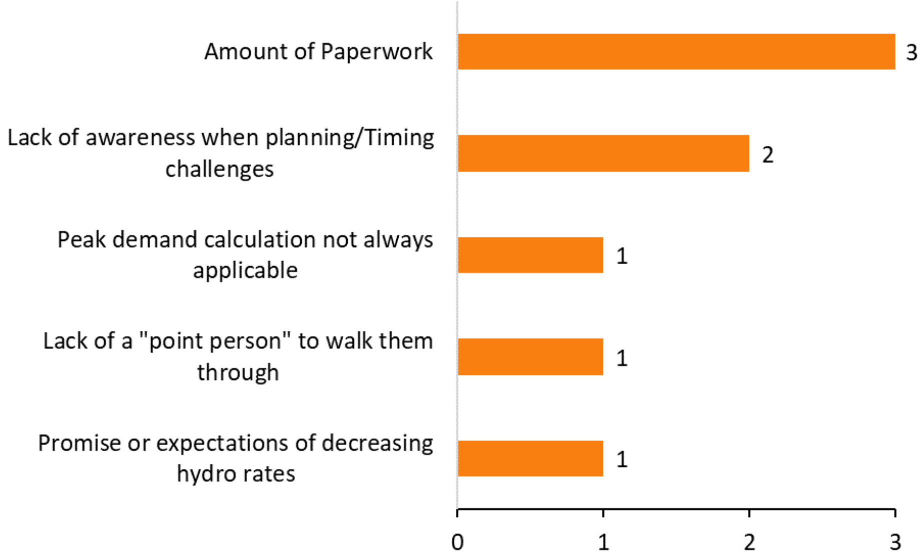


8.2.4.7 Perceptions of Building Owner and Developer Challenges in HPNC Participation

When asked about the challenges that building owners and developers face that may decrease their likelihood of participating in the HPNC program, engineers and architects most commonly identified the amount of paperwork to be the most limiting factor (Figure 8-29). Although two of the three acknowledged that all the paperwork was probably a necessity, this was the most common response. Two participants cited lack of awareness during planning, not understanding the timing, and the necessity of applying for the incentive up front as challenges. “Getting on board late is an issue, many owners think that this is a rebate and don’t realize it’s an incentive program. They think they can get it rebated for measures, but don’t realize they should be assessing upfront,” explained one respondent.

One engineer noted that some projects they worked on had substantial energy savings but that was not reflected as much in the demand savings due to the schedule of the building. He said that this meant the incentive would not cover the costs of making the upgrade when it was based on demand reduction rather than energy savings. One respondent said that many owners try to offload the project to a third party but suggested that this does not work very well. Instead, they suggested that owners identify a “point-person” who can go through the whole process along with them, although they acknowledged that this could be difficult. Finally, one interviewee suggested that leading up to elections, politicians had been promising decreased hydro-rates, which has led some building owners to believe it would be a waste of money to invest in more efficient buildings.

Figure 8-29: Perceived Challenges for HPNC Participation (multiple response allowed; n=5)*



8.2.4.8 Architect and Engineer Satisfaction

Architects and engineers reported that they were moderately satisfied with the program overall, providing an average rating of 3.0 on a 1 to 5 scale.[92] Despite this moderate overall satisfaction, most respondents reported relatively high levels of satisfaction with specific program elements (Figure 8-30). Only one participant received any program training over the past year, but he rated that experience as a 5. Interview participants gave average ratings of 4 to both the number and types of measures incentivized through the program, as well as to program marketing and outreach. They also gave average ratings of 3.5 or greater to both program worksheets and to the interactions they had with HPNC representatives from their LDCs. The engineers and architects did not give a satisfaction rating of 1 to any aspect of the program; however, two respondents provided a rating of 2 to the dollar amounts of the incentives. “The incentives aren’t always enough to cover the [incremental] cost of the energy efficient equipment,” explained one of these two respondents.

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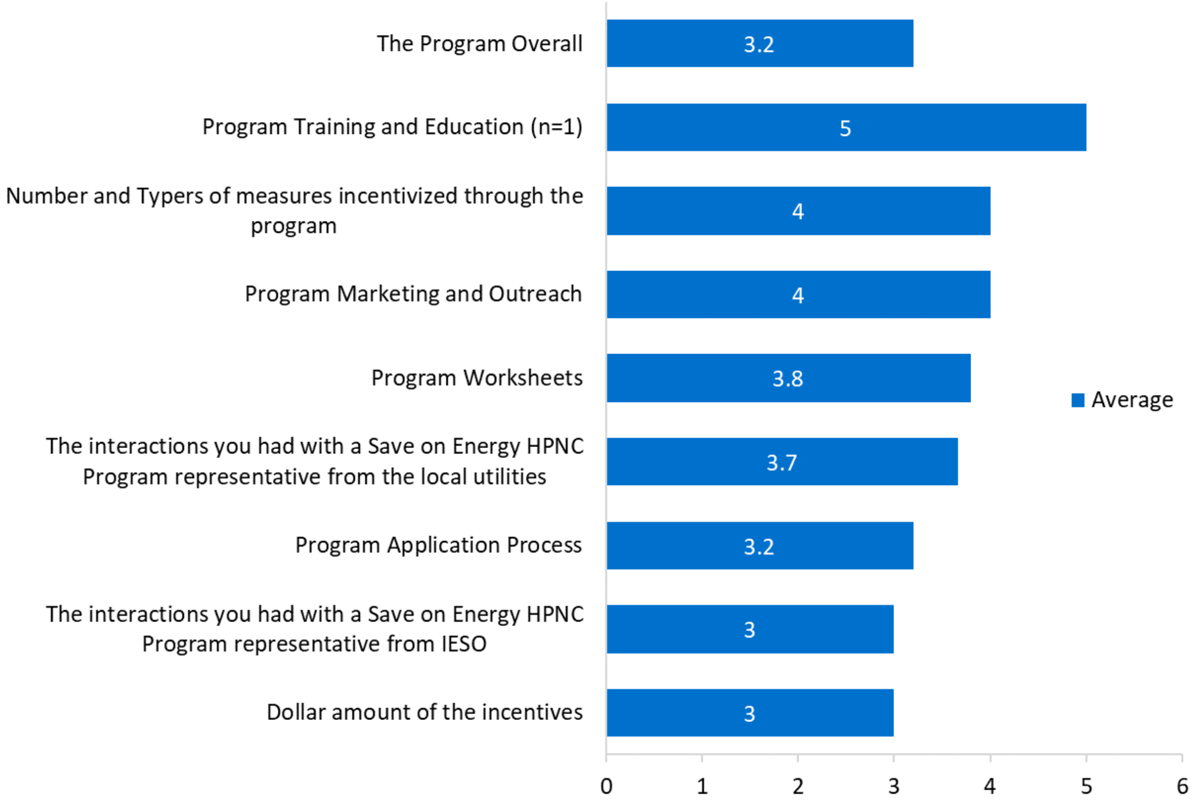
[92] Scale is 1 to 5, where 1 means “not at all satisfied”, 2 means “somewhat dissatisfied”, 3 means “neither satisfied nor dissatisfied”, 4 means “somewhat satisfied” and 5 means “completely satisfied”.

Figure 8-30: Engineer/Architect HPNC Program Satisfaction (n=5)



The team asked all architects and engineers for their recommendations on how to improve the program. Two suggested a need for continued or improved communication between the LDCs and participants to help navigate the difficulty of lining up all the documents needed to apply. “Tracking down paperwork can be tough, I understand why they need it all, but it can get confusing. The support from people in the LDC is crucial, they’ve been really good. Pushing on the owner side to make sure the LDC involves the owner early might help,” said one respondent. Another added that it would be beneficial “if there was more communication on how to effectively utilize the program.”

One respondent suggested that reduced time processing applications and more quickly delivered cheques would improve the program, although they acknowledged that this could be difficult. The final interviewee suggested a higher incentive for modeling, saying, “the main problem that we run into is that the modeling piece and getting all the drawings is very cumbersome. The time involved to do that versus what the incentive is sometimes doesn’t make it worth our while. Having a higher incentive for the modeling or for the participants would make it a more worthwhile investment.” Two respondents declined to answer the question.

8.2.5 Participant Perspectives

The following subsections highlight the feedback received from the HPNC Participant survey. Responses have been summarized and detailed findings can be found in Appendix I. Sample sizes differ given that not all respondents provided answers to all questions; the following subsections show percentages or counts depending on sample size.

8.2.5.1 Key Observations

Key observations from participants' responses include the following:

- Participants were very satisfied with the HPNC program. Sixteen out of 17 rated their satisfaction as were somewhat satisfied or very satisfied. They were also highly likely to recommend the program (4.7 average rating on a 5-point scale).
- Participants gave high satisfaction ratings to nearly every program factor. Most notably, more than 90% gave ratings were somewhat satisfied or very satisfied with the quality of the work done by the builder (100%), the energy savings achieved by the upgrade (94%), and the performance of the equipment (94%).
- Seventeen of 18 participants (94%) stated that they were motivated to participate in the program due to a desire to save energy or lower energy bills. Increased comfort and/or productivity was the next greatest motivator for participation, reported by 13 of 18 participants (72%).
- The majority of participants learned about the program through a contractor or equipment vendor (11 out of 17).
- There is some room to improve the clarity of program materials and the program application. Participants gave average satisfaction ratings of between 3.1 and 3.4 on a 5-point scale to both these elements. Although these are moderate ratings, they fall short of the high levels of satisfaction reported for other program elements.

8.2.5.2 Firmographics

The majority of HPNC participants who responded to the survey were the president or owner of their respective organization. Thirteen respondents held this title, along with one Project Manager, one Director of Operations, and one Secretary. One respondent declined to provide their title.

Figure 8-31: Title of Respondent (n=17)*

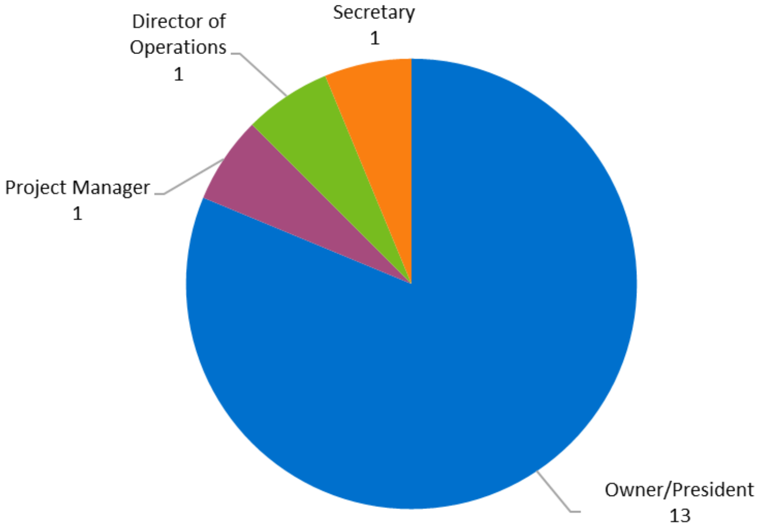


*Figure excludes two respondents who preferred not to answer.

Table 8-17 reveals that, among the 17 survey respondents, the majority of these HPNC projects were completed at Agribusiness sites (14), sites with less than 50,000 square feet (11), and sites that had one to ten employees (15). These sites were also typically independent rather than part of a larger chain (16), and participants tended to own the facilities (16). In the evaluation team's architect and engineer interviews, multiple participants corroborated this finding by telling the team, indicating that they found building owners much more likely to complete an HPNC project (or any project or upgrade geared towards energy efficiency) than those leasing a building.

Table 8-17: Firmographics (n=17)*

Firmographic Summary	Participants
Facility Size – Total Amount	
Under 25,000 square feet	5
25,000 to 49,999 square feet	4
50,000 to 99,999 square feet	1
100,000 square feet or greater	1
Facility Size – Average	
Under 25,000 square feet	1
25,000 to 49,999 square feet	1
Don’t know/Refused	1
Employment Count	
1	5
2-10	10
11-50	0
50+	2
Don’t know/Refused	0
Average Monthly kWh Consumption	
Under 10,000 kWh	2
Between 10,000 kWh to 100,000 kWh	2
Greater than 100,000 kWh	1
Don’t know/refused	12
Chain or Franchise Status	
No	16
Don’t Know/Refused	1
Ownership Status	
Own	16
Don’t know/ Refused	1
Primary Activity at Facility(ies) **	
Agriculture	15
Industrial	1
Institutional	1
Multifamily	1
Retail	1
School/University	1

*One respondent declined to answer firmographic questions.
**Count exceeds 17 because one respondent participated at three sites.

8.2.5.3 Program Outreach and Marketing

Table 8-18 reveals that most HPNC participants learned about the program from a contractor or equipment vendor (11 of 17). Respondents also cited six other sources of program awareness, each response provided by just a single participant. These included learning about the program from an LDC representative; advertising from the IESO, the LDC, or other energy efficiency advertising; their architect, engineer, or builder; or their property or energy management company.

Table 8-18 How Participants First Heard about the Program (n=17)*

How did you first hear about the High Performance New Construction (HPNC) Program?	Respondents
A contractor or equipment vendor	11
A representative from your LDC	1
Advertising from IESO	1
Advertising from LDC	1
Other energy efficiency advertising	1
My architect, engineer, or builder	1
Property or Energy Management Company	1

*Excludes one “don’t know” response

The survey asked participants about their knowledge of other Business Programs offered through their LDC (Table 8-19). Over one-half of respondents (10 of 18) knew of the Retrofit program, and just over two-fifths (8 of 10) had heard of the SBL program.

Table 8-19 Awareness of Other Business Programs (n=18)

What other business programs offered through your LDC are you aware of?	Count Aware
Retrofit Program	10
SBL Program	8
Audit Funding Program	4
EBCx Program	2
BRI Program	2
Process and Systems Upgrades (PSU) Program	2
PUMPsaver Program	2
OPsaver Program	1
Small & Medium Business Energy Management System Innovation Pilot	1
Intelligent Air Technology Pilot	1
Data Centre Pilot	1

8.2.5.4 Participation Motives and Decision Making

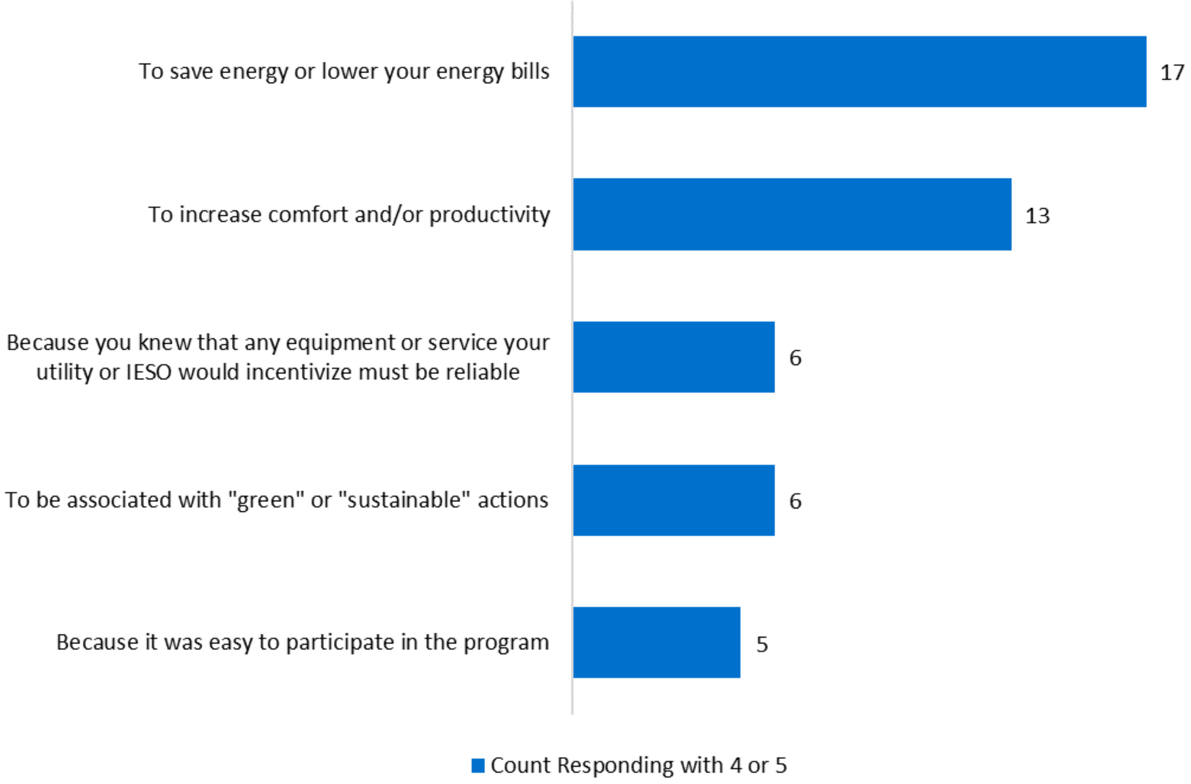
The team asked HPNC participants if they adhered to a sustainable or energy efficiency policy at their organization (Table 8-20). If they did, the survey asked them to describe what the policy required. Most of the respondents (14 out of 18) either did not have an official policy in place or did not know if their company had one. Four respondents had an unofficial commitment to energy efficient or sustainable practices.

Table 8-20 Sustainability or Energy Efficiency Policy (n=18)

Does your organization have a corporate policy related to energy efficiency or sustainability?	Respondents
Yes, an *unofficial* commitment to energy-efficient or sustainable practices	4
No	12
Don't know/Refused	2

The team asked respondents to rate the influence of several non-program specific factors on their decision to participate in the HPNC program. Respondents rated the influence of these factors using a scale of 1 to 5.[93] Figure 8-32 shows that respondents were most often driven by a desire to save energy or lower their energy bills, with 17 of 18 respondents rating this a 4 or 5. Increasing comfort or productivity was the next most popular option (13 ratings of 4 or 5), followed by confidence in the reliability of IESO or LDC supported measures (six respondents), a desire to be associated with green or sustainable actions (six respondents), and ease of participation (five respondents). Five respondents gave a 1 rating to ease of participation in the program, the most 1-ratings of any of these motives.

Figure 8-32: Motives for Participating in the Program (n=18)



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[93] Scale is 1 to 5, where 1 means “not influential at all”, 2 means “slightly influential”, 3 means “somewhat influential”, 4 means “very influential” and 5 means “extremely influential”.

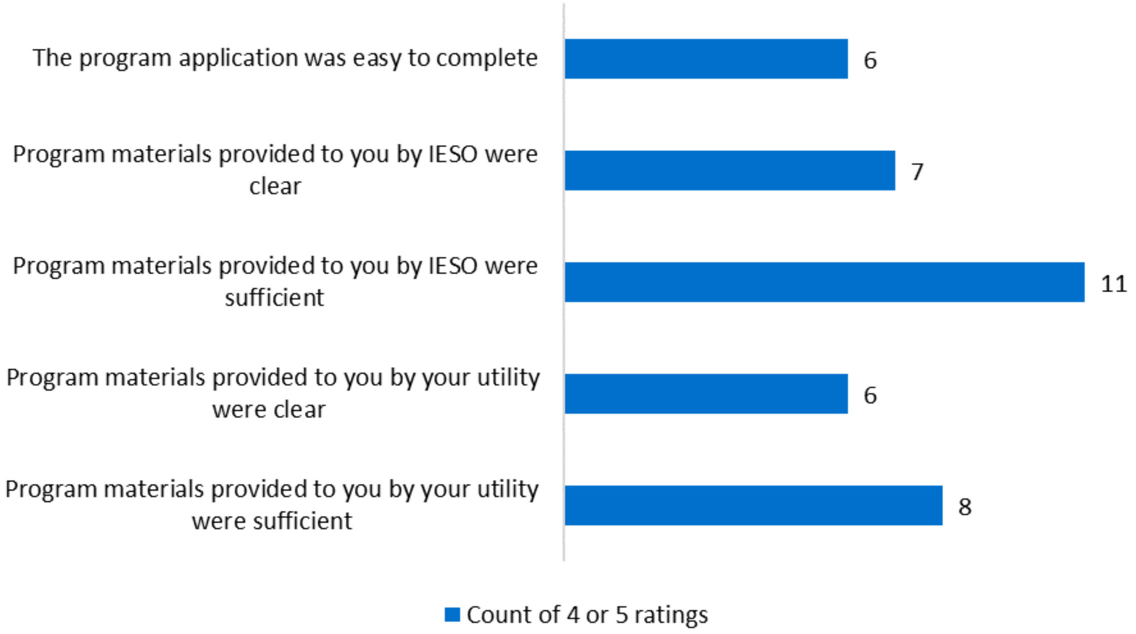
8.2.5.5 Participant Satisfaction

The team asked HPNC participants to use a 1 to 5 scale to rate whether the program materials provided by their LDC and the IESO were clear and sufficient, and whether the program application was easy to complete (Figure 8-33).[94]

Seven of 17 respondents rated the materials provided by the IESO as clear, while six gave high ratings to the clarity of LDC-provided materials. Respondents found the materials to be more sufficient than clear, with 11 of 17 giving high ratings to the sufficiency of IESO documents, and eight to LDC documents. Respondents did not give overwhelmingly high ratings to any of these categories, which may suggest that some opportunity may exist to better meet customers' needs.

Six of seventeen respondents said the application was easy to complete, suggesting that it was manageable for some but not all HPNC participants. Two respondents provided additional feedback on the application process; one was frustrated with the time that it took, while the other expressed a desire for more online support while completing the process.

Figure 8-33: Assessment of Program Materials and Application Process (n=17) (Rating of 4 or 5 on a scale of 1 to 5)



The team asked respondents to rate their satisfaction with various features of the program on a scale of 1 to 5 (Figure 8-34).[95] Respondents were largely very satisfied with the program, as 16 out of 17 respondents gave the HPNC program a 4 or 5 overall rating.

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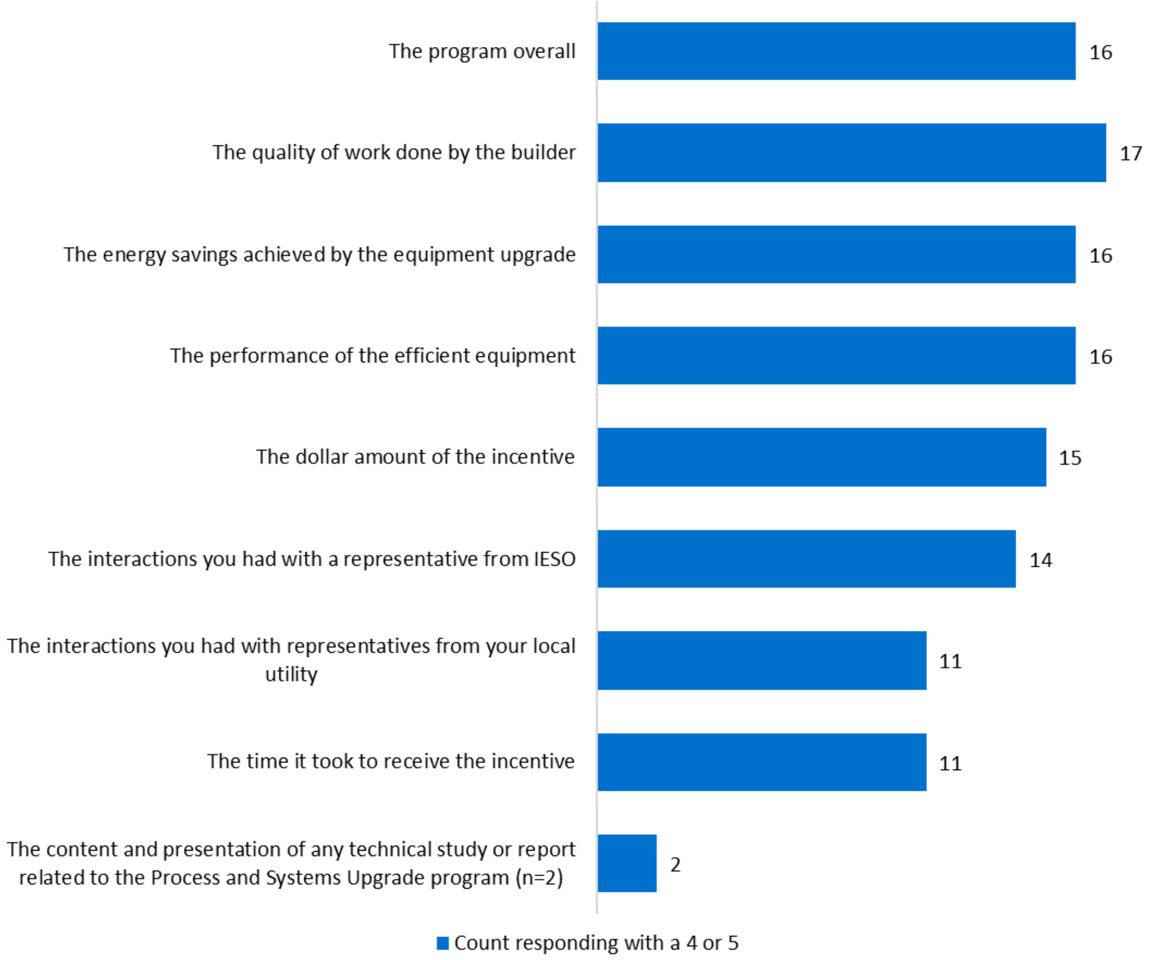
[94] Scale is 1 to 5, where 1 means "do not agree at all", 2 means "somewhat disagree", 3 means "neither agree nor disagree", 4 means "somewhat agree" and 5 means "completely agree".

[95] Scale is 1 to 5, where 1 means "not at all satisfied", 2 means "somewhat dissatisfied", 3 means "neither satisfied nor dissatisfied", 4 means "somewhat satisfied" and 5 means "completely satisfied".

Of the 17 survey respondents, the majority also were satisfied (rating of 4 or 5) with specific HPNC program factors, especially the quality of work done by the builders, which all 17 respondents rated as a 4 or 5 (including 13 rating it as a 5). Most of the respondents also gave high ratings (4 or 5) to the energy savings achieved by the equipment upgrade (16 respondents), the performance of the equipment (16 respondents), the dollar amount of the incentive (15 respondents), and the interactions with a representative from the IESO (14 respondents). Two respondents reported having experience with a technical study or report related to the Process and Systems Upgrade Program, and both participants gave a 5 rating to the content and presentation of these studies.

A further indicator of the high satisfaction that respondents had with the program was the lack of low ratings provided. Only two 1-ratings were given across all program factors, one for the time it took to receive the incentive and one for interactions with LDC staff.

Figure 8-34: Participant Satisfaction (n=17)
(Rating of 4 or 5 on a scale of 1 to 5)



Finally, the team asked respondents to rate their likelihood to recommend the HPNC program using a 1 to 5 scale.[96] Out of 15 responses, 11 rated this as a 5, three as a 4, and one as a 3. No respondents gave

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[96] Scale is 1 to 5, where 1 means “extremely unlikely”, 2 means “somewhat unlikely”, 3 means “neither likely nor unlikely”, 4 means “somewhat likely” and 5 means “extremely likely”.

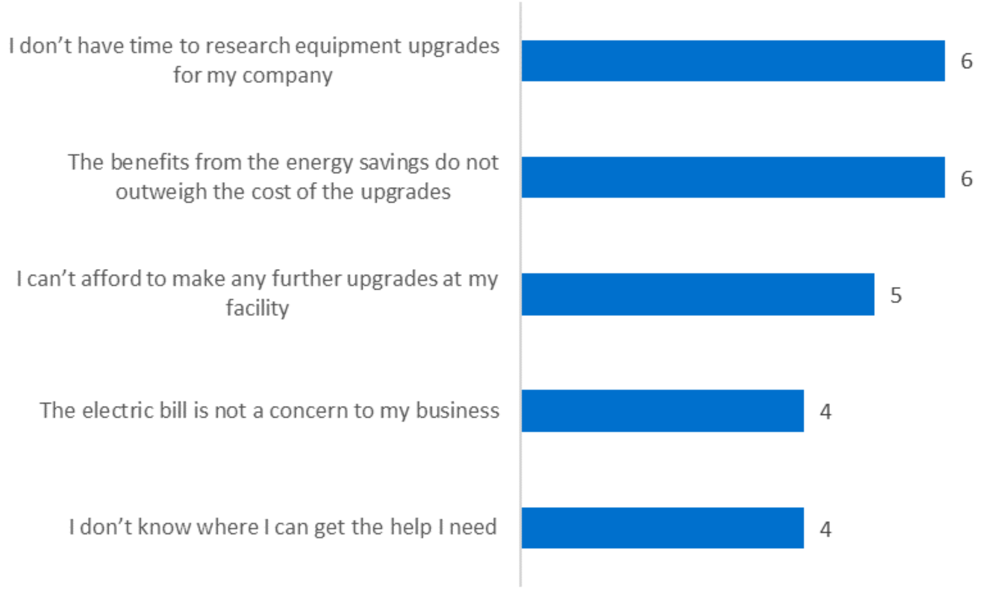
ratings below a 3. These responses, with an average rating of 4.7, suggest that participants are extremely likely to recommend the program. This result is significant, as word-of-mouth recommendations were the way that many respondents reported learning about HPNC.

8.2.5.6 Barriers to Future Participation

Figure 8-35 shows the responses related to why it could be difficult for HPNC participants to make future energy efficient equipment upgrades. Using a scale of 1 to 5 to rate the extent to which they agreed with a statement, respondents reported that the primary barriers to future efficient upgrades were a lack of time to research equipment upgrades and the benefits not outweighing the costs (six ratings of 4 or 5 for each).[97]

Other challenges included the electric bill not being a concern, not being able to afford the upgrades, and being unaware of where to get the necessary help, all rated 4 or 5 by five respondents. All 17 respondents gave a rating of 1 to the potential barrier of equipment being leased, implying that the respondents owned all their equipment. One respondent added that they had already upgraded all their equipment as a reason they would not be making future upgrades. Although five respondents gave 4 or 5 ratings to the electric bill not being a concern, this statement also received eight ratings of 1, suggesting that the electric bill was a substantial concern to many respondents when considering future upgrades.

Figure 8-35: Barriers to Future Participation (n=17)
(Rating of 4 or 5 on a scale of 1 to 5)



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[97] Scale is 1 to 5, where 1 means "not at all relevant", 2 means "slightly relevant", 3 means "somewhat relevant", 4 means "very relevant" and 5 means "extremely relevant".

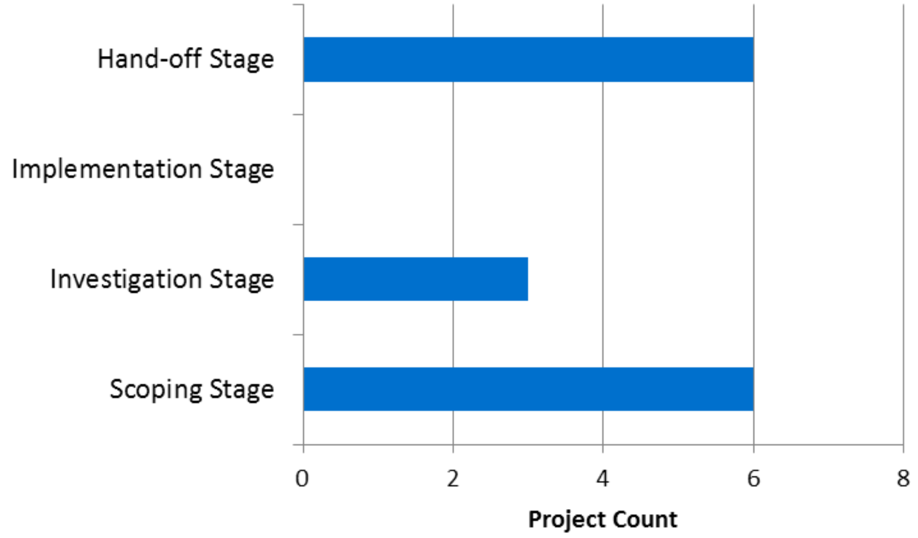
9 Existing Building Commissioning Program

9.1 Impact Evaluation

9.1.1 Participation

In 2017, there were 15 projects in various stages of completion in the EBCx pipeline, as shown in Figure 9-1. Six projects completed the hand-off stage in 2017.

Figure 9-1: EBCx Project Pipeline



All six of the projects completed in 2017 were commissioned by the same commissioning agent and involved chilled water systems in four office buildings and two hospitals. While the building type and commissioning agents were similar, the system configurations being commissioned and the recommended measures were varied due to the loads being served and the interaction of system components. Measures implemented ranged from chilled water and condenser water temperature reset strategies, to cleaning of the condenser and evaporator and optimization of chiller sequencing in order to stabilize compressor power.

9.1.2 Impact Results

The energy and demand impact results of the sample analysis are shown in Table 9-1 and Table 9-2, respectively. The verified gross energy savings were found to be identical to the reported energy savings. This was a result of both commissioning agents modeling hourly estimated cooling load across the cooling season (or year round in the case of plants serving data centers), based on Canadian Weather Year for Energy Calculation (CWEC) data. Chilled water plant power was monitored during the baseline and post-implementation phases of the project in order to generate regressions of the plant power compared to outside air temperature. These regressions of measured chiller plant kW against outside air temperature were then used to generate the baseline plant energy consumption and hand-off phase energy savings.

Table 9-1: 2015 EBCx Program Impact Results - Energy

Reported Energy Savings (GWh)	Realization Rate	Gross Verified Energy Savings (GWh)	Net-to-Gross Ratio	Net Verified Energy Savings (GWh)	Net Verified Energy Savings in 2020 (GWh)	Lifetime Net Verified Energy Savings (GWh)
1.61	100%	1.61	55%	0.88	0.88	4.41

Table 9-2: 2015 EBCx Program Impact Results - Demand

Reported Summer Demand Savings (MW)	Realization Rate	Gross Verified Summer Demand Savings (MW)	Net-to-Gross Ratio	Net Verified Summer Demand Savings (MW)	Net Verified Demand Savings in 2020
0.147	99.5%	0.146	55%	0.080	0.080

The overall demand realization rate was less than 99.5% due to one project’s measures yielding zero demand savings during peak compressor operation. This one project was the smallest contributor of reported demand savings (0.5% of the total reported demand savings).

9.1.3 Comparison of 2017 with 2016 and 2015

The number of EBCx projects completed in 2017 decreased from seven to six. Total net verified energy, shown in Figure 9-2, increased 31% in 2017 since the average savings per project of the 2017 projects was 53% greater than the 2016 projects due to one very large verified project in the 2017 population. Total net verified demand savings decreased slightly (-3%) compared to 2016.

Figure 9-2: Net Verified Energy Savings, 2017 vs. 2016 vs. 2015

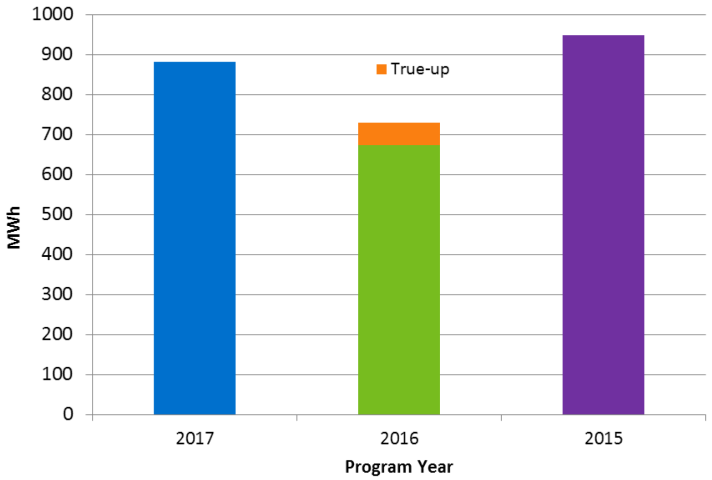
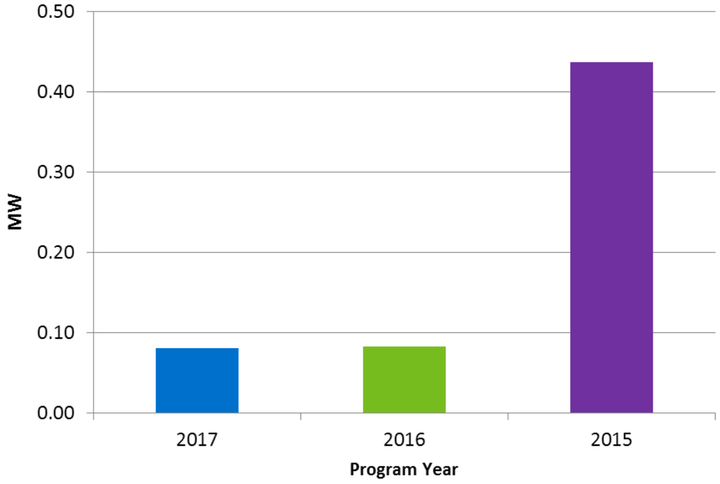


Figure 9-3: Net Verified Demand Savings, 2017 vs. 2016 vs. 2015



9.1.4 Lifetime Savings

The EBCx program achieved 4,411 MWh of net verified lifetime energy savings. The lifetime energy savings are based on a conservative assumption of a five-year EUL that was made in consideration of the types of measures attributable to the program and a review of literature and other prominent commissioning programs including those in Pennsylvania[98] and Illinois, .

9.1.5 Avoided Greenhouse Gas Emissions

The evaluation team used the IESO Conservation and Demand Management (CDM) Energy Efficiency Cost Effectiveness Tool to calculate avoided GHG emissions. Avoided GHG emissions were calculated for the first year or the 2017 program year and for the lifetime of the measures. Table 9-3 below presents the results of these calculations.

Table 9-3: EBCx Avoided Greenhouse Gas Emissions

Program Year	First Year GHG Avoided (Tonnes CO_2 equivalent)			Lifetime GHG Avoided Tonnes CO_2 equivalent)		
	Electric	Gas	Total	Electric	Gas	Total
2017	222.37	-	222.37	1,248.87	-	1,248.87

9.1.6 Cost Effectiveness

The evaluation team conducted a cost effectiveness analysis for the EBCx program. Cost effectiveness results are presented in Table 9-4. The EBCx program did not meet the required the TRC test and the PAC test thresholds; with both costs exceeding their respective benefits. The program cost effectiveness declined compared to 2016. In 2016 the program met the TRC test with a benefit ratio of 1.6 and PAC ratio of 1.4.

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[98] http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information/technical_reference_manual.aspx

There are several reasons the cost effectiveness declined in 2017. These include 1) an increase in the amount of incentives paid out relative to the amount of savings, 2) and decrease in the average energy savings per project, 3) an increase in the average incremental costs per project and 4) a backlog of projects that received incentives but have not yet been completed. The average per-project incentive increased 350% between 2016 and 2017. This increase is primarily due to one very large 2017 project with higher than usual incentives. The average energy savings per project decreased from 672,517 kWh in 2016 to 267,847 kWh I 2017. The average incremental cost of project increased from $6,071 in 2016 to $7,398 in 2017.

Table 9-4: EBCx Cost Effectiveness Results

Cost Effectiveness Test	Value
Total Resource Cost (TRC)	
TRC Costs ($)	$409,515
TRC Benefits ($)	$256,992
TRC Net Benefits ($)	-$152,522
TRC Net Benefit (Ratio)	0.63
Program Administrator Cost (PAC)	
PAC Costs ($)	$487,869
PAC Benefits ($)	$223,472
PAC Net Benefits ($)	-$264,397
PAC Net Benefit (Ratio)	0.46
Levelized Unit Energy Cost (LUEC)	
$/MWh	$125.20
$/MW	$1,377,831

The changes in the CE results between the 2015 and 2017 program years are shown in Table 9-5. These changes are influenced by the amount of projects completed in each program year, the magnitude of savings from these projects and the amount of program costs associated with both completed projects and projects in the program pipeline.

Table 9-5: Cost Effectiveness Comparison

Evaluation Year	TRC Test	PAC Test	Demand LUEC ($/MW)	Energy LUEC ($/MWh)
2017	0.63	0.46	$1,377,831	$125.20
2016	1.37	1.19	$337,487	$41.45
2015	0.23	0.20	$730,821	$337.16

9.1.7 Net-to-Gross

NTG observations for the EBCx Program are provided in the following subsections and detailed observations are provided in Appendix D. Additional details regarding the NTG methodology can be found in Appendix C.

9.1.7.1 Key Observations

The key NTG observations from the 2017 EBCx program impact evaluation are as follows:

- When asked what they would have done if they had never learned they could get incentives from the EBCx program, two of the three EBCx participants said they would have scaled back on the size or extent of their upgrades by a moderate amount, and one respondent said they would have done the exact same upgrade; this feedback is indicative of a higher levels of free-ridership.
- Previous experience with energy saving programs, availability of program incentives, and results of any audits or technical studies influenced two of the three respondents' decisions to perform the energy efficient upgrades.
- The participant survey did not find evidence of spillover.

9.1.7.2 NTG Strata Level Results

Table 9-6 shows the results of the 2017 EBCx program NTG evaluation. All LDCs included in the program were assigned the province-wide NTG values. The following subsections summarize the analyses completed to help interpret these values.

Table 9-6 NTG Assignments – EBCx Program

NTG Assignment	Sample size	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG *%	Demand Savings Weighted NTG* %
Province-wide	3	45.1%	0%	0%	54.9%	54.9%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net to gross.

9.1.7.3 Free-Ridership

The evaluation team assessed the extent of free-ridership within the program by asking participants a series of questions about their experiences and plans before learning about the program, what they would have done in the absence of the program, and how influential the program was on the participant's decision to do the energy-efficient upgrades.

The evaluation team first asked the three respondents when they had learned that they could receive energy efficiency incentives through the EBCx program. Two respondents stated they learned about the program before they started planning the upgrades. The remaining respondent mentioned that they had already started planning the upgrade before they learned about the program, but they had not started implementing the upgrade. All the respondents submitted their application before they began implementing their upgrades. This feedback is not directly used in the free-ridership estimation but is instead intended to provide additional context around the respondents' decision-making.

Had they not learned about the upgrades, two respondents would have scaled back on the size or extent of their upgrades by a moderate amount. The third respondent, who reported having the funds to cover the entire cost of the project, would have done the exact same upgrade anyway. This question regarding respondent intent in the absence of the program is used in the free-ridership estimation. Their responses are indicative of free-ridership, though the two respondents who would have done the work but would have had to scale it back are allotted lower (and thus more favorable) free-ridership scores than those who would have done the exact same project anyway.

The evaluation team also asked the respondents to use a 1 to 5 scale to rate how program features, such as the availability of the program incentive, information provided by representatives and contractors, and marketing influenced their decision to make upgrades.[99] This question, along with the previous question regarding participant intent in the absence of the program, is used in the free-ridership estimation. The following factors were very influential or extremely influential for two of the respondents:

- Previous experience with any energy saving program (two respondents rated this factor as extremely influential).
- Availability of the program incentive (two respondents rated this factor as very influential or extremely influential; one respondent rated it as not at all influential).).
- The results of any audits or technical studies (two respondents rated this factor as very influential; one respondent rated this factor as somewhat influential).

Recommendations provided by an LDC representative were less influential, with one respondent indicating it was very influential and two respondents indicating it was somewhat influential.

Information or recommendations from commissioning agents, contractors, vendors, or suppliers associated with the program, as well as marketing material from their LDC, played minor roles in influencing respondents to do the upgrades. For each factor, two respondents said these factors was somewhat influential while one respondent indicated these factors were only slightly influential.

9.1.7.4 Spillover

The participant survey did not find evidence of spillover.

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[99] Scale is 1 to 5, where 1 means "not influential at all", 2 means "slightly influential", 3 means "somewhat influential", 4 means "very influential" and 5 means "extremely influential".

9.2 Process Evaluation

The following subsections outline the process evaluation results of the EBCx Program. Responses have been summarized and detailed observations are provided in Appendix I. Additional details regarding the process methodology can be found in Appendix F.

9.2.1 LDC Staff Perspectives

The following subsections highlight the feedback received from LDC staff about the design and implementation of the EBCx Program in 2017.

9.2.1.1 Key Observations

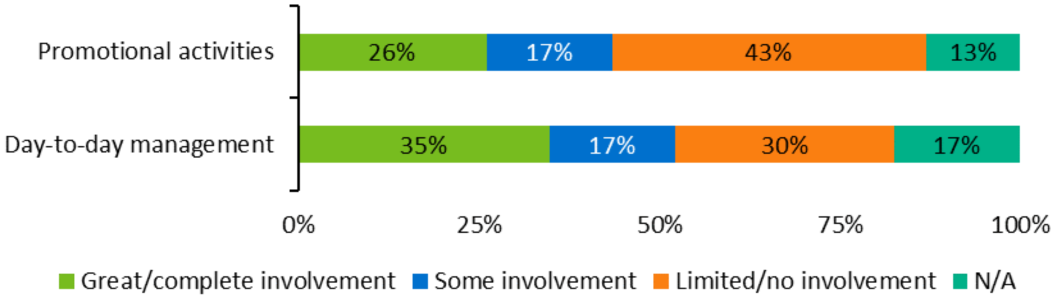
Key findings from LDC staff responses include the following:

- Less than half of the LDC staff surveyed were involved in the daily management (35%) or promotional activities (26%) related to the EBCx Program, and 65% expect that in 2018 their LDC will maintain its same level of involvement and engagement.
- On average, the LDC staff estimated that 1% of their LDC's total resources were allocated to the EBCx Program.
- LDCs most commonly (43%) managed the EBCx Program by using primarily in-house staff.
- The single largest barrier to increased customer participation in the EBCx Program is the lack of customer understanding, which was mentioned by 17% of LDC staff.

9.2.1.2 LDC Staff Involvement

More than one-third of the surveyed LDC staff (35%) responded that they were greatly involved in the day-to-day management of the EBCx Program and about one-fourth (26%) were greatly involved in its promotional activities ((Figure 9-4).

Figure 9-4 Level of 2018 LDC Involvement in the EBCx Program (n=23)

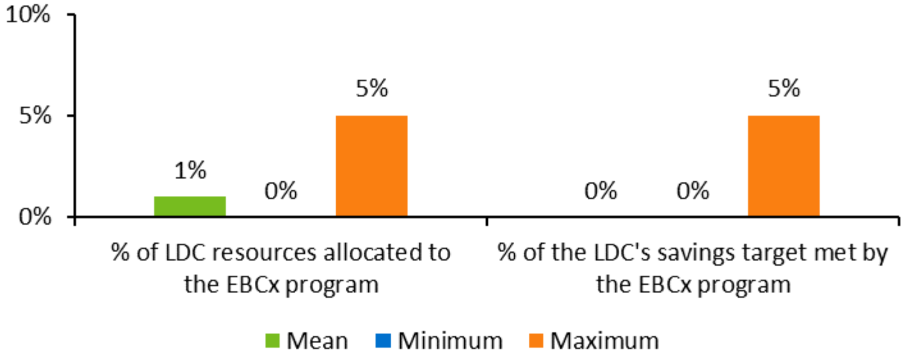


Nearly two-thirds (65%) of the LDC staff (n=23) expected that in 2018 their LDC will maintain its same level of involvement and engagement in the EBCx Program. Thirteen percent expect their LDC will increase its level of involvement, 9% expect to be less involved, and 9% indicated this is not applicable to them.

9.2.1.3 Allocated Resources and Expected Savings

The LDC staff was asked to estimate the approximate percentage of total resources their LDC allocated to the EBCx Program (Figure 9-5). On average, LDC staff estimated that 1% of their LDC's total resources were allocated to the EBCx Program. Responses ranged from 0% to 5% of resources. When asked what percent of their LDC's 2017 savings target would be met by the EBCx Program, LDC staff estimated an average of 0% with a minimum answer of 0% and a maximum of 5%.

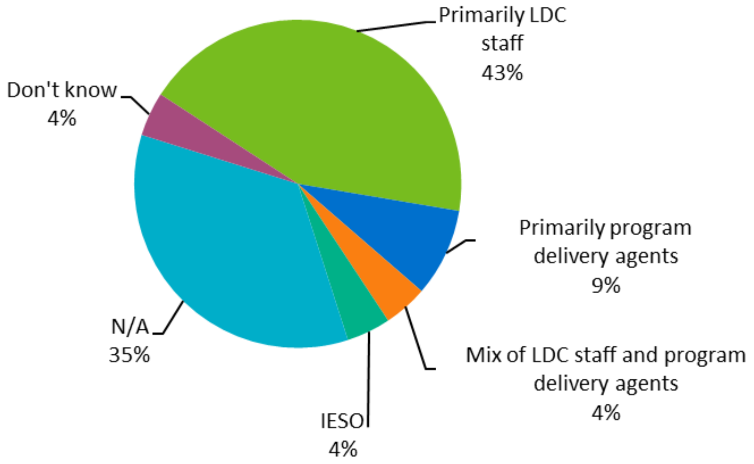
Figure 9-5 Allocated Resources and Expected Savings (n=25)



9.2.1.4 Program Management and Implementation

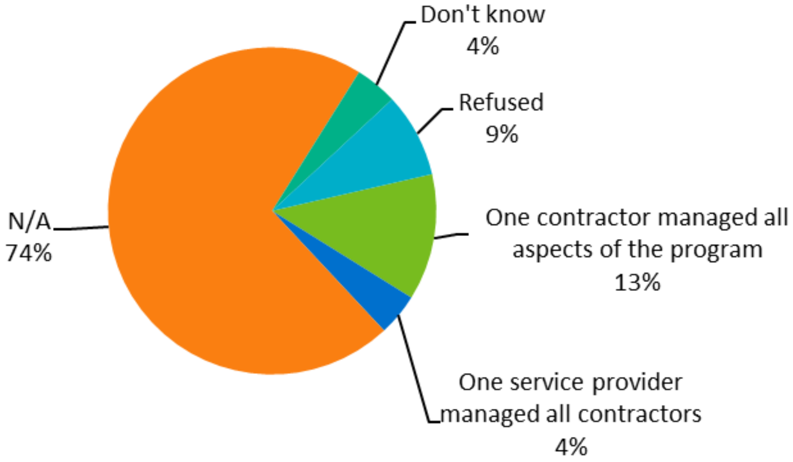
Forty-three percent the surveyed LDC staff reported that they managed and delivered the EBCx Program to market by primarily using in-house LDC staff (Figure 9-6). Nine percent used primarily program delivery agents, 4% used mixture of LDC staff and program delivery agents, and 4% delivered the program through IESO.

Figure 9-6 Program Management and Delivery (n=23)



The survey asked LDC staff how their LDC managed the contractors that were necessary to conduct any installations for the EBCx Program in 2017 (Figure 9-7). Most commonly, LDC staff indicated that their LDC engaged one contractor to manage all aspects of the program (13%) or one service provider to manage all contractors (4%).

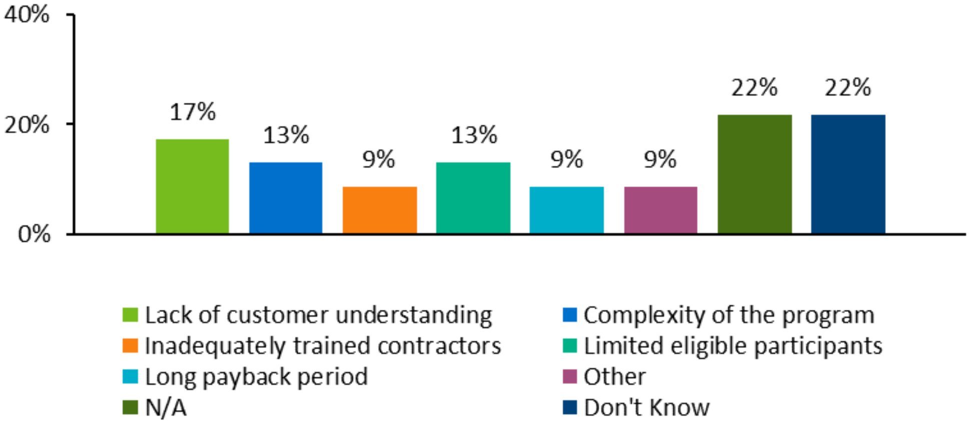
Figure 9-7 Contractor Management (n=23)



9.2.1.5 Barriers to Increased Customer Participation

As shown inFigure 9-8, the survey asked LDC staff about the single largest barrier to greater customer participation for each program. The most common responses include lack of customer understanding (17%) and %), the complexity of the program (13%). The percentage of respondents that mentioned cost of upgrades decreased significantly in 2017 compared to 2016 (0% and 9%, respectively).

Figure 9-8: Barriers to Customer Participation (multiple response allowed; n=23)



9.2.1.6 Expected Changes for 2018

The majority (86%) of surveyed LDC staff (n=21) indicated that their LDC's approach to implementing the EBCx Program in 2018 did not change from 2017. One LDC (5%) indicated making a change to implementation, citing that there are limited eligible customers interested in participating. Ten percent of LDC staff stated that this is not applicable to their LDC. Compared to 2016 results, a significant increase in LDCs in 2017 did not make changes to how the EBCx Program was implemented (62% and 86%, respectively).

9.2.2 TPE Staff Perspectives

The following subsections highlight the feedback received from the PDA and/or TPE staff who provided support to the implementation of the EBCx program in 2017. Feedback was received through a web survey that was administered in April 2018. Only one of the responding PDA and/or TPE firms provided support to the program in 2017, acting only as a TPE and not as a PDA. Therefore, the following subsections summarize the responses from this firm.

9.2.2.1 Key Observations

Key observations from TPE staff responses include the following:

- The process the TPE firm used to review applications involved an overall review to ensure that the application was complete and compliant with program rules, as well as a detailed review of the energy savings calculations and verification of proper documentation of the inputs to the calculations.

9.2.2.2 Respondent Roles and LDCs Supported

The responding TPE firm supported two LDCs in the delivery of the EBCx program in 2017. The firm provided TPE and audit support to the program and reported there were no issues with having multiple roles on EBCx projects.

The survey asked the respondent to describe the activities or duties that were involved in providing TPE support to the EBCx program in 2017. The firm indicated providing a mix of services as part of their role as a TPE including:

- an overall review to ensure that the application was complete and compliant with program rules,
- a detailed review of the energy savings calculations and verification of proper documentation of the inputs to the calculations,
- and a post-installation review to confirm installation of the proper equipment.

9.2.2.3 Review of Customer Applications

The responding TPE firm was responsible for reviewing customer applications for the 2017 EBCx program. The survey asked if their application review included assessing if the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program. The respondent indicated that making this type of assessment was not part of their application review process; however, it is possible that the LDC or some other entity performs this level of review.

9.2.2.4 TPE Interactions and Satisfaction with LDCs, IESO, and Customers

TPE Interactions and Satisfaction with LDCs: The survey asked the responding TPE firm to describe the nature or purpose of their interactions with the LDCs when providing support services to the EBCx program in 2017. The TPE firm reported that timing and amount of interaction with the two LDCs served was similar and occurred throughout the course of the review process. The TPE respondent provided the following context:

“Communication occurs throughout the process, from the time the review for the application is assigned until the application has been approved (or rejected). Any and all questions [we have] for the applicant are typically passed through the LDC. Requests for documentation, clarification, and edits to ensure a complete and accurate review are the most common causes for communication.”.

The survey asked the respondent to rate their level of satisfaction with specific elements of communications with the LDCs.[100] The firm indicated they were completely satisfied with their overall interactions with the LDCs, clarity on program goals, clarity on coordination needs, level of communication and collaboration, and clarity on roles and responsibilities of the different organizations involved in administering the program.

Program Support Received from the LDCs: The survey asked the TPE respondent what support their firm received from the LDCs to help in their role as the TPE in 2017. The firm indicated receiving responses to their questions as a general form of support provided by both LDCs. In addition, the LDCs act as the point of contact between the customer and the TPE staff. The respondent explained:

"The LDCs act as the middleman, so that the applicant as well as the evaluators would only have one point of contact. This ensures that the LDC is always involved in their applications, and as the TPE we can focus on our role in evaluating applications and not chasing down applicants for different reasons.".

The survey asked if the firm had any suggestions for additional support they would recommend the LDCs provide to the PDAs and TPEs. The firm did not have any specific suggestions for additional support.

TPE Interactions with Customers, Marketing, and Outreach: The survey asked the TPE respondent how frequently their firm interacted directly with customers. The respondent indicated they had infrequent customer interactions that occurred only when the LDC specifically requested the TPE firm contact the applicant directly.

The survey asked the respondent to describe the nature of their interactions with customers. The TPE firm reported they typically reached out to customers for clarification of application details, to gather documentation in support of the application, or to conduct a site visit inspection.

The survey asked the respondent what role their firm played in marketing the EBCx program. The TPE firm indicated they did not actively market the program.

9.2.2.5 Perspectives on Motivations, Barriers, and Suggestions for Program Improvement

The survey asked the TPE firm to use a scale of 1 to 5 to rate how influential certain factors were on the customer's decision to install the program-qualifying equipment.[101] The TPE firm indicated that many factors were very influential or extremely influential on their customer's decision to install the program-qualifying equipment, including the ability to save energy and lower their energy bills, to be associated with "green" or "sustainable" actions, to receive the incentive, and to increase comfort and/or productivity. This firm also thought that customer's trust that equipment incentivized by the IESO must be reliable was a very influential factor in the decision to install program-qualifying equipment.

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[100] Scale is 1 to 5, where 1 means "not at all satisfied," 2 means "somewhat dissatisfied," 3 means "neither satisfied nor dissatisfied," 4 means "somewhat satisfied," and 5 means "completely satisfied."

[101] Scale is 1 to 5, where 1 means the factor had "no influence at all," 2 means it was "slightly influential," 3 means it was "somewhat influential," 4 means it was "very influential," and 5 means it had a "extremely influential."

The survey also asked the TPE respondent what they thought were the primary barriers to increased customer participation. The respondent did not know what barriers may have prevented the customer from participating in the program.

The survey asked the TPE firm if they had any suggestions for improvements to the EBCx program. The firm did not have any suggestions for program improvements.

9.2.3 Participant and Commissioning Agent Perspectives

The following subsections highlight the feedback received from the five EBCx participant surveys and the one Commissioning Agent that was involved with EBCx projects in 2017. This agent has significant experience with the program, having operated in it since 2012. Three of the participant surveys were taken by one respondent (Participant 3), who was responsible for projects at three properties owned by the same company. His responses regarding all three were identical except for some small variation in firmographic data, and thus, will be treated as one, save the firmographic data described in Section 9.2.3.1 below. The EBCx participant survey, conducted over the phone, asked a series of questions encompassing respondent characteristics, program outreach and marketing, participant motives and decision making, participant satisfaction, and firm characteristics. The Commissioning Agent was asked questions regarding customer awareness, perceptions, and engagement, as well as descriptions of the phases of the program, his satisfaction with the program, and recommendations for program improvement.

9.2.3.1 Key Observations

Key observations from these responses include the following:

- All respondents noted high levels of satisfaction with the program.
- The commissioning agent cited project completion time as a significant problem. He cited a large amount of data gathering and reporting, as well as the lack of an implementation schedule and project management position as central causes of this problem.

9.2.3.2 Participant Firmographics

Participants were asked basic firmographic questions, as well as what their position in the company was. One respondent is an Energy Manager, another is a Technical Engineering Specialist, and the third (who is responsible for three projects) is an Energy Sustainability Analyst. Additional firmographic information is reported in Table 9-7. It is of note that only one respondent provided a reliable response to a question about energy consumption, which was estimated at 600,000 kWh. Participant 3 broadly estimated the consumption of the three facilities he was responsible for between 200,000 kWh and 3,000,000 kWh.

Table 9-7: Participant Firmographics

Do you own or rent the facility(ies) where the program/pilot upgrades were made for this project in 2016?	
Own	5
Rent	0
Is your business part of a chain or franchise?*	
Yes	1
No	4
What are the primary activities conducted at this/these facility(ies)?	
Manufacturing	1
Healthcare	1
Data Center/Office	1
Data Center	2
What is the square footage of the facility(ies)?	
30,000-45,000	2
315,000-340,000	3
How many employees are located in the facility(ies)?	
700-800	1
2,000	1
Don’t Know	3

*Participant three’s properties are part of a large, multinational corporation.

9.2.3.3 Program Outreach and Marketing

To assess how the EBCx program reached potential participants, the three surveyed EBCx participants were asked how they first heard about the program. Two heard about the program via a representative from the LDC (from both contact from and to the utility), and the other heard about the program via consultants.

9.2.3.4 Other LDC Energy Efficiency Program Awareness

Respondents were asked whether they were aware of other energy efficiency programs offered by their LDC. These results are displayed in Table 9-8. Participant 1 had heard of all but one program, and Participants 2 and 3 had heard of roughly half of the programs. Of the 12 programs respondents were asked about, only two had been heard of by all three respondents: the Audit Funding and Retrofit programs.

Table 9-8: Awareness of Other Energy Efficiency Programs

What other business programs offered through your LDC are you aware of?	Participant 1 Response	Participant 2 Response	Participant 3 Response
SBL	NA	Y	NA
HPNC	Y	Y	N
Audit Funding	Y	Y	Y
Retrofit Program	Y	Y	Y
BRI	Y	N	N
Process and System Upgrades (PSU)	Y	Y	Y
Pumpsaver	Y	N	Y
OPSaver	N	N	Y
RTU Saver	Y	N	Y
Small & Medium Business Energy Management System Innovation Pilot	Y	Y	N
Intelligent Air Technology Pilot	Y	N	N
Data Centre Pilot	Y	N	Y

9.2.3.5 Participant Motives and Decision-making

The survey asked participants to rate on a 1 to 5 scale what non-program specific factors influenced their decision to participate in the program.[102] As was the case in the last program cycle, cost reduction is the strongest motivator, by either taking the opportunity to save on initial costs of upgrades via energy efficiency incentives, or by seeking less expensive energy bills via energy saving upgrades. Detailed results are presented in Table 9-9.

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[102] Scale is 1 to 5, where 1 means “not influential at all”, 2 means “slightly influential”, 3 means “somewhat influential”, 4 means “very influential” and 5 means “extremely influential”.

Table 9-9: Motives for Participating in the EBCx Program

Motive*	Participant 1 Response	Participant 2 Response	Participant 3 Response
Because your contractor, commissioning agent, program representative, or other vendor recommended it	1	4	1
To take advantage of the opportunity for efficiency upgrades at a reduced cost	5	5	4
Because it was easy to participate in the program	3	4	2
Because you knew that any equipment or service the utility or IESO would incentivize must be reliable	4	4	1
To save energy or lower your energy bills	3	5	5
To be associated with “green” or “sustainable” actions	3	4	4
To increase comfort and/or productivity	2	4	1
To adhere to a sustainability / energy efficiency policy at your organization	3	3	NA

While Participant 3 was not aware of any policies directing sustainability or energy efficiency at his company, Participants 1 and 2 indicated the presence of a sustainability policy at their companies, though they also indicated that standards for said policy were informal. In these cases, it appears that the lack of policies, or requirements within them, were not important motivators for, or barriers to, participation in the EBCx Program.

Further, the program and application materials were not a barrier for respondents. The survey asked them to answer three questions regarding their agreement with positive statements about the effectiveness of program materials and the ease of application on a scale from 1 to 5.[103] All three questions received a 4 or 5 from all three respondents. This is not surprising, however, because the commissioning agent reported that he files 100% of the paperwork. He does so to ensure accuracy and keep the review and approval processes moving. To the agent, the primary problem with the program is that projects move much too slowly, mainly due to what he calls “onerous” requirements for data collection, reporting, and review. In terms of the latter, the agent cited delays that are a result of people who are not engineers reviewing and commenting on engineering reports. Addressing the concerns raised in such reviews can cause substantial delays. These concerns, according to him, would not be raised by an engineer.

Finally, the evaluation team asked all respondents to rate on a 1 to 5 scale their level of agreement with several statements about reasons why it could be difficult for their company to make future energy efficient equipment upgrades.[104] Two potential barriers arose: the initial affordability of energy efficiency equipment, and concerns about cost/benefit savings. It should be noted, however, that respondents reported these two barriers were only somewhat relevant.

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[103] Scale is 1 to 5, where 1 means “do not agree at all”, 2 means “somewhat disagree”, 3 means “neither agree nor disagree”, 4 means “somewhat agree” and 5 means “completely agree”.

[104] Scale is 1 to 5, where 1 means “not at all relevant”, 2 means “slightly relevant”, 3 means “somewhat relevant”, 4 means “very relevant” and 5 means “extremely relevant”.

9.2.3.6 Participant Satisfaction

To assess satisfaction with program components, participants were asked to rate given program-related factors on a five-point scale.105 As was the case in PY 2016, respondents reported high levels of satisfaction with the aspects of the program illustrated in Table 9-10, and expressed high levels of satisfaction with the program overall, as did the commissioning agent. The lowest rated element of the program, in some contrast to PY 2016, was the time it took to receive the incentive (also described by the commissioning agent as a problem, though the timeliness of the incentive reimbursement differs for each LDC), and the highest rated elements of the program were the interactions participants had with LDC representatives and the energy savings from the commissioned equipment. Further supporting these high overall satisfaction ratings were all three participant's declarations that they would be "extremely likely" to recommend the program to others.

Table 9-10: Satisfaction with Program and Program Elements

Using a scale from 1 to 5, where 1 means "not at all satisfied" and 5 means "completely satisfied", please rate your satisfaction with the following program-related factors:	Participant 1 Response	Participant 2 Response	Participant 3 Response
The time it took to receive the incentive	4	4	3
The quality of work done by the contractor / commissioning agent who commissioned the equipment	5	4	3
The dollar amount of the incentive	3	5	4
The interactions you had with representatives from LDC	5	4	4
The interactions you had with a representative from Ontario's Independent Electric System Operator (IESO)	N/A	N/A	N/A
The content and presentation of related studies and commissioning reports	4	4	4
The performance of the efficient equipment	4	4	4
The energy savings achieved from the commissioned equipment	4	5	4
The program overall	4	5	4

*"1" response = "not at all satisfied," "5" response = "completely satisfied."

9.2.3.7 Suggestions for Program Improvement

Overall, the participants and the commissioning agent were satisfied with the program, though there are some areas that may need adjustment.

- Consider ways to reduce the amount of reporting and data collection that must occur. The agent suggested combining the scoping and investigation phases together and combining the implementation and completion phases together. Because reports must be filed at each of the four stages, combining phases could significantly reduce the amount of reporting and drastically speed up project completion and cut costs for customers.
- Evaluate the feasibility of building some opportunity for funds for a project manager into the program. The agent is often the engine of projects, and spends significant time submitting paperwork, making

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[105] Scale is 1 to 5, where 1 means "not at all satisfied", 2 means "somewhat unsatisfied", 3 means "neither satisfied or unsatisfied", 4 means "somewhat satisfied", and 5 means "completely satisfied".

sure deadlines are met, setting meetings, maintaining contact with contractors, and other duties not explicitly included in his role.

- Following this, consider requiring an implementation schedule in the investigation report.
- Consider making incentive payments to trade partners at the front end of service processes, when applicable. This could reduce up-front costs to participants, and could increase participation. These costs were cited by EBCx participants and the agent as a potentially significant barrier to investment in efficiency upgrades.

10 Cross-Cutting Process Evaluation Results

10.1 Program Background

The following subsections highlight the cross-cutting feedback received from the IESO and LDC staff about the design and implementation of the CFF Business Programs in 2017. Responses have been summarized and detailed feedback can be found in Appendix I. Additional details regarding the process methodology can be found in Appendix F.

10.1.1 LDC Staff

LDC staff who responded to the survey provided estimates of the percent of total 2017 resources that their LDC had allocated to each CFF Business Program. On average, the Retrofit Program received the highest percentage of the total CFF Business Programs budget (61%), as seen in Table 10-1.

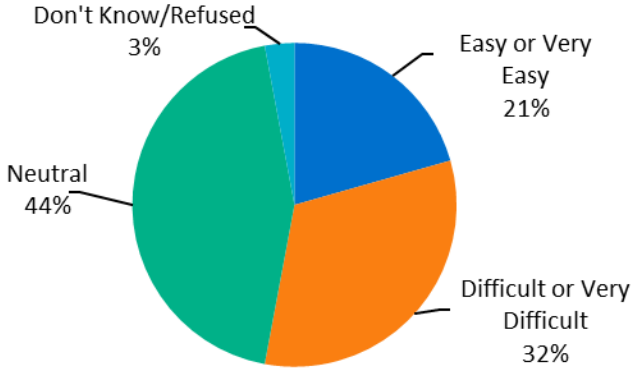
LDC staff also provided estimates of the percentage of their LDC’s 2017 savings targets that they expect to come from each program. On average, LDC staff expect that the Retrofit Program will provide most of their savings target (61%) followed by the SBL Program at 7%. Table 10-1 shows the expected savings target for the other programs.

Table 10-1 LDC Allocated Resources and Expected Savings in 2017

Program	% of Total Resources Allocated	Expected % of Savings Target
Retrofit Program (n=32)		
Mean	61%	61%
Minimum	30%	1%
Maximum	90%	97%
SBL Program (n=29)		
Mean	9%	7%
Minimum	0%	0%
Maximum	35%	29%
HPNC Program (n=31)		
Mean	4%	3%
Minimum	0%	0%
Maximum	11%	33%
Audit Funding Program (n=29)		
Mean	3%	2%
Minimum	0%	0%
Maximum	10%	8%
EBCx Program (n=25)		
Mean	1%	0%
Minimum	0%	0%
Maximum	5%	5%
BRI Program (n=24)		
Mean	3%	1%
Minimum	0%	0%
Maximum	10%	10%
Other Business Programs (n=25)		
Mean	13%	9%
Minimum	0%	0%
Maximum	46%	68%

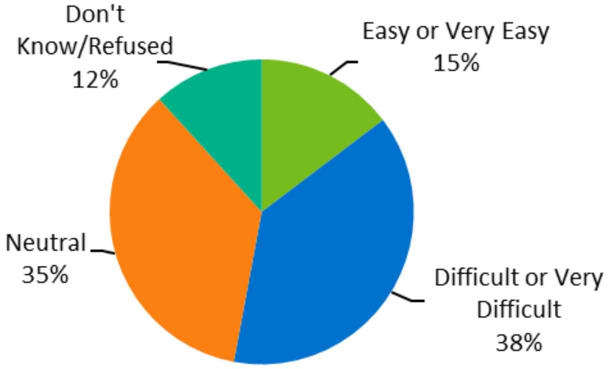
Just under one-third of the LDC staff (32%) stated that it was difficult or very difficult for their LDC to achieve its energy savings targets in 2017 (Figure 10-1). Of the LDCs that stated it was difficult, 9% said this was due to the amount and level of effort needed to achieve the desired results. Six percent indicated reaching their 2017 target was difficult because of the amount and level of effort needed to provide high quality customer service. Another 6% explained that it was difficult because savings are consolidated to only a few large projects that don’t always get completed when expected. Twenty-one percent of LDC staff said it was easy or very easy for their LDC to achieve its energy savings targets in 2017.

Figure 10-1 Ease of Achieving Energy Savings Targets in 2017 (n=34)



Over one-third of LDCs (38%) expect that it will be difficult or very difficult for their LDC to reach its energy savings target in 2018 (Figure 10-2). Of those who stated that it would be difficult, 9% said this was due to the increase in market saturation. Other explanations for difficulty reaching savings targets include the amount and level of effort needed to achieve the desired results, the timing of projects (and changes to project scheduling projections), and demonstrated low savings to date, each of which were cited by 6% of LDCs. Only 15% of LDC staff said it will be easy or very easy for their LDC to achieve its energy savings targets in 2018.

Figure 10-2 Ease of Achieving Energy Savings Targets in 2018 (n=34)



10.1.2 IESO Staff

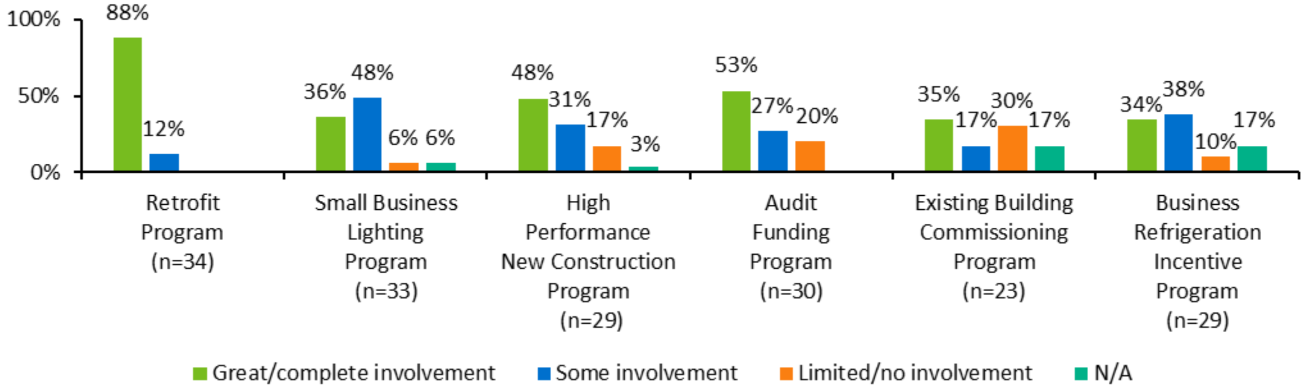
The evaluation team asked IESO staff to describe the overall goals of the Save on Energy Business Programs. They noted that in terms of the overall framework, the business programs are responsible for cost-effectively delivering most savings across the province. Staff said that the Business Programs are forecasted to be ahead of targets and spending is under budget. The Retrofit Program continues to be the greatest contributor in terms of cost-effectiveness and savings achieved. Staff said that other programs in the business portfolio have not had as much uptake and there may be a need to revisit these programs to see if there are ways to improve upon them.

10.2 Program Administration

10.2.1 LDC Staff

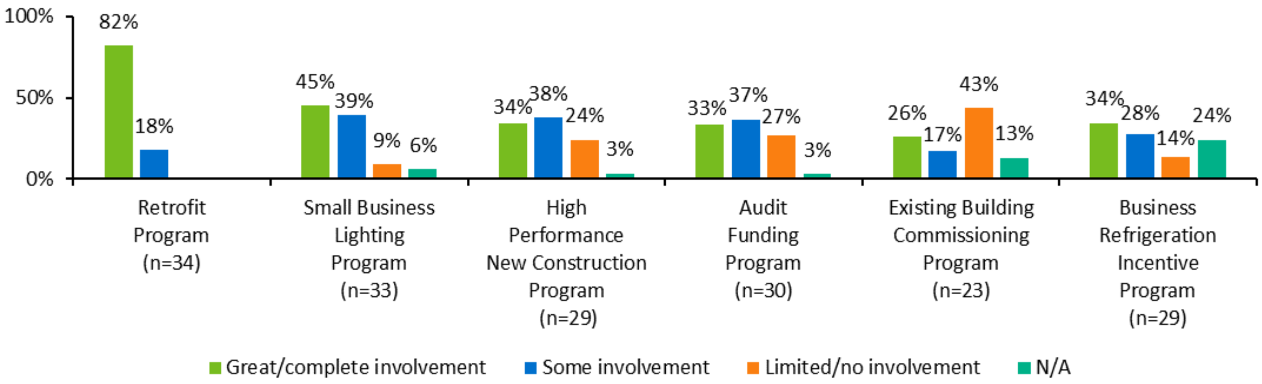
Almost nine-tenths of responding LDC staff (88%) were greatly or completely involved in the day-to-day management of the Retrofit Program, and the remaining 12% were somewhat involved (Figure 10-3). About half of LDC staff indicated they were heavily involved in the Audit Funding Program (53%) and HPNC Program (48%). LDCs were generally less involved in the other CFF Business Programs, with only 36% in the SBL Program, 35% in the EBCx Program, and 34% in the BRI Program. For the SBL, HPNC, Audit Funding, EBCx, and BRI programs, between 6% and 30% of LDC staff reported they had limited or no involvement in the day-to-day management activities.

Figure 10-3 Involvement in Day-To-Day Management



Similarly, LDC staff were more involved in promotional activities for the Retrofit Program than any other program, with 82% reporting great or complete involvement and the remaining 18% stating they are somewhat involved (Figure 10-4). LDC staff were less involved in the promotional activities of the other programs, with between 26%-45% reporting great/complete involvement, 17%-39% reporting some involvement, and 9%-43% stating limited or no involvement.

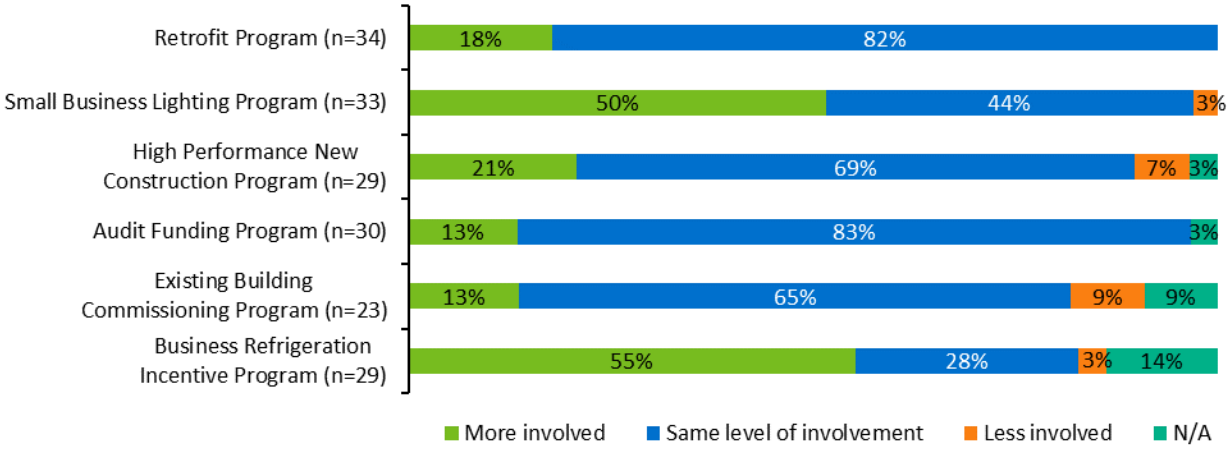
Figure 10-4 Involvement in Promotional Activities



A majority of all LDC staff stated that as compared to 2017, their LDC plans to be as involved or more involved in each program in 2018 (Figure 10-5). A small percentage of LDC staff indicated their LDC would become less involved in the SBL Program (3%), the HPNC Program (7%), the EBCx Program (9%), and the BRI Program (3%). As compared to 2016, the 2017 predicted level of involvement in the

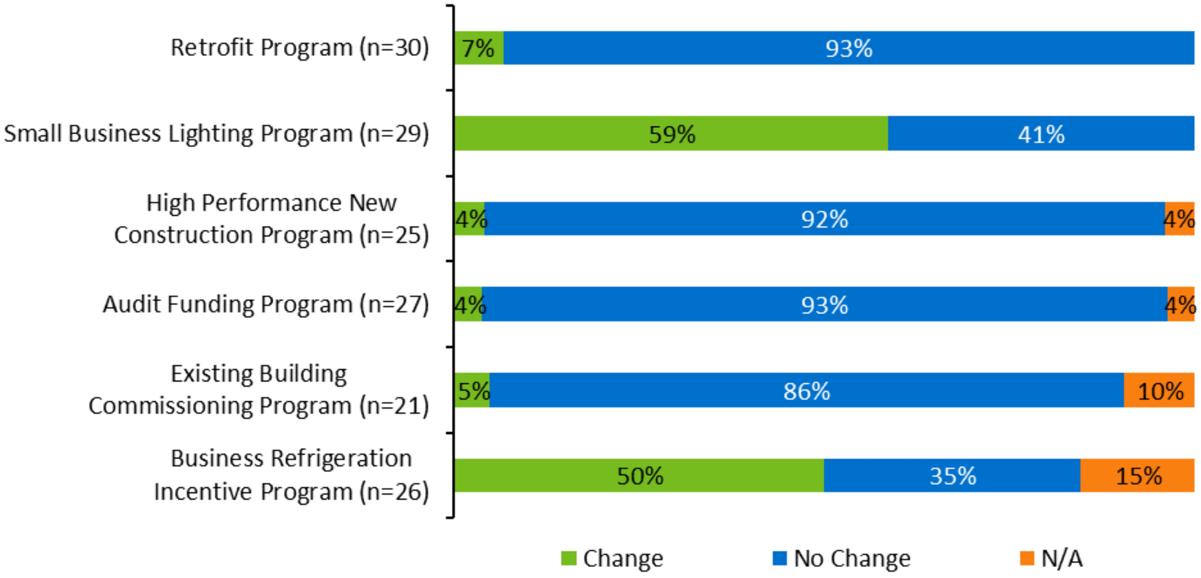
Retrofit Program has made a significant shift away from expectations of more involvement (44% and 18%, respectively) and towards maintaining the current level of involvement (56% and 82%, respectively). Similarly, between 2016 to 2017 the predicted level of involvement in the Audit Funding Program has also made a significant shifted away from expectations of less involvement (11% and 0%, respectively) and towards maintaining the current level of involvement (64% and 83%, respectively). These results may indicate that LDCs have started to find an optimal balance of involvement level and expected savings.

Figure 10-5 Projected Level of LDC Involvement in 2018



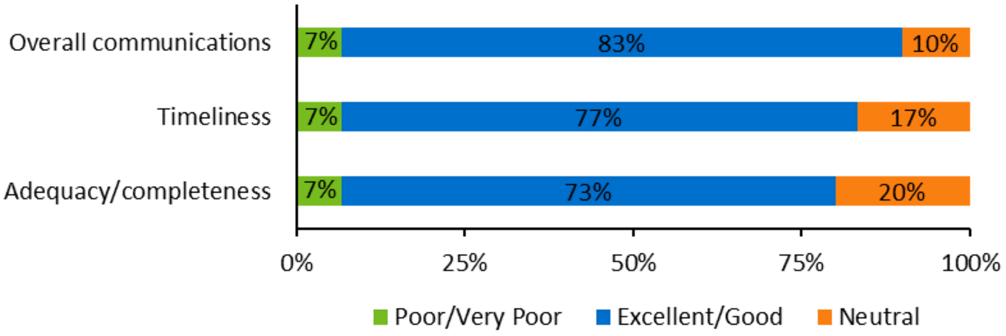
Most LDC staff stated that their LDC has not changed its approach to implementing any of the CFF Business Programs in 2018 (Figure 10-6). Among those who have made changes, the most frequent adjustments include an increase in marketing and outreach (29%), the launch of a new program (29%), and improved/increased targeting of customer segments (14%). As compared to 2016, a significant increase in respondents reported no change to their Retrofit Program implementation approach (75% and 93%, respectively) and fewer respondents reported making a change to implementation (38% and 7%, respectively). As compared to 2016, a significant increase in 2017 respondents reported no change to their HPNC Program implementation approach (75% and 92%, respectively). This may indicate that LDCs are more satisfied with the current programs and see fewer reasons to make changes to their implementation.

Figure 10-6 Implementation Changes Between 2017 and 2018



Overall, LDC staff think communications from the IESO were excellent or good (Figure 10-7). IESO communications were assessed in three areas: overall communications, adequacy or completeness of responses to inquiries or requests for clarification, and timeliness of responses. In each of these areas, approximately three-quarters of LDC staff said that IESO communications were excellent or good. Very few LDC staff provided a low rating for any aspects of IESO communications, and their specific reasons for doing so are shown in Appendix I.1. When asked how often IESO responds in a timely manner to requests for information or clarification, 63% of the 30 responding LDCs said all the time and the remainder said most of the time.

Figure 10-7 Quality of Communications from IESO (n=30)



10.3 Program Marketing and Outreach

10.3.1 LDC Staff

As seen in Table 10-2 the LDCs are engaging in a variety of marketing and outreach activities. The most frequently reported strategies include face-to-face meetings (used by 97% of LDC staff), personal phone calls (91%), marketing via channel partners such as contractors (76%) and hosting informational and training sessions (71%). The “other activities” category includes the following outreach strategies that were mentioned once or twice by LDC staff: collaboration with other LDCs, website, events, collaboration with a gas company, case studies, BIA involvement,[106] engagement with local business development agency, business awards, sales training, facilitating customer knowledge-shares, marketing in high-traffic areas, cheque presentations, newsletters, and a mobile app. As compared to 2016, the 2017 LDCs are holding more face to face meetings (85% and 97%, respectively).[107]

Table 10-2 Types of Marketing and Outreach (multiple response allowed; n=34)

Marketing and Outreach	Usage by LDCs
Face to face meetings	97%
Made personal calls	91%
Marketed via channel partners such as contractors	76%
Hosted Informational and training Sessions	71%
Social media	18%
Bill inserts/direct mail	18%
E-blasts	15%
Community events	12%
Customer breakfasts	12%
Conferences/expos/tradeshows	12%
Other activities	62%

Among LDC staff who said their LDC hosted informational and training sessions, 83% offered telephone assistance, 71% provided in-person classes, 38% offered in-person meetings and informational sessions, and 17% provided webinars (Table 10-3). “Other trainings” included a single mention of sales training.

Table 10-3 shows the topics covered during in-person classes and webinars. These trainings covered several topics such as the types of upgrades that qualify for incentives (94% of LDC staff) and), IESO program requirements about the application process (76% of LDC staff). “Other topics” included single mentions of the following topic areas: building optimization course, class A, iCon troubleshooting, holistic energy management, and training on how to sell energy. As compared to 2016, a significant increase in LDCs in 2017 are addressing how to sell comprehensive/multi-system upgrades (31% and 65%, respectively) and how to install equipment to maximize savings (38% and 65%, respectively).

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[106] The respondent did not further describe this acronym; it may refer to the Business Improvement Area (BIA). Website: www.toronto.ca/business-economy/business-operation-growth/business-improvement-areas/

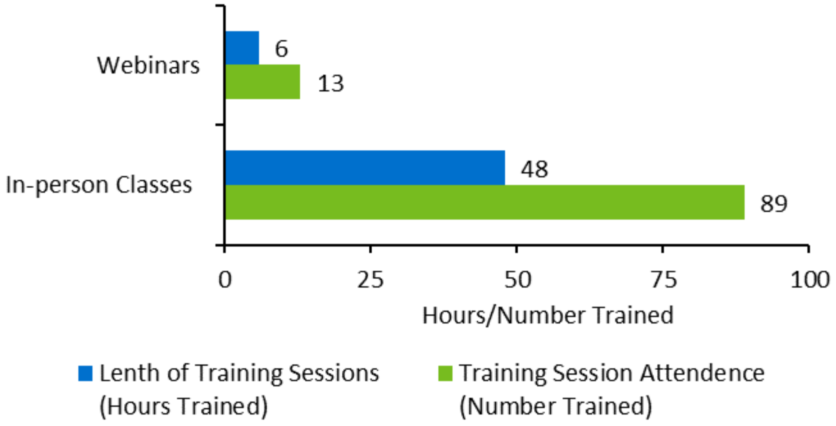
[107] The 2016 and 2017 percentages of LDCs holding face to face meetings is significantly different at the 90% confidence level.

Table 10-3 Informational and Training Sessions (multiple response allowed)

Trainings Types and Topics	Usage by LDCs (%)
Types of informational and training sessions (n=24)	
Telephone assistance	83%
In-person classes	71%
In-person meetings and info sessions	38%
Webinars	17%
Don’t know	4%
Other Trainings	4%
Topics covered during in-person classes or webinars (n=17)	
Types of upgrades that qualify for incentives	94%
IESO program requirements about the application process	76%
How to sell comprehensive/multi-system upgrades	65%
How to install equipment to maximise savings	65%
RETScreen training	18%
Technology-specific training	18%
M&V	12%
Other topics	29%

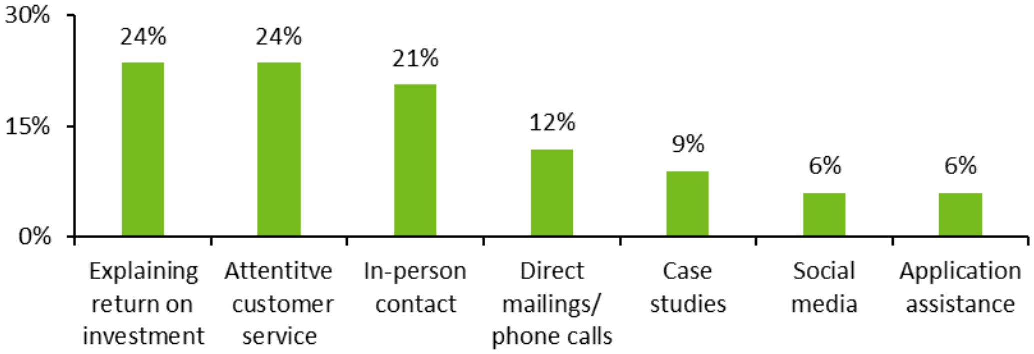
LDCs trained an average of 89 representatives, contractors, and customers during approximately 48 hours of in-person training (Figure 10-8). LDCs conducted an average of 6 hours of webinar trainings, during which they trained an average of 13 representatives, contractors, and customers.

Figure 10-8 Training Session Length and Attendance (n=34)



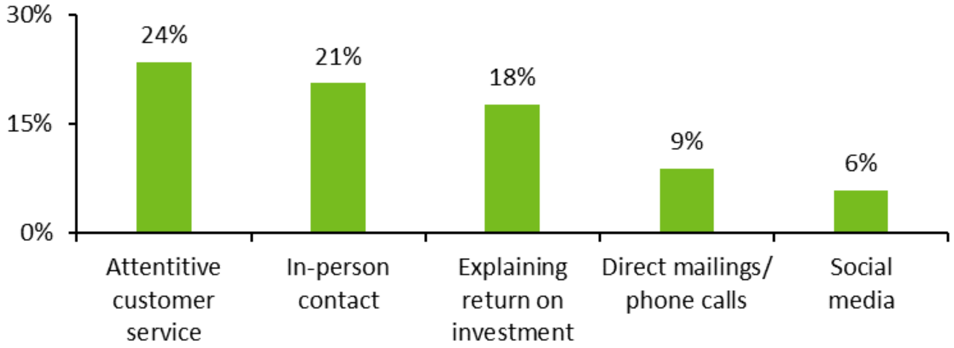
The survey asked LDC staff to describe any marketing and outreach strategies used to promote the CFF Business Programs specifically to customers who would not do upgrades without the program’s support (Figure 10-9). Return on investment (24%) and %), providing attentive customer service (24%) were most frequently cited %). As compared to 2016, LDCs in 2017 have significantly increased how frequently they explain to these customers the return on investment as part of their marketing strategy (6% and 24%, respectively).

Figure 10-9 Targeting Customers That Would Not Do Upgrades (open end response allowed; n=34)



The survey also asked LDC staff to describe any marketing and outreach strategies used to promote the CFF Business Programs specifically to customers who would do fewer upgrades without the program's support, but they required incentives to obtain more energy savings than originally planned (Figure 10-10). The most frequently mentioned outreach techniques for these customers included providing attentive customer service (24%) and %), in-person contact (21%).

Figure 10-10 Targeting Customers That Would Do Fewer Upgrades (open end response allowed; n=34)



10.3.2 PDA and TPE Staff

The evaluation team asked the PDA and TPE staff who interacted directly with customers what role their companies played in marketing the business program(s) they oversaw. Several firms indicated they provided various types of marketing support, but only a few firms were engaged with customers face-to-face when promoting the programs (13 of 19 respondents). This suggests that there may be room for further collaboration between program staff and delivery partners on effective marketing activities, such as face-to-face interactions, to promote the education of end-use customers on the potential energy savings and available program offerings.

10.3.3 IESO Staff

The evaluation team asked IESO staff about the type of responsibilities IESO has for marketing and outreach for the Business Programs. The marketing team at IESO oversees the marketing strategy and develops marketing materials (in partnership with outside firms) for both residential and business customers. Approximately 40% of the marketing budget is allocated to business programs, and 60% is directed towards residential programs. Staff indicated that while more savings are achieved through the Business Programs, it can be more effective to target residential customers through traditional marketing and to reach business customers through a mix of a relationship-based approach and a traditional marketing approach.

Staff indicated that they work in the Marketing and Sales Working Group, particularly with small and medium-sized LDCs, to help develop materials for their use. The Marketing Asset Portal gives LDCs access to these materials. Staff mentioned that marketing materials are becoming increasingly refined, with more segmented marketing on the business and industrial side. The IESO also recently relaunched its marketing standards. They require that LDCs submit any marketing materials they may develop to the IESO for their approval to maintain a consistent look and feel.

When asked what marketing approaches are most successful, staff said that often the most success is seen when upper management is made aware of the program opportunities. Staff reported they are making efforts to reach upper management; if the program opportunities are on their radar, there is more of a possibility of top-down initiatives to do energy efficiency work.

10.3.4 Marketing Material Review

The evaluation team performed a review of a subset of the most common types of marketing materials and resources that the IESO and some larger LDCs have developed to support the Save on Energy Business Programs. The purpose of the material review was to better understand how the Save on Energy Business Programs is marketed to customers and vendors, and to assess the effectiveness, quality and clarity of those materials. Please note that this review was intended to describe materials and provide feedback on some of the more common materials and resources used to market the Save on Energy Business Programs; it is not intended to be a comprehensive review of all marketing materials produced by the IESO or the LDCs.

In February and March of 2017, IESO staff provided the evaluation team with a subset of the most common marketing materials that the IESO uses to promote the Business Programs. IESO staff also helped the evaluation team collect marketing materials from four LDCs who produce their own marketing materials in support of these programs. The evaluation team reviewed these materials in March and April of 2017.

As indicated in sections 10.3.1, 10.3.2, and 10.3.3 the IESO distributes its own marketing materials across the province in its own efforts to promote the Save on Energy programs to business customers. Many of the marketing materials that the IESO produces can also be customized by an LDC to promote the programs to customers in their specific service territories.

The materials that the evaluation team reviewed from the four LDCs were developed by those LDCs specifically for their LDC. However, both IESO staff and LDC staff indicated that, in some instances, these types of materials are shared with smaller LDCs to help support their marketing efforts as well.

Based on the materials provided to the evaluation team for their review, common marketing materials for these programs include brochures, case studies, and sell sheets. The evaluation team’s review of the marketing materials determined nearly all materials to be high quality and rich in content. Most of the marketing materials reviewed showed the Save on Energy Logo, presented contact information, and emphasized energy savings. Information on Non-Energy Benefits and eligibility information were often present but less common; few materials included “Act Fast” messaging. While most materials received were of good quality and clarity, there were some materials that the team determined to be lower quality, typically due to a lack of information to help participation. This included missing phone and/or email addresses, and/or no information regarding eligibility. There were also three cases where the material used the phrase “call [your LDC] now,” but no phone number was listed. Ensuring contact and eligibility information are available where applicable would further improve these materials.

In conclusion, the analysis has indicated that the marketing materials and resources reviewed were generally clear and effective resources for customers and vendors to utilize. Some participants who responded to the process and NTG surveys indicated a desire for more clarity or more effective materials (refer to Sections 4.4.1.5, 4.2.4.5, 5.2.4.5, 6.2.3.5, 7.2.4.5, 8.2.5.5) and some vendors indicated additional marketing support from the LDCs or the IESO would better support them in their efforts to engage customers (refer to sections 4.2.3.5 and 5.2.3.5). Given this feedback, further opportunities may exist to engage customers or support vendors with marketing materials and resources in future program years.

10.4 Customer Participation

10.4.1 PDA and TPE Staff

PDA and TPE staff indicated that common barriers to customer participation including customers facing high upfront costs (10 of 19 respondents), and customers not having the time to research the appropriate equipment upgrades and often not knowing where to get the help they need to make an educated decision on what to install (7 of 19 respondents each). This suggests that there may be an opportunity to work more closely with delivery partners to ensure they are able to educate customers on program offerings, such as guidance on cross-promoting programs.

10.4.2 IESO Staff

The evaluation team asked IESO staff why they thought customers choose to participate in programs. IESO staff said that their research suggests that companies typically do energy efficiency upgrades for the monetary savings, less so for the energy savings. Safety, maintenance costs, and operational efficiency are also concerns for some companies. They noted that businesses may not fully appreciate the potential for energy savings because energy costs are often combined with other costs in a general “utilities” category.

The evaluation team asked what barriers there are to customer participation. Staff said that customers are often frustrated by the information collected, as the rules and worksheets are likely challenging for many to digest. Staff suggested that customer education about the application process could improve. They also noted that making it as easy as possible for customers to participate is a high priority. They indicated that the system used to submit applications for the Retrofit Program has been improved on over the last year, though some challenges remain.

10.5 Program Design and Delivery

10.5.1 LDC Staff

The number of contractors authorized to complete audits and/or installations in each LDC staff respondent’s service territory ranged from zero to over 1,600 (Figure 10-11)

Figure 10-11 Number of Authorized Contractors in Service Area

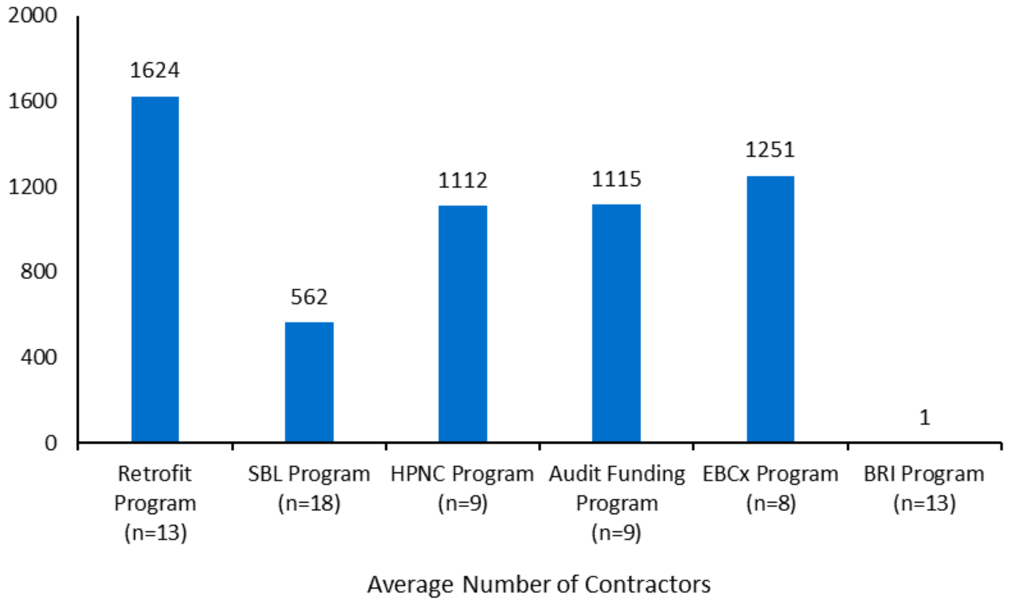


Table 10-4 shows whether LDC staff indicated that their LDC service area has enough qualified contractors to perform audits and/or installations. LDCs were most likely to indicate that their SBL Program has enough contractors, with 38% percent responding affirmatively. About one-quarter (26%) of Retrofit Programs and 15% of each the Audit Funding and BRI programs stated that they have enough contractors. Fewer LDCs indicated that the HPNC Program and EBCx Program have enough contractors (12% and 9%). These results only include LDCs that allocated resources to a program, provided several qualified contractors, and indicated whether this was a sufficient number. Appendix I shows a detailed breakdown of the number of available contractors and LDC indication of having a sufficient number to perform audits and/or installations.

Table 10-4: Availability of Qualified Contractors by Program Type*

Program	Do not have enough contractors	Have enough contractors	Don’t know if there are enough contractors
Retrofit (n=34)	0%	26%	3%
SBL (n=34)	3%	38%	3%
HPNC (n=34)	3%	12%	6%
Audit Funding (n=34)	6%	15%	0%
Existing Business Commissioning (n=34)	6%	9%	3%
BRI (n=34)	6%	15%	0%

* Program contractor range percentages may not equal 100% because not all LDCs implemented all programs.

For each CFF Business Program, LDC staff was asked whether they coordinate with other LDCs on implementation. Figure 10-12 shows that 44% reported coordinating with another LDC for the SBL Program and 41% for each the Retrofit and BRI programs. LDCs indicated a lower likelihood of such coordination on the other Business Programs, with about 24% of staff indicating they coordinate on the Audit Funding Program, 21% on the HPNC Program, and 15% on the EBCx Program.

Figure 10-13 on the following page provides a summary of the ways that LDCs coordinated by program type.

Figure 10-12 Coordination with other LDCs

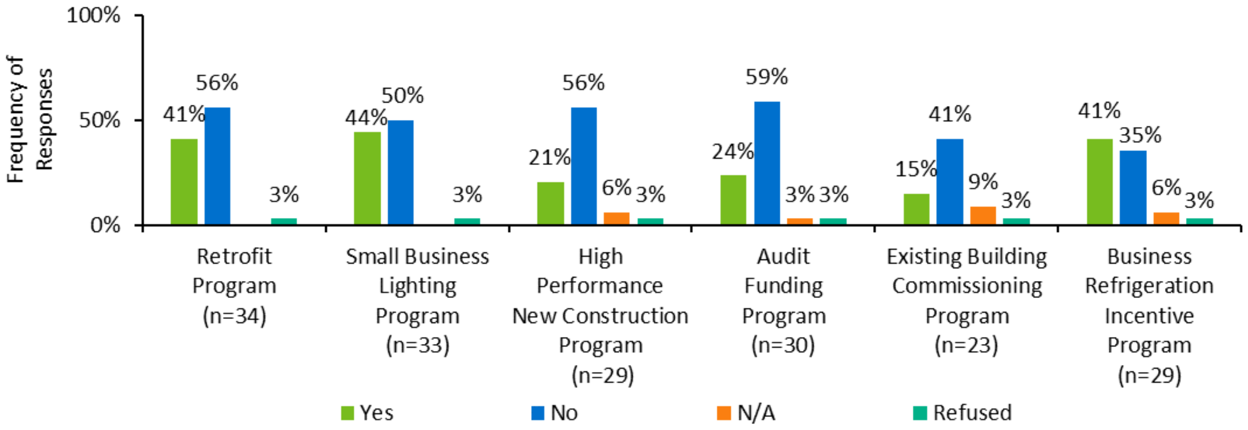
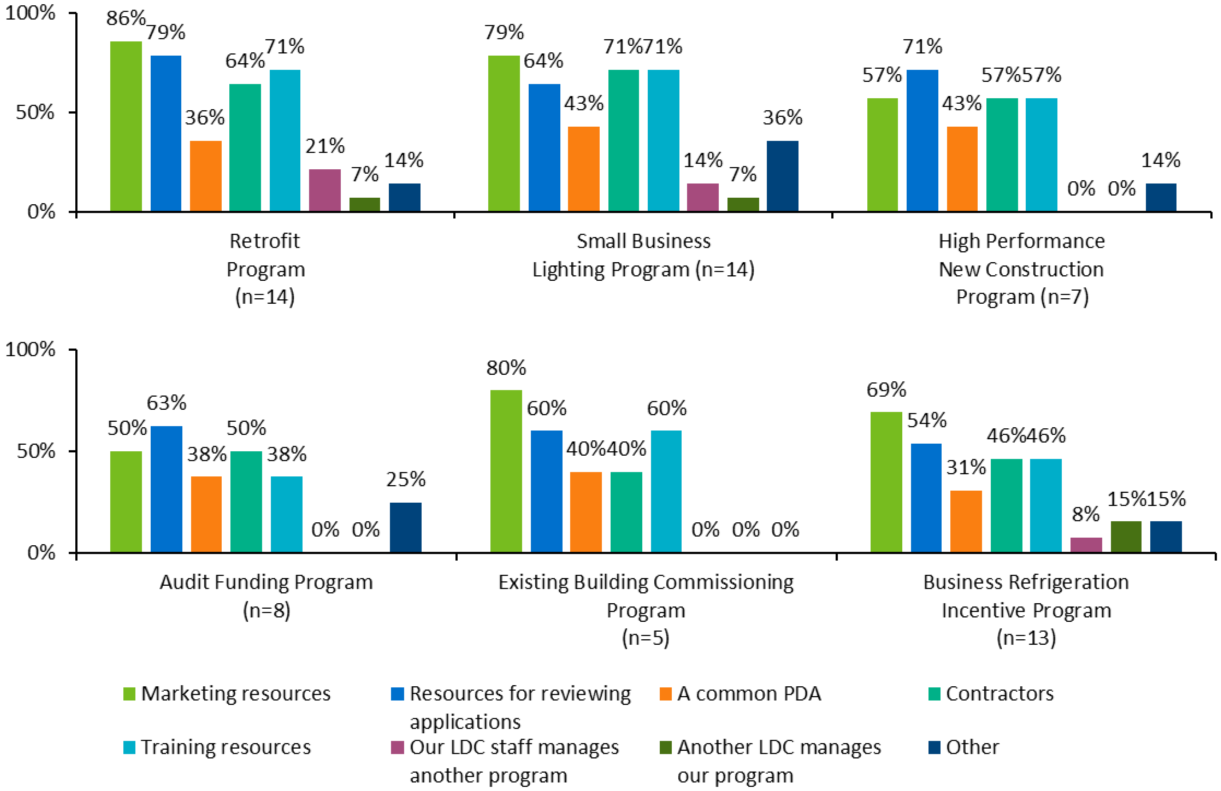


Figure 10-13 Types of Inter-LDC Sharing and Coordination (multiple response allowed)



10.5.2 PDA and TPE Staff

The evaluation team asked the PDA and TPE staff if their application review included assessing if the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program. Not all firms indicated their application review included this type of review (7 of

17 did not do so). It is possible that this level of review may have been addressed by the LDC, or another program delivery agent. Regardless, this suggests there may be room to improve on the customer application review process to ensure it includes an assessment of whether the customer had already installed, or made the decision to install, the program-qualifying equipment before applying to the program.

10.5.3 IESO Staff

The evaluation team asked how the types and amounts of incentive are selected. Staff said that it is largely based on feedback from LDCs, from the market conditions, from evaluation report findings and recommendations, savings impacts, and resource availability. They indicated that this work is most often carried out now by the Joint Program Operations Committee (JPOC).

The evaluation team asked what responsibilities the IESO has for delivery and implementation of the business programs. In most instances, the IESO does not have a direct role in delivering the business programs to customers. The LDCs are responsible for program delivery (unless the LDC decides to opt out of delivering certain programs). Staff said that in December of 2016, the Energy Minister directed[108] the IESO to ensure equitable province-wide access to programs (i.e. in instances where LDCs could not). To date, the IESO's involvement has been minor, occurring most often in remote province areas or for smaller programs. They expect that in future years, as funds decrease at LDCs, the IESO may take on more program delivery and implementation work.

10.6 Province-Wide Consistency

10.6.1 IESO Staff

The evaluation team asked how the IESO helps ensure province-wide consistency in delivery by LDCs of the business programs. Staff said that the lack of consistency at provincial level can be a challenge. For example, contractors and multi-site customers may find that there may be some differences in the program delivery experience approaches across LDCs, such as different rule interpretations or service level standards (approvals, payments, etc.). Staff said that the Conservation First Implementation Committee (CFIC), which supports the development of province-wide programs in order to meet the provincial conservation target, as well as the Joint Program Operations Committee (JPOC) are reflective of an effort to increase flexibility and to ensure a more streamlined customer experience. They also said that the working groups are effective ways to support and spread best practices.

Additionally, the IESO has developed a communications channel called the Conservation e-blast which they may use to clarify any consistent issues in the market or interpret rules where there is inconsistency. Staff also noted they might consider establishing service level standards with LDCs, which could require a commitment to minimum level of customer experience across the province. Finally, they mentioned that there could be room for the IESO to help foster greater consistency in the decommissioning and disposal of equipment.

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[108] http://www.ieso.ca/en/Corporate-IESO/Ministerial-Directives

10.7 Net-to-Gross

10.7.1 IESO Staff

The evaluation team asked IESO staff if they had any thoughts or comments about the NTG score that LDCs receive. Staff indicated that more outreach regarding the methodology used over the course of the year (not just during the time of the evaluation) could be helpful, particularly to smaller LDCs who may be more time and resource constrained. Additionally, staff suggested considering ways in which LDCs could be educated on this topic in a more interactive and familiar way, such as during road shows or as part of workshop-style sessions.

10.7.2 LDC Staff

The survey asked LDC staff how closely they review the NTG scores received from the IESO evaluation. Most LDCs (67%) indicated that they review the NTG scores extremely or very closely, 20% indicated they review it but not too closely, and 10% indicated that they do not review the score closely.

Less than half of LDC staff (43%) indicated they have a very good understanding of the methods the IESO program evaluators use to calculate NTG scores. Nearly one-quarter (20%) have a moderate understanding of these methods. Nearly one-third (30%) do not understand how the IESO program evaluators calculate NTG scores.

The survey asked LDC staff whether they adhere to any best practices or take any steps that could help improve the NTG scores that their programs receive. The majority (67%) indicated that they do take proactive steps, 7% do not, and 27% refused or did not know.

Table 10-5 shows the steps that LDC staff takes to help improve their NTG scores. Most often, LDC staff educate the customer (mentioned by 30% of LDCs that take steps to improve NTG scores), check application information (including project completion dates and invoices) (20%), follow the program rules (20%), have QA/QC procedures that exceed the minimum requirements (20%), promote technologies that customers would likely need program support to install (15%), use marketing and outreach efforts, and have LDC-provided M&V metering. “Other” strategies with single mentions include checking customer engagement activities, promoting IESO surveys, independently analyzing free-ridership, uploading evidence of prior intent, obtaining reasons for pursuing the project, and checking the customer’s contact information.

Table 10-5 Explanation of Steps Taken to Improve NTG Scores (open end response allowed; n=20)

Steps Taken	Mentions by LDCs (%)
Educate the customer	30%
Check application information (project completion dates, invoices, etc.)	20%
Follow program rules	20%
QAQC exceeds minimum requirements	20%
Promote technologies that customers would likely need program support to install	15%
Marketing and outreach efforts	10%
LDC provides M&V metering	10%
Other	30%

The survey asked LDC staff whether their process for reviewing applications includes assessing if the customer has already installed, or made the decision to install, the program-qualifying equipment before applying to the program. The majority (87%) indicated that they assess the timeline of events, 10% do not, and 3% did not know.

Table 10-6 shows the steps that LDC staff takes to assess whether a customer has already installed, or made the decision to install, the program-qualifying equipment before they applied to the program. Almost one-half of LDC staff that do include this type of assessment (46%) do so with QA/QC site inspections or photos. Thirty-eight percent assess the application paperwork, 27% confirm directly with the customer, 23% rely on conversations during customer engagement, and 8% reject the application if previous installation or intent to install has been determined. “Other” strategies with single mentions include comparing the application to project lists obtained from the IESO, following the program rules, and comparing the application to the customer’s past completed projects.

Table 10-6 Explanation of Steps Taken to Assess Customer Free-Ridership (open end response allowed; n=26)

Assessment of Customer	Mentions by LDCs (%)
QAQC site inspections/photos	46%
Assess paperwork	38%
Confirm with customer	27%
Customer engagement	23%
Reject application if previous intent is possible	8%
Other	12%

The survey asked whether LDC staff do anything to ensure that program participants respond to the survey that is conducted by the IESO evaluators. Table 10-7 shows that most commonly LDC staff provides the customer with advanced notice of the survey and confirm its legitimacy (33%). Twenty-seven percent do nothing to ensure survey completion, 17% confirm the customer's contact information, and 7% indicated that the LDCs are not allowed to interfere with EM&V procedures. "Other" steps with single mentions include confirming the validity of the survey after it is received by the customer, "surveys are a poor method for determining NTG," and "IESO could provide approved communications materials."

Table 10-7 Steps to Ensure Completion of IESO Evaluation Survey (open end response allowed; n=30)

Ensuring Survey Completion	Mentions by LDCs (%)
Provide advanced notice of the survey	33%
Nothing	27%
Confirm customer contact information	17%
We are not allowed to interfere with EM&V procedures	7%
Other	10%

10.8 Overall Assessment

10.8.1 LDC Staff

About three-quarters (73%) of LDC staff (n=30) indicated that the 2017 CFF Business Programs met their expectations. Of the remainder, 23% stated the programs failed to meet their expectations, and 3% did not know.

The survey asked LDCs an open-ended question about what worked best about the CFF Business Programs in 2017 (Table 10-8). Twenty-three percent of LDC staff mentioned the Retrofit Program. Other aspects that worked well included continually reviewing programs to make improvements (17%), the values of incentives (10%), the process of receiving funds from the IESO for prompt payment to customers (7%), and communications between the customer and the LDC (7%). Aspects that each received a single mention include improved marketing, ERII,[109] ability of programs to reach a wide variety of customers, reducing the Retrofit Program from three tracks to two, the simplicity of prescriptive applications, program delivery, the application system, communications between the IESO and LDCs, the time it takes to implement changes, and coupons/deal days.

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[109] The respondent did not further describe this acronym; it may refer to Equipment Replacement Incentive Initiative.

Table 10-8 Aspects of the CFF Business Programs that Work Best (open end response allowed; n=30)

Aspects that Worked Best	Mentions by LDCs (%)
Retrofit Program	23%
Continually reviewing programs to make improvements	17%
Values of incentives	10%
Process of receiving funds from IESO for prompt payment to customers	7%
Communications between the customer and the IESO	7%
Other	37%

The survey asked LDCs what has not worked so well about the CFF Business Programs and 20% of LDC staff mentioned the application process/website (Table 10-9). Other aspects that did not work well include the inability to quickly implement program refinements (17%), the SBL Program (13%), unclear rules and/or programs (10%), lack of customers in the service area (7%), low incentives (7%), and program requirements (7%). Topics that were each mentioned once include restrictive prescriptive worksheets, the amount of work for the customer/contractor, marketing, training new staff, NTG, changes to the programs, cost of the programs, lack of a solar option for SBL Program, customers doing multiple projects, assistance delivering the program, time it takes for the IESO to respond to inquiries, misalignment of program rules and customer needs, collaboration, measure selection, and inconsistent EM&V methodology around persistent savings. As compared to 2016, in 2017 significantly fewer LDCs noted that the application process/website did not work well (41% and 20% respectively).

Table 10-9 Aspects of the CFF Business Programs that Do Not Work Well (open end response allowed; n=30)

Aspects that Did Not Work as Well	Mentions by LDCs (%)
Application process/website	20%
Inability to quickly implement program refinements	17%
SBL Program	13%
Unclear rules and/or programs	10%
Lack of customers in the service area	7%
Low value incentives	7%
Program requirements	7%
Other	57%

The survey asked LDC staff to suggest enhancements that could increase customer participation (Table 10-10). One-third (33%) asked for the application process and online portal to be improved and 17% suggested less paperwork and administration. Topics mentioned once each include adding conservation voltage reduction (CVR) as a qualifying conservation technology, shortening and simplifying agreements and contracts, making the SBL Program more like the Retrofit Program, adding “how-to” manuals for customers, increasing LDC budgets, removing restrictions, adding staff to help customers with applications, province-wide marketing, removing DLC[110] and ENERGY STAR requirements, and adding a Retrofit prescriptive rebate for small products.

Table 10-10 Suggestions for Increased Participation (open end response allowed; n=30)

Suggestions	Mentions by LDCs (%)
Improve application process/online portal	33%
Less paperwork and administration	17%
Other	33%

10.8.2 IESO Staff

The evaluation team asked IESO staff to describe what impact the Business Programs have had on Ontario’s market for energy efficient products and services in terms of product availability and sales. Staff thought a culture of conservation is likely growing, especially with companies who have participated in programs. Staff suggested that more of a holistic, system-focused approach may create more savings opportunities, as this may allow businesses to be more innovation in the project work they complete.

When asked what they thought the programs’ greatest strengths and weaknesses were, IESO staff mentioned the benefits of the turn-key approach that has been used for some programs, such as the BRI Program and the SBL Program. They also pointed to the effective way in which they often work with multi-site applications where these customers receive more one-on-one support. They noted that the application process can be more of a challenge for small or medium-sized businesses who typically submit the application on their work. Staff stressed that it is relevant to keep these smaller businesses in mind as they do account for a significant portion of savings overall. Staff also mentioned that the core programs continue to drive savings, but the peripheral programs have not been as effective as they could be, noting that they are hopeful that the program redesigns that have taken place recently will improve participation levels in the second half of the framework.

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[110] The respondent did not further describe this acronym.

11 Portfolio Level Cost-Effectiveness Results

Cost-effectiveness results for the Retrofit FCR, Retrofit P4P, SBL, BRI, Audit Funding, HPNC, and EBCx Programs are presented below as well as the combined results for the entire portfolio of business programs. Additional details on the cost effectiveness tests are provided in Appendix E.

11.1 Total Resource Cost Test

Table 11-1 presents the TRC test results. All programs except the EBCx Program passed the TRC test. The overall portfolio level TRC ratio is 1.45 with total TRC net benefits of $202,730,121.

The Retrofit FCR Program had a large influence on the overall TRC ratio with 69% of the total TRC benefits and 80% of the TRC costs. However all other programs, with the exception of EBCx, performed better at the TRC test than the Retrofit FCR Program. This helped raise the overall TRC ratio to 1.45.

Combined the HPNC and Audit Funding Programs contributed a total of 42% of the net TRC benefits, 19% and 24% respectively. The Retrofit FCR Program only slightly outperforms these two programs with 44% of the total net TRC benefits.

Table 11-1 : 2017 Total Resource Cost Test Results

Program	TRC Costs ($)	TRC Benefits ($)	TRC Net Benefits ($)	TRC Net Benefit (Ratio)
Retrofit FCR	$364,616,765	$454,823,717	$90,206,952	1.25
Retrofit P4P	$19,438,585	$27,788,080	$8,349,495	1.43
SBL	$15,725,619	$32,475,414	$16,749,795	2.07
BRI	$2,243,172	$3,793,072	$1,549,900	1.69
Audit Funding	$33,407,009	$81,526,367	$48,119,358	2.44
HPNC	$18,297,443	$56,204,586	$37,907,144	3.07
EBCx	$409,515	$256,992	$(152,522)	0.63
Total	**$454,138,107**	**$656,868,228**	**$202,730,121**	**1.45**

11.2 Program Administrator Cost Test

Table 11-2 presents the program administrator cost (PAC) test results. All programs except the EBCx Program passed the Program Administrator Cost (PAC) test. The overall portfolio level PAC ratio is 3.99 with total TRC net benefits of $413,708,805.

The Retrofit FCR Program also has a strong influence on the overall PAC test results contributing 80% of the net PAC benefits. Since the PAC test only looks at costs and benefits from the perspective of the program administer, programs that cost more to implement, in the form of higher incentive per benefit or higher administrative costs per benefit, will perform worse. This is the case with the SBL and BRI programs where a higher percentage of the cost to implement the measure is paid by the program.

Table 11-2: 2017 Program Administrator Cost Test Results

Program	PAC Costs ($)	PAC Benefits ($)	PAC Net Benefits ($)	PAC Net Benefit (Ratio)
Retrofit FCR	$101,328,008	$431,543,086	$330,215,078	4.26
Retrofit P4P	$9,409,185	$26,802,268	$17,393,083	2.85
SBL	$13,622,901	$31,956,040	$18,333,140	2.35
BRI	$2,249,216	$3,298,324	$1,049,108	1.47
Audit Funding	$2,849,605	$9,185,137	$6,335,531	3.22
HPNC	$8,226,291	$48,873,553	$40,647,262	5.94
EBCx	$487,869	$223,472	$(264,397)	0.46
Total	**$138,173,074**	**$551,881,879**	**$413,708,805**	**3.99**

11.3 Levelized Unit Energy Cost Test

Table 11-3 presents the LUEC test results. The LUEC test provides a measure of how much a unit of energy derived from the program savings costs. This cost per unit can not only be used to compare the performance of other conservation or demand management programs but also to other supply-side resources. Overall the business portfolio program resulted in an overall LUEC of $119,370 per MW and $19.43 MWh.

Table 11-3: 2017 Levelized Unit Energy Cost Results

Program	Levelized Demand Cost ($/MW)	Levelized Energy Cost ($/MWh)
Retrofit FCR	$111,489	$18.14
Retrofit P4P	$163,644	$26.45
SBL	$174,058	$36.50
BRI	$367,163	$49.56
Audit Funding	$365,171	$16.22
HPNC	$83,422	$14.43
EBCx	$1,377,831	$125.20
Total	$119,370	$19.43

The HPNC Program had the lowest cost per unit in terms of both cost per MWh and cost per MW-yr with $83,422 per MW and $14.43 MWh. The Retrofit Program was the next least expense program in terms of cost per MW at $111,489 per MW but the Audit Funding Program was the next least expensive program in terms of cost per MWh at $16.22 per MWh.

12 Observations and Recommendations

The evaluation team offers the following observations and recommendations for maintaining and improving program success. These observations and recommendations were developed as a result of the team's evaluation activities and analysis. They focus on the areas of improvement that should be considered and investigated further.

12.1 Retrofit Program

12.1.1 Assumed Hours of Use

Based on evaluated projects that are part of this year's rolling sample the assumed hours of use (HOU) for omni-directional A-shape lamps may be inconsistent with actual operation. Review of 10 evaluated prescriptive lighting projects containing omni-directional A-shape lamps provided a weighted average of 6,350 hours per year of lighting operation, which is much higher than the program assumed HOU of 3,911.

Recommendation: *Review the HOU input assumptions applied to omni-directional A-shape lamps to determine if they are consistent with lamp operation in the field.*

Assumed hours of use (HOU) for LED tube re-lamping may be inconsistent with actual operation. Review of 9 evaluated prescriptive lighting projects containing LED tube re-lamping provided a weighted average of 3,325 hours per year of lighting operation, which is lower than the program assumed HOU of 4,594.

Recommendation: *Review the HOU input assumptions applied to LED tube re-lamping to determine if they are consistent with delivery cost lamp operation in the field.*

12.1.2 Consider Additional Measures as Suggested by Retrofit Contractors

Contractor suggestions for additional prescriptive track measures to incentivize through the Retrofit Program included other types of controls, sensors, energy management systems, a broader range of LED lamps and fixtures (T5s, luminaires), and building envelope upgrades.

Recommendation: *Since most of these measures can be included in the Retrofit Program through the custom track, this recommendation can help begin a conversation with LDCs, contractors, and participants about the feasibility of including these types of equipment in the prescriptive track. This can be a researchable question for future evaluation cycles and take into account program rules, market demand, savings potential, and cost-effectiveness to determine the best measures to add to the program.*

12.1.3 Identify Effective Ways to Engage Participants

In 2017, a large majority of participants were satisfied with the program overall (82%) and were very likely to recommend it to others (91%). These results were very similar to the 2016 results for overall satisfaction (83%) and likelihood to recommend (91%). In 2017, participants were least satisfied with the time it took to receive the incentive (63%) and the dollar amount of the incentive (68%); in 2016, participants were least satisfied with interactions with IESO (54%) and technical studies (48%). The most frequently mentioned barrier to making future energy-efficient upgrades was costs outweighing the benefits from energy savings (31%).

In both 2016 and 2017, 95% of participants mentioned saving energy and lowering energy bills as the primary motivator for their participation. This was followed by increasing comfort and/or productivity at their facilities (59% in 2017 and 60% in 2016) and being associated with “green” or “sustainable” actions (53% in 2017 and 54% in 2016). The majority of 2017 active nonparticipants also cited saving energy (86%) and keeping energy bills low (82%) as important motivators in addition to mentioning the importance of upgrading to more efficient equipment (87%).

Recommendation: *Consider ways of fast tracking customer incentive payments.*

Recommendation: *Ensure that customers fully understand the program savings opportunities. It is critical that the program clearly explain the energy and monetary savings opportunities to customers, as is helping customers identify deeper energy savings to justify participation.*

Recommendation: *Communications should describe the relationship between efficiency and sustainability. Making the connection between equipment upgrades and sustainability impacts will resonate with many businesses.*

Recommendation: *Communicate the value of non-energy benefits. For customers who may be less concerned about energy or monetary savings, describing the non-energy benefits associated with participation can be a more effective engagement strategy.*

12.1.4 Maintain Focus on Minimizing Free-Ridership

For the 2017 Retrofit Program, the overall free-ridership results were mostly positive. Nearly two-thirds of participants (65%) reported that they would not have completed the exact same upgrade without program incentives; a decline from 2016, where more respondents (74%) noted they would not have completed the exact same upgrade without program incentives. Identifying potential participants who exhibit low free-ridership could continue to be improved in future program years, as roughly one-fifth of 2017 participants (21%) learned about the incentives only after planning, starting, or even completing the project. This was an improvement, though, from 2016 when approximately 26% of participants had learned about the program only after project planning or implementation had begun.

Recommendation: *Maintain focus on minimizing free-ridership. Key areas of focus include: a) identifying and targeting customers who would not make upgrades without program support; and b) screening applications for customers who have not already begun implementing measures.*

12.2 Small Business Lighting Program

12.2.1 Assessment Tool Improvements

The new SBL Assessment Tool for the updated program is an improvement from the previous version. It collects important parameters necessary to calculate energy and demand savings and is relatively easy to use for contractors and implementers. The evaluator understands that it is important the Assessment tool not be overly complicated but discrepancies between the operating scheduled reported on the application and those verified in the field still contribute significantly to the realization rates being less than 100%.

Recommendation: *Provide clear instructions to SBL implementers and participants on what hours of operation should be entered in the SBL Assessment Tool. It should be clarified that the schedule entered in the Hours of Operation tab should be the hour the new efficient lamps are expected to operate and not the hours of operation of the business. Many times the hours the business is open to the public are entered into the SBL Assessment Tool when in fact the lights are turned on before and after the business is open to the public. Another option is to clarify in the Assessment Tool instructions and in contractor trainings that in cases where multiple schedules exist, the schedule entered should be for the lights that are expected to generate most of the energy savings.*

12.2.2 Savings Assumptions

For certain SBL measures, a range of allowable wattages is allowed. These measures typically allow an LED lamps to have up to a certain maximum wattage, less than or equal to 15W, for example. The prescriptive savings calculations for these measures assume the maximum wattage allowed as the new efficiency wattage. A discrepancy exists when the verified wattage of the actual lamp is found to be less that this maximum wattage values. This discrepancy leads to the reported savings to be less than the gross verified savings.

Recommendation: *Provide an optional field for contractors to enter the wattage of the new efficient lamp or fixture in the SBL Assessment Tool. This would only be necessary for measures that only specify a maximum wattage. The wattage value could be made to be optional in that if a value was not entered then the default lookup value could be used.*

12.2.3 Improved Baseline Photos

In PY 2017 SBL implementers submitted photos of the pre-existing baseline fixtures and lamps. These photos are important and helpful when verifying the in-situ baseline wattages. In many cases the photos were close up images of the lamps and contained make, model and wattage information. There were a few instances where the photos did not capture enough detail of the lamps or fixtures to definitely determine the baseline wattages. Several pictures collected by contractors are of light fixtures or lamps turned on from a few feet away which does not provide useful information about the lamp wattage or lamp type.

Recommendation: *Specify what information should be captured in the pre-retrofit and post-retrofit pictures that are collected by the SBL contractors. Specify that pictures of the equipment replaced equipment should capture the wattage of the lamps and, if applicable, the type of ballast.*

12.2.4 Closely Monitor and Track Delivery Partner Satisfaction

The evaluator is aware that the SBL Program is in the process of a re-design that will include several changes related to the measure list as well as dollar cost caps. The re-design is timely and justified as less than two-fifths (37%) of the surveyed SBL assessors and installers were satisfied with the 2017 program. These results contrast sharply with assessor and installer satisfaction in 2016 (73%). It is worth noting that the program was just ramping up in 2016, and therefore 2016 respondents may not have had a long enough experience with the program in comparison to 2017 survey timing.

The lowest satisfaction levels in 2017 were associated with program marketing and outreach (33%), dollar cost caps associated with each upgrade (26%), number and types of equipment incentivized through the program (23%), and dollar amount of the incentives (22%). In 2016, installers and assessors were most dissatisfied with dollar amount of the incentives and number and types of equipment incentivized through the program (55% satisfied each).

In 2017, installers and assessors who were dissatisfied with dollar cost caps associated with each upgrade (nine of 27 respondents) reported that certain bulb conversions were low due to low incentives (three respondents) and that cost caps associated with each upgrade were restricting the ability to upgrade an entire facility (three respondents). Installers and assessors who were dissatisfied with overall program cost caps of $2,000 (nine of 27 respondents) most commonly mentioned that increasing overall cost cap would allow customers to take full advantage of the program (four respondents). Over four-fifths (81%) of installers and assessors said more program-qualifying lighting equipment would have been installed if the overall cost cap had not existed.

Recommendation: *Closely monitor and track the new SBL Program for delivery partner satisfaction. The evaluation team recommends that the program continue to closely monitor the effectiveness of the program changes through fostering dialogue with program delivery partners, whether it be through in-person events, quarterly check-in calls, or one-on-one communications. Understanding what areas of delivery partner dissatisfaction remain as the delivery partners begin interacting with the redesigned program will help ensure that the program runs smoothly*

12.2.5 Closely Monitor and Track Participant Satisfaction

In both 2016 and 2017, the majority of SBL participants were satisfied with the overall program (83% in both years). In both 2016 and 2017, participants were most satisfied with the work done by the assessor and/or installer (89% and 84%, respectively). In both 2016 and 2017, participants were also very satisfied with the performance of the efficient equipment (85% in both years).

In 2016, participants highly rated their satisfaction with IESO and LDC representatives (88% and 87%, respectively) which contrasts with lower satisfaction ratings achieved in 2017 (78% and 69%, respectively). Results between years are statistically significant.

The most common suggestions for improvement in 2017 were to improve the quality of the upgrades (mentioned by 22% of participants), increase the number of equipment types covered (20%), and improve performance of the dimmable LEDs (14%). The most common improvement suggestions in 2016 were to speed up the overall process l and to improve customer service (mentioned by 3 respondents each).

More than four-fifths of 2017 participants (85%) agreed that program materials provided by their LDC were sufficient, while only about two-thirds (68%) agreed that the program application was easy to complete.

Recommendation: *Closely monitor and track the new SBL Program for customer satisfaction. The evaluation team recommends that the program continue to closely monitor the effectiveness of the program the program changes through engaging with customers at all phases of the participation process. Understanding what areas of participant dissatisfaction and barriers to entry remain will help ensure that the program runs smoothly*

12.2.6 Maintain Focus on Minimizing Free-Ridership

In 2017, the SBL Program's overall free-ridership results were mostly positive. Prior to contact with the SBL Program, most participants (67% in 2016 and 62% in 2017) had considered replacing their lights, although most had no specific plans to do so at the time (58% in 2016 and 59% in 2017).

In both years, notable proportions (38% in 2016 and 40% in 2017) were at some stage of planning to install new lighting.

In both years, in the absence of the program, over two-thirds of 2017 participants (69%) would have installed less expensive or less energy-efficient lighting, delayed the lighting upgrade by at least one year, or cancelled the lighting upgrade altogether.

Nearly one-fourth of 2017 participants would have installed the same lighting equipment and paid full cost absent the program (23%); these results were a slight improvement from 2016 were over one-fourth would have done the exact same project (26%), though the difference is not statistically significant across years.

Recommendation: *Maintain focus on minimizing free-ridership. Key areas of focus include: a) identifying and targeting customers who would not make upgrades without program support; and b) screening applications for customers who have not already begun implementing measures.*

12.3 Business Refrigeration Incentive Program

12.3.1 Expand Business Refrigeration Incentive Measure Definitions

Measure descriptions, such as ECM fan horsepower and LED case lighting length were captured in the program’s tracking database; however, the measure savings were not reflective of differences within the broader measure type.

In particular, the ECM fan motor measure has a very large influence on the program (77% of verified energy savings) yet only used a single deemed value for reported savings. Verified savings varied substantially per ECM fan motor measure depending on the motor’s application and size.

Recommendation: *The currently used broad measure types (e.g. ECM fan motor or LED case lighting) should be broken out into measure sub-types (e.g. 1/20 Horsepower ECM evaporator fan motor, 48 inch LED strip light) to appropriately capture unique savings estimates. By way of using more granular measure savings will allow for improved precision in savings estimates.*

Recommendation: *It is recommended to prioritize disaggregating the single ECM fan motor measure to distinguish sub-measure type key characteristics, as these variations have a significant influence on the measure’s savings. The most influential characteristics on the savings are the application of the motor (evaporator vs. condenser) and the size of the motor (Watts or HP).*

12.3.2 Capture and Document Measure Baseline Data

Assumed baseline types impact measure savings significantly, specifically for ECM fan motor and lighting measure types. However, baseline information was inconsistently captured in the BRI program’s tracking database and project files. Some measures were listed in the program tracking database with no reference to a baseline type while other measures included a baseline description.

Recommendation: *Standardizing a menu of measures for program implementers to select from when entering project data (such as Microsoft Excel’s data validation feature) will help ensure baseline information is included in the program tracking data, as well as standardize measure names used across LDCs.*

Recommendation: *Consider requiring equipment installers submit proof (e.g. photos) of baseline equipment at the time it is removed from service for all equipment, and provide these files to IESO. This would ensure the baseline is accurate and consistent between reported and verified savings estimates.*

12.3.3 Standardize Project File Documentation

Project file organization and available data supporting reported savings estimates was inconsistent between LDCs

Recommendation: *Across all LDCs, standardize how project files are collected, stored, and provided to IESO. It is recommended to have one main file folder for each project, with all supporting documents for the project contained within that folder, such as work orders and photos. Similarly, standardizing file naming conventions for different file types (e.g. work orders, photos) may prove to help program staff and evaluators alike quickly navigate project files.*

12.3.4 Further Educate Customers on Energy Savings Potential of Program Upgrades

Most surveyed participants (79%) were very satisfied with the program overall, and 84% would likely recommend the program to others. Participants were less satisfied with the energy savings achieved by the equipment upgrade (48% satisfied). Program delivery agents indicated the program needs to reach past the “low hanging fruit” to the harder-to-reach customers. A lack of proper education on potential savings and the challenges with providing long-term savings were the main barriers mentioned by program delivery agents, the refrigeration technician, and the motor supplier.

The refrigeration technician and motor supplier stressed the importance of ensuring that the program delivery agents are able to clearly describe the savings and payback periods of equipment to customers when conducting audits to ensure the acceptance of new technologies and products (such as ECM motors). Given that the program delivery agents are tasked with assessing and then deciding the energy-saving opportunities to recommend to the customer, it is critical that they have the education, guidance, and resources necessary to communicate the benefits of the program to the customer.

Recommendation: *Ensure that program delivery agents are well-versed in articulating the merits of the program to customers as well as the savings opportunities and payback periods when conducting audits. Program staff can coordinate with program delivery agents to ensure that their staff who perform the audits are well trained in how communicate with customers.*

Recommendation: *Customer education and outreach opportunities should be explored to provide information on the energy savings potential of program-incentivized measures. The program could consider direct measurement of energy savings to develop additional case studies that could be used as “testimonials” of verified energy savings. Program materials and market outreach should also be refined to clearly describe the savings opportunities and payback periods to customers.*

12.3.5 Identify Gaps in Coverage and Foster Communication between Program Delivery Partners

The motor supplier and refrigeration technician appear to have contradictory perspectives on equipment availability. The motor supplier reported there was “no product or supply-related issues.” However, the refrigeration technician reported shortage of program qualifying ECM motors was growing into a “consistent issue.”

Recommendation: *Ensure that the supplier maintains adequate inventory of program-qualifying equipment. Insufficient equipment availability will hinder the program from deriving all achievable savings and reaching its full potential. Clarify the program needs between the supplier and refrigeration technician* *and improve communication pathways to ensure adequate available supply of product. This could be made possible by creating more opportunities for program partners to discuss implementation constraints or by expanding the number of program suppliers that support the program to alleviate any bottlenecks in supply.*

12.3.6 Improve Customer Experience and Further Streamline Program

Ten of 66 participants said that they were not satisfied with the level of the incentive. Three participants indicated frustrations with the refrigeration technician and/or equipment options offered by the technician, and two participants suggested expanding the equipment options covered by the program. One program delivery agent suggested further streamlining the assessment and installation process by implementing a more “turn-key” type service, whereby the program delivery agents could be made responsible for all lead generation (rather than the LDC), and, in some instances, installations. Lead generation is done primarily by the LDC; however, delivery agents suggest more efficiencies may be experienced if they were primarily responsible for generating leads. Additionally, under the current delivery model, only the refrigeration technician can perform installations; special training is needed to install most program-supported equipment. However, there may be an opportunity for program delivery agents to install at least some of the equipment that does not require special training during the initial audit. This could, in turn, minimize the number of visits experienced by some customers, minimizing the amount of time they need to dedicate to participating in the program.

Recommendation: *Consider reviewing incentive types and levels as well as equipment options for alignment with customer needs, if feasible.*

Recommendation: *Consider implementing and promoting a BRI refrigeration technician network as a means of recommending quality technicians to program participants. This may become increasingly important as more LDCs begin to offer the BRI Program in future program years.*

Recommendation: *Improve customer experience by further streamlining the process. This could involve implementing more of a “turn-key” service where possible to simplify the process for participants. Examples of how this could be implemented include: 1) Allow program delivery agents the option to be primarily responsible for lead generation, 2) Allow program delivery agents to install equipment during initial audit that does not require special certification to install.*

12.3.7 Maintain Focus on Minimizing Free-Ridership

BRI Program participant feedback indicated moderate free-ridership (21%). The high (and thus positive) NTG score that was achieved in PY 2017 (100.5%) can largely be attributed to the amount of Spillover achieved (21.7%). The program helped nearly one-half of these participants (49%) with upgrades they otherwise would not have been able to implement or would have had to postpone. Just under one-fourth of the respondents (23%) stated they would not have gone through with their upgrades, and one-fourth (25%) would have delayed these upgrades by at least one year without the program incentive. Room for improvement exists in terms of identifying customers most in need of the program’s support, as close to one-fourth (23%) of participants would have done the exact same upgrade in the absence of the program.

Recommendation: *Maintain focus on minimizing free-ridership. Key areas of focus include: a) identifying and targeting customers who would not make upgrades without program support; and b) screening applications for customers who have not already begun implementing measures.*

12.4 Audit Funding

12.4.1 Promote Incentives in Audit Reports

Of the 36 total measures implemented, it was estimated that 16 (44%) were likely eligible for incentives in 2017; this figure was 38% in 2016. It was not determined if the participants were aware these recommended measures would likely qualify for incentives. In order to further increase the number of measures implemented as a result of the Audit Funding program the audit reports should clearly state which recommended measures may qualify for incentives through other CDM programs.

Recommendation: *Provide clear information on all available incentives for measures that are recommended in audit reports including contact information and instructions on how to apply.*

12.4.2 Maintain Focus on Minimizing Free-Ridership

The overall free-ridership results for the 2017 Audit Funding Program were low (5.9% FR). This was a significantly different improvement over the 2016 results which saw substantially higher levels of free-ridership (31.5%). Audit Funding participant responses indicate low levels of free-ridership, which in turn indicates the program is likely doing a good job of reaching the type of participants who would not have made efficient upgrades without the program.

Recommendation: *Maintain focus on minimizing free-ridership. Key areas of focus include: a) identifying and targeting customers who would not do the audit without program support; and b) screening applications for customers who have not already begun implementing measures.*

12.4.3 Build in Additional Flexibility to Audit Applications, Report Requirements, and Program Incentive Structure

Both auditors and participants reported high levels of satisfaction with the program. The review process, however, was a common focus of critique. For the most part, auditors were responsible for submitting program paperwork but there were some participants who submitted applications and audit invoices for incentive reimbursement. Across both groups, participants cited a complicated and rigid application and reporting structure. Some auditors thought that program requirements were a little rigid in places and would slow down projects or prevent participation altogether.

Recommendation*: Re-visit the program rules and documents for application and reporting, paying special attention to the aforementioned auditor and participant concerns.*

12.4.4 Make Resources Available for Customers and Auditors that Clarify Structure and Benefits of Program

According to some auditors, customers are unclear regarding the structure, process, and deadlines of the program, and can be skeptical about the financial benefits of efficiency upgrades discovered during the audit process.

Recommendation*: Materials need to be available which would clarify incentives, timelines and deadlines, financing options, and case study and benchmark data that will help recruit customers into the program, but will also help those already enrolled successfully complete the program and continue on with retrofits and installations of recommended equipment. These resources should be available, and easily found, on the program website.*

12.5 HPNC Program

12.5.1 Lighting Power Density Baseline

Lighting power density (LPD) describes the installed wattage of a lighting system per the floor area it serves. The 2015 National Energy Code of Canada for Buildings provides LPD allowances per building and space type. An LPD allowance specifies the maximum amount of wattage of lighting a particular building can utilize per square foot. Code-based LPD values are set based on how much light (in lumens) is needed at the work-space level for different building types (e.g., for safety reasons a manufacturing facility is allotted a greater LPD allowance than an office).

In order to calculate savings for a measure where the baseline is theoretical (as is the case in new construction), program administrators and evaluators are forced to make educated estimates as to what equipment the customer might have installed.

Reported lighting savings within the HPNC Program are currently calculated as retrofit measures where the consumption of the installed piece of equipment is compared to a hypothetical baseline fixture of an alternate type and wattage in a one-for-one replacement strategy.

Lighting measures had an overall energy realization rate of 125% and a demand realization rate of 124% across the 41 projects within the sample. The main reason the lighting realization rates are above 100% is the difference in LPD-based calculations versus retrofit-style calculations.

Recommendation: *Update the prescriptive worksheet assumptions and make the allowable lighting baseline for engineered worksheets be based on LDP requirements of the code for the space or building type.*

In the case of new construction the baseline equipment should at least be assumed to be code-compliant as a non-compliant piece of equipment is not a realistic alternative. As the code specifies lighting compliance in terms of LPD calculations, it follows that energy savings should also be calculated via this method.

12.5.2 Support Builders, Developers, Architects, and Engineers in Delivering the Program to Customers

In 2017, builders and developers were moderately satisfied with the program as were architects and engineers. In 2016, builders and developers indicated somewhat higher satisfaction. However, given the small number of respondents (6 in 2016 and 5 in 2017), it is not possible to determine if this difference is statistically significant.

Builders reported that most of their 2017 sales were from projects that did not participate in the HPNC Program. One builder reported that 35% of 2017 sales went through the HPNC Program, while no other builder reported more than 5% of their total sales going through the program. Given that most of the builders’ sales fell outside the program, and given that in 2016, 5 out of 6 builders made at least half of their sales through the program, there exists an opportunity to better inform builders about how to upsell the program to their customers.

Many 2017 participants learned about the program through builders, developers, or contractors. However, from the evaluation team’s interviews with builders, developers, architects, and engineers, it appears that, these program partners are largely unaware of the influence that their recommendations had on customers. This suggests that there may exist an opportunity for program staff to communicate with builders, developers, architects, and engineers about how the important role they can when it comes to informing customers about the program’s energy-efficiency opportunities.

Recommendation: *Provide training and education to a wider pool of builders, developers, architects, and engineers to ensure they 1) are aware of the program, 2) are aware of the important role they can play when it comes to informing customers of the program’s energy-efficiency program opportunities, and 3) effective sales tactics that demonstrate the benefits of the program to convert more of their customers into program participants.*

12.5.3 Identify Effective Ways to Engage Participants

In 2017, participants were very satisfied with the HPNC Program (94%). This is a statistically significant improvement from 2016 were only about one-half (53%) were satisfied or very satisfied with the program.

There is some room to improve the clarity of program materials and the program application. Participants in 2017 gave moderate satisfaction ratings of between 3.1 and 3.4 on a five-point scale to both these elements. Participants recommended making both the materials and application more user friendly.

In both 2016 and 2017, almost all the surveyed participants stated that they were motivated to participate in the program due to a desire to save energy or lower energy bills (95% in 2016; 94% in 2017). Increased comfort and/or productivity were the next greatest motivator for participation in 2017, reported by 72% of participants; this factor was less of an important motivator in 2016, mentioned by only 47% of participants.

2017 participants stated it could be difficult to make future energy efficient upgrades due to a lack of time to research equipment upgrades and the benefits not outweighing the costs (six respondents each). Other challenges included the electric costs not being a concern, not being able to afford the upgrades, and being unaware of where to get the necessary help (5 respondents each).

Architects and engineers reported that they find building owners to be most driven by the payback period and the energy savings available when they choose to complete a project up to the HPNC program standards. They considered the amount and complexity of paperwork the biggest challenge facing potential applicants.

Recommendation: *Improve on the clarity of the program materials and the program application process by making them more user friendly for customers.*

Recommendation: *Ensure that customers fully understand the program savings opportunities. It is critical that the program clearly explain the energy and monetary savings opportunities to customers, as is helping customers identify deeper energy savings to justify the work.*

Recommendation: *Communicate the value of Non-Energy Benefits. For customers who may be less concerned about energy or monetary savings, describing the non-energy benefits associated with participation may be a more effective engagement strategy.*

12.5.4 Maintain Focus on Minimizing Free-Ridership

The overall free-ridership results for the 2017 HPNC Program were high (43% FR), and there was little evidence of spillover. In contrast, the 2016 results saw slightly lower levels of free-ridership (35.8%), though it is challenging to compare across years given the small number of respondents and given that results are not statistically significant across years (19 in 2016; 17 in 2017).

Most 2017 participants (76%) reported that they would have done the same project (seven of 17 participants) or a scaled back version (6 of 17 participants) had they not been aware of the program incentive. This appears to be a slight improvement in comparison to 2016 where 89% would have done the same project (10 of 19) or done it but scaled it back (7 of 19). However, the difference is not statistically significant and therefore should be viewed with caution and considered directional at best.

Recommendation: *Maintain focus on minimizing free-ridership. Key areas of focus include: a) identifying and targeting customers who would not do the project without program support; and b) screening applications for customers who have not already begun implementing measures. Since the budget allocated to building energy efficiency is typically made early on in the project planning process, learning about the available budget and the measures it is intended to cover could provide an effective approach to identifying possible free riders.*

12.6 Existing Building Commissioning Program

12.6.1 Maintain Focus on Minimizing Free-Ridership

Like the HPNC Program, the EBCx Program's overall free-ridership results were moderately high (55%), though given the small number of respondents (n=3), it is difficult to identify any trends in customer decision-making. When asked what they would have done if they had never learned they could receive incentives from the EBCx Program, two respondents said they would have scaled back on the size or extent of their upgrades by a moderate amount, and one respondent said they would have done the exact same upgrade anyway. In contrast, in 2016, the two interviewed participants indicated 0% free-ridership. However, given the small number of respondents, it is not possible to determine if this difference is statistically significant.

Recommendation: *Maintain focus on minimizing free-ridership. Key areas of focus include: a) identifying and targeting customers who would not make upgrades without program support; and b) screening applications for customers who have not already begun implementing measures.*

12.6.2 Decrease Project Completion Time

Overall, the participants, as they were in 2016, and the commissioning agent were satisfied with the EBCx program. The commissioning agent thought that the length of project completion time was too long, and is a significant problem. Project delays can potentially result in a number of unfavorable outcomes:

- An inability for customers to realize monetary savings from efficient equipment installs
- An inability for IESO to realize energy savings from said installs until completion
- Program customer and project attrition
- Potentially decreased customer satisfaction levels

In general, project length may be explained in part by what the commissioning agent described as "onerous" data gathering and reporting requirements, corporate budget re-evaluation when projects are extended into subsequent fiscal years, the attrition of energy managers incentivized through the program in these cases, and in delays by some LDCs in completing reviews of required reports.

Recommendation: *Consider reducing the number of reports required at each of the four stages of the program to two. This would reduce monetary expenditures on data gathering and reporting by participants and incentivized by IESO, would reduce the potential for delays in the reporting and review processes, and ultimately shorten project completion time.*

Recommendation: *Formalizing a project management role and an implementation schedule within the program would help ensure the meeting of deadlines and accountability in doing so. This addresses the need in the program for a group familiar with the program deadlines, pressures, and requirements, and the issues faced by corporate customers.*

12.7 Cross Cutting Observations and Recommendations

12.7.1 Continue to Improve IESO Responsiveness

In 2017, LDC staff thought communications from the IESO were excellent or good; relatively similar levels of responsiveness were seen in 2017 as in 2016, though comparisons should only be considered directly as results are not statistically significant across years. IESO communications were assessed in three areas: overall communications (83% rated as excellent/good in 2017; 78% in 2016), adequacy or completeness of responses to inquiries or requests for clarification (73% rated as excellent/good in 2017; 81% in 2016), and timeliness of responses (77% rated as excellent/good in 2017; 78% in 2016).

Recommendation: *Continue to improve IESO responsiveness both in terms of quality of responsiveness and timeliness of response to LDC inquiries or requests for clarification.*

12.7.2 Continue to Foster Understanding of NTG and Related Best Practices

Both LDC staff and IESO staff provided constructive suggestions regarding educational opportunities surrounding NTG topics and best practices used to help improve NTG scores. Common suggestions included 1) more outreach regarding the NTG methodology over the course of the year (not just during the time of the evaluation), and 2) considering ways in which LDCs could be educated on this topic in a more interactive and familiar way, such as during road shows or as part of workshop-style sessions. Less than half of surveyed LDC staff (43%) indicated they have a very good understanding of the methods IESO program evaluators use to calculate NTG scores. Nearly one-quarter (20%) have a moderate understanding of these methods, and nearly one-third (30%) do not understand how the IESO program evaluators calculate NTG scores. However, the majority of LDCs (67%) indicated that they take proactive steps to help improve their NTG score such as educating customers (30%) and closely reviewing applications (20%).

Recommendation: *Although the free-ridership results for most of the Business Programs were mostly positive, it will continue to be important to: a) For program marketing and outreach to target customers who would not make upgrades without the support of the program; b) As part of the program application review process to effectively screen for eligible customers who have not begun work; and, c) For program delivery partners to more readily identify projects that would not be completed without the support of the program; and d) Continue to provide educational opportunities or materials to LDC staff and associated* *program delivery partners regarding NTG and related best practices as these educational opportunities or materials may be helpful when working to improve NTG scores.*

12.7.3 Continue to Improve Marketing Materials and Resources

In 2017, the evaluation team performed a review of a subset of the most common types of marketing materials and resources that the IESO and a subset of LDC staff have developed in support of the Save on Energy Business Programs. Common marketing materials included brochures, bill inserts, web pages, case studies, and sell sheets. The analysis has indicated that the marketing materials and resources reviewed were generally clear and effective for customers and vendors to utilize. While most materials reviewed were of good quality and clarity, there were some materials that the team determined to be lower quality, typically due to a lack of information to facilitate participation. This included missing phone and/or email addresses, and/or no information regarding eligibility. Brochures and Case Studies most often lacked this information.

Some participants who responded to the process and NTG surveys indicated a desire for more clarity or more effective materials; participants often suggested making the materials more user friends and straightforward, ensuring that information on materials do not conflict with information from LDCs or vendors, and ensure delivery of all materials. Some vendors indicated additional marketing support from the LDCs or the IESO would better support them in their efforts to engage customers. Given this feedback, further opportunities may exist to engage customers or support vendors with additional or updated marketing materials and resources in future program years.

Recommendation: *Continue to look for opportunities to improve upon existing—and develop additional—marketing materials and resources to engage customers and support vendors.*

Appendix A Purpose and Goals of Each Program

A.1 Retrofit Program

The Retrofit Program is designed to be a cost-effective means to support the LDCs' achievement of demand-reduction and energy-savings targets for the 2015-2020 Conservation Framework. The primary objective of the Retrofit Program is to assist owners and operators of commercial and institutional (C&I) buildings, farms, and multifamily residences to reduce demand and save energy through the purchase and operation of energy efficient equipment.

The LDCs and the IESO support the program with robust, segment-specific marketing and promotional activities. These activities are targeted at building owners, operators, occupants, tenants, and supply chain partners. LDCs deliver the program through a combination of their direct sales forces, which the technical and administrative resources support, and through shared service arrangements with other LDCs and third-party suppliers.

The program categorizes projects into two tracks:

1. **Prescriptive approach**. This track relies on a list of specific measures. Participant incentives for prescriptive projects follow the prescriptive forms and worksheets, which specify the dollar amount per unit installed, while the total incentives may not exceed 50% of the total project costs, there is no maximum incentive cap payable for the project.

2. **Custom approach.** At the other extreme, the custom approach requires a more sophisticated, and in some cases complex process to determine the potential for demand reductions or energy savings. Participant incentives are: (1) $400/kW or $0.05/kWh for lighting measures, whichever is higher, to a maximum of 50% of the project costs; and (2) $800/kW or $0.10/kWh for non-lighting measures, whichever is higher, to a maximum of 50% of the project costs; this includes lighting controls.

A.2 Small Business Lighting (SBL) Program

The SBL Program provides owners and tenants of commercial, institutional, agricultural facilities, and multifamily buildings the opportunity to receive up to $2,000 in incentives towards eligible energy efficient lighting upgrades. Participants who wish to have qualified equipment installed above the $2,000 limit are eligible for additional incentives that are intended to further the impacts and reach of the program.

To qualify for the retrofits, the participant must own or lease the facility where the installation will be carried out; lessees must demonstrate they have the right to install Eligible Measures, either as a term under their lease, or by consent of the owner or operator of the facility. Eligible measures are those specified on the Eligible Measures Price List and include a wide variety of lighting fixtures and lamps, as well as items such as insulation and pipe wrap for electric water heaters. If the facility in which the eligible measures are to be installed is individually metered, it must be a general-service account with less than 50 kW demand, as designated by the LDC. If the facility is not individually metered, the average estimated demand of all units connected to the bulk meter over a 12-month period must be less than 50 kW.

A.3 Business Refrigeration Incentive (BRI) Program

The BRI Program provides for Facility assessments to identify potential electricity savings opportunities and installation of commercial refrigeration upgrades aimed at reducing electricity consumption.

The BRI Program is aimed at promoting energy efficiency and giving small business owners an opportunity to implement refrigeration equipment upgrades. The program is designed to address and overcome barriers to the implementation of these measures by small business owners, including limited awareness of energy use and time of use rates, electricity operating costs of refrigeration equipment, and limited availability of refrigeration equipment from distributors and limited access to capital to upgrade refrigeration equipment.

The BRI Program offers Participants a service which provides:

- An assessment of their Facility at no charge to the Participant.
- Up to $2,500 of Eligible Measures provided and installed.
- An opportunity for the Participant to contribute their own capital for any measures in excess of $2,500.

A.4 Audit Funding Program

The objective of the Audit Funding Program is to provide incentives to owners and lessees of commercial and institutional facilities, multifamily buildings, and agricultural facilities to carry out energy audits to identify all possible opportunities to reduce electricity demand and consumption.

Under this program, owners of eligible facilities can receive participant incentives of up to $35,000, or 50% of the cost of the audit, for completion of an energy audit. Lessees of only part of a building—for example tenants in large office buildings—can receive participant incentives of up to $7,500 for an energy audit of the facility’s lighting systems and office equipment.

The intention is that most, if not all, of the recommended measures that are completed are implemented through the Retrofit Program.

A.5 High Performance New Construction (HPNC)

The HPNC Program provides design assistance and incentives for building owners and planners who design and implement energy efficient equipment within commercial, institutional, industrial, or multi-residential occupancy new construction or major renovation projects. Incentives are offered for measures or designs that exceed the current Ontario Building Code requirements.

Prescriptive track measures are offered to the Agribusiness sector only. Engineered worksheets are used to calculate savings and incentives for certain technologies that include exterior lighting, interior lighting, and unitary AC systems. The Custom track incentives are for measures not included in the prescriptive or engineered tracks and can be taken advantage of by the building owner, or by a design decision maker such as an architect, engineer, or consultant. Custom projects require the use of energy modeling software to demonstrate the incremental energy savings above what would be required by the OBC. The cost of modeling, up to the maximum incentive amount of $10,000.

A.6 Existing Building Commissioning (EBCx)

The EBCx Program provides funding for projects comprised of commissioning phases and the installation of measures to reduce electricity consumption associated with chilled water systems in existing industrial, commercial, institutional, and multifamily residential buildings.

Participant incentives are offered for the following phases of a project, subject to the eligibility requirements set out in the program rules:

- Scoping Study Phase
- Investigation Phase
- Implementation Phase
- Hand-Off/Completion Phase

Appendix B Impact Evaluation Methodology

B.1 Impact Evaluation Methodology

The evaluation team verified energy and demand savings by conducting the following impact evaluation activities:

- Sampling of projects
- Performing project audits on selected sites
- Comparing the IESO-reported savings to the savings established by site visits to determine “verified gross” savings
- Using attribution surveys to estimate net-to-gross ratios and “verified net” savings

B.1.1 Impact Evaluation Sampling Plan

Random sampling of projects under each program begins with studying population distributions and progresses to developing a sampling plan based on:

- Overall confidence/precision targets of 90/10 at the program level for each program year assuming a coefficient of variation (CV) of 0.5.
- Historical participation levels and relative proportions of the 2016 program year’s samples to understand the necessary size of the 2017 sample. This comparison was made for each program and, for the Retrofit Program, at the different tracks (prescriptive, engineered, and custom) and measure type (lighting / non-lighting) sub strata.
- Historical reported savings and relative proportions of the 2016 program years’ samples to understand where to focus the limited evaluation resources. Again this comparison was made for each program and, for the Retrofit Program, at the different tracks and measure type sub strata.
- Historical sample statistics (CVs and relative precision) from the 2016 Cross-cutting Business Programs evaluations to inform where the most uncertainty and variability can be expected.
- Historic sample counts from the 2015-2016 Cross-cutting Business Programs evaluations to build upon the evaluation work that has already been completed. Historical samples from the 2015-2016 evaluations were incorporated into the 2017 Retrofit sample. Only 2016 historical samples were incorporated into the 2017 SBL sample due to the redesign of the SBL Program. The Audit Funding Program did incorporate 2015 and 2016 historical sample into the 2017 sample. Only 2016 historical sample data was included into the 2017 HPNC sample. No historical samples were incorporated into the 2017 BRI or EBCx samples. The use of historical impact samples allows for higher confidence and precision reporting at the program and business sector levels, or track levels.
- Preliminary 2017 participation levels provided in program database extracts.

To provide the most cost-effective sample, a value of information (VOI) approach was employed. Evaluators use VOI to balance cost and rigor; VOI follows a process to allocate the bulk of the evaluation funds to programs and projects with high impact and high uncertainty. The evaluation team chose to use VOI to guide their sampling plans: IESO requires cost effective, yet reliable, evaluation methods; and it is expected that regulatory scrutiny concerning the evaluation may occur. The VOI algorithms supplement the deterministic sample-sizing of more-routine statistical sampling methods.

The total 2017 sample size was 379 projects. By including the sample projects collected during the 2015-2016 Cross-cutting Business Program evaluations, an additional 105 Retrofit, 61 77 SBL, 17 Audit Funding, and 48 HPNC and 6 EBCx sample projects were utilized in this year's analysis. These additional sample projects leverage the prior evaluation work and improve the confidence and precision of the 2016 results. These sample projects were used in the 2016 impact evaluation because the programs have not changed significantly and are still representative of the populations. The total effective sample size for the entire evaluation is 723 projects.

The sampling plan was carefully designed to achieve high levels of precision allocated to the right measure categories considering the value of information gained by each sample. Based on the team's experience on evaluating similar programs in other jurisdictions and the 2008-2016 Commercial and Industrial (C&I) evaluations for the IESO, the following sampling plans ensure higher levels of precision for the entire four-year evaluation effort. Samples are allocated annually to the programs using precision requirements by project size.

Retrofit Program Sampling Plan

The Retrofit Program sampling plan targeted 90% confidence at 10% precision at the track level for the 2016 program year.

- Samples collected in the 2015–2016 Retrofit Program evaluation were used to increase the confidence and precision of the 2017 reporting.
- The allocation of the 2017 sample across the prescriptive, engineered, and custom tracks was informed by analyzing the reported 2017 energy savings and the coefficients of variation of the 2015–2016 sample projects.
- On-site measurement and verification was conducted on 82 projects in 2017.

SBL Program Sampling Plan

The SBL Program sampling plan targeted 90% confidence at 10% precision at the program level for the 2017 program year. Only 2016 historical SBL samples were incorporated into the 2017 SBL sample since the program underwent significant changes in 2016.

BRI Program Sampling Plan

The BRI Program sampling plan targeted 90% confidence at 10% precision at the program level for the 2017 program year. No historical samples were incorporated into the 2017 sample since 2017 was the first year the program was offered at the provincial level.

Audit Funding Program Sampling Plan

The Audit Funding Program sampling plan targeted 90% confidence at 10% precision at the program level.

HPNC Program Sampling Plan

The HPNC Program sampling plan targeted 90% confidence at 10% precision at the track level for the 2017 program year.

EBCx Program Sampling Plan

The EBCx Program sampling plan targeted 90% confidence at 10% precision at the program level.

Overall 2017 Sampling Plan

The sampling plan for the impact evaluation is presented and discussed in the impact evaluation section of each program. The sampling criteria defined above were used to determine the final sample sizes.

B.1.2 Project Audits

The evaluation team performed project audits for all the programs. These audits are described in this section.

Retrofit Program Level-1 Audits

Level 1 audits were performed on all projects in the 2017 Retrofit Program sample. These consisted of desk reviews of project documentation available in IESO's iCon database, such as applications; IESO savings worksheets; savings calculations performed by participants or third-party contractors (if applicable); audits; metered data; invoices for equipment or contracting services; and any other documentation submitted to the IESO.

The first step in the audit is to determine whether the project documentation substantiates the project's eligibility. Application documents serve to validate the applicant, facility, and project eligibility; financial records confirm that incentive amounts were tabulated correctly and that the incentive caps were followed. This step also determines a project's proper classification as either commercial or industrial.

Retrofit Program Level-2 Audits

The Level 2 audit expands on the work conducted for the level 1 audit, adding an on-site review of the equipment installation, a financial audit, and a full review of the projects' eligibility. When feasible – for simple projects that involved only lighting measures and that had a well-defined operating schedule – the analysis is completed without visiting the participant at the associated facility. These desk-review-only projects were limited to a maximum of 30% of the Retrofit Program sample.

Retrofit On-Site Review

Before on-site activities are conducted, measurement and verification plans are developed to create a standardized, rigorous process for the verification of project claims. Common, measure-specific measurement and verification plans were created for measures in the prescriptive, engineered, and custom tracks. Custom projects received a heightened level of documentation review for the creation of site-specific measurement and verification plans.

In developing the measure-and site-specific measurement and verification plans, the IESO EM&V Protocols and the International Performance Measurement and Verification Protocol (IPMVP) were leveraged. All measurement and verification plans were tailored to verify that the equipment was installed as claimed, that the baseline scenario was appropriate, and that the installation achieved the claimed energy and demand savings. The plans also included questions and activities to address particular research topics, such as market effects, effectiveness of program operations, net-to-gross ratios, and customer satisfaction.

The choice of IPMVP option and the effort put into verifying the input assumptions depended on the type of equipment the project installed and the inherent variability in the input assumptions.

Because site inspections were critical to the accurate evaluation of programs, representing a significant portion of the effort, the evaluation team worked to carefully plan and cost-effectively execute site inspections. Data-collection input forms were developed for each measure and site. These forms standardized and streamlined data-collection efforts, minimized errors in data collection techniques, and enabled easier input into the data-collection database.

Once the measurement and verification plans and associated data collection forms were created, the evaluation team proceeded with on-site audits. Telephone calls with selected participants served as an introduction to the evaluation activities, and recruited participants were also encouraged for on-site inspections. On-site audit activities differed according to each measure and site’s measurement and verification plan, but generally included the following:

- Collecting baseline and retrofit equipment information.
- Obtaining the operating parameters.
- Conducting a visual inspection.
- Gathering equipment nameplate information.
- Metering and data-logging activities conducted per the site-specific measurement and verification plan.
- Conducting brief on-site interviews with relevant parties to understand the building operation, load shapes, equipment operating specifics, and other input parameters needed to calculate energy savings; during the interview, the inspector attempted to obtain information to assess the overall program comprehensiveness and direct employment.

The evaluation team paid particular attention to projects’ baseline conditions in specific cases: for custom-track projects; for large, engineered projects with a high degree of uncertainty surrounding their input assumptions; and for projects that represented a significant portion of the overall program’s savings. Baseline conditions were determined by interviewing participants, observing similar locations within the facility in question, considering local energy codes and standards, consulting application documents, and other means.

Attribution surveys were used to assess the net-to-gross savings ratios of participants. When participants were willing, these surveys were integrated into on-site activities. For more information on the attribution surveys, please refer to Section B.1.5.

In addition to the verification of energy impacts, on-site visits helped the evaluation team gather data for evaluating four critical issues in program delivery:

- IESO input assumptions.

- The examination of discrepancies between verified savings and reported savings, especially in custom projects where business process issues could have created the discrepancy.
- A qualitative and quantitative assessment of the audit process for projects that participated in the Audit Funding Program.
- The assessment of measure-penetration rates and measure preferences by participants' facility type.

SBL Audits

The analysis of the SBL Program first involved reviewing the reported measure types and quantities for all of the sampled projects. This was downloaded from the SBL Program database and entered into the measurement and verification plans for each site. During the on-site reviews the inputs pertinent to the calculation of gross savings were evaluated.

The methodology used for the site reviews incorporated a protocol that follows Option A IPMVP for lighting measures, called "Retrofit Isolation: Key Parameter Measurement." Engineering calculations were used, along with partial site measurements, to verify the savings resulting from specific measures. Key parameters that were investigated on-site included baseline and retrofitted equipment, installed lamp wattages, and operating hours.

Site inspectors gathered information on baseline and retrofit equipment, as well as actual operating conditions. Appendix Table B-1 outlines the data that were collected for each measure type by on-site engineers.

Table B-1: On-Site SBL Program Inspection Information

Measure	Baseline Information	Retrofit Information
Lighting measures	Baseline lamp type (Incand., T8, etc.) Baseline ballast type (Magnetic or electric) Lamp size (4 ft. or 8 ft.) Number of lamps per fixture Wattage per lamp Location of lamp Fixture Quantity # of Operating Hours for Different Weeks	Retrofit lamp type Confirm electronic ballast and factor Lamp size (4 ft. or 8 ft.) Number of lamps per fixture Wattage per lamp Location of lamp Fixture quantity Number of operating hours for different weeks

To verify the actual energy and demand savings, the evaluation team recorded lamp wattages and ballast factors of the retrofitted equipment. Normal, seasonal, and holiday operating hours were confirmed with the participant. When participating businesses had irregular operating schedules, lighting loggers that collected data for at least five business days were installed.

As is typical in many evaluations, baseline equipment data was not always available at the time of the site visit because the equipment had already been removed. When baseline data was not readily available, on-site engineers did their best to determine the correct baseline equipment through information available on-site, surveying project participants and reviewing equipment inventories to attempt to correctly estimate the baseline measure. If baseline information couldn't be collected through any of these channels, it was assumed that baseline equipment and quantities matched those in the measure description and the tracking database.

BRI Program Audits

Data collection included both desk reviews and on-site verification. The desk reviews consisted of reviewing project documentation available in the program's tracking database, such as installed measure types and quantities. For each desk review, Nexant contacted participants via phone to first verify which measures were implemented by the program. For measures the customer indicated as being implemented, the phone surveys then confirmed measure characteristics such as measure quantity, size, capacity, and hours of use.

The site visits expanded upon the work conducted for the desk reviews and also included an on-site review of the measures implemented and an in-person interview with the site contact. For a subset of the projects visited, the Nexant team deployed data loggers to verify equipment hours of use.

For each measure type implemented in the program, Nexant created a calculator to automate and standardize savings algorithms across all evaluated projects, yet allowed for data collected on site to be used as inputs when available. The algorithms used to determine savings primarily referenced Ontario Power Authority's (OPA) 2011 Quasi-Prescriptive Measures and Assumptions Release (Version 1). In some instances, algorithms from other regional Technical Reference Manuals (TRMs) were used, as these other algorithms allowed for more detailed site-gathered data inputs to be used. For example, the ECM evaporator fan motor savings algorithm listed in the OPA reference document simply uses a savings factor based on display case length, baseline motor type, and presence of display case doors. Alternatively, the savings algorithm listed in the 2017 Pennsylvania TRM for ECM evaporator fan motors also includes input parameters such as evaporator fan motor input wattage and refrigeration system coefficient of performance.

Audit Funding Program Audits

The evaluation team completed site visits, desk reviews, and telephone interviews for the 2016–2017 Audit Funding Program sample. The desk reviews included a review of the audit reports, invoices, applications, and other project documentation. Site visits were completed for the portion of the 2016 sample that indicated they had implemented recommended measures without an incentive. The audit reports were evaluated based on how comprehensive the scope of the audit was and whether the information provided for each recommended measure was complete. All recommended measures and estimated savings identified in the reports were compiled.

Telephone interviews were conducted with participants to determine how many of the recommended measures were installed, what measures are slated for installation in the future, and whether the participant received any incentives.

For measures that were not implemented, the evaluation team asked if and when the participant planned to implement them and what barriers were preventing them from implementing the recommended measures.

HPNC Program Audits

Data collection for the HPNC Program varied depending on the program track of the sampled project. All HPNC sample projects, including Custom track projects, received a Level 1 audit which involved a review of the project documentation and file transaction process.

A majority (30 of 48) of sampled Prescriptive and Engineered track projects received a Level 2 audit which included an on-site review and verification of the installed equipment. Project-specific

Measurement and Verification (M&V) plans were developed in advance of the on-site visits to ensure the time spent on site is focused on collecting and/or verifying the most important project information. Field engineers worked with facility staff to establish baseline conditions, equipment loads, and operating schedules. Results from all sampled projects were compiled at both the project level, to calculate strata level statistics, and the measure level, to determine if prescriptive per-input assumptions are appropriate.

Level 2 audits for sampled Custom track projects involved the review and verification of the modeled savings results. Nexant assigned engineering staff with direct model simulation experience for these projects. If model simulation reports, savings summaries, equipment specification sheets, design drawings, or other modeling data were missing, the Nexant team attempted to obtain these missing documents from the LDCs or participants directly. Model inputs and methodologies used by the participant were checked to make sure the appropriate baseline conditions were used and that the modeled design parameters are consistent with the implemented design.

EBCx Program Audits

The evaluation team completed desk reviews and telephone interviews for the six completed EBCx Program projects. These desk reviews included a review of the hand-off-stage reports, previously submitted reports, invoices, applications, and other project documentation. Telephone surveys were conducted to discuss the project with onsite personnel and with the commissioning agents who were responsible for implementing the commissioning measures and calculating the savings. When possible, additional data were collected and used in the analysis. The evaluation team studied the methodology used to calculate reported savings and then using similar methods and verified assumptions, verified savings values were developed. IPMVP Option C, for whole-building multiple-ECM projects was used in the reported and verified savings calculations.

B.1.3 Gross Reported Savings

Gross reported savings are the savings estimates taken from information submitted on participant applications. For the 2017 program year evaluation most reported savings estimates were provided in the IESO program datasets. The Audit Funding Program did not track savings information. The following section describes how the estimates for the Audit Funding Program were developed.

Audit Funding Program Savings

The Audit Funding Program is intended to identify potential retrofit opportunities for participants, and subsequently funnel them to the Retrofit Program for project implementation. Because of this interconnection, most of the electricity savings that stemmed from the Audit Funding Program were captured by the gross savings estimate for the Retrofit Program.

However, two potential situations exist in the Audit Funding Program which would be able to claim savings:

1) When electricity consumption reduction measures, identified by the Audit Funding Program, were later implemented outside of the Retrofit Program.

2) When measures to use non-electric energy resources (i.e., natural gas, propane, and water) identified by the Audit Funding Program were later implemented without the influence of a rebate from another resource provider (e.g., natural gas utility).

The evaluation team used level 1 audits and participant surveys to understand the amount of “spillover” savings that could thus be attributed to the Audit Funding Program.

The evaluation team conducted reviews of the available project documents before contacting the audit participants. The project documentation provided by the LDCs typically included the pre-application, post-application, invoices, credentials of the auditors, and the audit report. However, the IESO program tracking database did not contain information on the building statistics, energy consumption, or estimated potential savings of the audit recommendations. Hence, the initial Level 1 audit helped the evaluation team understand the scope, quality, and quantity of potential energy savings identified in the audits. The limited available information on the Audit Funding Program population also informed the choice of methods that was used to determine the savings that could be attributed to the program.

The engineers conducting the level 1 audits assessed the completeness and comprehensiveness of the audit reports and application documentation. The application documents were used to determine if the project incentives had been calculated correctly. Audit reports were also used to compile information on the type and size of audited facilities, the types of recommended energy-saving opportunities, the types of systems that were audited, and the methods used to estimate savings. This information was compiled from the Level 1 audits into spreadsheets for analysis and provided team members with a list of measures to investigate during the telephone surveys.

Before contacting the participants in the sample, the evaluation team used the IESO databases to determine if any of the Audit Funding Program participants in the sample had completed a Retrofit Program project. Any Audit participant that completed a Retrofit project was slated for an on-site review, because this indicated a willingness to implement measures and a higher likelihood that the participant had also implemented other recommended energy-saving measures. The evaluation team did not attribute the estimated energy savings associated with these measures to the Audit Funding Program, even though the audit may have first identified these measures.

During each participant survey, the evaluation team asked a series of specific questions. These questions explored whether any of the recommended measures had been implemented, and whether the participant received any non-Save on Energy rebates for the measure.

The data collected as a result of the Level 1 reviews and telephone surveys allowed the evaluation team to determine the ratio of attributable electrical annual energy savings to the total annual electricity consumption for the sample projects. This ratio was then multiplied by the annual electricity consumption of each project in the sample to provide an estimated amount of energy savings for each project in the sample. The average of these estimated project-level energy savings was then allocated to each completed audit in the 2016 population.

This method was used because of the limited data available in the Audit Funding Program database and because of the need for an estimated gross reported savings value.

B.1.4 Gross Verified Savings

The data collected as a result of the audit activities described in Appendix B.1.2 allowed the evaluation team to calculate energy and demand savings for each sample project; this resulting value was called the “gross verified savings.” The gross verified energy and demand savings represented the evaluation team’s estimate of the actual savings achieved as a result of the incentivized project.

From the sample projects, the ratio of gross verified savings to the reported savings, known as the project "realization rate," or adjustment factor, was calculated.

Appendix Equation B-2 shows the basic formula for calculating gross verified savings.

Equation B-2: Verified Savings

$$Savings_{ver} = Savings_{rep} \times Realization\_Rate$$

where:

Savings ver =	Savings (kWh or kW) verified by the evaluation team
Savings rep =	Savings (kWh or kW) reported by IESO
Realization Rate =	Average Savings $_{ver}$ /Savings $_{rep}$ for each sample project

The equation shows that a realization rate of 1.0 meant that the verified savings were equivalent to the reported savings. A deviation from 1.0 meant that actual savings were different than the values the IESO reported.

For each stratum identified in the sampling plan, the evaluation team calculated a stratum-level realization rate, as the weighted average of the project-level realization rate. Total stratum-level gross verified savings are the product of the reported savings for that stratum and the stratum's realization rate. Stratum-level gross verified savings reflect the direct energy and demand impact of the program's operations. These savings do not account for customer or market behavior impact that may have added to or subtracted from a particular program's direct results; these market effects are captured in the net impact analysis.

The evaluation team did not stratify the SBL population; hence one realization rate was applied to all reported lighting savings in the SBL Program population.

B.1.5 Gross Verified Peak Demand Savings

The evaluation team used the methodology and peak definitions outlined in the EM&V Protocols to calculate gross verified demand savings. As noted, the evaluation team calculated peak-demand reductions for the EM&V Protocols in one of two ways. For weather-independent measures, such as lighting, peak-demand savings were calculated as the average demand reduction across all peak hours. For weather-dependent measures, in addition to this average method, peak-demand savings were calculated as the weighted average of the top hour in each of the peak-period months during the defined peak hours. For weather-dependent measures, the highest estimate produced by either method to report EM&V Protocol demand savings was used.

The EM&V Protocols call for the calculation of both winter and summer peak-demand reductions; thus, numbers for both periods are presented in this report. However, the IESO has determined that only summer peak-demand savings should be used for reporting.

Interactive Equipment Energy Changes for Lighting Retrofits

The IESO's CDM programs incentivize the implementation of equipment whose efficiency is above that which a customer might otherwise install. By definition, this equipment should consume less input energy per unit of output energy. However, the energy consumption of equipment in an enclosed space cannot be viewed in isolation. Building systems interact with one another and a change in one system can affect the energy consumption of another. This interaction is important to consider when calculating the benefits provided by CDM programs because it adopts a comprehensive view of societal-level energy changes, rather than limiting the analysis to the energy change directly related to the modified equipment. In fact, the IESO Evaluation Measurement and Verification (EM&V) Protocols state that interactive energy changes should be quantified and accounted for whenever possible.

Based on the information that is currently tracked by the IESO, the evaluation team and the IESO agreed that the most defensible methodology would be to calculate interactive energy changes for lighting retrofits only. These energy changes have been included in verified savings estimates.

See Appendix G for a more detailed review of the method for calculating interactive energy changes for lighting retrofits.

8760 Load Shape Analysis

Load shapes are vital in calculating system on-peak demand savings, especially when the installed measures have daily and seasonal variations in operating schedule. The evaluation team used the operating schedules and metered data gathered during the project audits to construct 8,760 hourly load shapes for each sampled project. This made it possible to accurately calculate peak-demand savings following the EM&V Protocol definitions for standard and alternative peaks. See Appendix E.2 for information about the load shapes that were generated during the impact analysis.

Lifetime Savings

The EUL of retrofit equipment is an important consideration in the assessment of program effectiveness because the avoided energy, demand, and cost benefits continue to accrue over the lifetime of the measure.

An EUL for each impact stratum was calculated by weighting the individual project EUL values by the annual net verified energy savings. Individual project EULs were assigned based on the retrofit measure type, using values sourced from the Database for Energy Efficient Resources (DEER). For most measures, lifetime energy savings are calculated as:

Lifetime Energy Savings = EUL x Annual Energy Savings.

However, for lighting measures, this approach was adjusted, as described below.

Adjusted Baseline for Lighting Measures

Changes to Canada’s energy efficiency regulations are impacting the availability of specific lighting technologies in the marketplace, namely general-service linear fluorescent T12s and general service screw-in incandescent lamps. These technologies are part of the mixture of baseline lighting equipment applicable to lighting retrofit in IESO CDM Programs. To address the impact of changing efficiency requirements, baseline assumptions must reflect current market conditions when lighting efficiency projects are completed. In order to address the phase-out of certain baseline technologies, Nexant with its sub-consultant EcoMetric Consulting (EcoMetric) performed a study to identify the market conditions relevant to these technologies.

Surveys of Ontario’s lighting market actors were conducted via web and phone, including IESO program participants and non-participants. This survey data show there has clearly been significant market adoption of high-efficiency linear fluorescent lamps and ballasts as well as LED general service screw-in lamps. In order to provide robust qualitative and quantitative data to support a baseline adjustment, in-depth interviews (IDIs) were conducted with 24 market actors including major distributors, retailers, and contractors. Probing for current and future lighting sales in Ontario the IDIs confirmed that a significant share of Ontario's lighting market is composed of legacy lighting products and the respondent's sales expectations suggest these less-efficient technologies will remain in the market through 2020.

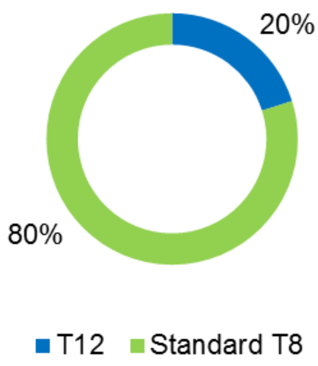
IDI response data shows that LEDs are expected to become the leading product type in Ontario's linear lighting market by 2020 with or without the IESO's program support. However, a surprisingly large amount of standard T8 and legacy T12s are expected to remain in the market even with IESO programs. Respondents generally felt that the cost of replacing ballasts, as well as a lack of familiarity of LED options in the linear market will remain as barriers to a complete shift towards more efficient linear lighting products.

The IDI data also shows that while LED technology has already assumed a dominant market share in Ontario's screw-in lighting market, incandescent and halogen technologies remain an important part of the market despite their comparative inefficiency. Despite incentives from IESO lighting programs, the high price of LED screw-in bulbs remains a barrier, especially in the retailer segment. In the non-LED screw-in market, halogen bulbs are expected to remain prominent—largely driven by the demand for halogen reflector lamps.

The combined results from participant and contractor phone and web surveys, review of Electrofed manufacturing data, and in-depth interviewing with distributors, retailers, and other market actors all provide enough evidence to support calculation of shifted baselines for linear lamps and general service screw-in bulbs. Rather than a baseline for linear lamps that accounts only for standard T8 fixtures, it is recommended to include a component for T12 lamps in the baseline for relevant measures. Similarly, the baseline for screw-in lamps should not be based solely on the legislated lumen per watt efficacy standard, but rather should still account for inclusion of some component for legacy incandescent and halogen lamps.

Adjusted baselines were created for both linear and screw-in lighting technology by normalizing average sales data responses from distributors and retails participating in the IDIs. Figure C-2 depicts the blended baseline for linear lighting technology, while blended baselines for screw-in lighting are shown in Figure B-3. Averaging all respondents' answers for 2017 linear lighting sales and expected 2020 sales (with IESO programs), and normalizing those percentages, shows that approximately 80% of legacy product sales are standard T8 lamps and 20% are T12 lamps. A flat adjusted baseline was applied across all of 2015 through 2020. Results showed that while the momentum of linear LEDs in the market will remain strong and likely make up roughly two-thirds of linear lamp market share by 2020, the baseline breakdown is not estimated to shift dramatically from this roughly 80/20 share of T8s to T12s. No step-down in adjusted baseline was used for linear lighting during the 2015–2020 period.

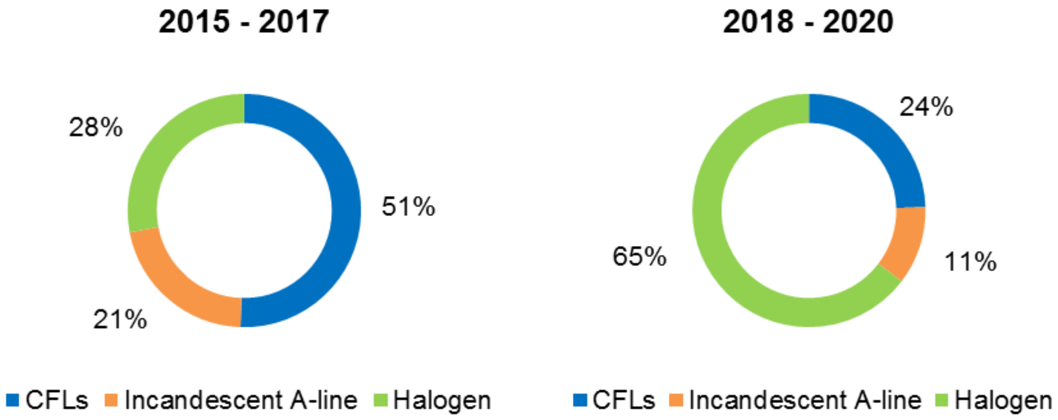
Figure B-3: Linear Blended Baseline



Averages of reported sales data from all distributor and retailer respondents was normalized to develop the breakdown of screw-in lamp types between CFLs, incandescents, and halogens. On average, distributors and retailers reported 73% of their 2017 screw-in lamp sales coming from LEDs, 12% from CFLs, 8% from incandescents, and 7% from halogens. Normalizing the breakdown of legacy lamp types (CFL, incandescent, halogen) shows that approximately 51% of legacy product sales in 2017 are CFLs, 21% are incandescent (A-line only), and 28% are halogen lamps. Put another way, of all legacy (non-high-efficient) screw-in lighting products in the market, there is a 51/21/28 split between CFL, incandescent, and halogen.

Contrary to the results found for linear technologies, this relative breakdown of baseline technologies is expected to shift appreciably by 2020. Distributors and retailers estimate that, on average, halogens will be sold longer than incandescents and CFLs. Even though LEDs are estimated to capture 90+% market share by 2020, the relative breakdown for the remaining technologies shifts from a 51/21/28 split in 2017 to a 24/11/65 split in 2020 for CFLs, incandescent (A-line), and halogen respectively. In other words, distributors and retailers envision the growth of LED screw-in lamps to come at the expense of CFL and incandescent market share, while halogens are expected to retain a stronger hold on the non-LED market. Code compliant halogens remain an affordable option and manufacturers continue to push these lamps due to their relatively short useful life. Figure B-3 shows the blended baselines for screw-in lighting technology.

Figure B-4: Screw-in Blended Baseline



Nexant implement adjusted baselines retrospectively using the first breakdown for program years 2015 and 2016, as well as to apply them to final 2017 estimates. In subsequent years, 2018–2020, adjusted baselines using the second breakdown shown should be used. These blended baselines are intended to only apply to A-type lamps, not including reflector or PAR lamps.

Since this study focused on the availability of specific lighting technologies in the marketplace, namely general-service linear fluorescent T12s and general service screw-in incandescent lamps impacted by Canada’s new energy efficiency regulations, it was determined that only the prescriptive lighting measures with these specific lighting technologies as the assumed baseline should have the blended baselines described in this report applied. This excluded any of the prescriptive lighting measures for pin-based fixtures, reflector lamps, and metal halide fixtures as well as the measures where a single specific type of lamp is the appropriate baseline.

Nexant applied the blended baselines to the 2015 and 2016 Retrofit populations and also removed the previous adjustment factors associated with the previous baseline shift assumption.

Appendix C Net-to-Gross Methodology

The following subsections provide details on the sampling plans for collecting NTG data for each program, the instruments used to assess free-ridership and spillover, the implementation of the data collection, and the analysis methods.

C.1 Net-to-Gross (NTG) Sampling Plan

The 2017 NTG sampling plan was developed to provide NTG results that were as representative as possible of individual LDC projects. This was accomplished by stratifying the program populations into three different strata that were dependent on the sample available for each LDC within a program. The three different strata of NTG values included (1) the LDC stratum, (2) the regional stratum, and (3) the province-wide stratum. For most programs, LDCs received the province-wide strata level NTG score for that program. Given the larger sample sizes associated with the Retrofit and SBL Programs, many LDCs were able to receive individual LDC strata level NTG scores for the 2017 program as those LDCs had survey responses that achieved 90% coincidence at 10% precision. The remaining LDCs in the Retrofit and SBL Programs either received their regional score or the provincial score, depending on the level of confidence and precision achieved. The following sections provide more details on the NTG stratification and sampling.

C.2 Net-to-Gross (NTG) Instrument

The evaluation team adapted and employed an effective questionnaire to assess free-ridership and spillover, which have been used successfully in many previous evaluations. For the majority of programs, the NTG ratio is defined as follows in Equation C-1:

Equation C-1: Net-to-Gross Ratio

$$\boldsymbol{NTG = 100\% - FR + SO}$$

where FR is free-ridership and SO is spillover.

For the Retrofit Program, the NTG ratio is defined by Equation C-2, where *FR* is the free-ridership percentage associated with the participants (including participants whose FR values were augmented by contractor FR estimates),[111] *SOpart* is the participant spillover percentage, and *SO active non-part* is the active non-participant spillover percentage.[112]

Equation C-2: Net-to-Gross Ratio – Retrofit Program

$$\boldsymbol{NTG = 100\% - FR + SOpart + SOactive\ non - part}$$

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[111] The free-ridership information collected from Retrofit Contractors was used to adjust participant free-ridership values for those participants who reported the contractor was influential on their installation decision-making.

[112] A Retrofit Program active non-participant is defined as any customer who applied to but did not ultimately participate in the Retrofit Program for reasons other than ineligibility.

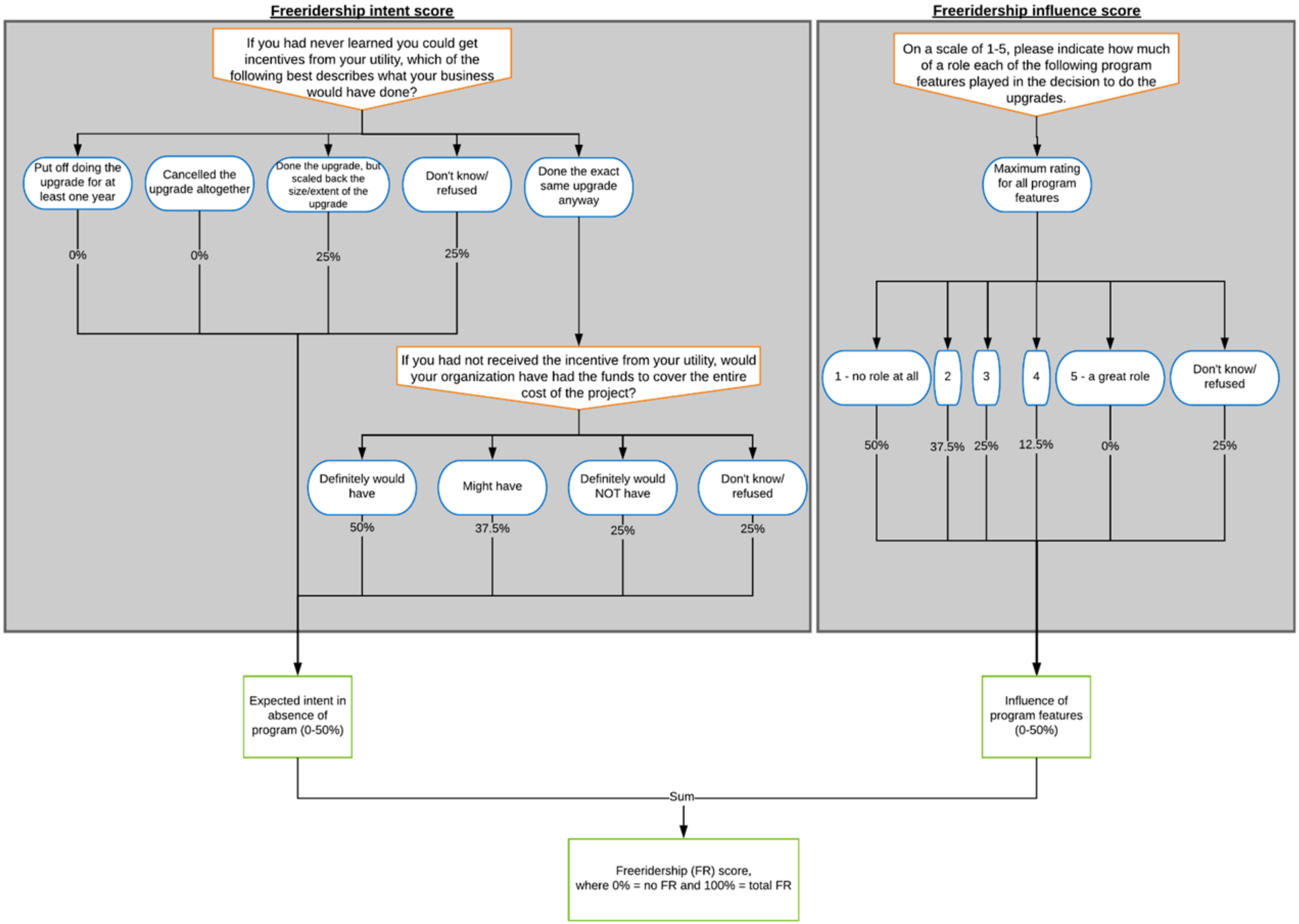
C.2.1 Free-Ridership Methodology

The questionnaire addresses attribution of savings for each sampled project (in the case of Retrofit, Retrofit P4P, SBL, BRI, HPNC, and EBCx) or type of equipment (in the case of Audit Funding) through two main components:

- Intention or the expected behavior in the absence of the program.
- Influence of various program features, such as the incentive, program marketing and outreach, and any technical assistance received.

Each component produces scores ranging from 0 to 50; the two components are summed to produce a total free-ridership score ranging from 0 (not a free rider) to 100 (complete free rider). The total score is interpreted as a percentage (0% to 100%) for the calculation of the mean free-ridership level for a given stratum. Figure C-1 on the following page illustrates the free-ridership methodology.

Figure C-1: Free-ridership Methodology



C.2.1.1 Intention

The intention component of the free-ridership score asks participants how the evaluated project would have been different in the absence of the program. The two key questions that determine the intention score are as follows:

Question 1: If you had never learned you could get incentives from your LDC, which of the following best describes what your business would have done? Your business would have...

1. Put off doing the upgrade for at least one year.
2. Cancelled the upgrade altogether.
3. Done the upgrade, but scaled back the size or extent of the upgrade.
4. Done the exact same upgrade anyway → Ask Question 2

98. Don't know
99. Refused

[ASK ONLY IF RESPONSE TO QUESTION 1=4: Done the exact same upgrade anyway]
Question 2: If you had not received the incentive from your LDC, would you say your organization definitely would have, might have, or definitely would not have had the funds to cover the entire cost of the project?

1. Definitely would have
2. Might have
3. Definitely would NOT have

98. Don't know
99. Refused

Table C-2 on the following page indicates the possible intention scores a respondent could have received depending on their responses to these two questions.

When asked the first question, if a respondent provides an answer of 1 or 2 (would postpone or cancel the upgrade), the respondent receives a free-ridership intention score of 0% (on a scale of 0% to 50%, where 0% is associated with no free-ridership and 50% is associated with high free-ridership). If a respondent provides an answer of 1 (would have done the project, but reduced size or extent of it without the incentive), or if they said they did not know or refused the question, the respondent receives a free-ridership intention score of 25% (associated with moderate free-ridership). If the respondent provides an answer of 4 (would have done the project exactly the same without program assistance), they are asked the second question before a free-ridership intention score can be assigned.

The second question asks the participants who had said they would have done the exact same project without the program's assistance, whether their organization would have made the funds available to cover the entire project cost. If the respondent provides an answer of 1 (definitely would have the funds), the respondent receives a score of 50% (associated with high free-ridership). If the respondent provides an answer of 2 (might have had the funds available), they receive a slightly lower free-ridership score of 37.5%. If the respondent provides an answer of 3 (definitely would not have the funds), or if they said they did not know or refused the question, the respondent receives a free-ridership intention score of 25% (associated with moderate free-ridership).

Table C-2 Cost-Effectiveness Load Profiles

Question 1 Response	Question 2 Response	Intention Score (%)
1 or 2	Not asked	0 (no free-ridership for intention score)
3, 98 (Don't Know), or 99 (Refused)	Not asked	25
4	3, 98 (Don't Know), or 99 (Refused)	25
4	2	37.5
4	1	50 (high free-ridership for intention score)

The bullet points below display the same Free-ridership Intention scoring approach in list form. As mentioned above, for each respondent, an intention score, ranging from 0% to 50%, was calculated based on the respondent's report of how the project (or audit-recommended upgrade) would have changed had there been no program:

- Project postponement or cancellation = 0%
- Reduction in size or scope or use of less energy efficient equipment = 25%
- Respondent does not know what they would have done in the absence of the program = 25%
- No change and respondent states firm would not have made funds available = 25%
- No change but respondent is not sure whether firm would have made funds available = 37.5%
- No change and respondent confirms firm would have made funds available = 50%

C.2.1.2 Influence

The influence component of the free-ridership score asks each respondent to rate how much of a role various potential program-related influence factors had on their decision to do the upgrade(s) in question. Influence is reported using a scale from 1 to 5 where 1 means "it played no role at all" and 5 means "it played a great role." The potential influence factors vary somewhat among the four programs.

For all of the programs besides Audit Funding, the influence factors assessed are:

- Incentives (note that for the HPNC and EBCx Programs the participants are asked about both the incentives for modeling as well as incentives for the equipment)
- Information or recommendations provided by LDC staff
- Information or recommendations provided by IESO staff (if applicable)
- The results of any audits or technical studies that were done
- Information or recommendations provided by relevant supply channel partners (such as contractors, auditors, assessors, installers, commissioning agents, vendors, or suppliers) depending on the program
- Marketing materials or information provided by the program

- Previous experience with any energy saving program
- Others (identified by the respondent)

For Audit Funding, the only influence factor assessed is the respondent’s experience with the LDC-funded audit.

Table C-3 indicates the possible influence scores a respondent could have received depending on how they rated the influence factors above. For each respondent, the program influence is set equal to the maximum influence rating that a respondent reports across the various influence factors. For example, if the respondent provided a score of 5 (great role) to at least one of the influence factors, then the program is considered to have had a great role in their decision to do the upgrade and the influence component of free-ridership is set to 0% (not a free rider).

Table C-3 Key to Free-ridership Influence Score

Maximum Influence Rating	Influence Score (%)
5 - program factor(s) highly influential	0
4	12.5
3	25
2	37.5
1 - program factor(s) not influential	50
98 – Don’t know	25
99 - Refused	25

The bullet points below display the same Free-ridership Influence scoring approach in list form. As mentioned above, for each project, a program influence score, also ranging from 0% to 50%, was calculated based on the highest influence rating given, among the potential influence factors:

- Maximum rating of 1 (no influence factor had a role in the decision to do the project) = 50%
- Maximum rating of 2 = 37.5%
- Maximum rating of 3 = 25%
- Maximum rating of 4 = 12.5%
- Maximum rating of 5 (at least one influence factor had a great role) = 0%
- Respondent does not know how much influence any factor had = 25%

The intention and program influence scores for each project were summed to generate a free-ridership score ranging from 0 to 100. The scores are interpreted as % free-ridership: a score of 0 means 0% free-ridership (i.e., the participant was not at all a free rider); a score of 100 means 100% free-ridership (the participant was a complete free rider); a score between 0 and 100 means the participant was a partial free rider.

C.2.1.3 Retrofit Program Free-Ridership – Additional Methodology Details

For the Retrofit Program, the free-ridership calculation takes into account both the participant free-ridership was well as the contractor free-ridership. The participant survey asked respondents how they made their selection of the equipment they installed through the program. If the participant did some research on the equipment and made their own choice, they received the free-ridership value associated with their own free-ridership survey responses. If the participant's installer suggested the particular equipment that was installed, they received the contractor free-ridership score, which was an average associated with all of the respondents to the contractor survey.[113] If the participant said that their installer suggested different models of equipment and they chose one, their free-ridership score was an average of the contractor free-ridership score and their participant free-ridership score.

C.2.2 Spillover Methodology

To assess spillover, the survey instrument asks about the installation of energy efficient equipment or systems that were done without a program incentive. The equipment-specific details assessed are:

- ENERGY STAR® Appliance: type and quantity
- Fan: type, size, quantity
- HVAC - Air conditioner replacement, above code minimum: tonnage and quantity
- Lighting: type, quantity, wattage, hours of operation, location, and fixture length
- Lighting – Controls: type of control, type and quantity of lights connected to control, hours of operation, and percentage of time the timer turns off lights
- Motor/Pump Upgrade: type, end use, horse power, and efficiency quantity
- Motor/Pump Drive Improvement (VSD and Sync Belt): type, end use, horse power, and quantity
- Others (identified by the respondent)

For other types of upgrades, the survey instrument instructs the data collector to solicit details about the upgrade.

For each equipment type the respondent reports installing without a program incentive the survey instrument then asks about the extent of influence that earlier involvement in the program had on the decision to carry out the upgrades. Influence is reported using a scale from 1 to 5 where 1 means "it played no role at all" and 5 means "it played a great role." If the influence score is between 3 to 5 for a particular equipment type the survey instrument solicits details about the upgrades to estimate the quantity of energy savings that the upgrade produced.

For each upgrade, the program influence rating was converted to an influence score ranging from 0% to 100%, as follows:

- Maximum rating of 1 or 2 (no influence) = 0%
- Maximum rating of 3 = 50%
- Maximum rating of 4 or 5 (great influence) = 100%

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[113] To develop an average contractor free-ridership value, the Retrofit Contactor survey asked contractors who installed projects through the Retrofit Program in 2017 to provide information about the number of retrofit projects they installed in 2017, the number they installed through the Retrofit Program, and an estimate of how many of these projects would have installed the same equipment with the same efficiency level if there had been no incentives available. A weighted average free-ridership, which was dependent on the relative number of installations made by each contractor, was developed to help estimate the final average contractor free-ridership score, which was 10.6%.

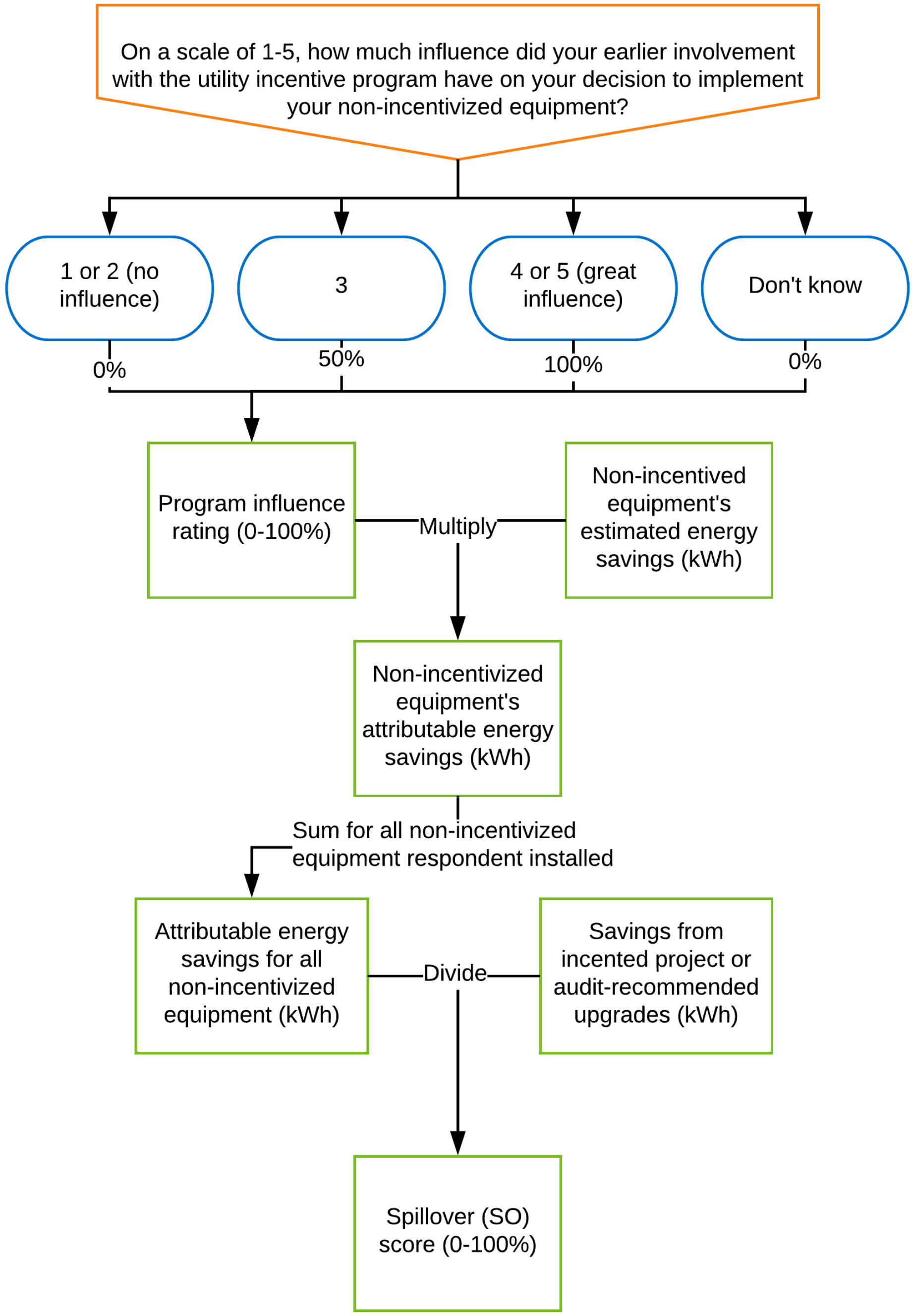
- Respondent does not know how much influence any factor had = 50%

The evaluation team used the following procedure to calculate a spillover percentage for each respondent:

- Multiplying the estimated energy savings for each upgrade by the influence percentage to calculate the upgrade’s program-attributable energy savings.
- Summing program-attributable energy savings from all identified upgrades for each respondent to calculate the respondent’s total spillover savings.
- Dividing each respondent’s total spillover savings by the savings from the incented project (for Retrofit, Retrofit P4P, SBL, BRI, HPNC, and EBCx) or audit-recommended upgrades (for Audit Funding).

Figure C-4 on the following page illustrates the spillover methodology.

Figure C-4: Spillover Methodology



C.2.2.4 Retrofit Program Spillover – Additional Methodology Details

For the Retrofit Program, the spillover for the program overall is a combination of participant spillover, which is calculated in the same way as all other programs, as well as active non-participant spillover, which is the average spillover estimated from the active non-participant spillover survey.[114]

Program year 2017 was the first year that active non-participant spillover was estimated for the Retrofit Program. Active non-participant spillover was not estimated for other programs because there was not sufficient sample available to conduct a survey of this population.

C.2.3 Identification of Project or Upgrade for NTG Assessment

For each program, the survey asked participants to consider all the projects (or audits) they may have completed in 2017 through the particular program in question. This approach allowed the evaluation team to apply the respondent's NTG value across all of the projects they completed in 2017 rather than just one.

C.2.4 Other Survey Questions

In addition to the questions addressing free-ridership and spillover, the survey covered the following topics:

- Whether the respondent is the person primarily involved in decisions about upgrading equipment at their company (if the respondent is not the appropriate contact, they are asked by the interviewer to be transferred to or be provided contact information for the appropriate person).[115]
- Whether the respondent had primary or shared responsibility for the budget or expenditure decisions for the program-incentivized work completed at their company.
- The respondent's work title.
- When the respondent first learned about the energy efficiency incentives, relative to the upgrade in question (before planning; after planning, but before implementation; after implementation began, but before project completion; or after project completion).
- When the respondent submitted their application to the program, and what their reasons were for submitting it after the work was started or completed, if applicable.
- Who the respondent learned about the incentives from.

The responses to these questions are not included the algorithms for calculating free-ridership or spillover, but do provide additional context. The first question ensures that the appropriate person responded to the survey. The other questions provide feedback to the IESO and the LDCs about responsibility for budget and expenditure decisions, the position of the respondent, application submission process details, as well as how and when program influence occurs.

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[114] A Retrofit Program active non-participant is defined as any customer who applied to but did not ultimately participate in the Retrofit Program for reasons other than ineligibility.

[115] Participants that were sent the web-version of the survey were told to forward the survey web-link to the appropriate person if they were not the person who is most familiar with their company's decision to participate in the program in 2017.

C.3 Net-to-Gross (NTG) Survey Implementation

The evaluation team implemented the survey on-line for all programs. Additionally, the evaluation team implemented telephone surveys for the Retrofit, Retrofit P4P, and SBL Programs. For these three programs that where implemented as both a web-based and telephone-based survey, the survey firm was instructed to avoid duplicate responses by no longer calling on respondents if they had responded to the web survey or deactivating the survey link of the respondent if they had responded to the telephone survey.

For each of the telephone surveys, the evaluation team randomized the order of the participant contacts in each contact list and called participants in the randomized order to complete the survey. After reaching the identified contact for a given participant, the caller explained the purpose of the survey and identified the IESO as the sponsor. The caller asked if the contact was involved in decisions about upgrading equipment at that organization. If the contact was not involved in decisions about upgrading equipment, the caller asked for the contact information for the appropriate decision-maker and terminated the call. The caller then attempted to reach the identified decision-maker.

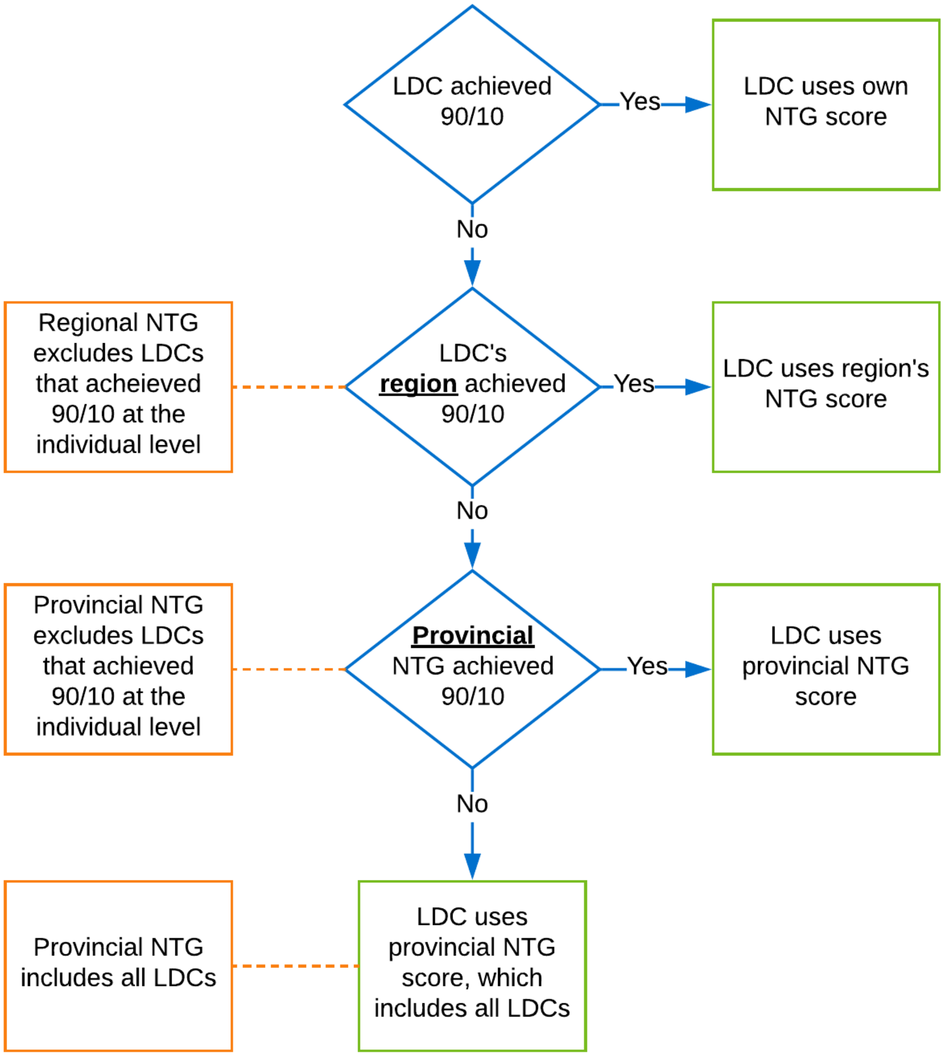
It is assumed that all contacts that responded to the web-versions of all the surveys were the appropriate contacts to answer the questions because, as mentioned above, if the contact in the sample received the survey but was not the appropriate contact, the evaluation team asked them to forward it on to the appropriate person to fill it out.

C.4 Calculation of Stratum-level NTG Values

The evaluation team established guidelines for the calculation of the stratum level NTG values that would be used to calculate net impact results. The objective of the NTG analysis was to calculate NTG values for each LDC that was the most representative within reasonable levels of precision and confidence. The guidelines set minimum standards for the precision of the NTG values and defined three different strata. The three different strata of NTG values included (1) the LDC stratum, (2) the regional stratum, and (3) the province-wide stratum.

The NTG guidelines were applied consistently to each program. Stratum-level NTG values were calculated as an average of the individual participant NTG values in the stratum weighted by the reported savings associated with each participant’s projects within the stratum. The remainder of this section provides a description of the NTG guidelines for each stratum. Figure C-5 on the following page illustrates the process for assigning stratum-level NTG.

Figure C-5: Stratum-level NTG Assignments



C.4.5 LDC NTG Stratum

As shown above, for each program LDC NTG Stratum values were first calculated for each LDC using participant survey responses associated with that LDC. If the precision of the resulting LDC-level NTG value was less than or equal to 10% precision at the 90% confidence level then this NTG value was used to calculate the LDC’s net impact results. This is the same approach that was used in the 2016 Business Program evaluation. Note that the only programs where at least some LDCs fell into the LDC NTG Stratum were the Retrofit and SBL Programs. This is because some of the LDCs in these programs had enough survey responses to achieve 90% confidence at 10% precision at the LDC level.

C.4.6 Regional NTG Stratum

As shown above, all participant responses from LDCs who’s LDC NTG stratum precision was greater than 10% were combined into Regional NTG Strata. There were six regional strata delineated based on climate zone, the Greater Toronto Area (GTA), and LDC territories. The six regions included the GTA, North, South, East, West, and Hydro One Networks Inc. Hydro One Networks Inc. was designated as its own stratum since its territory spanned all geographic regions. These are the same regions defined in the 2015 and 2016 Business Program evaluation and are shown in Figure C-6 on the following page.

Figure C-6: Geographic Regions Used for NTG Stratification

For each program, the Regional NTG Strata values were calculated using only survey responses from participants within the region whose LDC NTG responses were worse than 90% confidence at 10% precision at the LDC level. Participant responses from LDCs who fell into the LDC NTG strata were excluded from the Regional NTG Strata calculations. If the precision of the Regional NTG Strata was less than or equal to 10% at the 90% confidence level then it was used to calculate the net impact results of the LDCs in that region that did not already receive an LDC level NTG. This is the same approach that was used in the 2016 Business Program evaluation. Note that the only programs where at least some LDCs received the regional NTG values were the Retrofit and SBL Programs. This is because some of the regions in these programs had enough survey responses to achieve 90% confidence at 10% precision at the regional level.

C.4.7 Province-wide NTG Stratum

Province-wide NTG stratum was calculated in one of two ways. First, all participant responses from LDCs that had LDC NTG and Regional NTG Strata precision levels greater than 10% were combined into a Province-wide NTG Stratum value. If the precision of this stratum was less than or equal to 10%, this value was assigned to the associated LDCs and was used to calculate the net impact results for these LDCs. If the calculated Province-wide NTG Stratum value had a precision of greater than 10%, responses from all LDCs (regardless of whether they fell into the individual LDC Strata, the Regional Strata, or the Province-Wide Strata) were combined to calculate a Province-wide NTG Stratum value. The purpose of this secondary province-wide NTG Stratum approach is meant to help ensure that the province-wide value achieves 90% confidence at 10% precision. Note that in 2017, for most of the programs, the province-wide NTG score was applied where the LDCs that received the individual NTG Stratum score were excluded. For the Retrofit and SBL Programs, some, but not all, LDCs received the province-wide score (with many receiving individual LDC NTG scores).

Appendix D Additional Strata-Level Net-to-Gross Findings

Tables D-1 through D-6 on the following pages present additional detail regarding the NTG scores by program. Please refer to Appendix C for a detailed description of the NTG methodology.

Net-to-Gross results are presented in Table D-1 for the Retrofit program at the individual LDC level for those LDCs who received individual NTG scores and at the regional or provincial level for LDCs that did not receive individual NTG scores. Thirty-six LDCs received individual NTG scores, as these LDCs achieved 90 percent confidence at 10 percent precision for their NTG scores. Twenty-nine LDCs received the province-wide NTG score.

Table D-1: Retrofit Program – Strata Level Net-to-Gross Results

NTG Assignment	Facility LDC Name	Sample size	Energy Influence Score	Energy Intention Score	Savings Weighted FR*	Energy SO*	Demand SO*	Active Non-participant SO**	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Individual	Alectra Utilities Corporation	137	3.7%	15.5%	12.2%	1.8%	3.3%	2.01%	91.6%	94.3%
Individual	Atikokan Hydro Inc.	2	0.0%	29.7%	26.0%	0.0%	0.0%	2.01%	76.0%	77.2%
Individual	Bluewater Power Distribution Corporation	15	0.8%	23.2%	23.4%	3.0%	3.3%	2.01%	81.6%	83.1%
Individual	Burlington Hydro Inc.	17	19.6%	44.6%	14.0%	0.0%	0.0%	2.01%	88.1%	89.3%
Individual	Canadian Niagara Power Inc.	24	4.5%	25.4%	9.6%	0.6%	1.0%	2.01%	93.0%	94.6%
Individual	E.L.K. Energy Inc.	4	3.8%	34.4%	21.2%	0.0%	0.0%	2.01%	80.8%	81.9%
Individual	Energy+ Inc.	33	2.1%	27.5%	20.7%	0.0%	1.0%	2.01%	81.4%	83.5%
Individual	Entegrus Powerlines Inc.	24	1.2%	7.0%	6.2%	2.3%	6.9%	2.01%	98.2%	103.9%
Individual	Erie Thames Powerlines Corporation	12	4.7%	12.6%	14.9%	0.1%	0.4%	2.01%	87.2%	88.7%
Individual	Essex Powerlines Corporation	2	1.5%	2.9%	7.5%	0.0%	0.0%	2.01%	94.5%	95.7%
Individual	Festival Hydro Inc.	12	1.3%	7.3%	10.9%	0.4%	13.0%	2.01%	91.5%	105.3%
Individual	Greater Sudbury Hydro Inc.	17	4.6%	16.2%	19.5%	4.6%	11.5%	2.01%	87.1%	95.2%
Individual	Guelph Hydro Electric Systems Inc.	21	4.6%	13.0%	9.4%	2.8%	7.5%	2.01%	95.4%	101.2%
Individual	Hydro One Networks Inc.	218	5.8%	22.4%	17.9%	1.9%	1.7%	2.01%	86.0%	87.0%
Individual	InnPower Corporation	3	0.0%	0.0%	8.5%	0.0%	0.0%	2.01%	93.5%	94.7%
Individual	Kenora Hydro Electric Corporation Ltd.	3	5.2%	25.0%	20.0%	0.0%	0.0%	2.01%	82.0%	83.2%
Individual	Kingston Hydro Corporation	6	0.0%	19.0%	12.4%	0.6%	1.4%	2.01%	90.3%	92.2%
Individual	London Hydro Inc.	40	1.3%	20.1%	10.4%	4.5%	14.2%	2.01%	96.1%	107.0%
Individual	Milton Hydro Distribution Inc.	6	0.0%	20.0%	16.2%	0.0%	0.0%	2.01%	85.8%	87.0%
Individual	Newmarket-Tay Power Distribution Ltd.	11	1.6%	16.8%	17.6%	0.0%	0.0%	2.01%	84.4%	85.5%
Individual	Niagara Peninsula Energy Inc.	15	6.2%	25.5%	20.4%	0.7%	0.3%	2.01%	82.3%	83.1%
Individual	Northern Ontario Wires Inc.	3	3.3%	21.6%	15.9%	0.0%	0.0%	2.01%	86.1%	87.3%
Individual	Orillia Power Distribution Corporation	5	12.5%	17.9%	21.2%	0.0%	0.0%	2.01%	80.8%	82.0%

NTG Assignment	Facility LDC Name	Sample size	Energy Influence Score	Energy Intention Score	Savings Weighted FR*	Energy SO*	Demand SO*	Active Non-participant SO**	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Individual	Renfrew Hydro Inc.	2	0.0%	25.0%	23.7%	0.0%	0.0%	2.01%	78.3%	79.5%
Individual	Rideau St. Lawrence Distribution Inc.	2	1.9%	23.1%	24.4%	0.0%	0.0%	2.01%	77.6%	78.7%
Individual	Sioux Lookout Hydro Inc.	3	8.0%	0.0%	6.6%	0.0%	0.0%	2.01%	95.4%	96.6%
Individual	St. Thomas Energy Inc.	2	0.0%	36.9%	27.5%	0.0%	0.0%	2.01%	74.5%	75.7%
Individual	Thunder Bay Hydro Electricity Distribution Inc.	16	10.2%	28.2%	27.5%	0.0%	0.0%	2.01%	74.5%	75.7%
Individual	Tillsonburg Hydro Inc.	5	0.1%	0.5%	6.7%	0.0%	0.0%	2.01%	95.3%	96.5%
Individual	Toronto Hydro-Electric System Limited	133	4.1%	20.6%	19.6%	2.8%	3.9%	2.01%	85.3%	87.5%
Individual	Veridian Connections Inc.	34	3.8%	20.0%	19.4%	3.7%	4.9%	2.01%	86.3%	88.7%
Individual	Waterloo North Hydro Inc.	25	2.7%	21.6%	14.8%	0.2%	0.3%	2.01%	87.4%	88.7%
Individual	Welland Hydro-Electric System Corp.	3	10.5%	23.7%	21.4%	0.0%	0.0%	2.01%	80.6%	81.8%
Individual	West Coast Huron Energy Inc.	4	0.0%	21.8%	10.6%	0.0%	0.0%	2.01%	91.4%	92.6%
Individual	Westario Power Inc.	10	0.5%	25.6%	25.8%	3.0%	2.6%	2.01%	79.2%	80.0%
Individual	Whitby Hydro Electric Corporation	3	1.4%	25.0%	12.8%	0.0%	0.0%	2.01%	89.2%	90.4%
Province-wide	29 LDCs[116]	242	4.2%	22.9%	22.80%	10.60 %	31.40%	2.01%	89.80%	111.90%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net-to-Gross; **Active Non-participant SO: Average Spillover value associated with the Retrofit Program Active Non-participant survey respondents. ***Note: the Energy Influence Score and the Energy Intention Score to do not sum to the Savings Weighted FR score because they are calculated before the Savings Weighted FR score is adjusted by the Retrofit Contractor Average Free-ridership Score. Please refer to Appendix D for a detailed description of the NTG methodology.

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[116] The 29 LDCs that received the Province-wide score for the Retrofit Program include Algoma Power Inc., Brantford Power Inc., Centre Wellington Hydro Ltd., Chapleau Public Utilities Corporation, COLLUS PowerStream Corp., Cooperative Hydro Embrun Inc., EnWin Utilities Ltd., Espanola Regional Hydro Distribution Corporation, Fort Frances Power Corporation, Grimsby Power Incorporated, Halton Hills Hydro Inc., Hearst Power Distribution Company Limited, Hydro 2000 Inc., Hydro Hawkesbury Inc., Hydro Ottawa Limited, Kitchener-Wilmot Hydro Inc., Lakefront Utilities Inc., Lakeland Power Distribution Ltd., Midland Power Utility Corporation, Niagara-on-the-Lake Hydro Inc., North Bay Hydro Distribution Limited, Oakville Hydro Electricity Distribution Inc., Oakville Hydro Electricity Distribution Inc., Orangeville Hydro Limited, Oshawa PUC Networks Inc., Ottawa River Power Corporation, Peterborough Distribution Incorporated, PUC Distribution Inc., Wasaga Distribution Inc., Wellington North Power Inc.

Net-to-Gross results are presented in Table D-2 for the SBL Program at the individual LDC level for those LDCs who received individual NTG scores and at the regional or province-wide level for LDCs that did not receive individual NTG scores. Twenty-one LDCs received individual NTG scores, as these LDCs achieved 90 percent confidence at 10 percent precision for their NTG scores. Nineteen LDCs received their regional NTG scores, and four LDCs received the province-wide NTG score.

Table D-2: SBL Program Strata Level Net-to-Gross Results

NTG Assignment	Facility LDC	Sample Size	Energy Influence Score	Energy Intention Score	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Individual	Alectra Utilities Corporation	123	2.8%	4.3%	7.1%	7.0%	4.2%	99.9%	97.1%
Individual	Algoma Power Inc.	7	0.0%	6.6%	6.6%	0.0%	0.0%	93.4%	93.4%
Individual	Atikokan Hydro Inc.	2	6.2%	0.0%	6.2%	0.0%	0.0%	93.8%	93.8%
Individual	Brantford Power Inc.	5	0.0%	3.9%	3.9%	0.0%	0.0%	96.1%	96.1%
Individual	Canadian Niagara Power Inc.	6	2.0%	0.0%	2.0%	0.0%	0.0%	98.0%	98.0%
Individual	Centre Wellington Hydro Ltd.	4	4.2%	0.0%	4.2%	0.0%	0.0%	95.8%	95.8%
Individual	Entegrus Powerlines Inc.	15	3.1%	1.5%	4.5%	4.0%	5.1%	99.5%	100.6%
Individual	Erie Thames Powerlines Corporation	19	6.2%	0.0%	6.2%	6.9%	7.8%	100.7%	101.6%
Individual	Fort Frances Power Corporation	2	12.5%	0.0%	12.5%	0.0%	0.0%	87.5%	87.5%
Individual	Grimsby Power Incorporated	2	7.5%	0.0%	7.5%	0.0%	0.0%	92.5%	92.5%
Individual	Hydro One Networks Inc.	441	5.8%	6.0%	11.9%	3.6%	3.4%	91.7%	91.5%
Individual	Lakefront Utilities Inc.	5	5.9%	0.0%	5.9%	0.0%	0.0%	94.1%	94.1%
Individual	Lakeland Power Distribution Ltd.	14	2.7%	3.3%	6.0%	0.0%	0.0%	94.0%	94.0%
Individual	Midland Power Utility Corporation	5	4.3%	4.7%	9.0%	0.0%	0.0%	91.0%	91.0%
Individual	Niagara Peninsula Energy Inc.	7	0.9%	0.0%	0.9%	0.0%	0.0%	99.1%	99.1%
Individual	Niagara-on-the-Lake Hydro Inc.	10	11.9%	5.2%	17.1%	0.0%	0.0%	82.9%	82.9%
Individual	North Bay Hydro Distribution Limited	3	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Individual	Northern	2	0.0%	0.0%	0.0%	2.8%	6.2%	102.8%	106.2%

NTG Assignment	Facility LDC	Sample Size	Energy Influence Score	Energy Intention Score	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
	Ontario Wires Inc.								
Individual	Orillia Power Distribution Corporation	6	5.9%	0.0%	5.9%	2.7%	0.3%	96.8%	94.4%
Individual	Toronto Hydro-Electric System Limited	67	3.9%	5.6%	9.5%	2.5%	2.5%	92.9%	93.0%
Individual	Whitby Hydro Electric Corporation	3	4.0%	0.0%	4.0%	0.0%	0.0%	96.0%	96.0%
South[117]	2 LDCs	5	10.5%	0.0%	10.5%	0.0%	0.0%	89.5%	89.5%
West[118]	5 LDCs	23	13.5%	10.8%	24.3%	9.9%	2.4%	85.6%	78.1%
GTA[119]	3 LDCs	26	3.4%	2.6%	6.0%	25.4%	29.9%	119.4%	123.9%
East[120]	4 LDCs	20	6.0%	15.1%	21.1%	10.3%	6.4%	89.2%	85.3%
Province-wide[121]	4 LDCs	88	7.7%	7.9%	15.60%	15.47%	11.34%	99.87%	95.74%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net-to-Gross

Net-to-Gross results are presented in Table D-3 for the BRI Province-wide Program. All LDCs received the province-wide level NTG score.

Table D-3: BRI Province-Wide Program Strata Level Net-to-Gross Results

NTG Assignment	Sample size	Energy Influence Score	Energy Intention Score	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG *%	Demand Savings Weighted NTG* %
Province-wide	60	8.2%	13.1%	21.3%	21.7%	40.5%	100.5%	119.2%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net-to-Gross

Net-to-Gross results are presented for the Auditing Funding Program at the province-wide level in Table D-4.

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[117] The two LDCs that received the South's regional score for the SBL Program include EnWin Utilities Ltd. And Essex Powerlines Corporation.

[118] The five LDCs that received the West's regional score for the SBL Program include Energy+ Inc., Festival Hydro Inc., Orangeville Hydro Limited, West Coast Huron Energy Inc., and Westario Power Inc.

[119] The three LDCs that received the GTA's regional score for the SBL Program include Oakville Hydro Electricity Distribution Inc., Oshawa PUC Networks Inc., and Veridian Connections Inc.

[120] The four LDCs that received the East's regional score for the SBL Program include COLLUS PowerStream Corp., Hydro Ottawa Limited, InnPower Corporation, and Peterborough Distribution Incorporated.

[121] The four LDCs that received the province-wide score for the SBL Program include Kenora Hydro Electric Corporation Ltd., Ottawa River Power Corporation, Sioux Lookout Hydro Inc., Thunder Bay Hydro Electricity Distribution Inc.

Table D-4: Audit Funding Program Strata Level Net-to-Gross Results

NTG Assignment	Sample size	Energy Influence Score**	Energy Intention Score**	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG *%	Demand Savings Weighted NTG* %
Province-wide	33	3.6%	3.0%	5.9%	0%	0%	94.1%	94.1%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net-to-Gross; **Note: Energy Influence Score and Energy Intention Score in this table do not sum to the Savings Weighted FR score because the Savings Weighted FR score is an average of the unique respondent Energy Influence and Intention Scores across all technology types assessed in the participant survey.

Net-to-Gross results are presented for the HPNC Program at the province-wide level in Table D-5.

Table D-5: HPNC Program Strata Level Net-to-Gross Results

NTG Assignment	Sample size	Energy Influence Score	Energy Intention Score	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Province-wide	17	7.5%	35.9%	43.4%	0.0%	0.0%	56.6%	56.6%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net-to-Gross

Net-to-Gross results are presented for the EBCx Program at the province-wide level in Table D-6.

Table D-6: EBCx Program Strata Level Net-to-Gross Results

NTG Assignment	Sample size	Energy Influence Score	Energy Intention Score	Savings Weighted FR*	Energy SO*	Demand SO*	Energy Savings Weighted NTG* %	Demand Savings Weighted NTG* %
Province-wide	3	0%	45.1%	45.1%	0.0%	0.0%	54.9%	54.9%

*Note: FR: Free-ridership; SO: Spillover; NTG: Net-to-Gross

Appendix E Cost Effectiveness Methodology

E.1 Program Cost Effectiveness

The program cost effectiveness is discussed in the following section in terms of the total resource cost test (TRC), the program administrator cost test (PAC), and the levelized unit energy costs (LUEC).

E.1.1 Incentives

Due to the delay between project completion and the payment of incentive, there are a number of completed 2016 projects that have not received incentives as of the writing of this report. Thus, the actual program incentive payment totals provided by the IESO do not reflect the full anticipated incentive payments for the population of 2016 projects. In order to more closely align expected savings with expected costs, the evaluation team uses anticipated incentive payments in all cost-effectiveness calculations rather than the actual incentive payments made to-date. Anticipated incentive payments are calculated according to the rules outlined in the program materials.

E.1.2 Total Resource Cost Test (TRC)

The TRC test measures the net costs of a program as a resource option based on the total costs of the program, including both the participants' and the utility's costs[122]. In general, it is the ratio of the discounted total benefits of the program to the discounted total costs over a specified time period. A benefit-cost ratio above one indicates that the program is beneficial to the utility and its ratepayers on a total resource cost basis.

The benefits calculated in the TRC test are the avoided supply costs, the reduction in transmission, distribution, generation, and energy costs valued at marginal cost for the periods when there is a load reduction. For the TRC test only, avoided supply costs also include the avoided supply costs of alternative fuel resources, such as natural gas, propane, and water.[123] The costs associated with this test are the net program costs paid by both the utility and the participants; this includes administration costs, non-free rider equipment costs, and free rider incentives.

In algebraic form:[124]

$$Benefits = \sum_{t=1}^{n} \frac{UAC_t}{(1+d)^{t-1}}$$

$$Costs = \sum_{t=1}^{n} \frac{PRC_t + PCN_t + FRINC_t}{(1+d)^{t-1}}$$

$$TRC\ Ratio = \frac{Benefits}{Costs}$$

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[122] *California Standard Practice Manual: Economic Analysis of Demand-Side Management Programs and Projects*. July 2002.

[123] OPA Conservation and Demand Management Cost Effectiveness Guide. 10/15/2010. Pg. 5.

[124] According to California Standard Practice Manual 2007 Clarification Memo. D.07-09-043.

Where:

UAC_t = Utility net avoided supply costs in year t

PRC_t = Program administrator program costs in year t

PCN_t = Net participant costs (equipment costs) in year t

$FRINC_t$ = Incentives paid to free riders in year t

d = Nominal discount rate[125]

E.1.3 Program Administrator Cost Test (PAC)

The PAC test measures the net costs of a program as a resource option based on the costs incurred by the program administrator and excluding any net costs incurred by the participant. A benefit to cost ratio above one indicates that the program would benefit the administrator's cost environment.

Similar to the TRC test, the benefits calculated in the PAC test are the avoided supply costs of energy and demand. However, the net avoided supply costs for the PAC test include only the avoided costs of supplying electricity, not the avoided societal costs of natural gas, propane, or water. The costs associated with this test are the program costs incurred by the administrator and the incentives paid to the customers.

In algebraic form:

Equation E-1: TRC Benefits

$$Benefits = \sum_{t=1}^{n} \frac{UAC_t}{(1+d)^{t-1}}$$

Equation E-2: TRC Costs

$$Costs = \sum_{t=1}^{n} \frac{PRC_t + INC_t}{(1+d)^{t-1}}$$

Equation E-3: Administrator Cost Test

$$PAC\ Ratio = \frac{Benefits}{Costs}$$

Where:

UAC_t = Utility net avoided supply costs in year t

PRC_t = Program administrator program costs in year t

INC_t = Incentives paid to participants in year t

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[125] Based on the information given to the Evaluation Team by OPA, the real discount rate = 4% and the inflation rate = 2%. Using the exact form of the Fisher Equation, or (1+nominal rate) = (1+real rate)*(1+inflation rate), the nominal rate is thus 6.08%.

d = Nominal discount rate

E.1.4 Levelized Unit Energy Cost

Levelizing the delivery costs of each program is a useful way to express the program delivery costs per unit of energy or capacity savings. From the IESO's perspective, the levelized unit energy costs are useful when comparing the programs to others in their demand-side management portfolio.

Program delivery costs are the sum of program administrator costs and incentives paid to the participants. To levelize these costs for energy and demand savings, the following formula is used.[126]

Equation E-4: Levelized Unit Energy Cost

$$Levelized\ Delivery\ Costs = \frac{Delivery\ Costs}{\sum_{t=1}^{n} \frac{Q_t}{(1+d)^{t-1}}}$$

Where:

Q_t = Energy or capacity savings in year t

d = Nominal discount rate

E.2 Cost-Effectiveness Load Profiles

The evaluation team conducted all analyses for the impact evaluation at the hourly level, so that 8,760 load shapes (one for each hour of the year) can be created. For the 2017 evaluation load profiles were selected from a list of available load profiles using the cost-effectiveness tool, and were a combination of IESO provided load profiles and custom load profiles generated during the 2011-2017 evaluation.

Table E-1 on the following page displays weighted average sample load shapes for each impact stratum aggregated to IESO-defined time-of-use periods. All load profiles applied in the 2017 Retrofit cost effectiveness are included in Table E-1.

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[126] Short, Walter, et.al. *A Manual for the Economic Evaluation of Energy Efficiency and Renewable Energy Technologies.* National Renewable Energy Laboratory. March 1995.

Table E-1 Cost-Effectiveness Load Profiles

Stratum	Winter			Summer			Shoulder Seasons	
	Peak	Mid-Peak	Off-Peak	Peak	Mid-Peak	Off-Peak	Mid-Peak	Off-Peak
Clothes Washer	10.73%	9.29%	16.04%	6.29%	9.96%	12.95%	18.48%	16.25%
Custom Lighting	6.25%	8.78%	18.65%	6.19%	8.36%	18.48%	13.93%	19.36%
Custom Non-Lighting	6.45%	7.63%	17.72%	6.44%	9.32%	19.39%	13.87%	19.18%
Dishwasher	8.44%	8.06%	18.13%	4.26%	9.83%	16.34%	15.54%	19.42%
Domestic Hot Water	9.21%	10.39%	18.99%	6.39%	8.44%	14.28%	16.00%	16.31%
Double Creep Pad	13.88%	13.88%	13.88%	10.20%	10.20%	10.20%	13.88%	13.88%
Compressed Air	6.28%	7.64%	19.23%	5.93%	8.12%	19.46%	13.24%	20.11%
Engineered Lighting	7.86%	8.80%	16.85%	7.07%	9.47%	17.08%	15.21%	17.65%
Exhaust Fans	0.00%	0.00%	0.00%	58.33%	19.44%	11.75%	7.78%	2.70%
High Volume Low Speed Fan	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%
Livestock Waterer	12.72%	22.27%	65.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Motor	6.89%	8.42%	16.99%	6.03%	8.88%	17.81%	15.52%	19.45%
Prescriptive Lighting	8.12%	10.00%	16.02%	7.80%	9.47%	15.75%	16.30%	16.54%
Refrigeration	6.01%	6.90%	16.73%	6.43%	9.59%	20.44%	14.07%	19.83%
Single Creep Pad	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%
Unitary AC	0.13%	0.21%	0.40%	26.05%	25.29%	35.30%	6.44%	6.17%
Variable Speed Drive	6.59%	8.93%	13.80%	8.12%	9.17%	14.05%	21.23%	18.11%

Appendix F Process Evaluation Methodology

As seen in Section 3.2 the process evaluation collected primary data from key influencers and decision makers including IESO and LDC program staff, participants, and program delivery partners (e.g., PDAs and TPEs, contractors, installers, assessors, suppliers, technicians, builders, developers, engineers, architects, auditors, and commissioning agents). The evaluation team collected the data using different methods, depending on what was most suitable for a particular respondent group (e.g., telephone surveys, web-based surveys, both web and phone-based surveys, telephone-based in-depth interviews). This data, when collected and synthesized, provides a comprehensive picture of the implementation of the six 2017 Save on Energy Business Programs covered under the scope of this evaluation (Retrofit, Retrofit P4P, SBL, BRI, Audit Funding, HPNC, and EBCx – See Table F-1).

The evaluation team directly carried out or managed all process evaluation data collection activities. The team developed all survey instruments, interview guides, and sample files for use in the interviews and surveys. The survey instruments and interview guides were approved by IESO staff, and the data used to develop the sample files came from program records supplied by the IESO.

The evaluation team conducted the in-depth telephone interviews (IDIs) using in-house staff (rather than the through a survey firm). These IDIs were conducted with IESO staff, a subset of LDC staff, a subset of PDA/TPE staff, BRI suppliers and technicians, Audit Funding Auditors, HPNC architects and engineers, and EBCx commissioning agents.

The Retrofit Participant, Retrofit P4P Participant, and SBL Participant surveys were fielded as both telephone and web-based surveys. The evaluation team designed the survey instruments and developed the sample lists, and Nexant's survey implementation team was responsible for programming, distributing, and collecting data for these surveys. The evaluation team worked closely with the survey implementation team to test the programming of all surveys.

The remaining surveys were distributed over the web and programmed using Qualtrics. These Qualtrics web-based surveys were sent to LDC staff, PDA/TPE staff, Retrofit Contractors, Retrofit Active Non-participants, SBL Installers and Assessors, BRI Participants, Audit Funding Participants, and HPNC Participants.

Table F-1 Process Evaluation Primary Data Sources

Respondent Type	Methodology	Completed	Population**	90% CI Error Margin
IESO Staff	Phone	4	4	0%
LDC Representatives	Web & Phone	34	56	9.0%
PDAs and TPEs	Web & Phone	21	43	N/A*
Retrofit Active Non-participants	Web	89	2,856	8.6%
Retrofit Contractors	Web	97	404	7.3%
Retrofit Participants	Web & Phone	987	4,889	2.3%
Retrofit Pay-for-Performance Participants	Web & Phone	115	164	4.2%
SBL Installers and Assessors	Web	27	76	N/A*
SBL Participants	Web & Phone	827	7,136	2.7%
BRI Program Staff and Implementers	Phone	3	3	0%
BRI Supplier and Technician	Phone	2	2	0%
BRI Participants	Web	72	481	9.0%
Audit Funding Auditors	Phone	10	81	N/A*
Audit Funding Participants	Web	33	123	12%
HPNC Builders and Developers	Web	7	18	N/A*
HPNC Architects and Engineers	Phone	6	22	N/A*
HPNC Participants	Web	18	78	N/A*
EBCx Commissioning Agents	Phone	1	1	N/A*
EBCx Participants	Phone	3	13	N/A*

*Error margin not displayed if the respondent count is below 30; **In some instances where the contact information was not available for a participant, the population count differs from the sample count.

The following subsections provide additional details about the process evaluation methodology.

F.1 IESO Staff Interviews

The evaluation team interviewed four IESO staff to gain a detailed understanding of the Save on Energy Business Programs in 2017 (Table F-2). The topics covered included program roles and responsibilities, program design and delivery, working with LDCs, trade ally engagement, marketing and outreach, customer participation, program measurement and tracking, and market impacts.

The in-depth interviews were conducted via phone with IESO staff from May 31st to June 11th of 2018. The evaluation team identified the appropriate staff to interview in consultation with the IESO evaluation staff. IESO staff interviewees included a Senior Data and Reporting Specialist, the Co-Chair of the Business Working Group, a Business Advisor to the LDCs, and the Advisor on Content and Marketing. Each interview took approximately 30 minutes to complete.

Table F-2 IESO Staff Interview Disposition

Disposition Report	Count
Completes	4
No Response	0
Unsubscribed	0
Partial Complete	0
Bad Contact Info (No Replacement Found)	0
Total Invited to Participate	4
Total in Population	4

F.2 LDC Staff Interviews and Surveys

The evaluation team interviewed and surveyed the LDCs staff to better understand their perspectives regarding design and implementation for the Save on Energy Business Programs in 2017. In total, the evaluation team interviewed or surveyed 34 unique LDCs from a sample of 56 (Table F-3). IESO evaluation staff helped the team to identify appropriate contacts to invite to participate in the surveys and interviews. The evaluation team used three different data collection methods with the LDCs, which are detailed below.

Full-length Web-Based Survey: The evaluation team invited 51 LDCs to complete a web-based survey. The web survey was sent to all the LDCs in the sample with the goal of achieving a census of responses given the small sample size; 30 responses were received. A small number of LDCs were not sent the web survey either because (1) they did not deliver business programs in 2017, (2) the evaluation team wanted to reduce survey burden for LDC staff who oversaw more than one LDC, or (3) the LDC was interviewed over the telephone instead.

The evaluation team programmed the survey, distributed it to the LDCs, and collected the data through Qualtrics. The survey asked LDCs to provide details about resource allocation and savings targets, involvement with program administration, marketing and outreach activities to customers, NTG, and market actor engagement across all programs the LDC delivers. The survey was made available to the LDCs between June 11th and July 10th of 2018 and took approximately 15-30 minutes to complete. Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

In-Depth Phone Interviews: The evaluation team also conducted in-depth telephone interviews (IDIs) with five LDCs who had either consistently high or low NTG values for the Retrofit and/or SBL Programs across both 2016 and 2017. The purpose of the interviews was to better understand LDC perspectives regarding the design and delivery of the Retrofit and/or SBL Programs. The evaluation team interviewed five LDCs about the Retrofit Program and one LDC about the SBL Program. One LDC was interviewed about both the Retrofit and SBL Programs. The in-depth interviews were conducted by telephone with the five LDC staff from June 12th to June 18th of 2018 and took approximately 45 minutes to complete.

Abbreviated Web-Based Survey: Following the in-depth telephone interviews with the LDCs with the high or low NTG values, the evaluation team sent these same five LDCs an abbreviated version of the web-based survey that had been sent to the larger group of 51 LDCs mentioned above. The abbreviated survey covered broader topics applicable to all programs an LDC might offer (beyond just the Retrofit and

SBL Programs). Topics covered included resource allocation and savings targets, involvement with program administration, marketing and outreach activities to customers, and market actor engagement across all programs the LDC delivers. Four of the five LDCs who were sent the abbreviated web survey completed it. The survey was made available to the LDCs between June 12th and July 10th of 2017 and took approximately 10 to 20 minutes to complete. Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-3 LDC Surveys and Interviews Disposition

Respondent Type	Invited to Participate	Unable to Reach	Completed
In-depth Interviews (subset of LDCs)	5	--	5
Abbreviated Web Survey (subset of LDCs)	5	4	4
Web Survey (All other LDCs)	51	21	30

F.3 Program Delivery Agent and Technical Project Evaluator Survey

The evaluation team interviewed and surveyed 21 PDA and TPE staff from a sample of 46 unique companies. The purpose of the interviews and surveys was to better understand what rolls the PDAs and TPEs played in the delivery of the business programs (Table F-4).

The evaluation team conducted three preliminary in-depth telephone interviews with PDA and TPE staff to provide the evaluation team with a better understanding of the PDA and TPE rolls, and to validate that the team's web-based survey questions were both framed and worded correctly. Once this was confirmed, and the web-based survey was finalized, the evaluation team programmed and administered the PDA and TPE web-based survey using Qualtrics software. The evaluation team received 18 web completes, in addition to the three completed in-depth telephone interviews, from a sample of 43 unique contacts yielding a 49% response rate.

The evaluation team developed the final sample from a list of PDA and TPE company contacts provided by IESO staff. Given the small sample size, a census of participants was attempted. Despite the high response rate, the results of the survey did not achieve 90% confidence at 10% precision at the program level, but this was expected as there was a limited sample size.

Topics covered in the survey included the company role in supporting a specific business program, specific activities covered by PDA and TPE roles, interactions and satisfaction with the LDC(s), interactions and satisfaction with the IESO, frequency of customer interactions, PDA and TPE role in marketing the program, and their perspective on participants motivations and barriers to participating in the program.

The evaluation team released the survey to the sample via individualized email invitations between May 11th and May 29th of 2018.

Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-4 PDA and TPE Survey and Interview Disposition

Respondent Type	Invited to Participate	Completed
In-depth Telephone Interviews (subset of PDAs and TPEs)	3	3
Web-based Survey	43	18
Total	**46**	**21**

F.4 Retrofit Program Active Non-participant Survey

The evaluation team surveyed 89 retrofit active non-participants (59 completes; 30 partial completes) from a sample of 2,856 unique companies. The purpose of the survey was to better understand the reasons behind why customers did not complete their Retrofit Program projects.

The evaluation team developed the sample from program records provided by IESO staff. The survey was designed and programmed by the evaluation team, and sent as a web-based survey through Qualtrics to all Retrofit Program active non-participants in the sample, with the goal of reaching a census of participants given the hard to reach nature of this group.

The survey addressed company role and firmographics, confirmation of whether the respondent applied for but did not ultimately participate in the Retrofit Program for reasons other than ineligibility, program awareness, reasons for applying to the program, reasons for not participating in the program, likelihood of future participation, and spillover questions.

The survey was made available to the retrofit active non-participants between February 20th to March 25th of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-5 Retrofit Active Non-participant Survey Disposition

Disposition Report	Count
Completes	59
No Response	2,172
Unsubscribed	0
Partial Complete	30
Bad Contact Info (No Replacement Found)	148
Screened Out	343
Initiated Survey	104
Total Invited to Participate	2,856
Total in Population	2,856

F.5 Retrofit Contractor Survey

The evaluation team surveyed 97 retrofit contractors (77 completes; 20 partial completes) from a sample of 404 unique companies. The purpose of the survey was to better understand retrofit contractor perspectives related to program delivery (Table F-6).

The evaluation team developed the sample from program records provided by IESO staff. The survey was designed and programmed by the evaluation team, and sent as a web-based survey through Qualtrics to all retrofit contractors in the sample, with the goal of reaching a census of participants given the small sample and hard to reach nature of this group.

The survey addressed company role and firmographics, sales by equipment type (both in general and through the Retrofit Program), program awareness, training and education received, outreach and marketing to customers, their roles in implementing projects and advising customers, program satisfaction, estimates of participant intent to complete the upgrades in the absence of the program (free-ridership), and whether participants were influenced by the program to undertake energy efficient projects without program incentives (spillover).[127]

The survey was made available to the retrofit contractors between March 21st and April 21st of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-6 Retrofit Contractor Survey Disposition

Disposition Report	Count
Completes	77
No Response	292
Unsubscribed	0
Partial Complete	20
Bad Contact Info (No Replacement Found)	14
Total Invited to Participate	403
Total in Population	403

F.6 Retrofit Participant Survey

The evaluation team surveyed 987 Retrofit Program participants from a sample of 5,823 unique contacts. The purpose of the survey was to better understand Retrofit Program participant perspectives related to program delivery (Table F-7).

The evaluation team developed the sample from program records provided by IESO staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

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[127] The free-ridership information collected from retrofit contractors was used to adjust participant free-ridership values for those participants who reported the contractor was influential on their installation decision-making. Spillover information was collected for qualitative purposes only and to inform future program evaluations.

The survey addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for doing the upgrades, the role of the contractor in the process, satisfaction with various aspects of the program process, reasons why it could be difficult to make future energy efficient equipment upgrades, participant intent to complete the upgrade in the absence of the program (free-ridership), and whether participants undertook energy efficient projects without program incentives (spillover), and firmographics.

The survey was delivered both over the phone and over the web with the support of Nexant's survey implementation team. It was also deployed in two separate phases. An initial round of survey implementation was conducted between November 1st and November 30th of 2017 to capture survey responses as close to the time of participation as possible from customers who had participated in Q1 or Q2 of 2017. A second round of survey implementation was conducted between March 29th and April 23rd of 2018 to capture survey responses from customers who participated in Q3 or Q4 of 2017.

For web-survey non-respondents, weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-7 Retrofit Participant Survey Disposition

Disposition Report	Count (Web)	Count (Phone)	Total Count
Completes	871	116	**987**
No Response	3,691	605	**4,296**
Refused	0	159	159
No Eligible Respondent	0	26	**26**
Language Barrier	0	1	**1**
Bad Contact Info (No Replacement Found)	0	48	**48**
Did Not Pass Screening	0	9	**9**
Total Attempted	4,562	964	**5,526**
Total Invited to Participate	4,562	5,823	**5,823**

F.7 Retrofit Pay-for-Performance Program Survey

The evaluation team surveyed 115 Retrofit Program participants from a sample of 341 unique contacts. The purpose of the survey was to better understand Retrofit Program participant perspectives related to program delivery (Table F-8).

The evaluation team developed the sample from program records provided by IESO staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for doing the upgrades, the role of the contractor in the process, satisfaction with various aspects of the program process, reasons why it could be difficult to make future energy efficient equipment upgrades, participant intent to complete the upgrade in the absence of the program (free-ridership), whether participants undertook energy efficient projects without program incentives (spillover), and firmographics.

The survey was delivered both over the phone and over the web with the support of Nexant's survey implementation team. It was also deployed on a quarterly basis. The first quarterly survey was conducted over both the web and phone between October 4th and October 16th of 2017. The second quarterly survey was conducted over both the web and phone between November 29th and December 13th of 2017. The third quarterly survey was conducted over the web between February 8th and Marth 19th of 2018. The fourth quarterly survey was conducted over the web between March 31st and April 5th of 2018.

For web-survey non-respondents, weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-8 Retrofit P4P Participant Survey Disposition

Disposition Report	Count (Web)	Count (Phone)	Total Count
Completes	96	19	**115**
No Response	68	140	**208**
Refused	0	11	**11**
No Eligible Respondent	0	2	**2**
Language barrier	0	0	**0**
Bad Contact Info (No Replacement Found)	0	5	**5**
Did Not Pass Screening	0	0	**0**
Total Invited to Participate	164	177	**341**

F.8 SBL Assessor and Installer Survey

The evaluation team surveyed 27 installers and assessors (with 16 partial completes) associated with the SBL Program from a sample of 79 unique companies.

The purpose of the survey was to better understand SBL assessor and installer perspectives related to program delivery.

The sample list used to complete these interviews and surveys was provided by the IESO EM&V staff. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed company role and firmographics, sales by equipment type (both in general and through the SBL Program), program awareness, training and education received, outreach and marketing to customers, program satisfaction, effect of the overall program cost cap, estimates of participant intent to complete the upgrades in the absence of the program, and whether participants were influenced by the program to undertake energy efficient projects for which they did not receive program incentives.[128]

The survey was designed and programmed by the evaluation team, and sent as a web-based survey through Qualtrics to all SBL assessors and installers in the sample, with the goal of reaching a census of participants given the small sample and hard to reach nature of this group.

The survey was made available to the assessors and installers between March 16th and April 23rd of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-9 SBL Installer and Assessor Survey Disposition

Disposition Report	Count
Completes	27
No Response	22
Unsubscribed	1
Partial Complete	16
Bad Contact Info (No Replacement Found)	13
Total Invited to Participate	79
Total in Population	104

F.9 SBL Participant Survey

The evaluation team surveyed 827 SBL participants from a sample of 5,778 unique contacts. The purpose of the survey was to better understand SBL participant perspectives related to program delivery (Table F-10).

The evaluation team developed the sample from program records provided by IESO staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for doing the lighting upgrades, the role of the installer and assessor in the process, satisfaction with various aspects of the program process, reasons why it could be difficult to make future energy efficient equipment upgrades, participant intent to complete the upgrade in the absence of the program (free-ridership), whether participants undertook energy efficient projects without program incentives (spillover), and firmographics.

The survey was delivered both over the phone and over the web with the support of Nexant's survey implementation team. It was also deployed in two separate phases—an initial round of survey

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[128] Free-ridership and spillover information was collected from SBL Assessor and Installer in 2017 for qualitative purposes and to inform future program evaluations. The data was not used for estimating the net-to-gross ratio.

implementation was conducted between November 1st and November 30th of 2017 to capture survey responses as close to the time of participation as possible from customers who had participated in Q1 or Q2 of 2017. A second round of survey implementation was conducted between March 29th and April 23rd of 2018 to capture survey responses from customers who participated in Q3 or Q4 of 2017.

For web-survey non-respondents, weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-10 SBL Participant Survey Disposition

Disposition Report	Count (Web)	Count (Phone)	Total Count
Completes	722	105	**827**
No Response	5,056	778	**5,834**
Refused	0	182	**182**
No Eligible Respondent	0	35	**35**
Language Barrier	0	3	**3**
Bad Contact Info (No Replacement Found)	0	109	**109**
Did Not Pass Screening	0	12	**12**
Quota Filled	0	1	**1**
Total Attempted	5,778	1,225	**5,778**
Total Invited to Participate	5,778	4,294	**5,778**

F.10 BRI Program Staff and Implementer Interviews

The evaluation conducted one interview with LDC program staff and two separate interviews with the implementers for the program. The purpose of the interviews was to better understand BRI program staff and implementer perspectives related to program design, administration, and implementation (Table F-11).

The sample list used to complete these interviews was provided to the evaluation team by IESO staff.

The interviews addressed program roles, program changes, program delivery partners, barriers to implementation, perspectives on the success of the program, and suggestions for program improvement.

The evaluation team conducted the in-depth telephone interviews from January 17th to April 6th of 2018 and took approximately 10 to 20 minutes to complete.

Table F-11 BRI Program Staff and Implementer Interview Disposition

Disposition Report	Count
Completes	3
No Response	0
Unsubscribed	0
Partial Complete	0
Bad Contact Info (No Replacement Found)	0
Total Invited to Participate	3
Total in Population	3

F.11 BRI Program Supplier and Technician Interviews

The evaluation interviewed one BRI motor supplier and one installation technician from a sample of two unique companies. The purpose of the interviews was to better understand BRI supplier and technician perspectives related to program implementation (Table F-12).

The sample list used to complete these interviews was provided to the evaluation team by LDC staff.

The interview addressed program roles, sales details, program-incentivized technologies, implementation, satisfaction with the program, training received, barriers to implementation, and suggestions for program improvement.

The evaluation team conducted the in-depth telephone interviews from May 31st to June 11th of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of telephone survey fielding.

Table F-12 BRI Technician and Supplier Interview Disposition

Disposition Report	Count
Completes	2
No Response	0
Unsubscribed	0
Partial Complete	0
Bad Contact Info (No Replacement Found)	0
Total Invited to Participate	2
Total in Population	2

F.12 BRI Program Participant Survey

The evaluation team surveyed 72 BRI participants (60 completes; 12 partial completes) from a sample of 481 unique companies.[129] The purpose of the survey was to better understand BRI participant perspectives related to program delivery (Table F-13).

The evaluation team developed the sample from program records provided by IESO staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for doing the refrigeration upgrades, satisfaction with various aspects of the program process, reasons why it could be difficult to make future energy efficient equipment upgrades, participant intent to complete the upgrade in the absence of the program (free-ridership), whether participants undertook energy efficient projects without program incentives (spillover), and firmographics.

The survey was designed and programmed by the evaluation team, and sent as a web-based survey through Qualtrics to all BRI participants in the sample, with the goal of reaching a census of respondents given the small sample and hard to reach nature of this group.

The survey was made available to BRI participants between March 20th and April 20th of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-13 BRI Participant Survey Disposition

Disposition Report	Count
Completes	60
No Response	442
Unsubscribed	0
Deceased	1
Out of Business	1
Partial Complete	12
Bad Contact Info (No Replacement Found)	25
Total Invited to Participate	481

F.13 Audit Funding Program Auditor Interviews

The evaluation team interviewed 10 Audit Funding Program auditors from a sample of 81 unique companies. The purpose of the interviews was to better understand auditor perspectives related to program implementation (Table F-14).

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[129] The sample list used to complete these surveys was developed from a database of Save on Energy Business Program participants information provided to the evaluation team by IESO EM&V staff.

The sample list used to complete these interviews was provided by the IESO EM&V staff. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed company role and firmographics, respondent experience conducting audits, participation history with the Audit Funding Program, program awareness, training and education received, number of audits completed through the program in 2017, customer program awareness, influence of the audit report on customers, reasons why customers may not move forward with a retrofit after an audit, and program satisfaction.

The survey was conducted by the evaluation team over the telephone, with the goal of reaching a census of respondents given the small sample and hard to reach nature of this group.

The survey was made available to the auditors between June 21st and June 29th of 2018 and took approximately 20-40 minutes to complete.

Table F-14 Auditor Survey Disposition

Disposition Report	Count
Completes	10
No Response	13
Unsubscribed	0
Partial Complete	0
Bad Contact Info (No Replacement Found)	3
Total Invited to Participate	81
Total In Population	81

F.14 Audit Funding Program Participant Survey

The evaluation team surveyed 33 audit participants from a sample of 123 unique companies. The purpose of the interviews was to better understand Audit Funding participant perspectives related to program delivery (Table 12-1).

The evaluation team developed the sample from program records provided by IESO staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for having the audit performed, satisfaction with various aspects of the program process, reasons why it could be difficult to make future energy efficient equipment upgrades (free-ridership), whether participants undertook retrofit projects without IESO incentives and the influence of the program on those upgrades (spillover), and firmographics.

The survey was designed and programmed by the evaluation team, and was sent as a web-based survey through Qualtrics to all Audit Funding participants in the sample with available e-mail addresses. The goal was to reach a census of respondents given the small sample and hard to reach nature of this group.

Table 12-1 Audit Funding Participant Survey Disposition

Disposition Report	Count
Completes	33
No Response	61
Unsubscribed	0
Partial Complete	24
Bad Contact Info (No Replacement Found)	5
Total Invited to Participate	118
Total In Population	123

F.15 HPNC Program Builders and Developers Survey

The evaluation team interviewed eight builders and developers (7 completes; 1 partial complete) from a sample of 18 unique companies. The purpose of the interviews was to better understand HPNC participant perspectives related to program delivery (Table F-15).

The sample list used to complete these interviews and surveys was provided by the IESO EM&V staff. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed company role and firmographics, sales by equipment type (both in general and through the HPNC Program), program awareness, training and education received, outreach and marketing to customers, their roles in implementing projects and advising customers, and program satisfaction.

The survey was designed and programmed by the evaluation team, and sent as a web-based survey through Qualtrics to all HPNC builders and developers in the sample, with the goal of reaching a census of participants given the small sample and hard to reach nature of this group.

The survey was made available to the auditors between March 19th and April 23rd of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

Table F-15 HPNC Builder and Developer Survey Disposition

Disposition Report	Count
Completes	7
No Response	8
Unsubscribed	0
Partial Complete	1
Bad Contact Info (No Replacement Found)	2
Total Invited to Participate	16
Total in Population	18

F.16 HPNC Program Architects and Engineers Interviews

The evaluation team interviewed six HPNC engineers and architects from a sample of 22 unique companies. The purpose of the interviews was to better understand HPNC engineers' and architects' perspectives related to program implementation (Table F-16).

The sample list used to complete these interviews and surveys was provided by the IESO EM&V staff. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed company role and firmographics, relationships with other HPNC Program delivery partners, services provided to the HPNC Program, program challenges, customer motivations, program awareness, training and education received, their roles in implementing projects and advising customers, and program satisfaction.

The survey was conducted by the evaluation team over the telephone, with the goal of reaching a census of participants given the small sample and hard to reach nature of this group.

The survey was made available to the HPNC engineers and architects between April 4th and April 13th of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of telephone survey fielding.

Table F-16 HPNC Engineer and Architect Survey Disposition

Disposition Report	Count
Completes	6
No Response	10
Unsubscribed	3
Partial Complete	0
Bad Contact Info (No Replacement Found)	3
Total Invited to Participate	19
Total in Population	22

F.17 HPNC Program Participant Survey

The evaluation team surveyed 18 participants (16 completes; 2 partial completes) from a sample of 78 unique companies.[130] The purpose of the interviews was to better understand HPNC participant perspectives related to program delivery (Table F-17).

The evaluation team developed the sample from program records provided by IESO staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for building the project, satisfaction with various aspects of the program process, participant intent to build the project in the absence of the program (free-ridership), whether participants undertook energy efficient projects without program incentives (spillover), and firmographics.

The survey was designed and programmed by the evaluation team, and sent as a web-based survey through Qualtrics to all HPNC participants in the sample, with the goal of reaching a census of respondents given the small sample and hard to reach nature of this group.

The survey was made available to HPNC participants between March 15th and April 23rd of 2018 and took approximately 10 to 20 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of web survey fielding.

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[130] The sample list used to complete these surveys was developed from a database of Save on Energy Business Program participants information provided to the evaluation team by IESO EM&V staff.

Table F-17 HPNC Participant Survey Disposition

Disposition Report	Count
Completes	16
No Response	57
Unsubscribed	0
Partial Complete	2
Bad Contact Info (No Replacement Found)	1
Total Invited to Participate	77
Total in Population	78

F.18 EBCx Program Commissioning Agent Interviews

The evaluation team interviewed one EBCx commissioning agent from a sample of one unique company.[131] The purpose of the interviews was to better understand EBCx commissioning agent perspectives related to program implementation (Table F-18).

The sample list used to complete these interviews and surveys was provided by the IESO EM&V staff. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The interview addressed company role and firmographics, respondent experience with chiller commissioning, participation history with the EBCx Program, program awareness, training and education received, number of project completed through the program in 2017, customer program awareness, their roles in implementing projects and advising customers, and program satisfaction.

The interview was conducted by the evaluation team over the telephone, with the goal of reaching a census of participants given the small sample and hard to reach nature of this group.

The interview was conducted in June 2018 and took approximately 30 minutes to complete.

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[131] The sample list used to complete these interviews and surveys was provided by the IESO EM&V staff to the evaluation team. The list was populated by LDC staff who responded to a request for this information from the IESO EM&V staff.

Table F-18 Commissioning Agent Survey Disposition

Disposition Report	Count
Completes	1
No Response	0
Unsubscribed	0
Partial Complete	0
Bad Contact Info (No Replacement Found)	0
Total Invited to Participate	1
Total in Population	1

F.19 Existing Building Commissioning Program Participant Survey

The evaluation team surveyed three EBCx participants from a sample of 5 unique companies.[132] The purpose of the interviews was to better understand EBCx participant perspectives related to program delivery (Table F-19).

The evaluation team developed the sample from program records provided by IESO staff. A census-based approach was employed to reach the largest number of respondents possible given the small number of unique contacts.

The survey addressed how participants learned about the program, which other business programs they are aware of, their company sustainability policy, motivations for making the program upgrades, satisfaction with various aspects of the program process, reasons why it could be difficult to make future energy efficient equipment upgrades, participant intent to complete the upgrade in the absence of the program (free-ridership), whether participants undertook energy efficient projects without program incentives (spillover), and firmographics.

The survey was conducted by the evaluation team over the telephone, with the goal of reaching a census of participants given the small sample and hard to reach nature of this group.

The interviews were conducted in April of 2018 and took approximately 30 minutes to complete.

Weekly e-mail reminders were sent to non-responsive contacts over the course of telephone survey fielding.

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[132] The sample list used to complete these surveys was developed from a database of Save on Energy Business Program participants information provided to the evaluation team by IESO EM&V staff.

Table F-19 EBCx Participant Survey Disposition

Disposition Report	Count
Completes	3
No Response	10
Unsubscribed	0
Partial Complete	0
Bad Contact Info (no replacement found)	0
Total Invited to Participate	13
Total in Population	13

Appendix G Confidence and Precision

Confidence and precision are important considerations when undertaking an impact evaluation. For each program being evaluated sample sizes are developed; allocation of samples across the prescriptive, engineered, and custom strata are determined; and realization rates, as well as confidence and precision, are calculated once results are generated.

G.1 Impact Evaluation Sample Size Development

To begin sample development, an overall sample size for each program that would target the confidence and precision levels required by the IESO is calculated. The overall confidence and precision target for the total evaluation level for 2016 was 90% confidence and 10% precision (90/10), assuming a coefficient of variation (CV) of 0.5. The annual program-specific 2016 targets were:

- Retrofit Program: 90/10 at the track level
- SBL Program: 90/10 at the program level
- Audit Funding Program: 90/10 at the program level
- HPNC: 90/10 at the program level

LDCs had until April 1, 2017, to finalize their projects for the 2016 program year. Hence, the evaluation team used forecasts of participation provided by the IESO to determine initial sample sizes.

To calculate overall sample size, the following formula is used, assuming a population of infinite size:

Equation G-1: Sample Size – Infinite Populations

$$n_o = \left(\frac{\mathrm{Er} * Z}{P}\right)^2$$

Where:

Er = Overall population error ratio = 0.5 (assumed)
Z = Z-Statistic based on 90% confidence = 1.645
P = Precision from targets as described above (10%)

To correct this formula for a less-than-infinite population size, the following population correction formula was used:

Equation G-2: Sample Size – Finite Populations

$$n = \frac{n_o}{1 + \frac{n_o}{N}}$$

Where:

N = Population size
n = Sample Size

G.1.1 Retrofit Sample Allocation

As a whole, the population of Retrofit Program participants was heterogeneous because the three different measure tracks—prescriptive, engineered, and custom—allowed varying levels of rigor in program measurement and verification activities. Furthermore, the measure types submitted under these tracks covered a wide range of retrofits. Therefore, the evaluation team divided the sample frame for the Retrofit Program into three levels of strata to create more homogenous groups. This was done because, as sampling frames become more homogenous, the expected variation in the verified savings results decreases.

The Retrofit Program population is first divided across measure tracks to control for program measurement and verification rigor; this was the level one stratification. Next, measure tracks were divided into measure types—either lighting or non-lighting—because the increased complexity of non-lighting savings calculations could create increased uncertainty; this was the level two stratification. Finally, if the sample size at the measure-type level could support increased stratification this is further broken down by another level of strata—large, medium, and small—to reflect the size of project energy savings; this was the third level of stratification. For this final exercise, the Dalenius-Hodges method of stratification was used to create strata boundaries.

To guide the process of allocating the overall sample size among these three levels of strata, the evaluation team sought to capture those projects with the highest impact and uncertainty to minimize the overall error in the final impact estimate. To accomplish this goal, the Neyman allocation method was used, which evaluators generally believe creates optimal sample designs when used in conjunction with the Dalenius-Hodges method of stratification. An allocation variable was created as a function of the total lighting strata-reported energy savings and the assumed coefficient of variation of the particular strata. The allocation of the overall program stream sample size was computed using Equation H-3.

Equation G-3: Program Stream Sample Size

$$n_h = n\frac{S_h C_h}{\sum_i S_i C_i}$$

Where:

n_h = Sample size for stratum h
n = Total sample size
S_h = Sum of total energy savings for each project in stratum h
C_h = Assumed coefficient of variation in savings estimates for stratum h

Strata that received a sample allocation greater than the population size of that stratum were sampled with certainty, and the remaining sample size was allocated to the rest of the strata using the same methodology.

G.1.2 Calculation of Realization Rates and Confidence/Precision Achieved

To determine a strata realization rate, the savings that were estimated from measurement and verification activities at the strata level were first aggregated; then these savings are compared to the reported savings from project documentation. For strata from which the sample was taken, the strata realization rate was used to calculate an overall, stratum-verified savings estimate by multiplying the strata realization rate by the total reported savings.

The stratum realization rate was calculated using Equation G-4.

Equation G-4: Stratum Realization Rate

$$b_h = \frac{\sum_{i=1}^{n_h} y_i}{\sum_{i=1}^{n_h} x_i}$$

Where:

b_h = Realization rate for stratum h
n_h = Number of projects in stratum h sample
y_i = Verified savings of project i
x_i = Reported savings of project i

Thus, the overall stratum savings are calculated as:

Equation G-5: Stratum Savings

$$Savings_{ver,h} = Savings_{rep,h} * b_h$$

Where:

$Savings_{ver,h}$ = Total verified gross savings for stratum h
$Savingsr_{ep,h}$ = Total reported gross savings for stratum h

The total program savings are calculated as the sum of all strata, or:

Equation G-6: Program Savings

$$Savings_{ver,I} = \sum_{h} Savings_{ver,h}$$

Where:

$Savings_{ver,I}$ = Total verified savings of the program

The uncertainty in the verified savings estimates was a function of the variability of the verified savings, relative to the reported savings.

Equation G-7: Verified Savings Standard Error

$$se(b) = \frac{\sqrt{\frac{\sum_{i=1}^{n}(y_i - bx_i)^2}{n(n-1)}}}{\frac{1}{n}\sum_{i=1}^{n} x_i} * \sqrt{1 - \frac{n}{N}}$$

Where:

se(b) = Standard error for the realization rate

$$P = \frac{Z * se(b)}{b}$$

Where:

P = Relative precision of the realization rate (this will be the same as the relative precision of the verified savings estimate)
Z = Z-statistic based on 90% confidence = 1.645

Appendix H Interactive Energy Changes for Lighting Retrofits

As discussed in Section 3.1, understanding how energy efficiency projects change the energy use of other equipment, not associated directly with the projects themselves, is an important consideration in calculating the benefit of energy efficiency programs. However, these interactive energy changes may be difficult to quantify. In this section, the following are discussed: difficulties encountered in estimating interactive energy changes in the context of IESO's programs; the methodology that the evaluation team and IESO agreed upon—specifically on addressing lighting retrofit projects only; and the results of the interactive energy analysis for lighting.

H.1 Introduction

The IESO Evaluation Measurement and Verification (EM&V) Protocols state that interactive energy changes should be quantified and accounted for whenever possible.

Interactive energy changes come in a number of forms and affect different fuel types. A measure that directly saves electricity may also cause another building system to consume less energy. Alternatively, a measure that directly saves electricity could cause another building system to consume more energy. Sometimes, a single project can have both positive and negative interactive effects on other systems. For example, upgrading to energy efficient lighting reduces the electricity that a participant uses on lighting; the associated reduction in waste heat reduces the burden on the cooling system in the summer—but increases the burden on the heating system in the winter.

Table I-1 highlights a few examples of measures that participants have implemented through IESO's commercial DSM programs, together with the measures' possible interactive energy changes.

Table H-1 Examples of Interactive Energy Changes

Measure Description	Direct Energy Savings	Possible Interactive Energy Changes
Chilled water temperature reset	Lowers electricity consumption at the chiller	May raise electricity consumption at the air-handling unit
Schedule makeup air unit to reduce outside air during the night	Lowers fan energy consumption of the makeup air unit	Lowers both the air conditioning (electrical) and heating (fossil fuel) load needed to condition outside air
Upgrade to more efficient lighting	Lowers electricity consumption of the lighting system	Lowers summer air conditioning load (electrical), but raises winter heating load (fossil fuel) because efficient lighting gives off less waste heat
Replace a set of air-cooled chillers with a large water-cooled chiller	Lowers total electricity consumption of the chiller plant	Increases water consumption

Although there is a good understanding of the potential interactive energy changes associated with program projects, neither participants nor the IESO consistently track these energy changes. Without tracking evaluators have difficulty producing estimates of total interactive energy changes for the overall population of participant retrofits; no reported savings values exist from which to create realization rates.

In these situations evaluators can use the average of a sample to evaluate the overall population interactive savings. However attaining an average with a reasonable degree of uncertainty for the heterogeneous population of IESO commercial retrofits would require large, resource-intensive sample sizes

Given the lack of interactive energy tracking and the variability among commercial retrofit projects, the IESO and the evaluation team agreed that the most defensible methodology for the 2016–2020 Evaluation Cycle is to produce estimates of interactive energy changes for lighting projects only. This approach obviates the need for existing interactive energy change tracking because lighting projects produce relatively predictable interactive energy changes for the participant population as a whole; this predictability enabled the evaluation team to adopt a stipulated approach that will produce defensible estimates of interactive energy changes at the strata level. Focusing on lighting projects also avoids the concern about too much variability across projects; lighting projects represent the largest and most homogeneous measure category for reported savings.

H.2 Methodology

The evaluation team calculated the interactive effects for every project in the sample, using 8760 interactive effect load shapes (electric and gas) based on building type and regional weather data. This analysis was conducted for lighting projects in the 2017 impact sample, and enabled the evaluation team to reflect differences in typical equipment saturations and lighting project characteristics by project size and measure track. The following steps were undertaken for lighting projects within the three tracks:

- 8760 HVAC electric and natural gas load shapes were based on DOE2 modeling data[133] for different building types.[134] The modeled HVAC usage data was combined with typical Toronto weather to create an interactive effect estimate for each hour of the year for a given building type. This process was duplicated for all available building types.
- During project level analysis a building type was selected and the 8760 interactive effects load shape was applied to the energy savings load shape to provide an hourly project specific estimate of electric and natural gas interactive effects. The analysis tool differentiated between lights in conditioned and unconditioned spaces, and applied zero interactive effects in areas without electric cooling or gas based heating.
- Interactive Effect Factors for a given strata or project type (e.g., Prescriptive Lighting Small, SBL, BRI) were calculated by taking a ratio of the interactive energy savings from all projects within the strata and the non-interactive energy savings. The ratio, listed as a percentage, became the adjustment factor applied to all projects within a given strata. This process was duplicated with summer demand, winter demand, and natural gas savings and provided a strata-based interactive factor for each of these evaluation outputs.
- For the BRI program, an assumed interactive factor was applied to savings estimates for lighting measures. The magnitude of the interactive effect the lighting savings had was based on the

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[133] https://www.energycodes.gov/development/commercial/prototype_models

[134] Office, conditioned storage, retail, restaurant, nursing home, motel, hotel, manufacturing, hospital, university, primary school, secondary school, community college, grocery, assembly

temperature of the environment in which the new lighting was installed. The assumed values referenced the 2016 Pennsylvania TRM.[135] See Table H-2 for the specific interactive factors used.

Applying an 8760 interactive effects load shape to individual project savings allowed for calculated, strata specific, interactive factors that accounted for the building type, typical weather conditions, and the operational schedule of the systems under review.

H.3 Results

Equation 12-1: Calculation of Interactive Effects

$$IE_{energy} = Energy_{GV} \times IF_{energy}$$

$$IE_{demand,summer} = Summer\ Demand_{GV} \times IF_{demand,summer}$$

$$IE_{natural\ gas} = Energy_{GV} \times IF_{natural\ gas}$$

Where:

IE = Interactive Effect
EnergyGV = Gross Verified Energy Savings
Summer DemandGV = Gross Verified Summer Demand Savings
IF = Interactive Factor (dependent on track and strata size)

Less efficient lighting technologies consume additional energy by emitting heat along with their lumen output. When these lamps are replaced with more efficient technologies the amount of heat created by the lamp is reduced and as a result electric cooling systems will run less often to maintain temperature in a room. Energy and demand interactive effects estimate savings attributable to the cooling system's reduced run-time and provide additional savings for the program. Conversely winter demand and natural gas interactive factors are negative because these systems run more often to replace space heat lost by upgrading the lighting system to higher efficiency equipment that emits less thermal energy. The negative interactive factor is translated to lower winter demand savings for a project or additional natural gas consumed.

Table H-2 lists the estimates that were applied to the Retrofit Program population from the interactive energy analysis by project size and measure track. Equation 12-1 provides the methodology used to calculate interactive effects based on gross verified energy for a project and the lighting interactive factor based on track and strata size.

Equation 12-1: Calculation of Interactive Effects

$$IE_{energy} = Energy_{GV} \times IF_{energy}$$

$$IE_{demand,summer} = Summer\ Demand_{GV} \times IF_{demand,summer}$$

$$IE_{natural\ gas} = Energy_{GV} \times IF_{natural\ gas}$$

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[135] Pennsylvania Technical Reference Manual, State of Pennsylvania Public Utility Commission, June 2016.

Where:

IE = Interactive Effect
Energy_{GV} = Gross Verified Energy Savings
$\text{Summer Demand}_{GV}$ = Gross Verified Summer Demand Savings
IF = Interactive Factor (dependent on track and strata size)

Less efficient lighting technologies consume additional energy by emitting heat along with their lumen output. When these lamps are replaced with more efficient technologies the amount of heat created by the lamp is reduced and as a result electric cooling systems will run less often to maintain temperature in a room. Energy and demand interactive effects estimate savings attributable to the cooling system's reduced run-time and provide additional savings for the program. Conversely winter demand and natural gas interactive factors are negative because these systems run more often to replace space heat lost by upgrading the lighting system to higher efficiency equipment that emits less thermal energy. The negative interactive factor is translated to lower winter demand savings for a project or additional natural gas consumed.

Table H-2 Retrofit Interactive Factors for Lighting Projects

Measure Track and Lighting Energy Savings Size	Energy Interactive Factor	Summer Demand Interactive Factor	Winter Demand Interactive Factor	Natural Gas Interactive Factor (therms/kWh)
Prescriptive				
Small	3.6%	15.9%	-1.6%	-0.6%
Medium	3.9%	16.6%	-2.1%	-0.9%
Large	2.6%	16.3%	-1.8%	-0.6%
Engineered				
Small	3.9%	11.1%	-1.3%	-0.9%
Medium	3.0%	11.8%	-2.6%	-0.6%
Large	2.5%	11.9%	-1.4%	-0.9%
Custom				
Small	1.3%	3.3%	-1.3%	-1.1%
Medium	3.0%	13.4%	-1.6%	-1.0%
Large	1.4%	8.5%	-1.5%	-0.3%

Table H-3 lists the estimates that were applied to the Retrofit Program population from the interactive energy analysis by project.

Table H-3 BRI Interactive Factors for Lighting Projects

Measure Track and Lighting Energy Savings Size	Approximate Temperature	Energy Interactive Factor
Freezer	-37° to -6°C	50%
Medium Temp. Cooler	-6°C to 4°C	29%
High Temp. Cooler	4°C to 16°C	18%

Appendix I Additional Process and NTG Evaluation Findings

The following figures and tables are the expanded results from the NTG and process evaluation. They are meant to provide additional support to the analysis summary. All key findings from the analysis are discussed in the main body of the report.

I.1 LDC Staff Perspectives: Additional Process Findings

The following tables are the expanded results from process evaluation of the LDC Staff surveys and interviews.

Table I-1: Explanation of Low Rating Given to IESO Communications*
(open end response allowed; n=2)

Explanation of Rating	Sample
Adequacy or completeness of IESO's responses to inquiries	
Responses are ambiguous and not transparent	1
Responses require multiple follow-ups	1
LDC asks IESO only if other LDCs can't answer	1
Timeliness of responses from IEO	
Responses are ambiguous and not transparent	1
Responses require multiple follow-ups	1
IESO responds at the end of the day or end of the week	1
Responses are too slow for customer deadlines	1
Overall communications with IESO	
Responses are ambiguous and not transparent	1
Responses require multiple follow-ups	1
IESO responds at the end of the day or end of the week	1

* Some respondents provided multiple unique answers for each aspect of communication.

Table I-2: Availability of Qualified Contractors

Contractor Availability	Do not have enough contractors	Have enough contractors	Don't know if there are enough contractors
Retrofit (n=34)	**0%**	**26%**	**3%**
0 (3 respondents)	0%	0%	33%
1-10 (4 respondents)	0%	100%	0%
11-50 (3 respondents)	0%	67%	0%
500+ (3 respondents)	0%	100%	0%
Refused (19 respondents)	--	--	--
SBL (n=34)	**3%**	**38%**	**3%**
1-10 (16 respondents)	6%	69%	6%
51-499 (1 respondents)	0%	100%	0%
500+ (1 respondents)	0%	100%	0%
Refused (13 respondents)	--	--	--
HPNC (n=34)	**3%**	**12%**	**6%**
0 (3 respondents)	0%	0%	33%
1-10 (5 respondents)	20%	80%	0%
500+ (1 respondents)	0%	0%	100%
Refused (17 respondents)	--	--	--
Audit Funding (n=34)	**6%**	**15%**	**0%**
1-10 (5 respondents)	20%	80%	0%
11-50 (1 respondents)	0%	100%	0%
500+ (1 respondents)	100%	0%	0%
Refused (18 respondents)	--	--	--
Existing Business Commissioning (n=34)	**6%**	**9%**	**3%**
0 (1 respondents)	0%	0%	50%
1-10 (5 respondents)	40%	60%	0%
Refused (7 respondents)	--	--	--
BRI (n=34)	**6%**	**15%**	**0%**
0 (1 respondents)	0%	0%	100%
1-10 (8 respondents)	25%	63%	0%
Refused (9 respondents)	--	--	--

I.2 Retrofit PDA and TPE Perspectives: Additional Process Findings

The following tables and figures are the expanded results from the PDA and TPE staff survey.

Figure I-1: PDA and TPE Satisfaction with IESO Interactions (n=6)

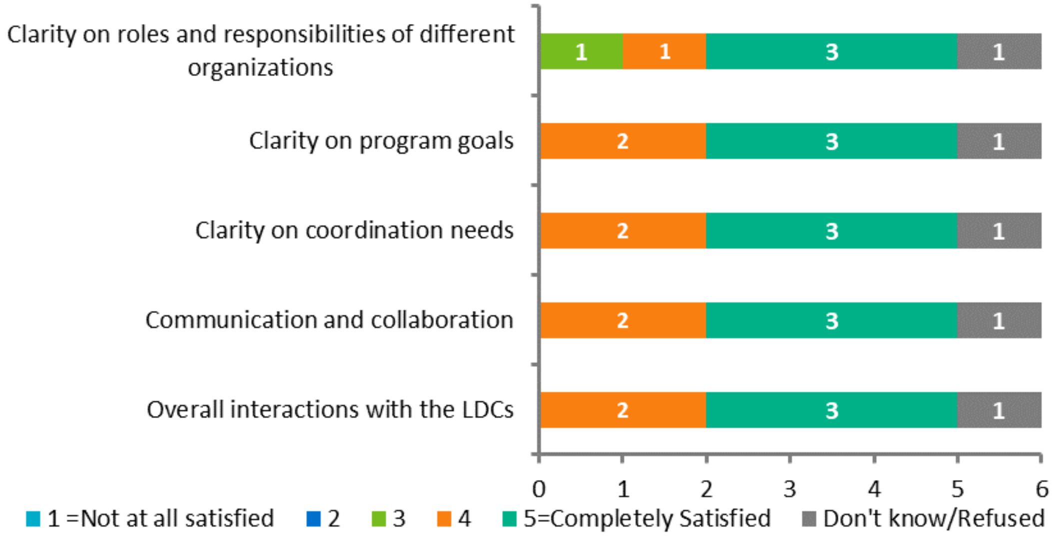


Figure I-2: PDA and TPE Satisfaction with IESO Interactions (n=5)

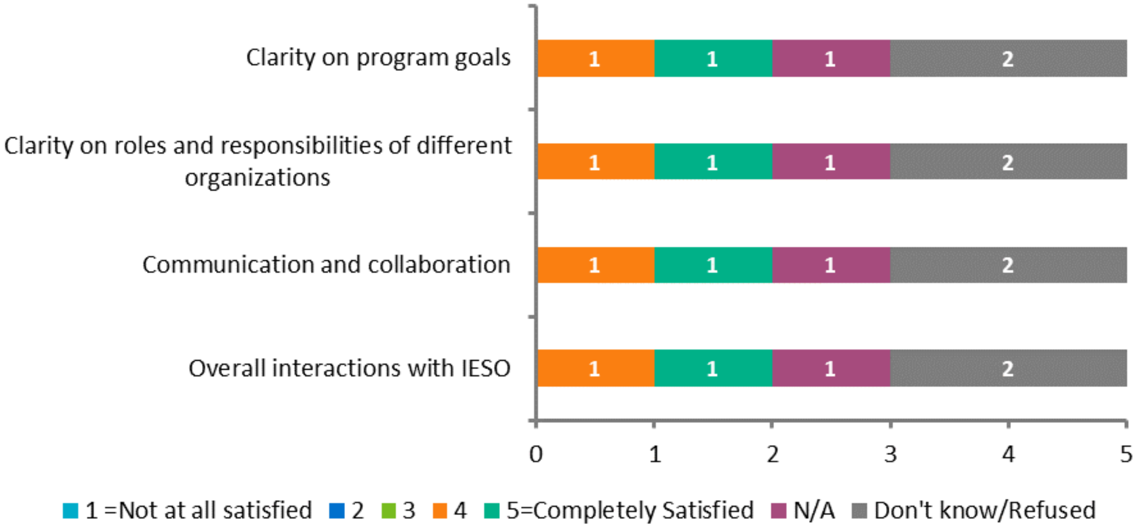
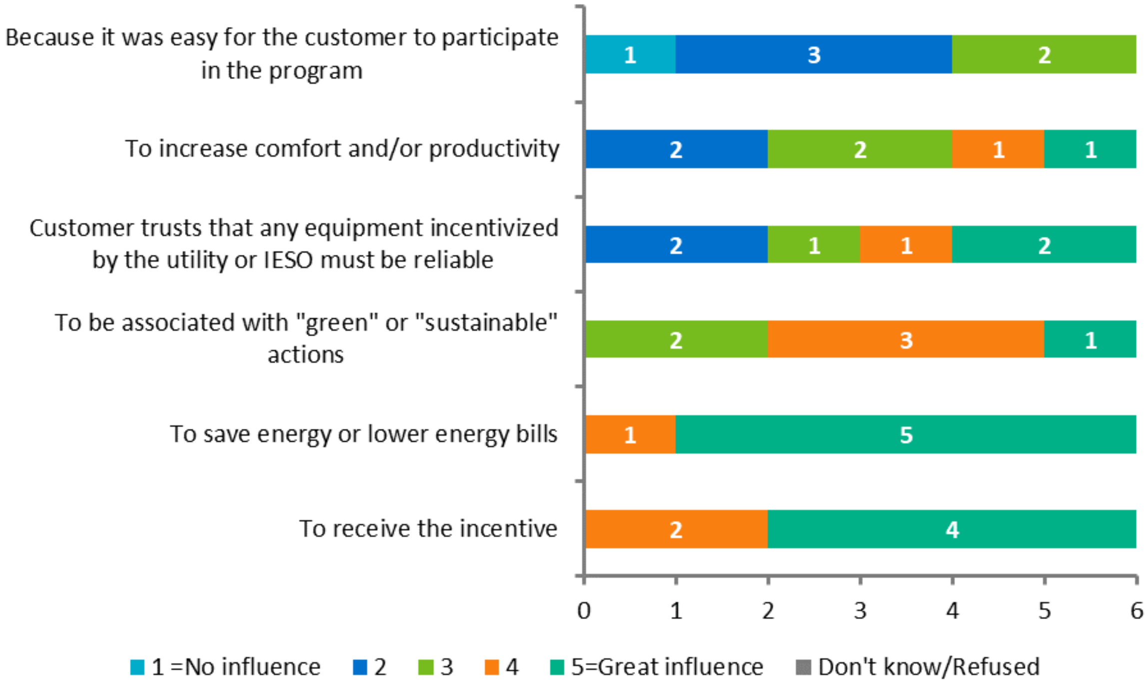


Figure I-3: PDA and TPE Perspective on Customer Motivation to Install Program-Qualifying Equipment (n=6)



I.3 Retrofit Contractor Perspectives: Additional NTG Findings

The following figures are the expanded results from the Retrofit Contractor survey.

Figure I-4: Contractors' Spillover Installations and Program Influence (n=57)

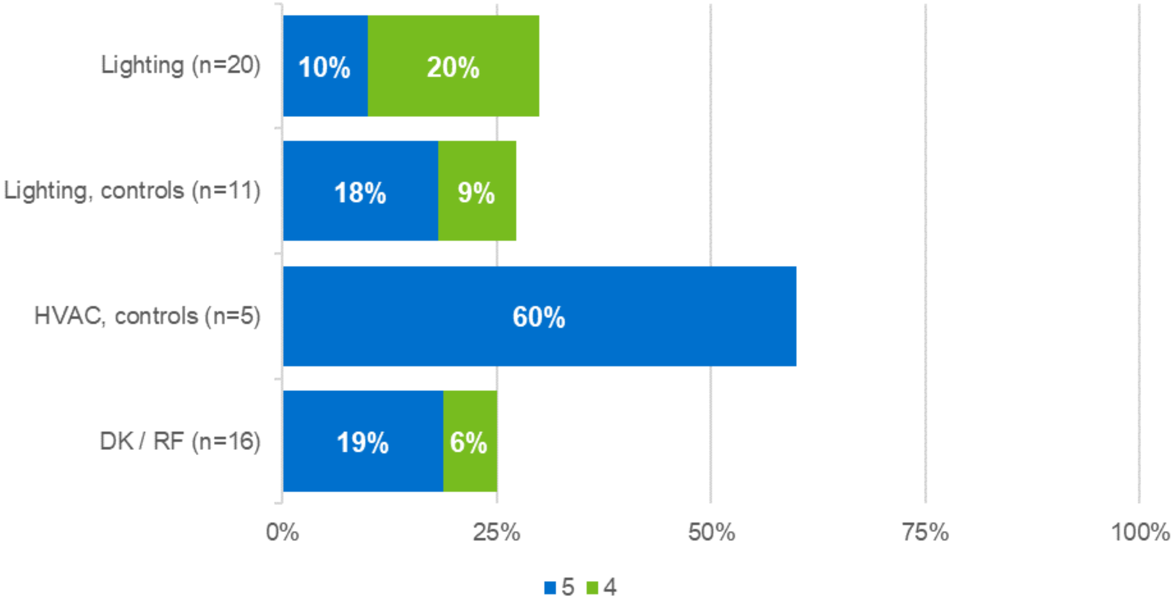


Table I-3: Free-ridership by Retrofit Project Track

Projects per Respondent	Track	Incentivised	Free rider	Participants (n=58)
0 to 10	Custom	66	18	27%
0 to 10	Prescriptive	65	16	25%
11 to 100	Custom	988	56	6%
11 to 100	Prescriptive	975	100	10%
101 to 500	Custom	510	66	13%
101 to 500	Prescriptive	510	39	8%
501+	Custom	2	0	0%

Table I-4: Free-ridership by Equipment Type

Equipment Type	FR Respondents	Percentage of Sales Through Program	Percentage of Sales That Would Have Installed without Program
Lighting	25	67%	31%
Lighting, controls	10	23%	15%
HVAC	5	34%	35%
HVAC, controls	4	47%	22%
Motor replacement / VSD install	3	24%	33%
Pump replacement / VSD install	1	26%	75%
Energy mgmt. systems	1	25%	25%
Refrigeration	2	12%	12%
Other	5	49%	20%

Table I-5: Program Influence on Spillover Volume, General

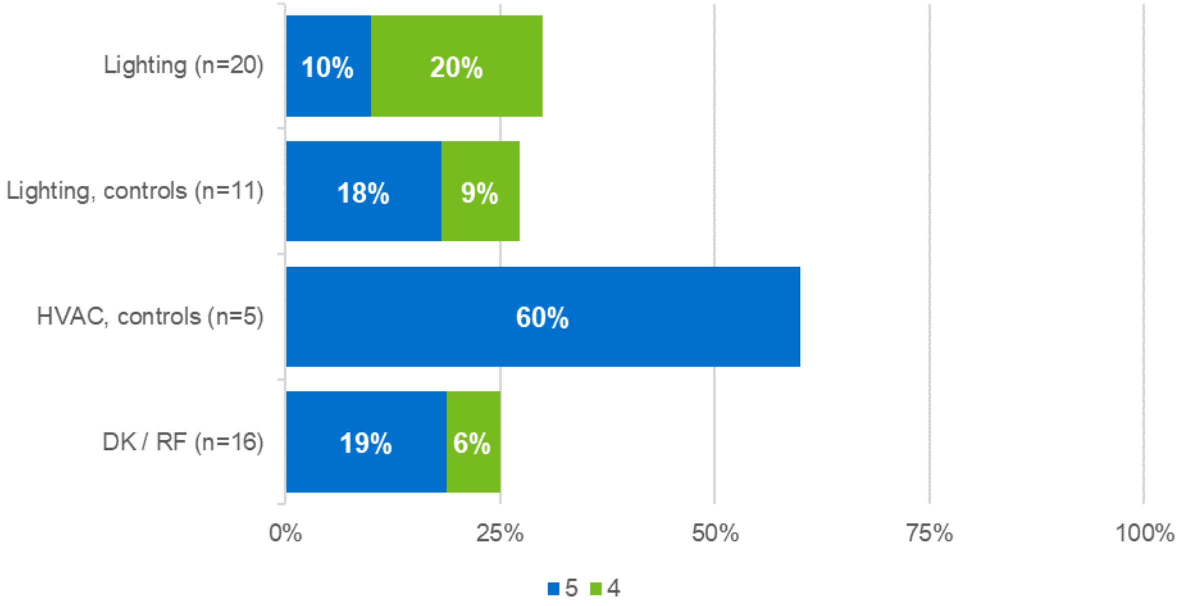
Program Influence Rating	Number of Spillover Projects (n=15)
5	9997
4	9998
3	2
2	40
1	268
Don’t know / I’d rather not say	45

Both 5 and 4 ratings contain participants who listed 9997 = “9997 projects or more”

Table I-6: Program Influence on Spillover Volume by Equipment Type

Equipment Type	3	4	5
Lighting (n=20)	25%	20%	10%
Lighting, controls (n=11)	27%	9%	18%
HVAC, controls (n=5)	--	--	60%
HVAC (n=5)	20%	--	--
DK / RF (n=16)	25%	6%	19%

Figure I-5: Contractors' Spillover Installations and Program Influence (n=57)



I.4 Retrofit Active Non-participant Perspectives: Additional Process Findings

The following tables and figures are the expanded results from the Retrofit Active Non-participant survey.

Figure I-6: Participation Status of Survey Respondents (n=439)

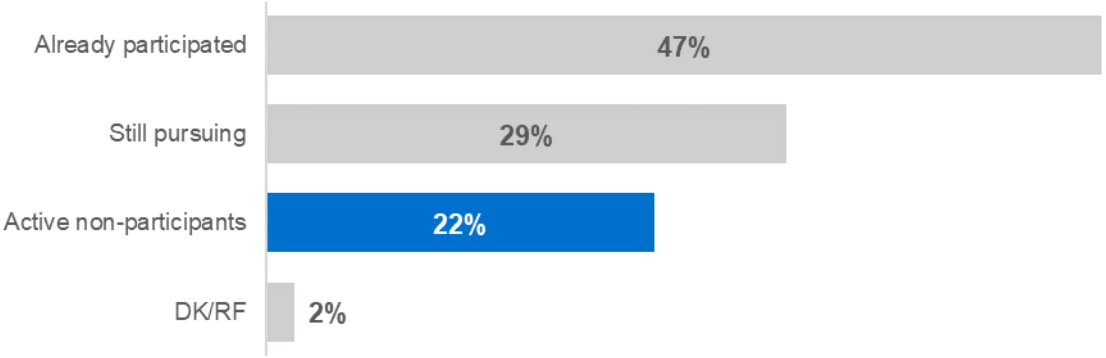


Figure I-7: Rates of Project Ineligibility and Rejection among Survey Respondents (n=102)

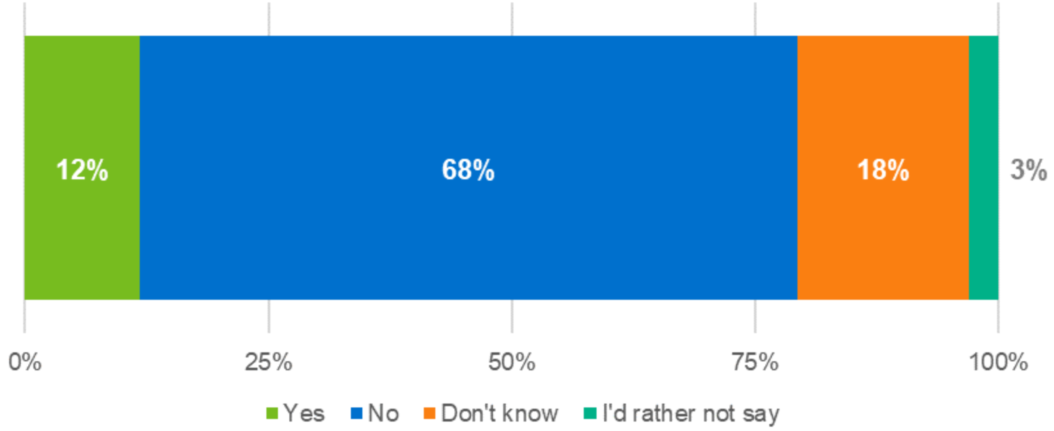


Figure I-8: Rates of Project Ineligibility and Rejection among Survey Respondents (n=102)

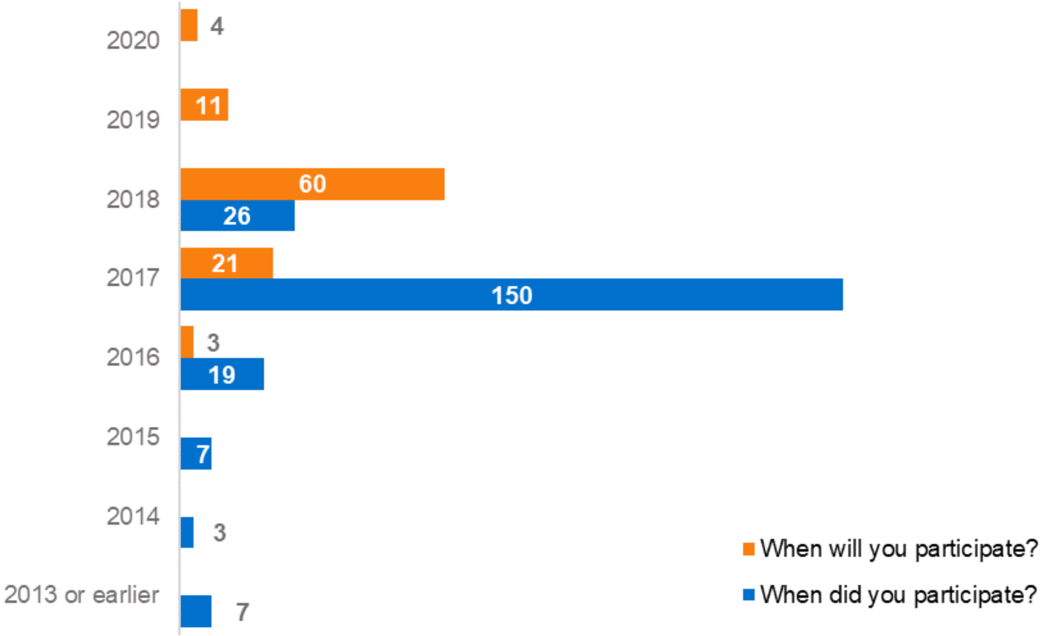


Table I-7: Project Status among Survey Respondents who had Already Participated (n=195)

Have you completed your project?	Have you received an incentive?	Respondents	Percent of Respondents
Yes	Yes	99	51%
	No	67	34%
	Don't know	11	6%
No	N/A	12	6%
Don't know	Yes	2	1%
	No	3	2%
	N/A	1	1%

I.5 Retrofit Participant Perspectives: Additional Process and NTG Findings

The following tables figures are the expanded results from the Retrofit Participant survey.

Figure I-9: Motives for Participating in the Retrofit Program Expanded Results (n=995)

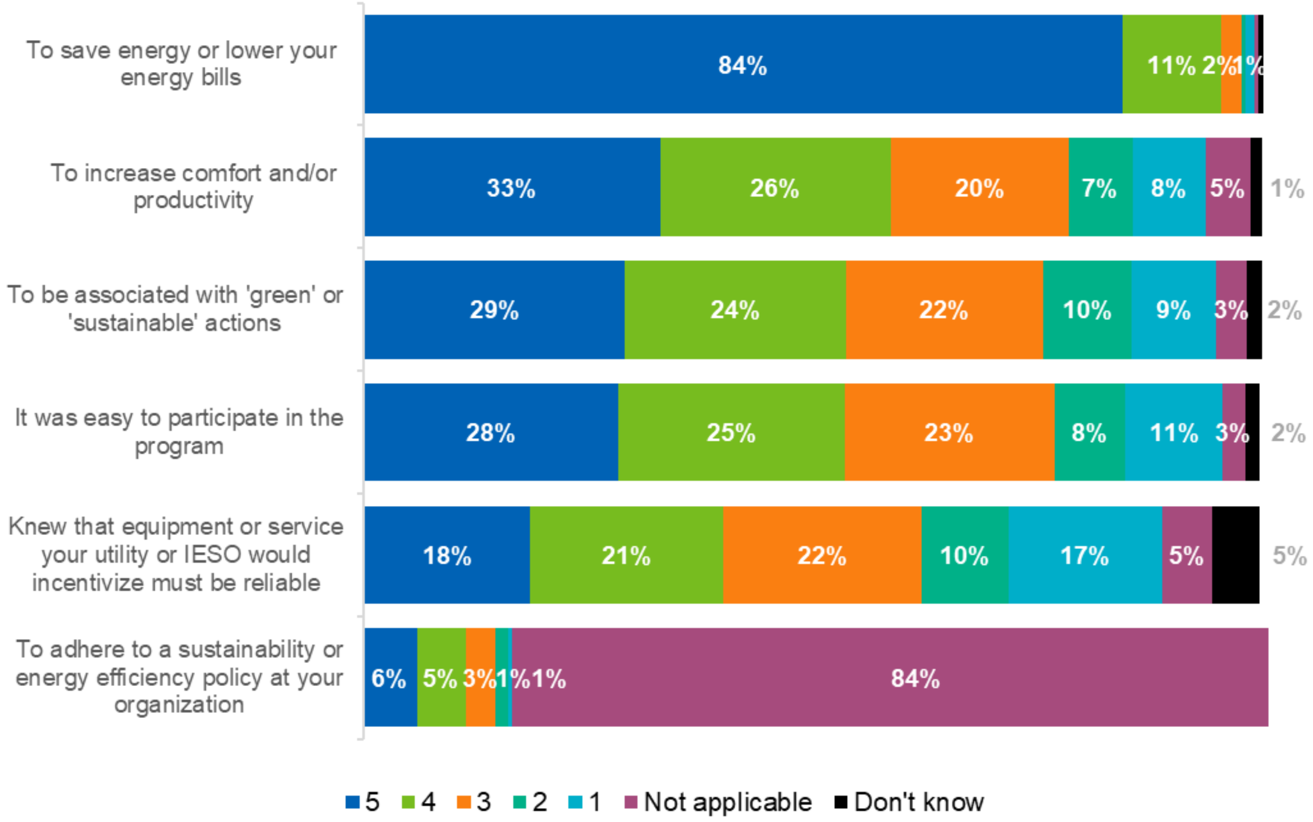


Figure I-10: Retrofit Participant Satisfaction Expanded Results (n=995)

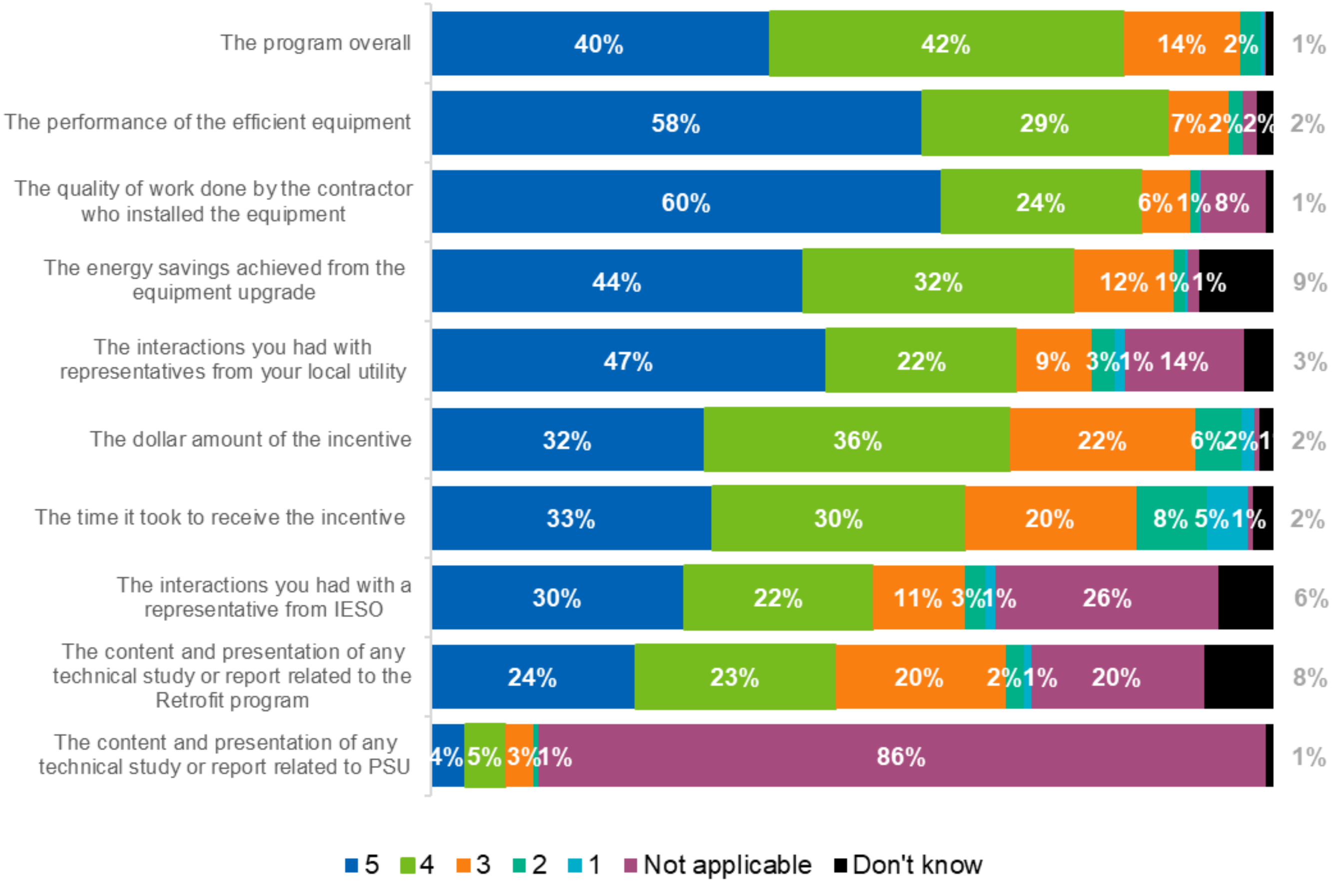


Figure I-11: Retrofit Program Recommendation Expanded Results (n=995)

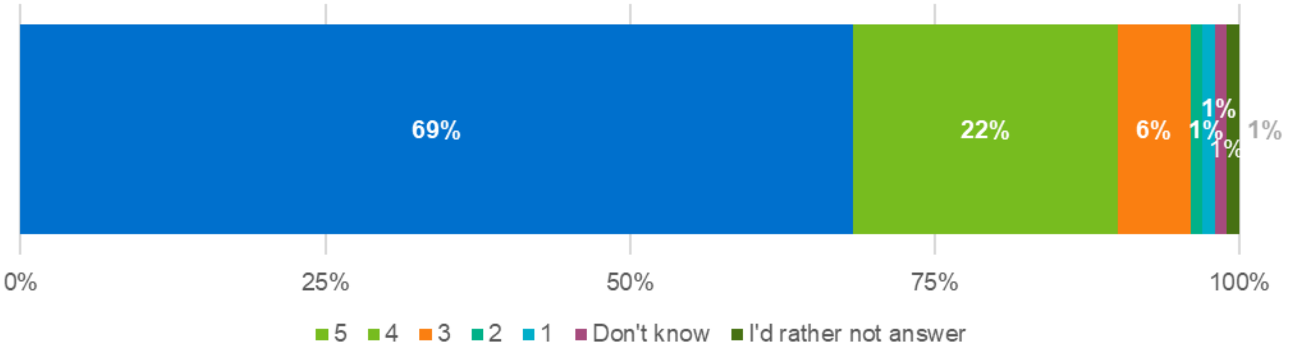


Figure I-12: Influence on Upgrade Decision Expanded Results (n=995)

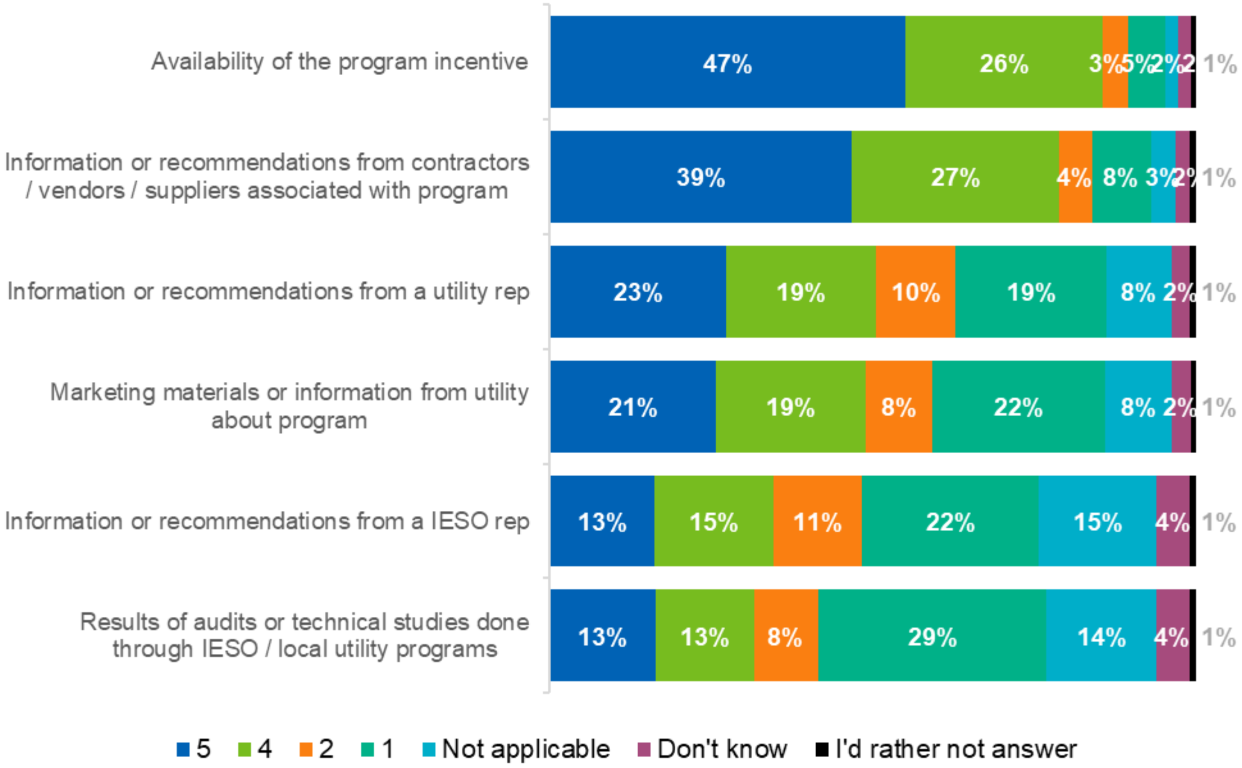


Table I-8: Type of Lighting Installed* (multiple responses allowed; n=87)

Spillover Lighting	Respondents
LED linear	39%
LED exterior	29%
LED screw base	21%
Compact fluorescent (CFL)	5%
Linear fluorescent	5%

*Does not sum to 100% due to rounding.

Table I-9: Quantity of CFL and LED Screw Base Bulbs Installed
(multiple responses allowed; n=37)

Lighting	Wattage	Respondents	Bulbs Installed		
			Median	Maximum	Percent
Compact fluorescent (CFL)	<10W	1	4	4	0.1%
	11-20W	3	80	150	4.4%
	21-30W	2	20	30	0.7%
	30+	2	13	25	0.4%
LED screw base	<10W	11	100	2000	57.0%
	11-20W	8	31	200	7.2%
	21-30W	2	18	30	0.6%
	30+	10	52	1000	29.7%

Table I-10: LED Exterior Lighting Mount (n=44)

Location	Responents	Equipment	Median Installed	Max Installed	Percent
Pole mount	14	932	13.5	400	47%
Under canopy	8	605	15.0	500	31%
Against building	22	437	17.5	50	22%

Table I-11: Quantity of Linear Fixtures Installed*
(multiple responses allowed; n=60)

Fixtures Installed per Respondent	LED linear (n=58)	Linear fluorescent (n=8)
1-10	24%	50%
11-40	24%	50%
41-120	22%	--
121+	29%	--

*Does not sum to 100% due to rounding.

Table I-12: Linear Fixture Ceiling Installation
(multiple responses allowed; n=59)

Type	Installed in >20ft. Ceiling?	Responents	Equipment	Median Installed	Max Installed	Percent
LED linear (n=57)	Yes	24	7561	82.5	3000	43%
	No	33	10095	24.0	8000	57%
Linear fluorescent (n=8)	Yes	3	39	10.0	25	0%
	No	5	89	20.0	40	1%

Table I-13: Length of Lamps in Each Fixture*

(multiple responses allowed; n=59)

Type	Lamp Length (ft)	Respondents	Equipment	Median Installed	Max Installed	Percent
LED linear (n=57)	2	7	203	20	120	1%
	4	49	17299	50	8000	97%
	8	1	154	154	154	1%
Linear fluorescent (n=8)	2	2	26	13	25	0%
	4	5	82	10	40	0%
	8	1	20	20	20	0%

*Does not sum to 100% due to rounding.

Table I-14: Type of Linear Fluorescent Installations (n=8)

Type	Respondents	Equipment	Median Installed	Max Installed	Percent
T5	4	93	22.5	40	73%
T8	4	35	7.0	20	27%

Table I-15: Quantity of Linear Fluorescent Lamps in Each Fixture (n=8)*

Fluorescent Lamps per Fixture	Respondents	Equipment	Median Installed	Max Installed	Percent
1	1	20	20	20	16%
2	3	70	20	40	55%
3	1	1	1	1	1%
4	3	37	8	25	29%

*Does not sum to 100% due to rounding.

Table I-16: Lighting Controls and Lighting Type (n=23)

Control Type	Compact fluorescent (CFL)	LED exterior	LED linear	LED screw base	Linear fluorescent
Occupancy Sensor	2	11	16	7	2
Timer	1	2	4	2	1
Total	3	13	20	9	3

Table I-17: End Uses of Motor/Pump Upgrades (n=21)

End-use	Respondents
Process motor / pump	11
HVAC fan	5
Domestic hot water pump	3
HVAC water pump	2

Table I-18: Efficiency and Horsepower of Motor/Pump Upgrades (n=21)*

Efficiency	Horsepower	Respondents	Equipment	Percent
Standard	1.1-5	1	1	1%
	5.1-15	4	14	9%
	15.1-30	3	17	11%
	30.1-50	1	4	2%
	50.1+	1	6	4%
Premium	Less than 1	1	2	1%
	1.1-5	3	56	35%
	5.1-15	4	19	12%
	15.1-30	2	28	17%
	30.1-50	1	14	9%

*Does not sum to 100% due to rounding.

Table I-19: Motor/Pump Drive Improvement Type and Horsepower (n=17)

Equipment Type	Type	HP	Respondents	Equipment	Percent Equipment
Motor	Variable speed / frequency drive	1.1-5	1	4	5%
		5.1-15	3	26	35%
		15.1-30	1	5	7%
		30.1-50	2	7	9%
		50.1+	2	15	20%
	Synchronous belt	1.1-5	1	1	1%
		5.1-15	1	2	3%
Pump	Variable speed / frequency drive	<1	1	1	1%
		5.1-15	4	9	12%
	Synchronous belt	15.1-30	1	4	5%

Table I-20: ENERGY STAR Appliance and Quantity Installed (multiple responses allowed; n=13)

Appliance	Respondents	Equipment	Average quantity of appliances installed
Refrigerator	10	31	3.10
Clothes Washer	5	9	1.80
Freezer	5	20	4.00
Ice Machine	5	27	5.40
Dishwasher	4	17	4.25

Table I-21: Size of Air Conditioners Installed (n=18)

Size	Respondents	Equipment	Percent Equipment
Less than 5.4 Tons (65,000 Btuh)	5	10	11%
5.4-11.4 Tons (65,000-137,000 Btuh)	8	23	24%
11.41-20 Tons (137,100-240,000 Btuh)	1	50	53%
20.01-63-6 Tons (240,100-763,000 Btuh)	2	6	6%
63.61+ Tons (763,100+ Btuh)	2	5	5%

Table I-22: Diameter of Fans Installed (n=5)

Diameter (ft)	Respondents	Equipment
<1	2	5
1-1.99	1	20
2-3.99	2	8

I.6 Retrofit P4P Participant Perspectives: Additional Process and NTG Findings

The following figures are the expanded results from the Retrofit P4P Participant survey.

Figure I-13: Influence on Upgrade Decision (n=114)

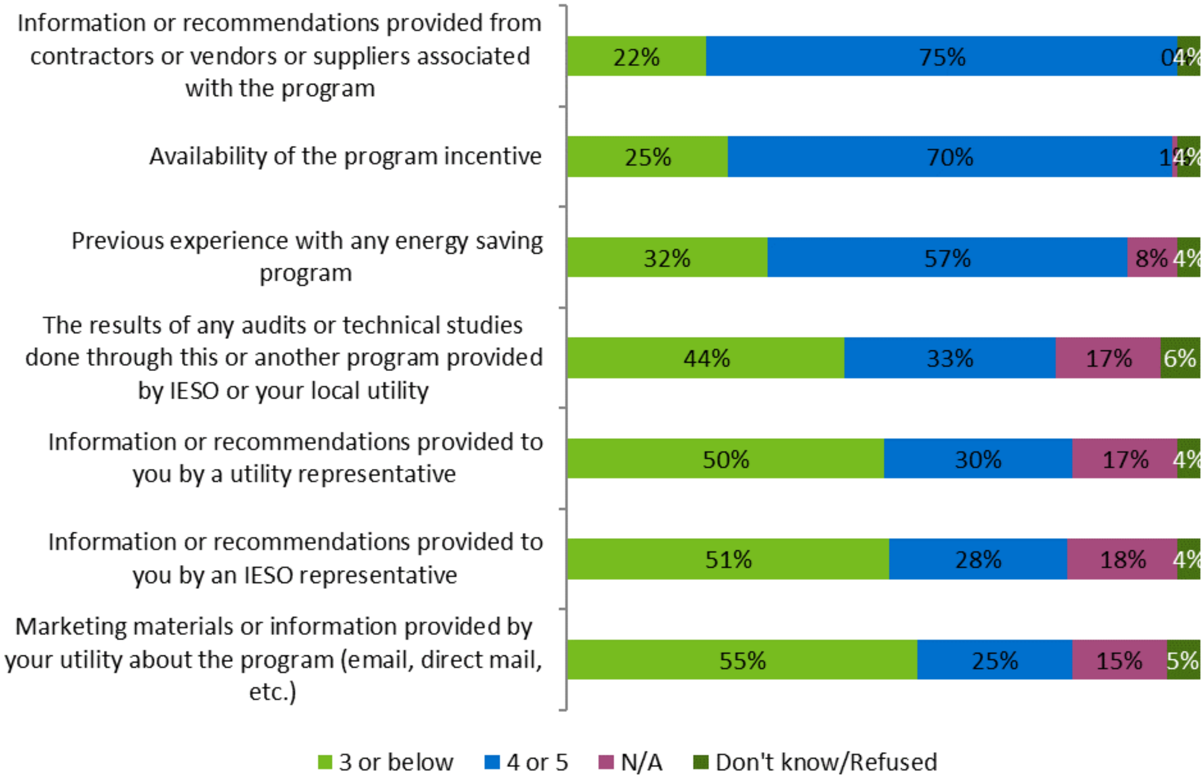


Figure I-14: Influence on Upgrade Decision Extended Results (n=114)

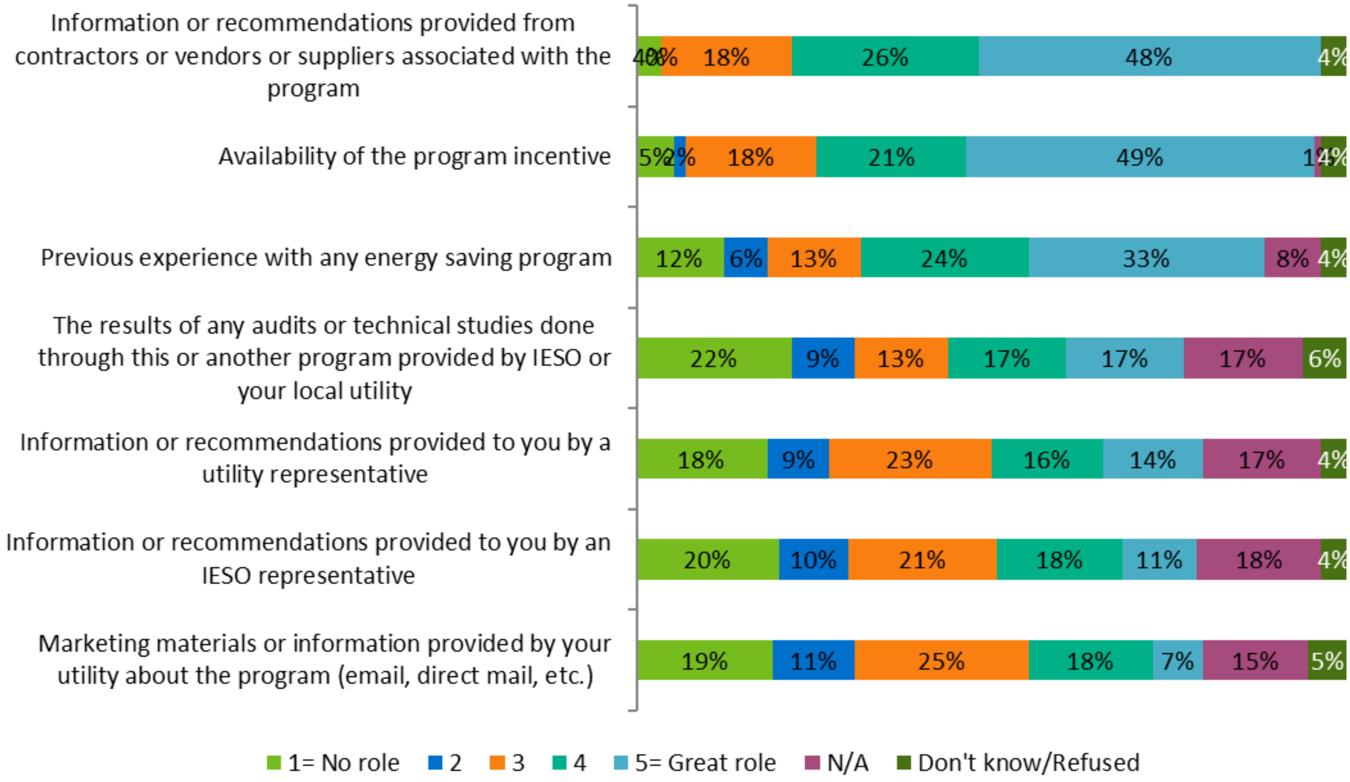


Figure I-15: Motives for Participating in the Retrofit P4P Program (n=114)

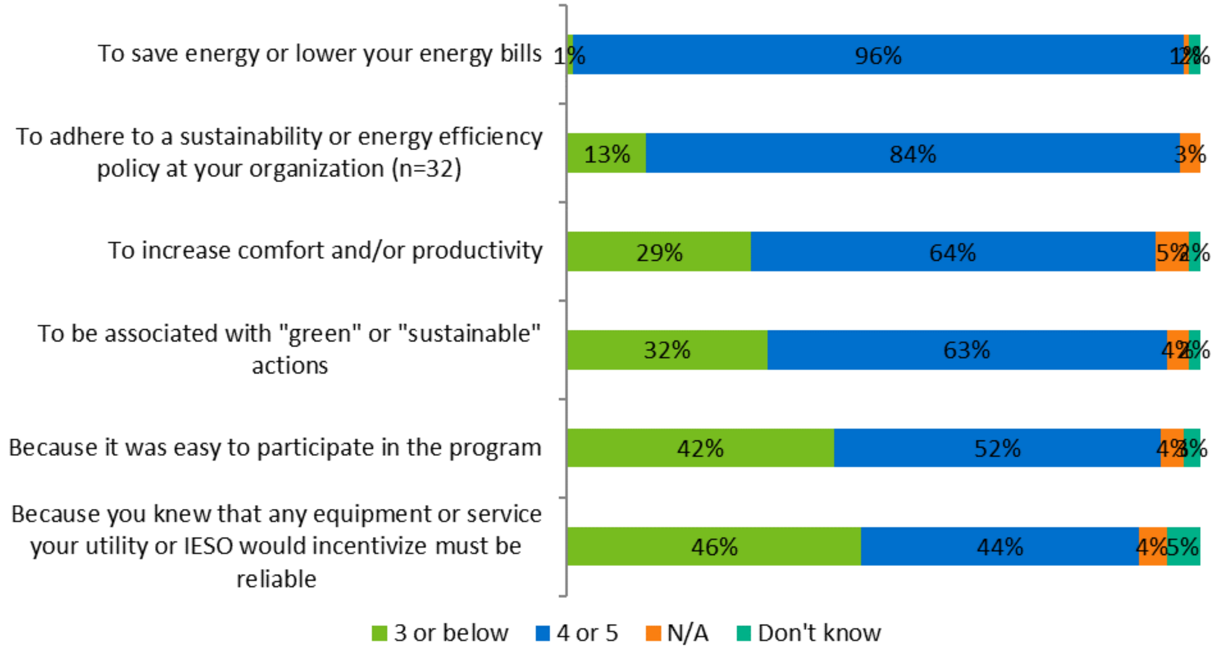


Figure I-16: Motives for Participating in the Retrofit P4P Program Extended Results (n=114)

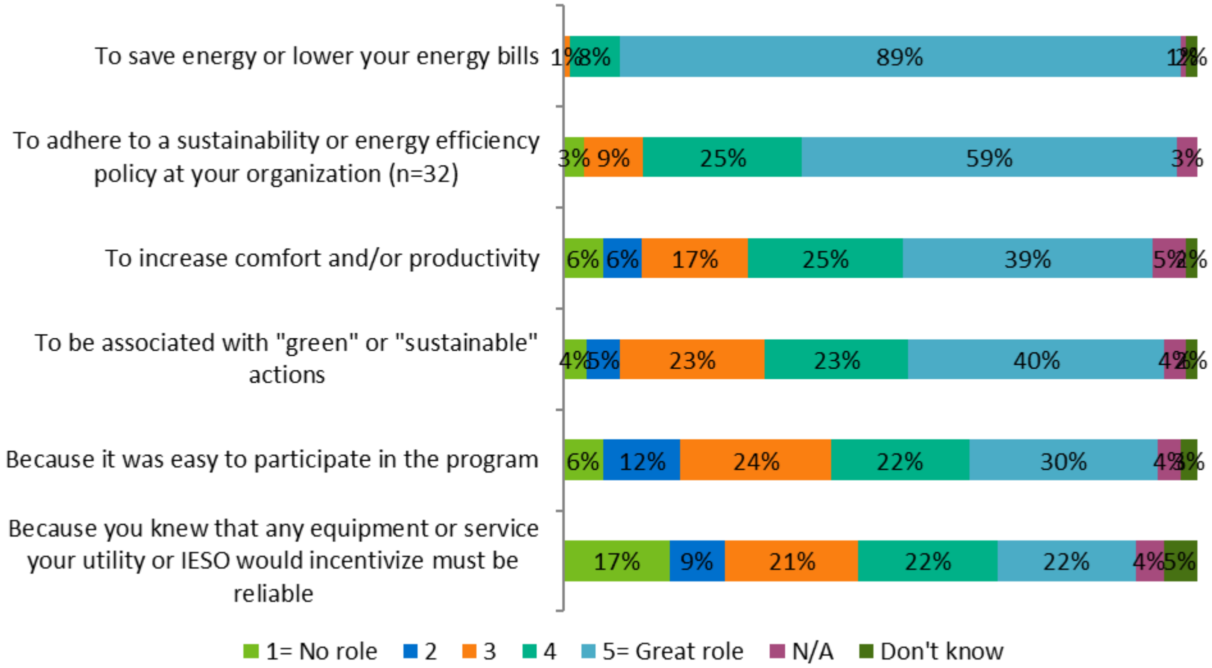


Figure I-17: Participant Satisfaction with Program Materials and Application (n=114)

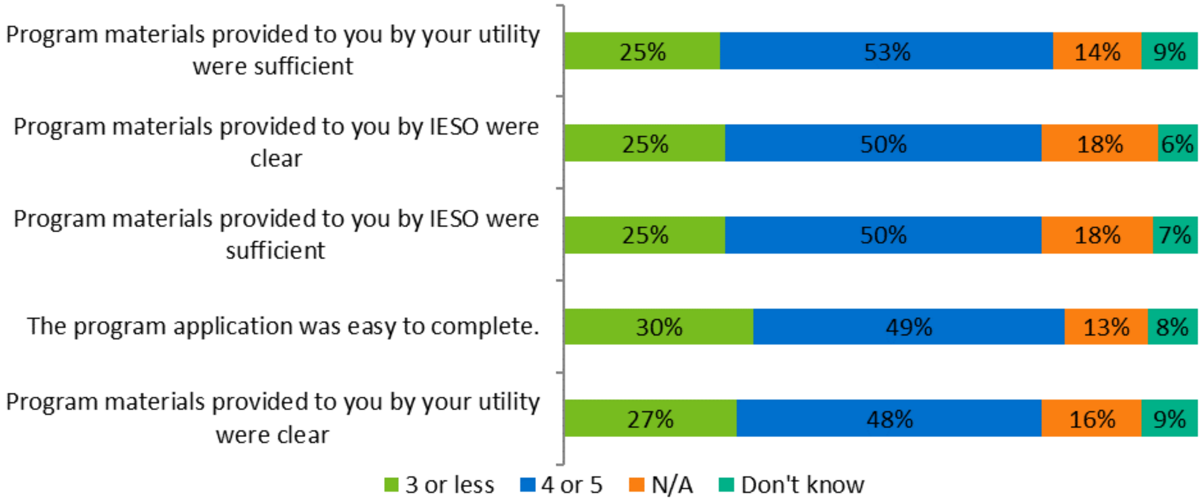


Figure I-18: Participant Satisfaction with Program Materials and Application Extended Results (n=114)

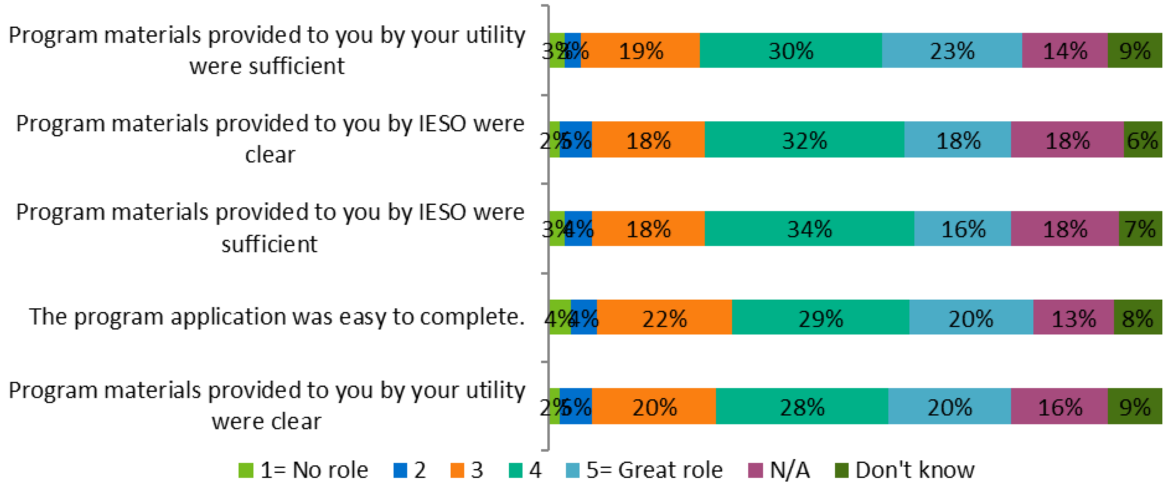


Figure I-19: Retrofit P4P Participant Satisfaction (n=114)

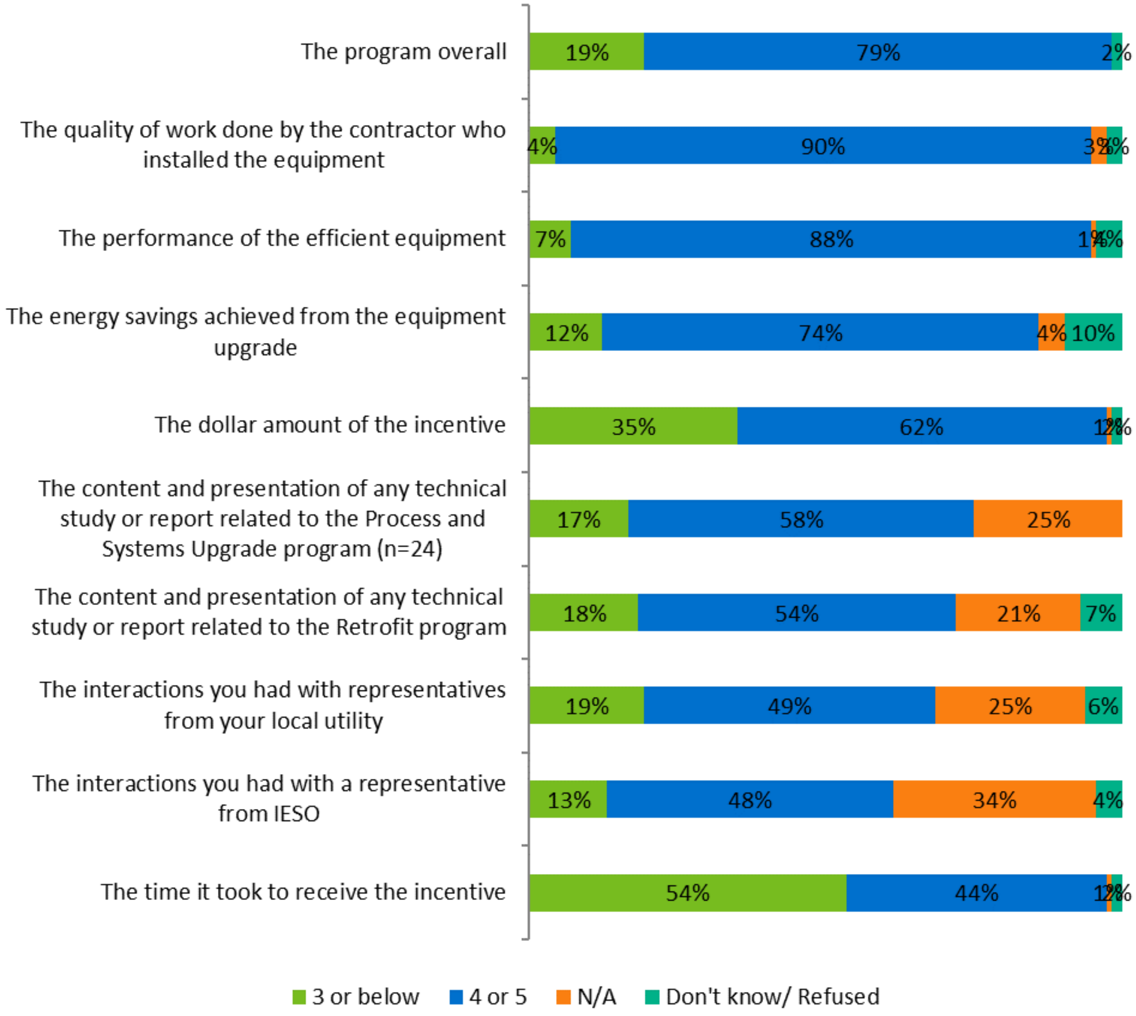


Figure I-20: Retrofit P4P Participant Satisfaction Extended Results (n=114)

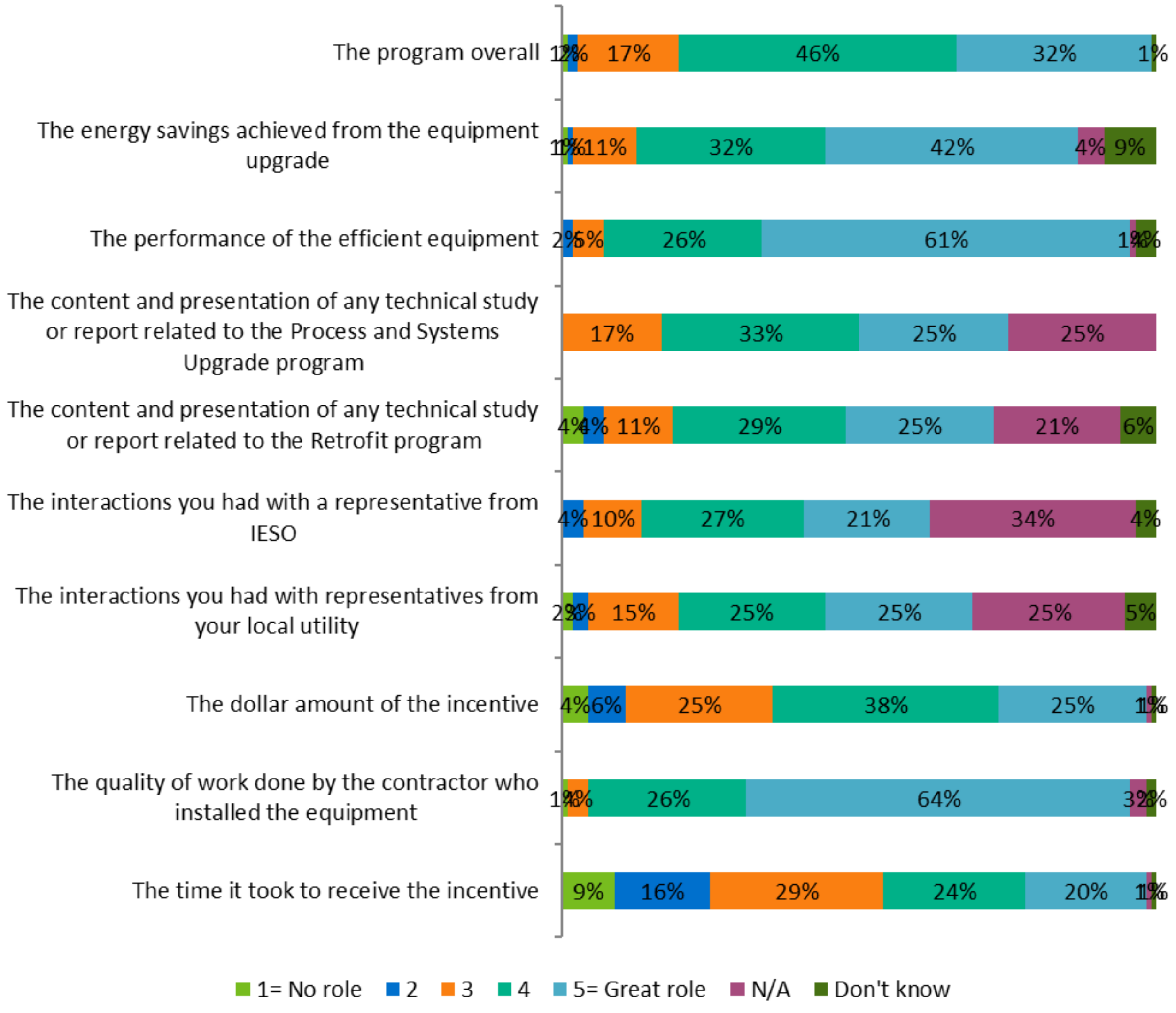


Figure I-21: Retrofit P4P Program Recommendation Extended Results (n=114)

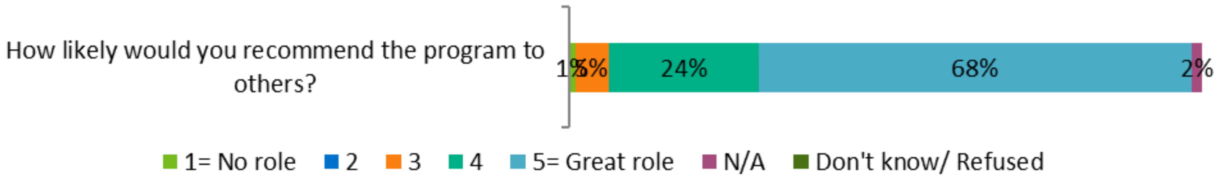


Figure I-22: Barriers to Future Participation (n=114)

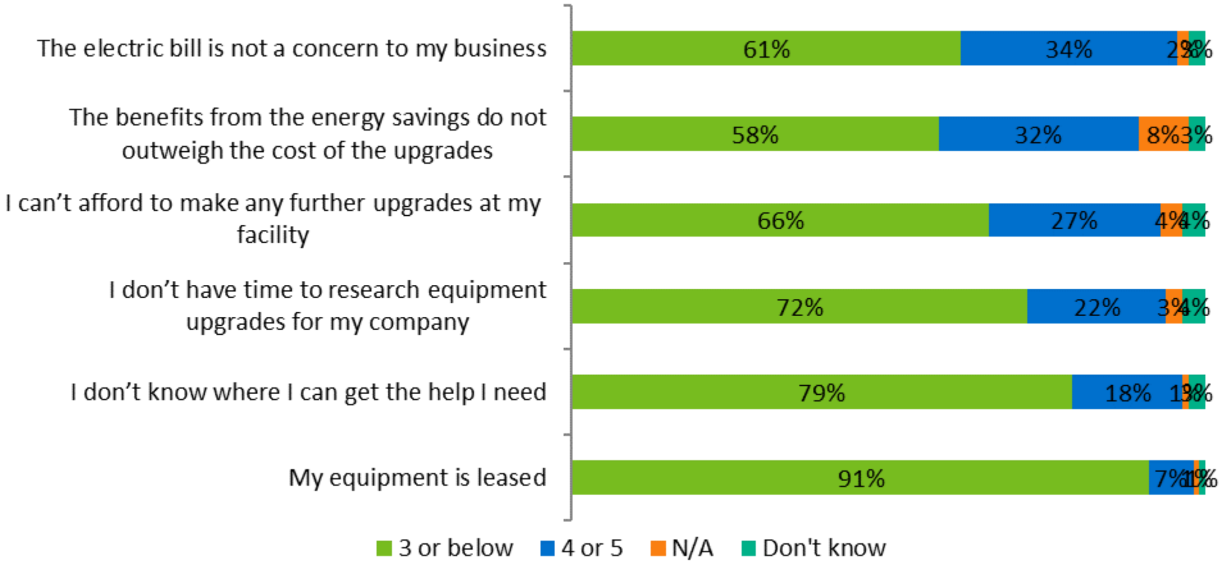
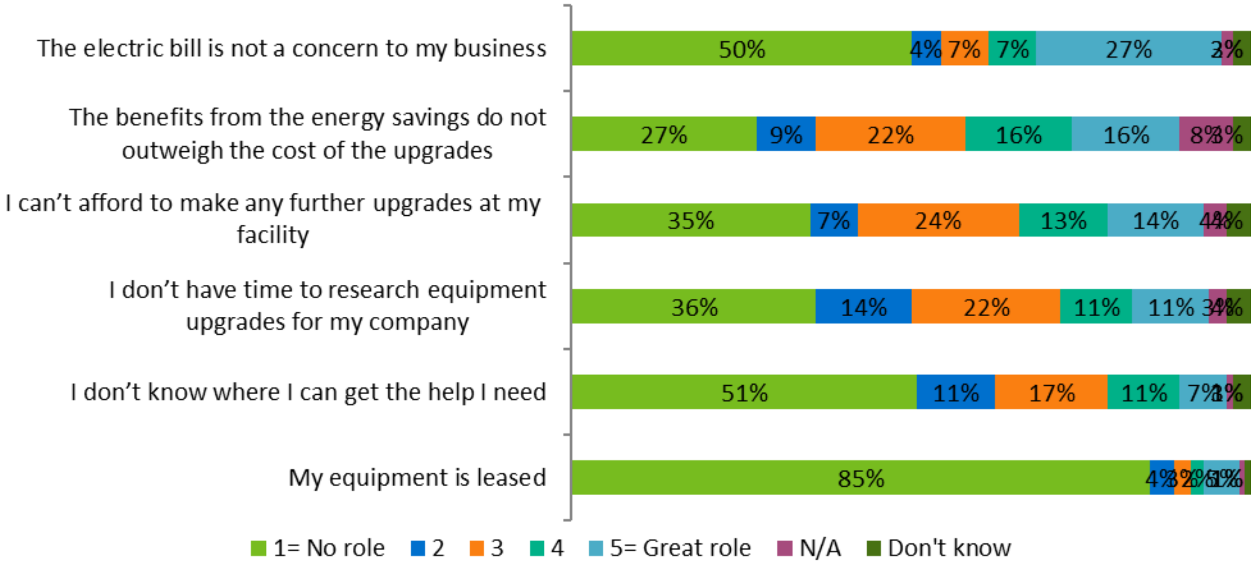


Figure I-23: Barriers to Future Participation Extended Results (n=114)



I.7 SBL Assessor and Installer Perspectives: Additional Process and NTG Findings

The following tables and figures are the expanded results from the SBL Assessor and Installer survey.

Figure I-24: Average Number of Small Business Projects

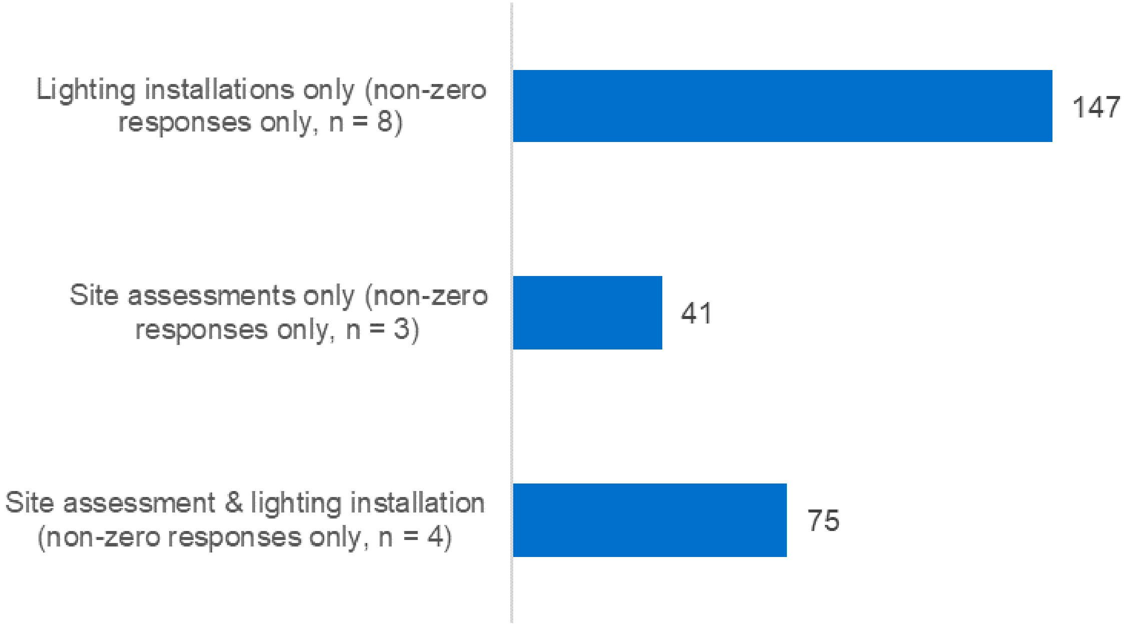


Figure I-25: Likelihood of Recommending Other Programs (n=27)

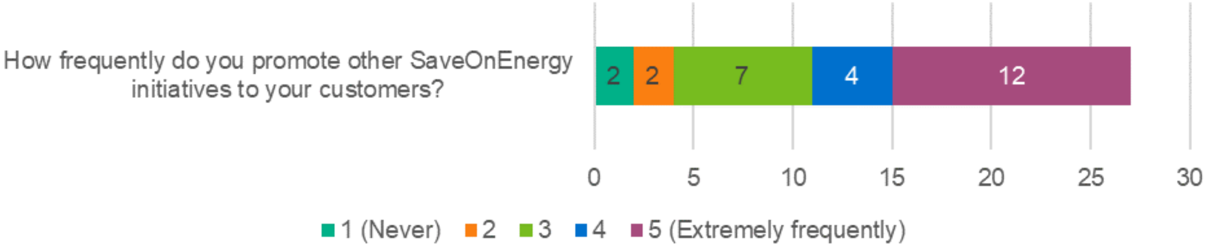
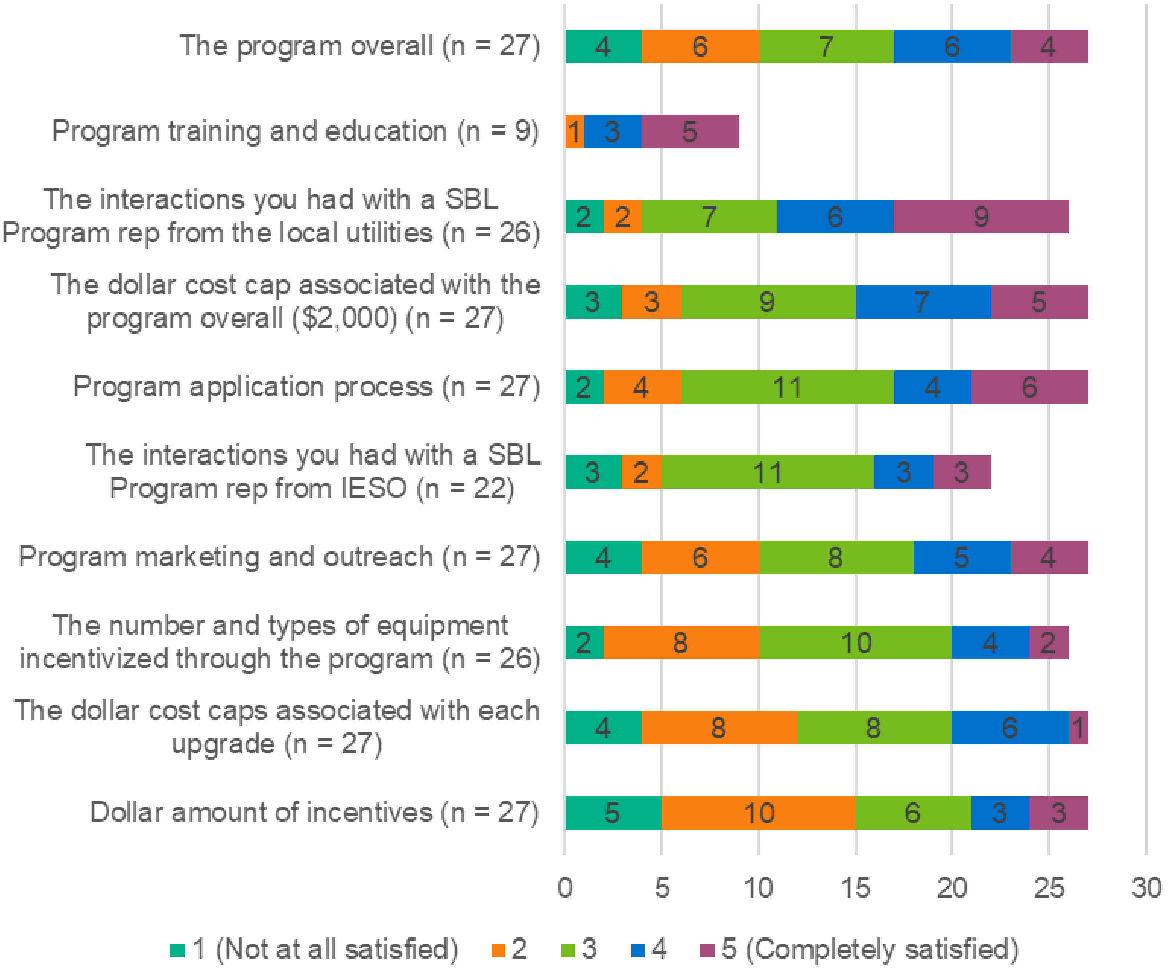


Figure I-26: Satisfaction with Program Components



	1 (Not at all satisfied)	2	3	4	5 (Completely satisfied)
The program overall (n = 27)	4	6	7	6	4
Program training and education (n = 9)		1		3	5
The interactions you had with a SBL Program rep from the local utilities (n = 26)	2	2	7	6	9
The dollar cost cap associated with the program overall ($2,000) (n = 27)	3	3	9	7	5
Program application process (n = 27)	2	4	11	4	6
The interactions you had with a SBL Program rep from IESO (n = 22)	3	2	11	3	3
Program marketing and outreach (n = 27)	4	6	8	5	4
The number and types of equipment incentivized through the program (n = 26)	2	8	10	4	2
The dollar cost caps associated with each upgrade (n = 27)	4	8	8	6	1
Dollar amount of incentives (n = 27)	5	10	6	3	3

Table I-23: Lighting Installations without Incentive[136]

How many projects would have installed the same lighting products if there had been no incentive available from the SBL Program?	Average percent of projects
Lighting installations only (n=8)	25%
Both site assessments and lighting installations (n=3)	27%

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[136] Please note that SBL assessors and installer free-ridership information was not used as part of the NTG algorithm in PY 2017, but will be used by the evaluation team to inform future year evaluation efforts.

Table I-24: Bulb Installations without Incentive[137]

What percentage of each LED bulb type do you think would have been installed if there had been no incentive available from the program?	Average percentage of bulb type installed without incentive
ENERGY STAR® A-Shape (n = 8)	8%
ENERGY STAR® Decorative Bulb (n = 4)	12%
ENERGY STAR® Reflector Bulb (BR, MR, PAR) (n = 5)	14%
Exterior Area LEDs (n = 9)	8%
High Bay LEDs (n = 8)	16%
Linear LEDs (n = 5)	21%
Refrigerated Display Case LEDs (n = 0)	--

Table I-25: Bulb Installation Spillover[138]

What was the influence that the SBL Program had on the decision to install the efficient equipment outside the program?	Average percent of lighting sold outside SBL Program (n=13)	Average influence rating* of SBL Program on lighting installation decision (n=4)
ENERGY STAR® A-Shape	47%	2.0
ENERGY STAR® Decorative Bulb	81%	--**
ENERGY STAR® Reflector Bulb (BR, MR, PAR)	70%	2.5
Exterior Area LEDs	79%	2.5
High Bay LEDs	82%	3
Linear LEDs	100%	5

*On a scale of 1-5.

** No survey respondents answered this question

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[137] Ibid.

[138] Please note that SBL assessors and installer free-ridership information was not used as part of the NTG algorithm in PY 2017, but will be used by the evaluation team to inform future year evaluation efforts.

I.8 SBL Participant Perspectives: Additional Process Findings

The following figures are the expanded results from the SBL Participant survey.

Figure I-27: Motives for Participating in the SBL Program

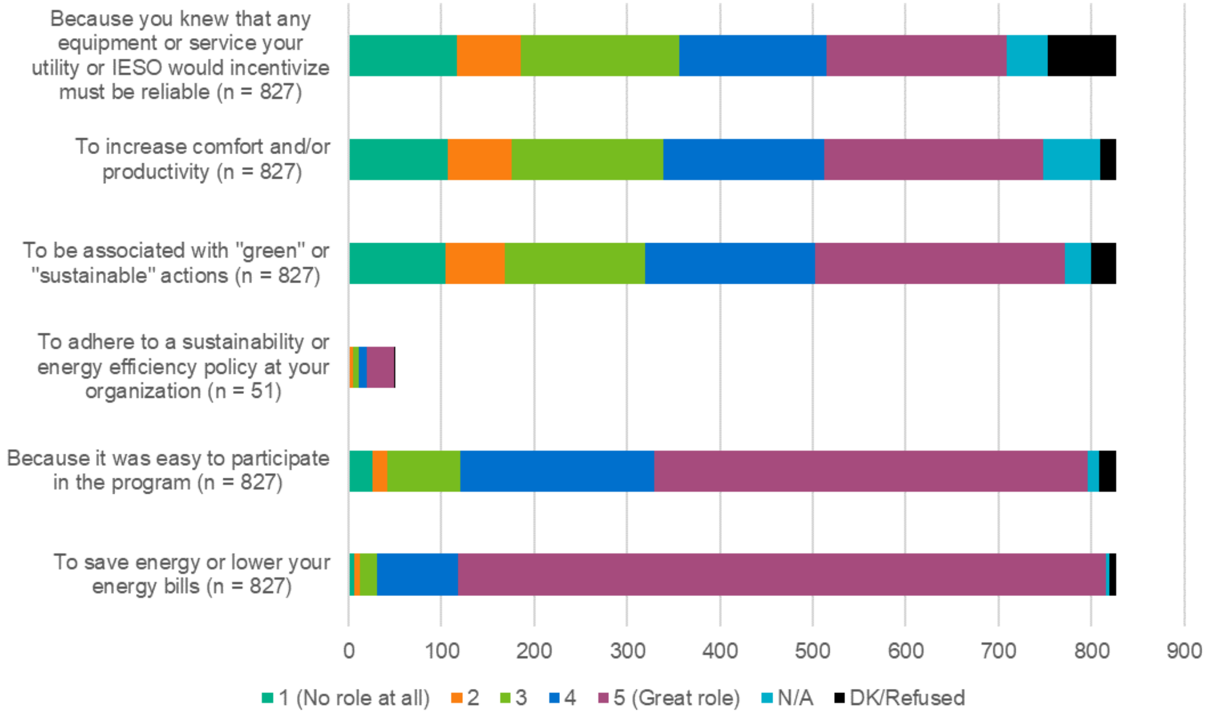


Figure I-28: SBL Participant Satisfaction Results (n=827, unless otherwise noted)

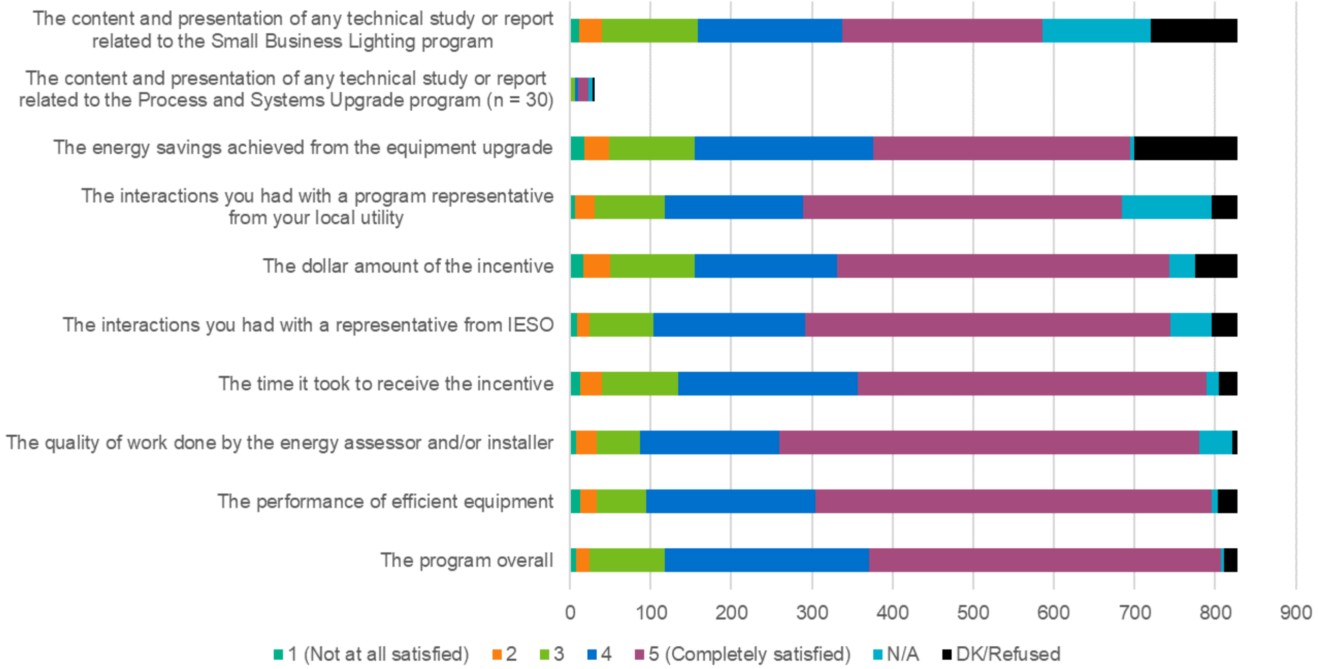


Figure I-29: Program Recommendation (n=827)

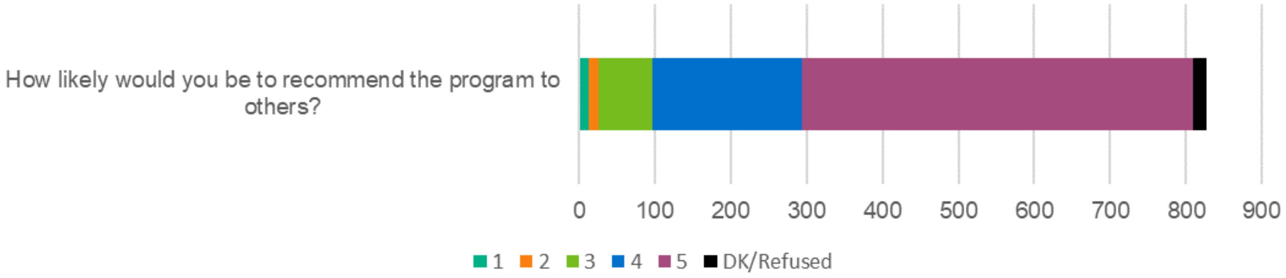


Figure I-30: Decision Making and Free-ridership (n=827)

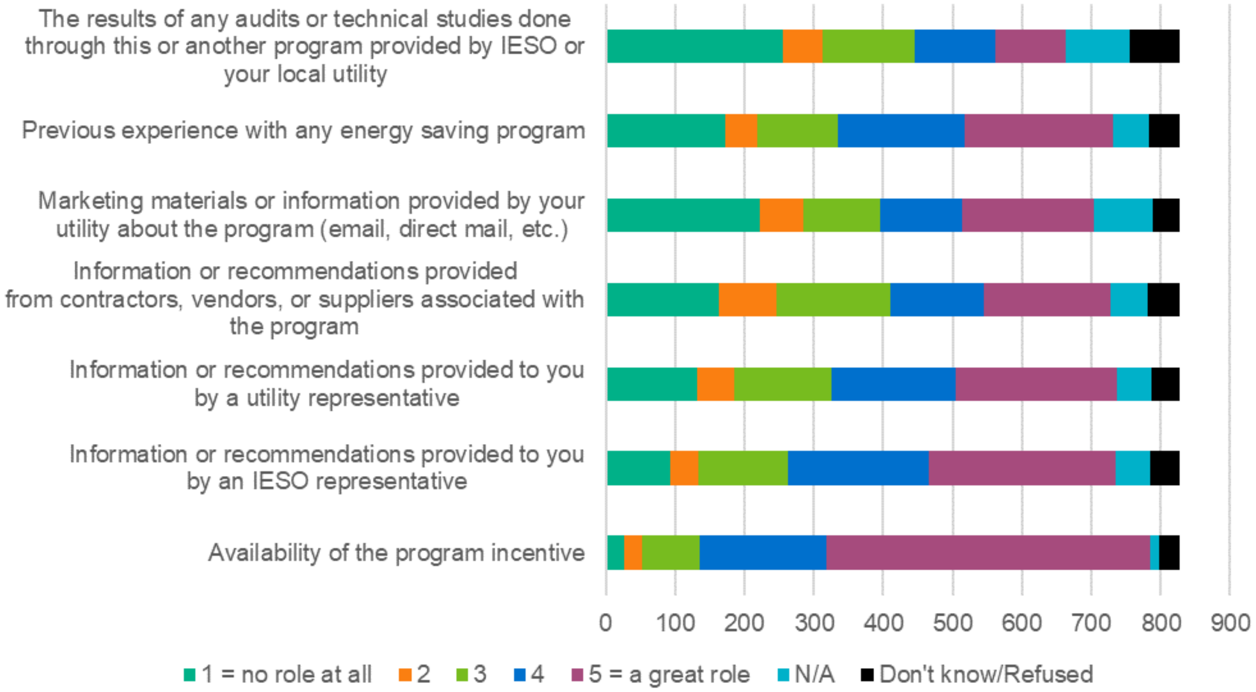
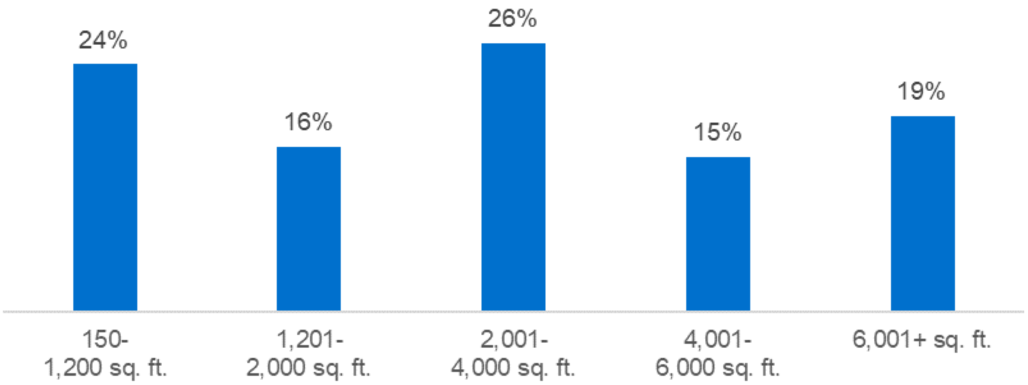


Figure I-31: Average Square Footage Per Building (n=62)



I.9 BRI Participant Perspectives: Additional Process Findings

The following figures are the expanded results from the SBL Participant survey.

Figure I-32: Participant Motives for Participating in the BRI Program Expanded Results (n=69)

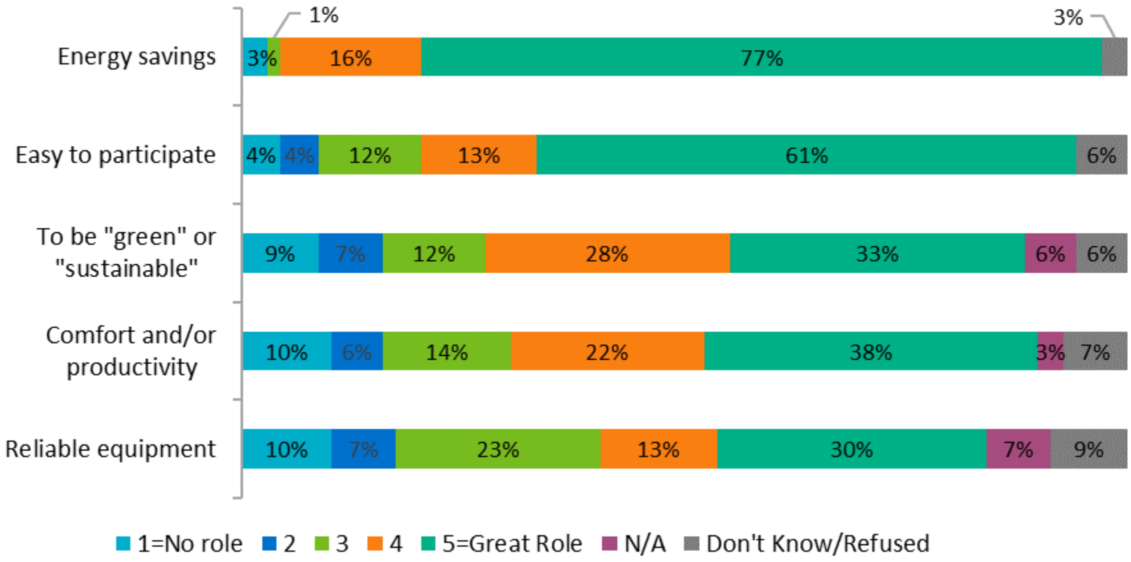


Figure I-33: BRI Participant Satisfaction Expanded Results (n=66)

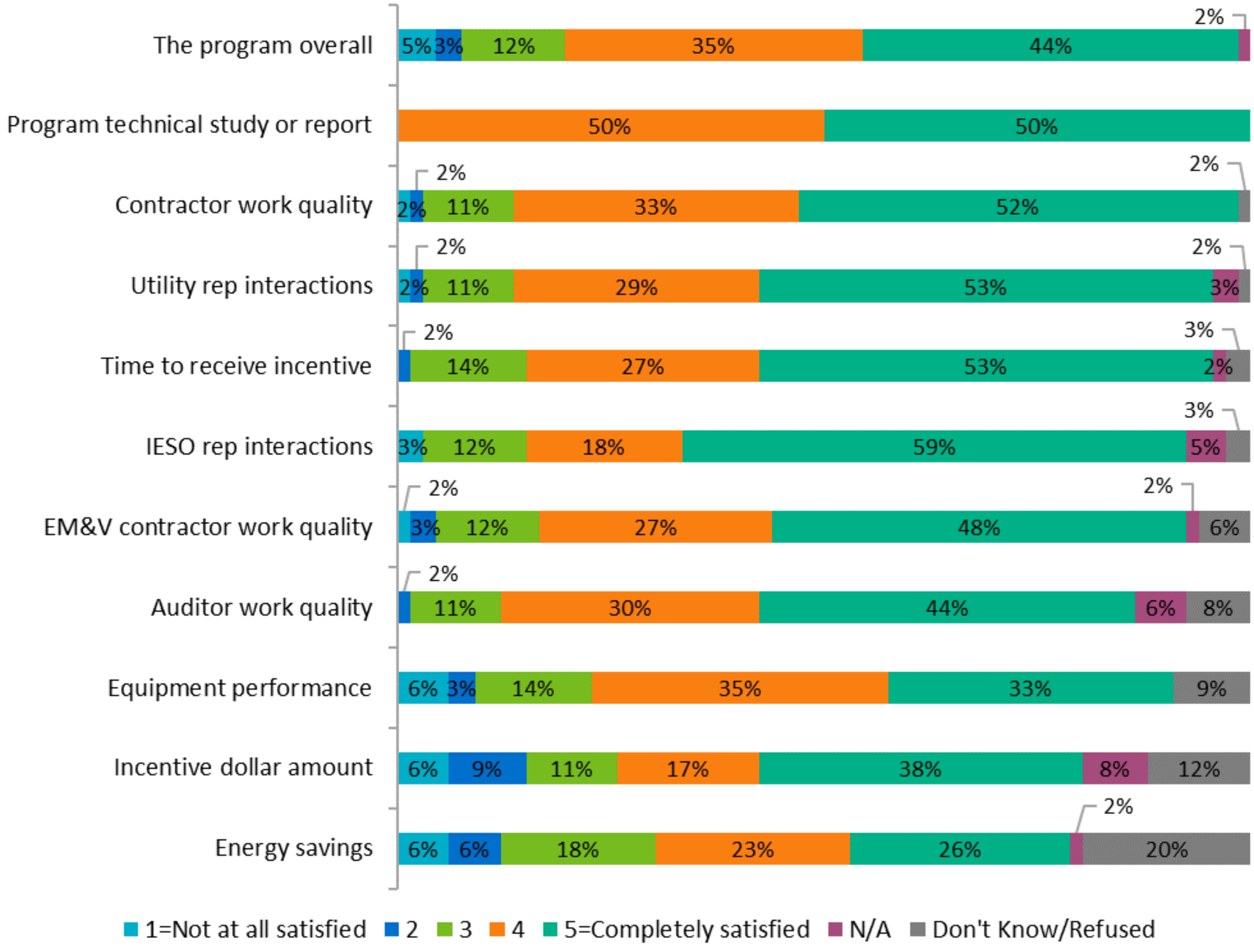


Figure I-34: BRI Participant Program Recommendation Expanded Results (n=64)

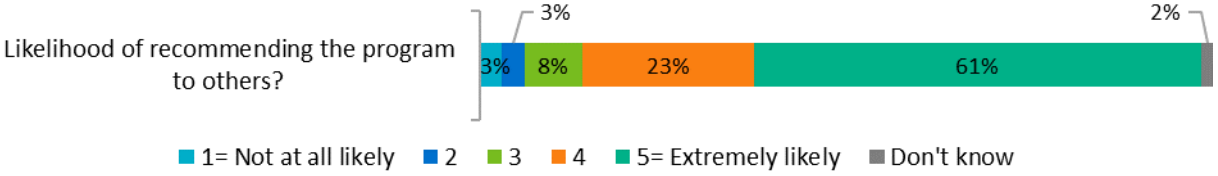


Figure I-35: Participant Satisfaction with Program Materials Expanded Results (n=69)

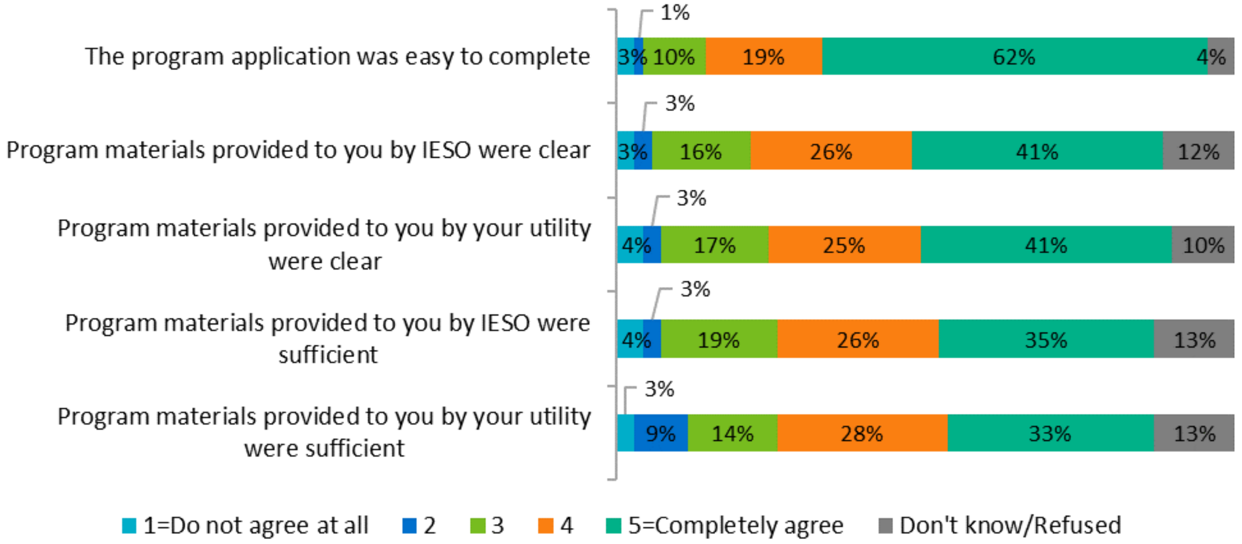


Figure I-36: Influence on Participant Upgrade Decision Expanded Results (n=59)

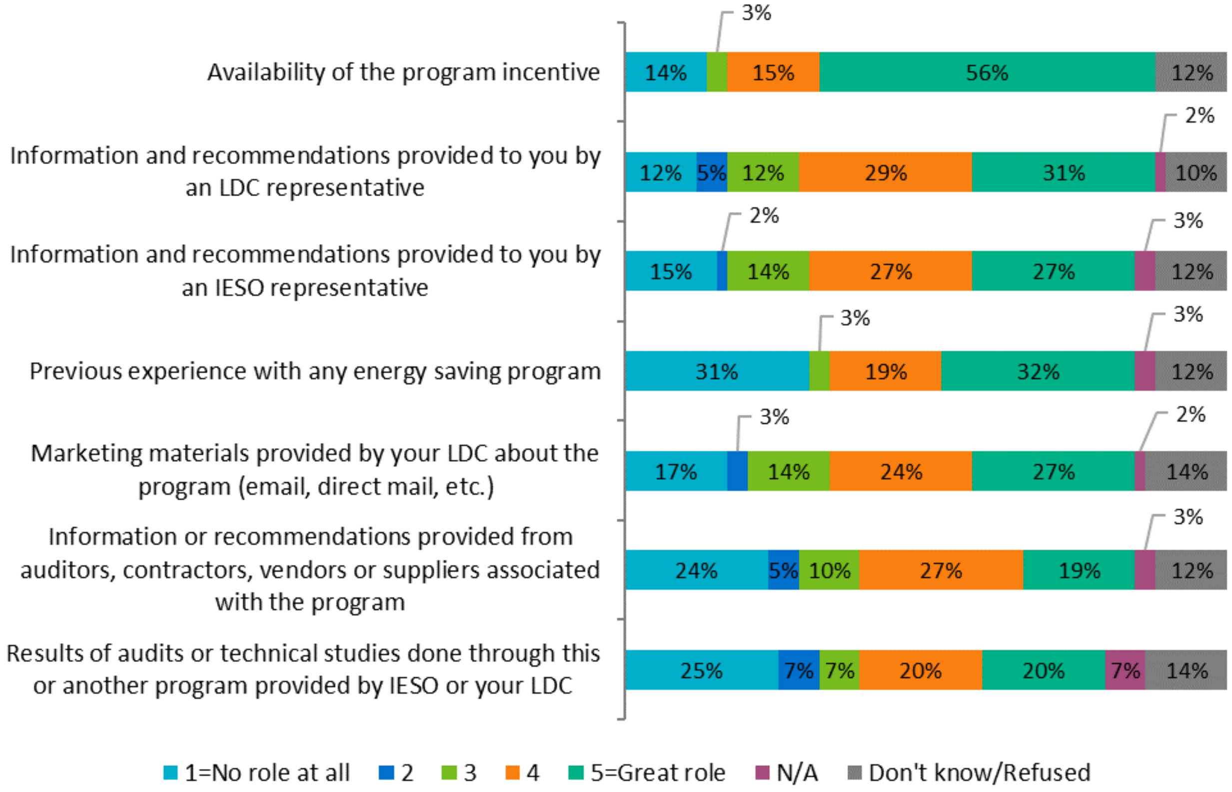
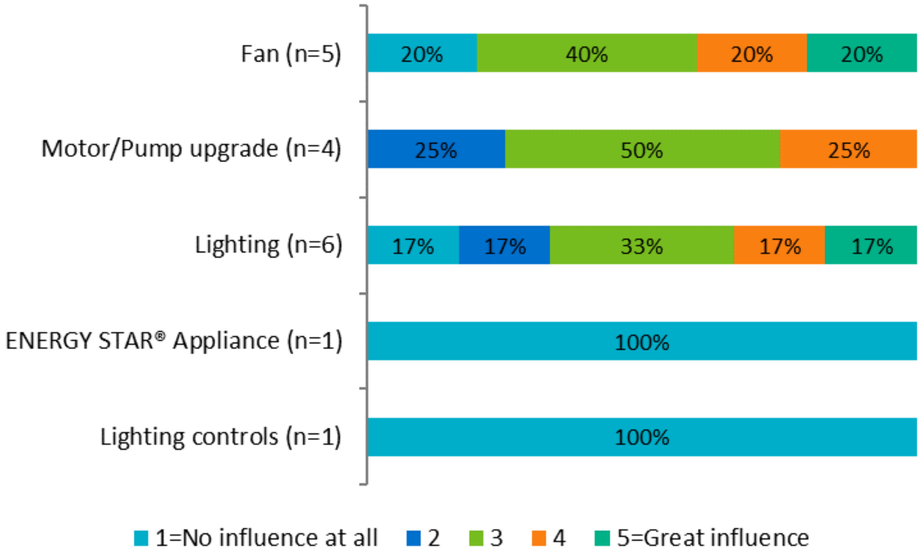


Figure I-37: Influence of BRI Program on Equipment Installed Outside the Program Expanded Results (n=14)



I.10 Audit Funding PDA and TPE Perspectives: Additional Findings

The following figures are the expanded results from the Audit Funding PDA and TPE survey.

Figure I-38: PDA and TPE Satisfaction with LDC Interactions (n=3)

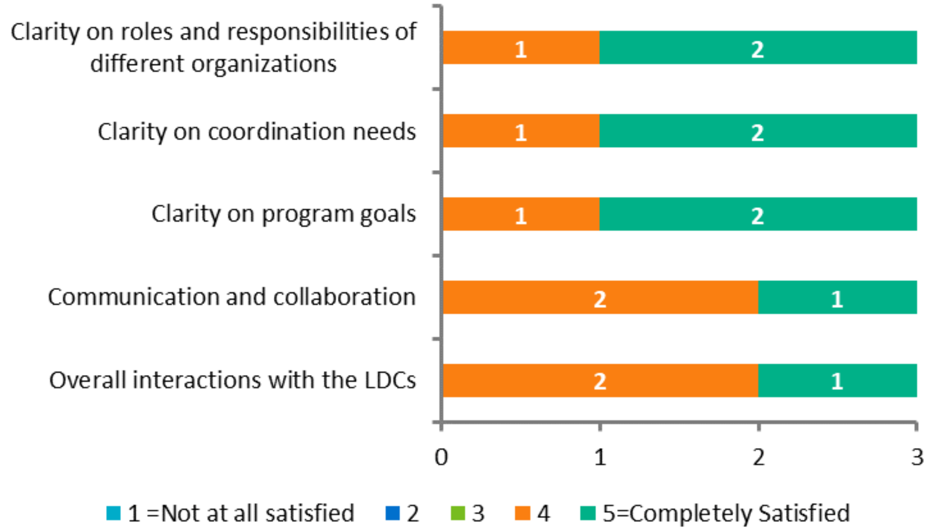
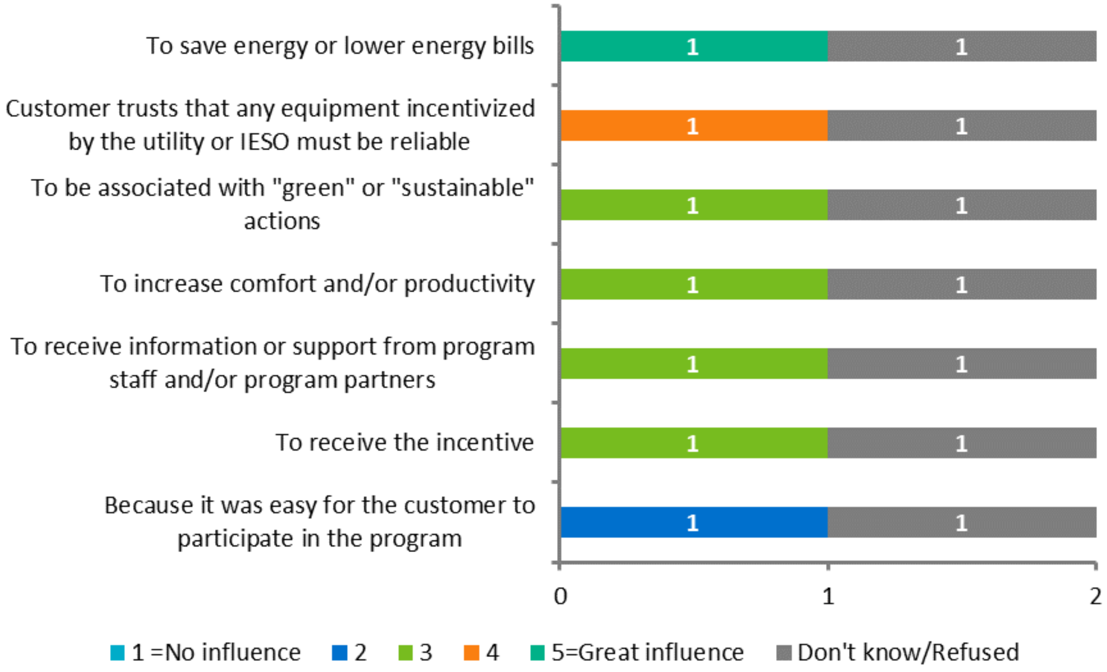


Figure I-39: PDA and TPE Perspective on Customer Motivation to Install Program-Qualifying Equipment (n=2)



I.11 Audit Funding Participant Perspectives: Additional Process Findings

The following tables and figures are the expanded results from the Audit Funding Participant survey.

Figure I-40: Existence of Organizational Energy Efficiency Policy (n=33)

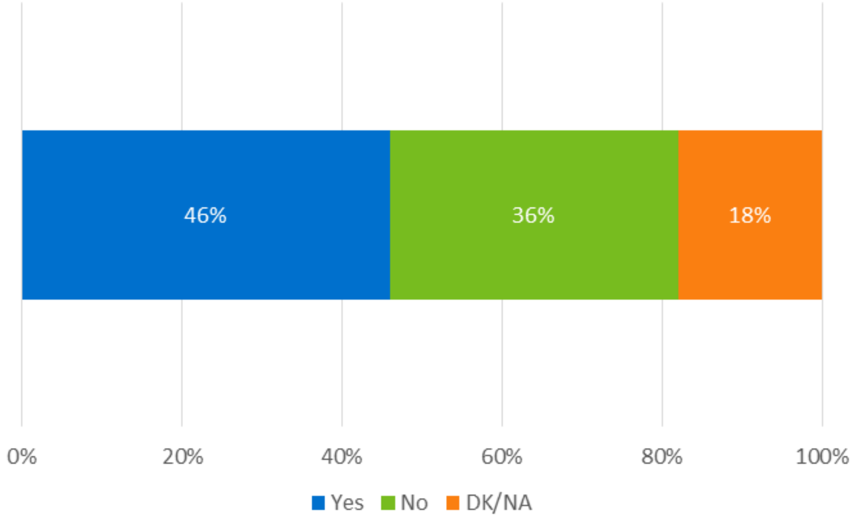


Figure I-41: Type of Organizational Energy Efficiency Policy (n=15)

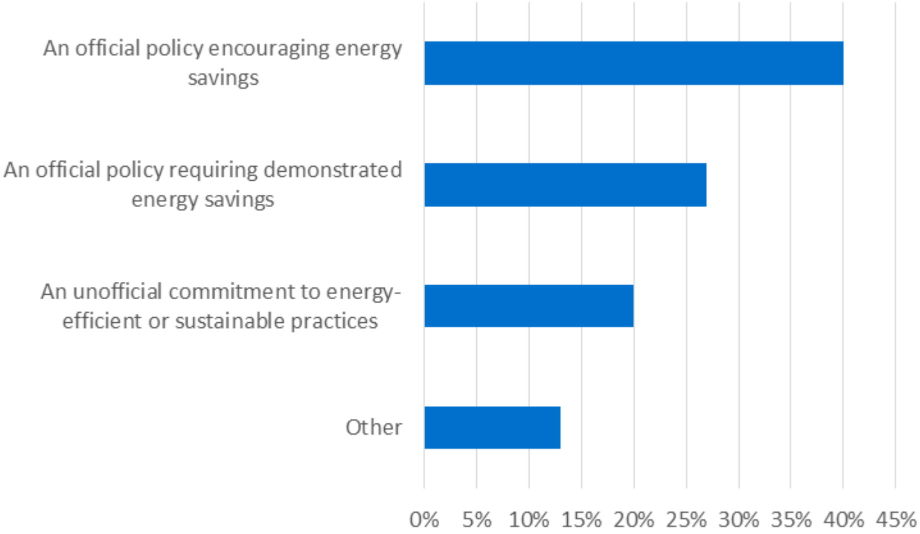


Figure I-42: Motivation for Participation in the Program (n=33)

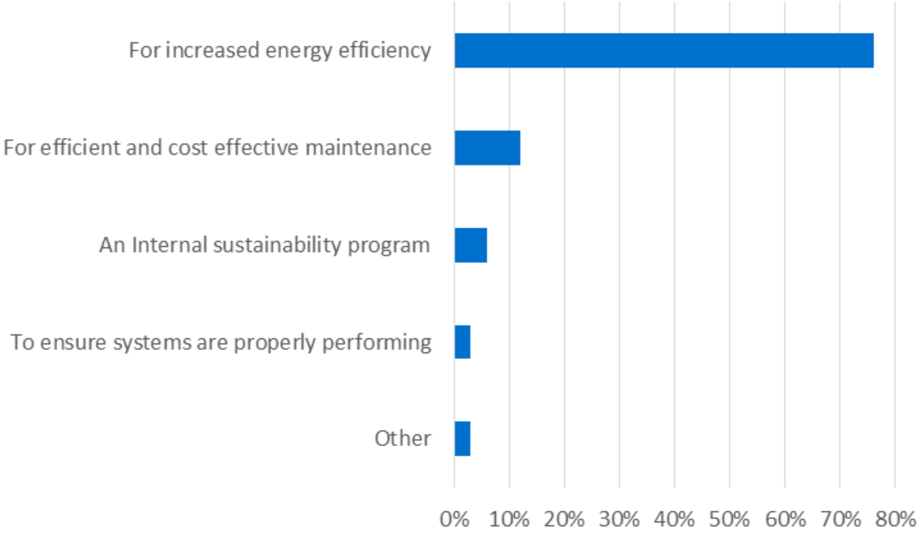


Figure I-43: Barriers to Energy Efficient Equipment Upgrades

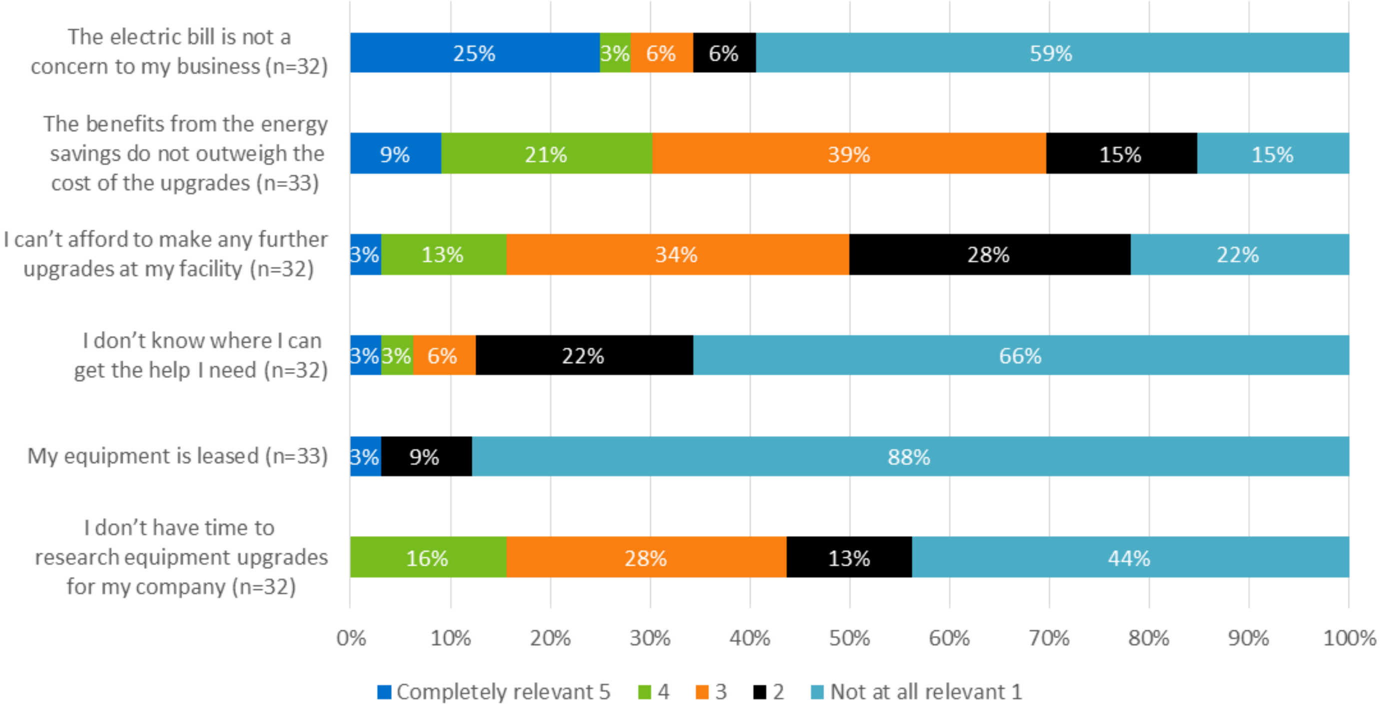


Table I-26: Audit Funding Firmographics (n=33)

Firmographic Summary	Participants
Facility Size	
Under 25,000 square feet	5
25,000 to 49,999 square feet	4
50,000 to 99,999 square feet	4
100,000 square feet or greater	0
Don’t know/Refused	24
Number of Employees	
<10	5
11-49	4
50-150	10
>150	7
Don’t know/Refused	7
Average Monthly kWh Usage	
Under 100,000 kWh	6
Between 100,000 kWh and 500,000 kWh	6
Greater than 500,000 kWh	8
Don’t know/refused	13
Part of a Chain or Franchise?	
Yes	3
No	30
Own or Rent the Facility	
Own	29
Rent	2
Mix of Own and Rent	1
Don’t know	1
Primary Business Activity (Multiple Responses Allowed)	
Office / Professional	6
Manufacturing	8
Government/Public Administration	6
Warehouse/Storage	5
Food Sales or Service	5
Education	4
Other	19
Refused	1

I.12 HPNC PDA and TPE Perspectives: Additional Process Findings

The following figures are the expanded results from the Audit Funding PDA and TPE survey.

Figure I-44: PDA and TPE Satisfaction with LDC Interactions (n=5)

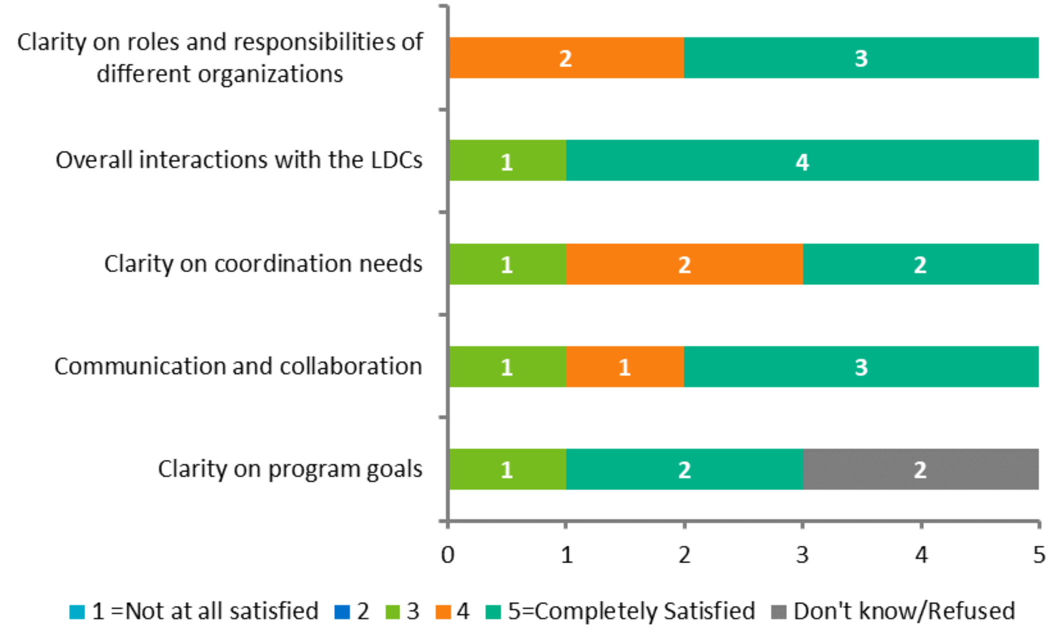


Figure I-45: PDA and TPE Satisfaction with IESO Interactions (n=4)

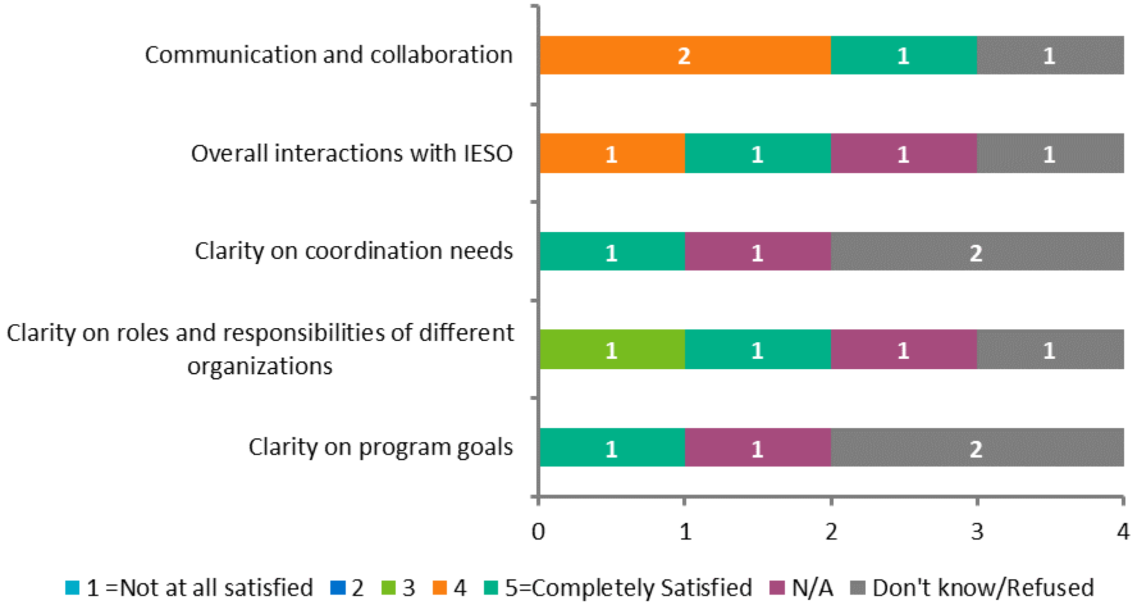
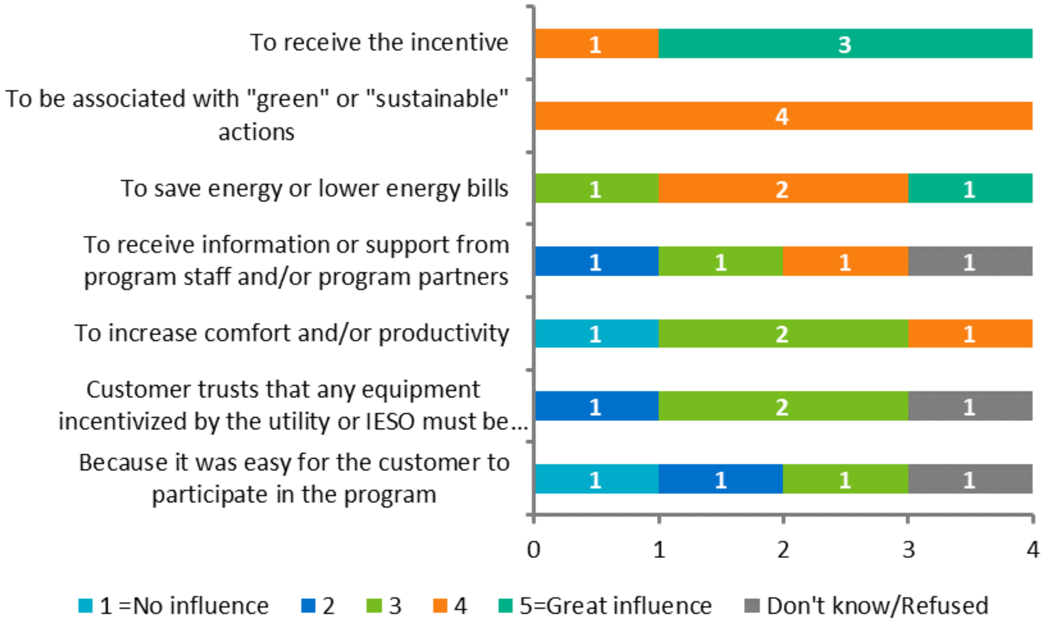


Figure I-46: PDA and TPE Perspective on Customer Motivation to Install Program-Qualifying Equipment (n=4)



I.13 HPNC Builder and Developer Perspectives: Additional Process Findings

The following tables are the expanded results from the HPNC Builders and Developer survey.

Table I-27: Full HPNC Builder/Developer Program Satisfaction Ratings (n=7)

Satisfaction with select program-related factors	1=Not at all Satisfied	2	3	4	5=Completely Satisfied	Don't Know/Not Applicable	Average Rating
Program Overall	0	1	3	1	0	2	3.0
Program Training and Education	0	0	0	0	0	7	N/A
Program Marketing and Outreach	0	1	3	0	1	2	3.2
Program Application Process	1	1	0	0	3	2	3.0
Program Worksheets	0	0	4	0	0	3	3.0
Number and Types of Measures Incentivized Through the Program	0	2	2	0	1	2	3.0
Dollar Amount of the Incentive	0	2	1	1	1	2	3.2
Interactions with a LDC Representative	0	0	1	2	2	2	4.2
Interactions with an IESO Representative	1	0	2	0	1	3	3.0

Table I-28: Firmographics (n=7)

Firmographics	Participants
Number of Employees	
100 or fewer	1
200-1,000	2
1,000-10,000	1
10,000+	1
Don't Know/I'd rather not answer	2
Is your company independent or part of a larger firm?	
Independent	3
Part of a Larger Company	3
Prefer not to answer	1

I.14 HPNC Architect and Engineer Perspectives: Additional Process Findings

The following table presents expanded results from the HPNC Builders and Developer survey.

Table I-29: Full HPNC Architect/Engineer Program Satisfaction Ratings (n=6)

Satisfaction with select program-related factors	1=Not at all Satisfied	2	3	4	5=Completely Satisfied	Don't Know/Not Applicable	Average Rating
Program Overall	0	1	3	2	0	0	3.2
Program Training and Education	0	0	0	0	1	5	5.0
Program Marketing and Outreach	0	0	1	2	1	2	4.0
Program Application Process	0	2	2	1	1	0	3.2
Program Worksheets	0	0	2	3	1	0	3.8
Number and Types of Measures Incentivized Through the Program	0	0	1	4	1	0	4.0
Dollar Amount of the Incentive	0	2	2	2	0	0	3.0
Interactions with a LDC Representative	0	1	2	1	2	2	3.7
Interactions with an IESO Representative	0	0	1	0	0	6	3.0

I.15 HPNC Participant Perspectives: Additional Process and NTG Findings

The following tables are the expanded results from the HPNC Participant survey.

Table I-30: Full Responses of Factors Influencing Decision to Do Efficient Upgrades (n=18)

What factor(s) influenced the decision to do the efficient upgrades?	1=No Role	2	3	4	5=Great Role	Don’t Know/Not Applicable	Average Rating
Because it was easy to participate in the program	5	2	6	3	2	0	2.7
Because you knew that any equipment of service your LDC or IESO would incentivize must be reliable	2	2	4	3	4	2	3.3
To save energy or lower your energy bills	1	0	0	2	15	0	4.7
To be associated with "green" or "sustainable" actions	4	0	7	**1**	**5**	1	3.2
To increase comfort and/or productivity	1	1	2	2	11	1	4.2
To adhere to a sustainable/energy efficiency policy at your organization	0	0	0	0	0	18	N/A

Table I-31: Full Responses of Satisfaction Levels with Select Program-Related Factors (n=17)

What was your satisfaction with the following program-related factor(s)?	1=Not at All Satisfied	2	3	4	5=Completely Satisfied	Don’t Know/Not Applicable	Average Rating
The program overall	0	1	0	9	7	0	4.4
The time it took to receive the incentive	3	1	2	6	5	0	3.5
The quality of work done by the builder	0	0	0	4	13	0	4.8
The dollar amount of the incentive	0	1	1	8	7	0	4.2
The interactions you have with representatives from your LDC	1	2	0	6	5	3	3.9
The interactions you had with a representative from Ontario's Independent Electric System Operator (IESO)	0	1	0	7	7	2	4.3
The content and presentation of any technical study or report related to the program	0	0	0	2	0	15	4.0
The performance of the efficient equipment	0	0	1	2	14	0	4.8
The energy savings achieved by the equipment upgrade	0	0	0	6	10	1	4.6

Table I-32: Full Responses of Experiences with Program Materials and Application (n=17)

How much do you agree with the following statements?	1=Completely Disagree	2	3	4	5=Completely Agree	Don't Know/Not Applicable	Average Rating
The program application was easy to complete	1	2	6	2	4	2	3.4
Program materials provided to you by your LDC were clear	1	4	4	4	2	2	3.1
Program materials provided to you by your LDC were sufficient	1	2	4	7	1	2	3.3
Program materials provided to you by IESO were clear	2	2	5	4	3	1	3.3
Program materials provided to you by IESO were sufficient	2	0	3	6	5	1	3.8

Table I-33: Full Responses of Potential Challenges for Future Efficient Equipment Upgrades (n=17)

How much do you agree with the following statements?	1=Completely Disagree	2	3	4	5=Completely Agree	Don't Know/Not Applicable	Average Rating
The benefits from the energy savings do not outweigh the cost of the upgrades	3	3	3	2	4	2	3.1
I can't afford to make any further upgrades at my facility	4	3	4	3	2	1	2.8
My equipment is leased	16	0	0	0	0	1	1.0
The electric bill is not a concern to my business	8	0	3	3	2	1	2.4
I don't know where I can get the help I need	5	1	7	3	1	0	2.6
I don't have time to research equipment upgrades for my company	5	1	4	3	3	1	2.9

Table I-34: Full Responses of Factors Influencing Decision to Participate in HPNC Program (n=17)

How did specific program factors influence your decision to build up to HPNC standards?	1=No Role	2	3	4	5=Great Role	Don't Know/ Not Applicable	Average Rating
Availability of the program incentive for modeling	3	2	4	3	4	1	3.2
Availability of the program incentive in your decision to include energy efficiency measures	2	1	4	2	8	0	3.8
Information or recommendations provided to you by an LDC representative	5	1	5	2	3	1	2.8
Information or recommendations provided to you by an IESO representative	3	3	5	3	2	1	2.9
The results of any audits or technical studies done through this or another program provided by IESO or your LDC	4	3	4	3	1	2	2.6
Information or recommendations provided from any builders, contractors, vendors, or suppliers associated with the program	1	2	4	4	6	0	3.7
Marketing materials or information provided by your LDC about the program (email, direct mail, etc.)	3	2	7	1	2	2	2.9
Previous experience with any energy saving programs	5	2	1	3	5	1	2.9

Appendix J Retrofit Program – Evaluation of Intent to Apply Memo

The evaluation team submitted the following subsections as a standalone memo to the IESO staff on March 2, 2018.

J.1 Background

In October of 2017, the Nexant evaluation team sent a web-based survey to LDCs to gather information about how each LDC managed relationships with 2016 Retrofit Program participants who needed to demonstrate a *prior intent to apply to the program*. This activity was conducted as part of the evaluation of the Conservation First Framework business programs implemented by the Ontario LDCs and the IESO.

The purpose of the survey was to help the IESO try to better identify possible reasons for variances between LDCs 2016 Net-to-Gross (NTG) results for the Retrofit Program. The survey questions were designed to explore whether there exists a correlation between LDC NTG values and the percentage of LDC participants that were required to demonstrate a *prior intent to apply to the program* to be considered eligible program participants. This type of participant would have already entered into a binding commitment to acquire the relevant program measures or services required to install the measures prior to submitting the program application. If sufficient evidence existed to demonstrate to the LDC that the participant intended to apply to the program prior to entering into a binding contract, the LDC could deem the participant’s project eligible to receive program incentives and support.

The survey asked respondents about three primary topics:

1) The percent of 2016 Retrofit projects that demonstrated a prior intent to apply.
2) The eligibility criteria that were most important in helping the LDC decide which projects sufficiently demonstrated prior intent to apply.
3) Whether the LDC kept records of these projects and if so, whether the LDC was willing to share the data with the IESO for additional analysis.

The IESO provided the evaluation team with the contact information for the appropriate contact at each LDC. Just over three-fifths (62%, or 34 respondents) of LDCs who were contacted by the evaluation team completed the survey (Table K-1).

Table J-1: LDCs Contacted for Survey (n=55)

LDCs	Percent LDCs
Completed survey	62%
Did not complete survey	38%

Prior to the survey launch, IESO staff sent an introductory e-mail to these contacts describing the purpose of the survey and requesting LDC participation. The evaluation team launched the survey on October 10th and made the survey available to the LDCs for four weeks. Three reminder emails were sent to non-responsive contacts over the course of survey fielding (two from the evaluation team and one from IESO staff). The survey took an average of eight minutes to complete.

J.2 Prior Intent to Apply

The survey asked respondents to indicate the percent of their LDC's business customer Retrofit projects that demonstrated a prior intent to apply to the program in 2016 (Table K-2). Just under three-fifths (59%) reported that at least some of their 2016 Retrofit customers demonstrated a prior intent to apply (range: 0.05% to 62% of Retrofit projects; average: 9.3% of Retrofit projects). Nine percent of responding LDCs reported that there were no Retrofit customers who demonstrated a prior intent to apply to the program in 2016. Just over one-fourth (26%) of responding LDCs *could not* provide the information, 3% (one respondent) *would not* provide the information, and one respondent did not know this information.

When comparing across LDCs with NTG of varying ranges, there is no clear correlation between the percent of 2016 Retrofit projects demonstrating prior intent to apply and the 2016 Energy NTG of the responding LDCs.

Table J-2: Percent of Projects Demonstrating Prior Intent to Apply to the Retrofit Program in 2016 (n=34)

Percent of Projects Demonstrating Prior Intent to Apply	70-79% Energy NTG (n=20)	80-89% Energy NTG (n=8)*	90-99% Energy NTG (n=6)*	Total (n=34)
0% of Retrofit projects	10%	13%	0%	9%
0.05% to 5% of Retrofit projects	40%	50%	17%	38%
10% of Retrofit projects	10%	0%	33%	12%
25% of Retrofit projects	10%	0%	0%	6%
62% of Retrofit projects	0%	13%	0%	3%
I cannot provide info	25%	13%	50%	26%
I will not provide this info	0%	13%	0%	3%
Don't know	5%	0%	0%	3%

*Percentage values provided rather than counts despite small sample size to allow for comparison to other categories. Percentages may not add to 100% due to rounding.

The summary statistics in Table K-3 show very minor differences in the mean NTG, median NTG, and the Standard Deviations for those LDCs that had some projects that demonstrated a prior intent to apply to the program in 2016 and for those LDCs that did not. If the maximum NTG value of 97.5% is considered an outlier and were to be removed from the data, the Standard Deviation between these two groups would be even closer (6.0% with some projects demonstrating prior intent to apply and 5.9% with 0% of projects demonstrating prior intent to apply).

Table J-3: Comparison of Energy NTG and Prior Intent to Apply

Summary Statistics	2016 Energy NTG	
	Some Projects with Intent to Apply (n=20)	0% Intent to Apply (n=3)
Mean	82.2%	82.7%
Median	79.4%	79.4%
Max	97.5%	89.6%
Min	73.8%	79.2%
Std Dev	6.9%	5.9%

This data therefore *does not* support the hypothesis that projects that need to demonstrate a prior intent to apply to the program contribute to lower NTG values. Overall, the data suggest that there may be little difference between the NTG values across the two comparison groups. However, given that close to two-fifths (38%) of the LDCs invited to participate did not respond to the survey (including six out of seven of the largest LDCs), and given the number of respondents who either could not or would not provide this information, this finding cannot be considered definitive.

J.3 Eligibility Criteria

At the outset of the survey, respondents were provided the following information to refresh their recollection of the program eligibility criteria.

> In responding to this survey, please keep in mind the program eligibility rules which state that participants must not have previously entered into a binding commitment to acquire the measures or services required to install the measures. The rules, however, allow LDCs to waive this requirement if:
>
> (i) it determines that the participant intended to apply to the program prior to the commitment or
>
> (ii) if, for unplanned replacements of recently failed equipment, the measure is considered a small project with an estimated incentive under $10,000 and the application is submitted within 45 days of completing the project.

In a subsequent question, the survey asked respondents to rate the importance of criteria they may use to help determine whether a project is eligible to participate in the program. The possible responses included options that reflected the eligibility requirements as described in Section 3.1 and 3.3(c) of the Save on Energy Retrofit Program rules. The specific language used in the program rules was displayed to the respondents as part of the survey:

From Section 3.1 – Participant Eligibility: Participants must be Non-Residential Distribution Customers or Recognized Farm Operations that have not previously entered into a binding commitment to acquire the Measures or services required to install the Measures, provided that the LDC may waive this requirement where (A) the circumstances in Section 3.3(c) apply, or (B) where the Participant can demonstrate to the LDC's satisfaction, at the LDC's sole discretion, that the Participant intended to apply to the program prior to entering into a binding commitment.

From Section 3.3(c): Project and Measures Eligibility: A Project must: for the unplanned replacement of recently failed existing equipment with a Prescriptive Measure listed on the Unitary AC Eligible Measures Worksheet or the VFD or VD Compressor Eligible Measures Worksheet that comprises a Small Project, have the following: (i) an Estimated Participant Incentive less than $10,000; and (2) an Application submitted within 45 days following the completion of such Small Project.

Specifically, the survey provided the following four response options, of which the first three reflected the IESO-specified eligibility criteria:

A. Customer applied after entering a binding commitment to acquire the relevant program measures or services, but before work had been completed.

B. Customer/contractor requested incentives issued for technologies not covered by Retrofit program, but for which the LDC was willing to grant an incentive.

C. Customer completed work for an unplanned replacement for recently failed existing equipment for a Small Project with an estimated participant incentive less than $10,000 and applied within 45 days of completion of the project.

D. Some other criteria. Please describe the criteria and rate its importance in helping your LDC determine whether a project demonstrates sufficient intent to apply.

Survey respondents were then asked to rate the importance of each response option on a scale of 1 to 5 where 1 means "Not at all important criterion used to help demonstrate a project's intent to apply" and 5 means "Very important criterion used to help demonstrate a project's intent to apply." Table K-4 depicts the results.

The criteria listed in options A and B as shown above were rated as very important or important (rating of 4 or 5) to most survey respondents' decision-making. Over three-fifths (64%) of respondents rated the criterion related to customers applying to the program after entering into binding commitments (option A) as very important or important, and close to three-fourths (72%) rated the criteria related to unplanned replacements as very important or important (option C). Fewer respondents overall rated that the criterion listed in option B (related to technologies not covered by the program) as very important or important to their decision-making (25%).

Table J-4: Eligibility Criteria*

Criteria	5-Very Important & 4-Important	3-Neutral	2-Not Very Important & 1-Not At All Important
Customer applied after entering a binding commitment to acquire the relevant program measures or services, but before work had been completed (n=33)	64%	18%	18%
Customer completed work for an unplanned replacement for recently failed existing equipment for a Small Project with an estimated participant incentive less than $10,000 and applied within 45 days of completion of the project (n=32)	72%	22%	6%
Customer/contractor requested incentives issued for technologies not covered by Retrofit Program, but for which the LDC was willing to grant an incentive (n=20)	25%	25%	50%

*Note: those who provided a response of “Not applicable,” “Refused,” or left the response blank are not included in the analysis.

Notably also, 19 respondents provided an open-end response in option D, “Some other criteria.” The survey team recoded the open-end responses into the seven closed-end categories listed below. Note that these criteria are not associated with the IESO eligibility criteria.

- Documentation demonstrating contact with LDC, applicant rep, Efficiency Advisor, or channel partner prior to entering binding commitment (13)
- Customer awareness and knowledge of program (3)
- Previous program participant (3)
- Difficulty submitting application through program database (2)
- Partial submission of documents in program database prior to start date (2)
- Applicant representative submits the project after completion to avoid revisions (1)
- Time or resource restraints (1)

The criteria above were rated as very important or important (rating of 4 or 5) to the respondents who mentioned them. The criterion most commonly mentioned by 13 of these 19 respondents was “Documentation demonstrating contact with LDC, applicant representative, Efficiency Advisor, or channel partner prior to entering binding commitment.” Other commonly mentioned criteria were “Customer awareness and knowledge of program” (3 respondents) and “Previous program participant” (three respondents). In summary, the overall intent of this question was to assess if the respondents were utilizing the program-specified criteria for screening program participants or if they were using any other criteria. If they were using some other criteria which they described, that could have provided insight into whether they were allowing free riders into the program by deviating from the program-specified criteria and thereby receiving lower NTG values. The responses show that LDCs rely primarily on the eligibility criteria as outlined in the IESO’s program rules to help determine whether a project should be classified as program eligible. This suggests that, in general, LDC NTG values cannot be associated with the way they are using the intent to apply mechanism to make exceptions for projects that are allowed to participate in the Retrofit Program.

J.4 Willingness to Share Data

The survey asked respondents if their LDC kept records of the Retrofit projects for their customers who demonstrated a prior intent to apply to the program in 2016, and if so, whether they were willing to share this data with the IESO and the evaluation team for additional analysis purposes. Of the five respondents who reported keeping records of this data, three reported they would be willing to share it with the IESO.

At the close of the survey fielding period, the evaluation team reached out to these three respondents to discuss how best to share this data. One LDC was responsive to this request, and shared the application IDs of their 2016 Retrofit customers who demonstrated a prior intent to apply to the program. The evaluation team compared the applications IDs provided to those customers who had responded to the 2016 Retrofit participant survey. Unfortunately, none of these customers demonstrating intent to apply had responded to the survey.

If at least some of these applicants had responded to the survey, or if more data had been provided from other LDCs, the evaluation team could have performed a more granular analysis to understand whether there was a correlation between customer intent to apply and customer Free-ridership values.

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Appendix 6 – 2017 Industrial Programs Evaluation Report

ECOMETRIC

PROGRAM YEAR 2017 EVALUATION REPORT

CONSERVATION FIRST FRAMEWORK INDUSTRIAL PROGRAMS

Date: 15 November 2018

Prepared for: Independent Electricity System Operator (IESO)

Prepared by: EcoMetric Consulting LLC and Energy & Resource Solutions

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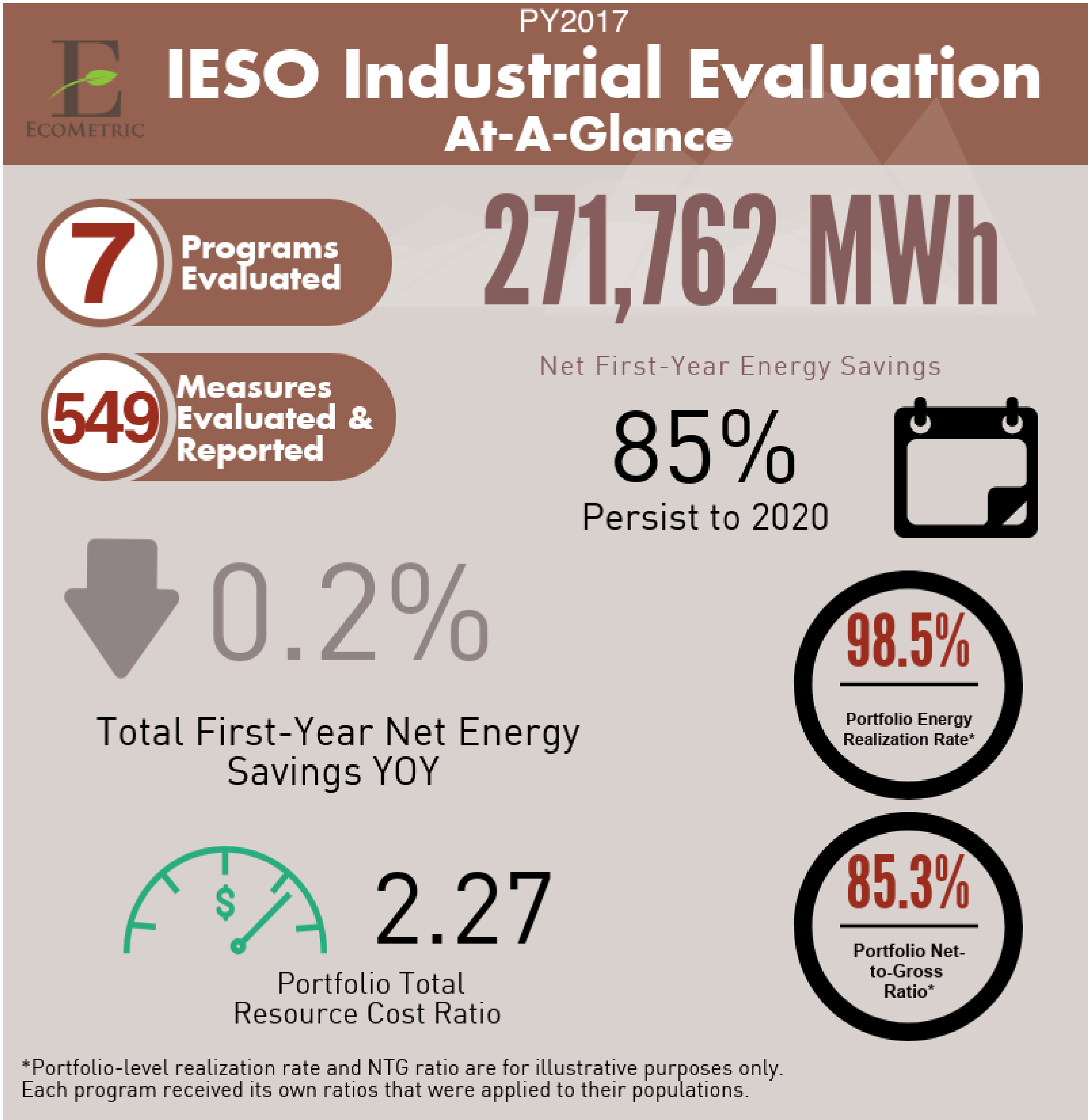
ABBREVIATIONS

AESP	Association of Energy Services Professionals
BMG	Behind-the-meter Generation
CBECS	Commercial Buildings Energy Consumption Survey
CDM	Conservation and Demand Management
CE	Cost Effectiveness
CFF	Conservation First Framework
CHP	Combined Heat and Power
CO2e	Carbon Dioxide Equivalent
CRM	Customer Resource Management
DST	Daylight Saving Time
EE	Energy Efficiency
EF	Emissions Factor
EIA	U.S. Energy Information Association
EM	Energy Manager
EM&V	Evaluation, Measurement and Verification
EPP	Energy Performance Program
EUL	Effective Useful Life
FR	Free-rider
GA	Global Adjustment
GHG	Greenhouse Gas
HPNC	High Performance New Construction
HVAC	Heating, Ventilation and Air Conditioning
IAC	U.S. Dept. of Energy's Industrial Assessment Center
IAP	Industrial Accelerator Program
IAP CI	Industrial Accelerator Program: Capital Incentives
ICI	Industrial Conservation Initiative
IESO	Independent Electricity System Operator
IPMVP	International Performance Measurement and Verification Protocol
IR	Information Request
ISP	Industry Standard Practice
kW	Kilowatt
kWh	Kilowatt hour
LC	Levelized Cost
LDC	Local Distribution Company
M	Million
M&T	Monitoring and Targeting
M&V	Measurement and Verification

MMBtu	One Million British Thermal Units
MPN	Modeled Partial Net
MW	Megawatt
MWh	Megawatt Hour
NAICS	North American Industry Classification System
NTG	Net-to-Gross
O&M	Operation and Maintenance
PAC	Program Administrator Cost
PES	Program Enabled Savings
PSUP	Process and Systems Upgrades Program
PY	Program Year
P&S	Process and Systems
QC	Quality Control
RR	Realization Rate
SO	Spillover
TRC	Total Resource Cost
YOY	Year-on-Year

Figure 1: PY2017 IESO Industrial Evaluation Results At-a-Glance



PY2017

IESO Industrial Evaluation

At-A-Glance

7 Programs Evaluated

549 Measures Evaluated & Reported

271,762 MWh

Net First-Year Energy Savings

85%

Persist to 2020

0.2%

Total First-Year Net Energy Savings YOY

98.5%

Portfolio Energy Realization Rate*

2.27

Portfolio Total Resource Cost Ratio

85.3%

Portfolio Net-to-Gross Ratio*

*Portfolio-level realization rate and NTG ratio are for illustrative purposes only. Each program received its own ratios that were applied to their populations.

1 EXECUTIVE SUMMARY

The Independent Electricity System Operator (IESO) retained EcoMetric Consulting, LLC to conduct PY2017 evaluation of Conservation First Framework (CFF) Industrial Programs. Industrial Programs incentivize equipment measures, engineering studies and Energy Manager services for commercial and Industrial facilities in Ontario. This report contains gross and net energy and demand impacts, greenhouse gas (GHG) emissions impacts, cost-effectiveness results, process findings, and recommendations for improvement for the following industrial programs:

- Process and Systems Upgrades Program (PSUP),
- Industrial Accelerator Program (IAP),
- Energy Manager Non-Incented measures (EM)
- Monitoring and Targeting (M&T), and
- Program Enabled Savings (PES).

PSUP is LDC administered and offered to companies connected to the distribution system of Local Distribution Companies (LDCs). The program provides financial support for the implementation of energy efficiency projects and system optimization projects for facilities that are intrinsically complex and capital-intensive.

IAP is offered to companies connected directly to the transmission system. The initiative provides incentives through three program streams: Capital Incentives (referred to interchangeably as IAP Process & Systems), Retrofit, and Energy Manager.

The Energy Manager program is offered to both sets of customers noted above. The program subsidizes the salary of a trained energy manager to work directly with participating facilities to find energy savings, identify smart energy investments, secure financial incentives, and unleash competitive advantage.

The Monitoring and Targeting program encourages industrial distribution customers to install or upgrade M&T systems to relate a facility's energy consumption data to the weather, production schedule, or other measures in such a way as to provide a better understanding of how energy is being used.

Finally, the Program Enabled Savings initiative provides an opportunity for LDCs to quantify savings generated through their customer interactions outside of the existing suite of efficiency programs.

1.1 EVALUATION RESULTS SUMMARY

In the evaluation of the CFF industrial portfolio of programs for program year 2017 (PY2017), 549 projects were evaluated and reported. **Total industrial portfolio gross verified energy savings from the PY2017 evaluation are 318,491 MWh. Verified net first year energy savings are 271,762 MWh, or 85.3% of gross verified savings, indicating low levels of free-ridership, on average, across the programs.** There is no spillover attributed to the industrial programs across the portfolio.

Savings persistence is an important component of the CFF, and over 85% of first-year PY2017 savings persist through 2020. This is typical of industrial sector measures that tend to have relatively long measure lives.

Verified savings from the PY2017 evaluation of industrial programs is summarized in Figure 2 and Table 1 below. These results include projects that were evaluated during the PY2017, including projects that went into service starting in 2017 under the CFF, as well as projects that went into service in 2016 under the CFF which are referred to as 2016 adjustments. Results throughout this report also include projects that went into service in 2015 under the *2011 - 2014 + 2015 Extension Legacy Green Energy Act Framework* (Legacy) but were not included in prior evaluations.

Figure 2: PY2017 Reported, Gross Verified, and Net Verified Savings by Program (MWh)

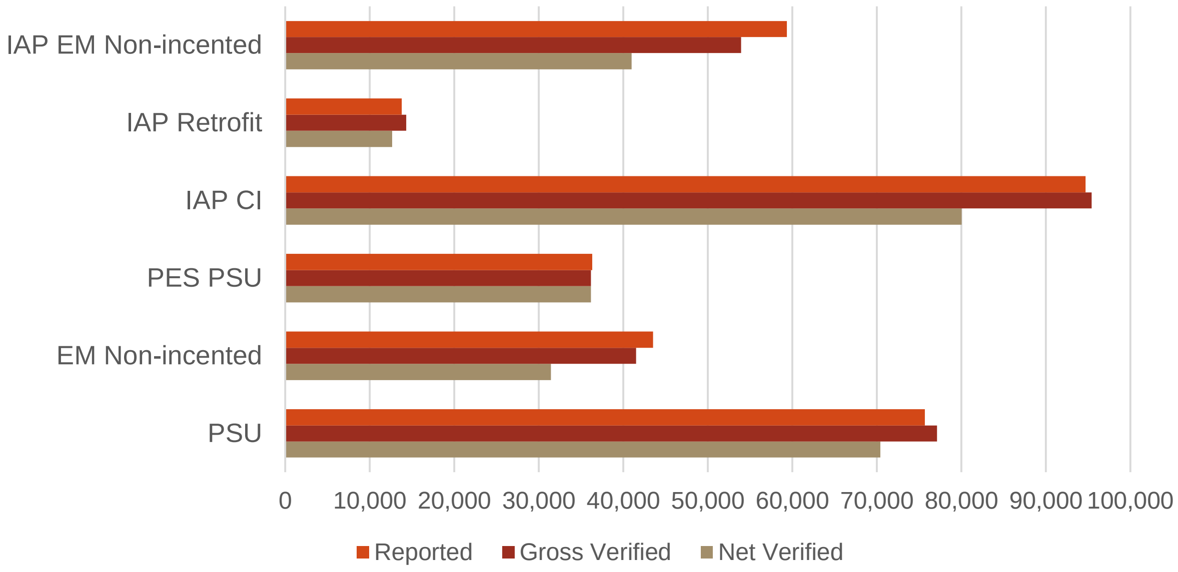


Table 1: Impact Evaluation Results Summary

Program	# of Projects Evaluated & Reported	Energy RR	Gross Verified Energy Savings (MWh)	Demand RR	Gross Verified Summer Peak Demand Savings (MW)	NTG Ratio[1]	Net Verified Energy Savings (MWh)	Net Verified Summer Peak Demand Savings (MW)	Persistence of Savings in 2020
LDC-Administered Programs									
Process & Systems Upgrades (PSUP)	31	101.9%	77,140	158.4%	11.00	91.3%	70,433	9.95	100%
Program Enabled Savings (PES)[2]	4	99.6%	36,185	n/a	-	100.0%	36,185	-	59%
Energy Manager Non-Incented (EM)	438	95.3%	41,503	104.5%	6.05	75.8%	31,442	4.63	64%
Monitoring & Targeting (M&T)	0	n/a	0	n/a	0.00	n/a	0	0.00	n/a
Total LDC	**473**	**98.6%**	**154,828**	**112.7%**	**17.05**	**86.4%**	**138,060**	**14.58**	**81%**
IESO-Administered Programs									
IAP Capital Incentives	4	100.7%	95,415	100.1%	10.92	83.9%	80,066	9.16	100%
IAP Retrofit	19	103.8%	14,316	111.3%	2.04	88.4%	12,654	1.80	100%
IAP Energy Manager Non-Incented	53	90.8%	53,932	89.2%	4.90	76.0%	40,982	3.77	68%
Total IESO	**76**	**97.5%**	**163,663**	**97.9%**	**17.86**	**81.7%**	**133,702**	**14.74**	**90%**
GRAND TOTAL	**549**	**98.5%**	**318,491**	**112.7%**	**34.92**	**85.3%**	**271,762**	**29.31**	**85%**

Total industrial portfolio net energy savings are summarized below in Figure 3. These results include all projects under the CFF that have been evaluated and their savings reported in PY2016 or PY2017. **As part of the CFF framework, the industrial portfolio has achieved 389,935 MWh of net first-year energy savings, representing 87.8% of gross verified first-year energy savings.** Growth in the portfolio's net first-year energy savings was relatively flat in PY2017 compared to the 149,797 MWh net first-year energy savings achieved and evaluated in PY2016. While the total number of projects evaluated and reported increased YOY in PY2017, total net first-year energy savings decreased just 0.4% YOY in PY2017 compared to PY2016 results without 2016 adjustment savings. Net first-year energy savings increased YOY for all

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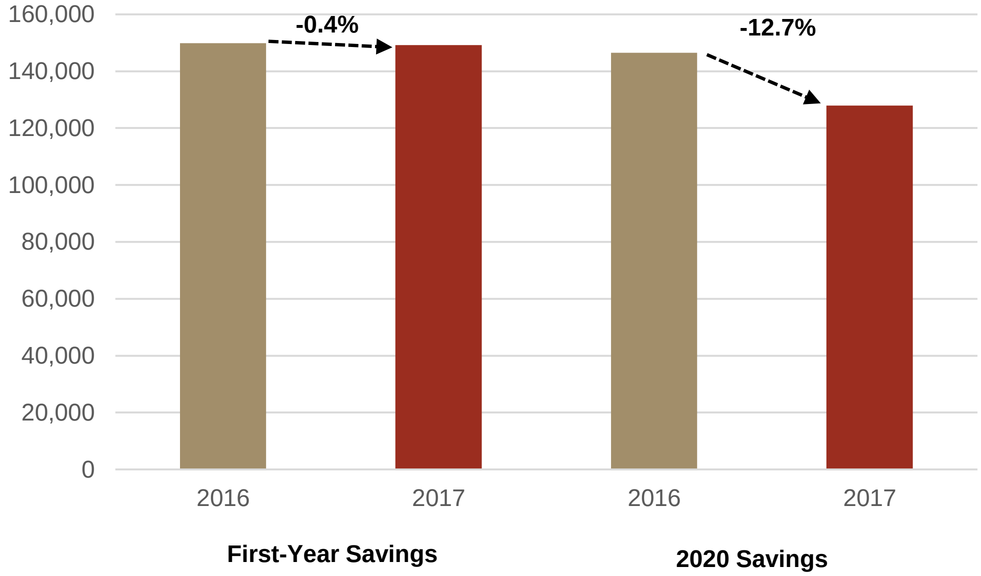
[1] Program-level NTG ratios are for illustrative purposes only. Summary NTG ratios in this table are total net verified savings divided by total gross verified savings.

[2] Includes only PES savings attributed to PSUP.

programs in PY2017 except for the IAP CI program which experienced a 27% decline YOY due to slightly lower participation. The IAP CI program is characterized by a small number of very large and impactful projects, representing over 29% of the industrial portfolio's net energy savings in PY2017.

Figure 3: Industrial Portfolio Total First-Year and 2020 Net Energy Savings (MWh)



2016 adjustment projects, those that were implemented in 2016 but evaluated in PY2017, account for 90,939 MWh of net first-year energy savings—23% of the total portfolio net energy savings achieved through the CFF to date. Adjustment savings are not included in Figure 3 but are detailed in *Section 4.1* and the following program-specific sections in *Chapter 5*. Adjustment projects account for a large part of the industrial portfolio's savings each year as projects tend to be much more complex in the industrial sector compared to residential and commercial and this complexity requires longer monitoring and verification processes. As such, projects in the industrial portfolio are often evaluated more than a year after they are implemented.

Projects implemented in the industrial portfolio in PY2017 and evaluated in PY2017 had 127,945 MWh of net 2020 energy savings—84% of gross first-year energy savings. Compared to PY2016 projects without 2016 adjustments from the PY2017 evaluation, total portfolio net 2020 energy savings decreased 12.7% YOY in PY2017. The main driver for this decline was the decrease in persistent savings from the Energy Manager non-incented program which experienced an uptick in PY2017 of operations and maintenance (O&M) measures that have shorter effective useful lives (EULs).

The industrial portfolio was highly cost-effective in 2017 according to both TRC and PAC tests, when using a benefit-cost threshold of 1.0. The cost effectiveness of the portfolio is supported by the IESO-administered programs which have a TRC ratio of 3.72, compared to a TRC ratio of 0.64 for LDC-administered programs. The IAP CI program accounts for 78% of the Industrial Portfolio's total TRC benefits in net present value terms, largely due to a large CHP project that resulted in major energy and natural gas savings. PSUP has the lowest TRC ratio at 0.54, due to the cost of increased natural gas consumption by the CHP units prevalent in the program. Compared to the one CHP unit in the IAP CI program that was highly cost-effective, the CHP units in PSUP resulted in increased net natural gas consumption and high fuel supply costs. The details of the PSUP cost effectiveness analysis, and the effect of CHPs on the TRC ratio, is detailed in *Section 5.1.5*.

Table 2 below includes select cost-effectiveness results for the industrial portfolio. While these results indicate an overall cost-effective set of programs, variance in the timing of costs incurred and savings achieved can impact the precision of these cost tests.

Detailed cost effectiveness assumptions by program are included in *Appendix D*.

Table 2: PY2017 Cost Effectiveness Results

Admin	Program	TRC Ratio	PAC Ratio	LC $/kWh
LDCs	PSUP	0.54	1.57	0.05
	PES PSUP	-	-	-
	EM	0.89	2.66	0.02
	M&T	-	-	-
	Total LDCs	**0.64**	**1.87**	**0.04**
IESO	IAP (CI)	3.71	2.84	0.03
	IAP (Retrofit)	3.23	7.88	0.01
	IAP (EM)	4.30	-	-
	Total IESO	**3.72**	**3.22**	**0.02**
PORTFOLIO TOTAL		**2.27**	**2.81**	**0.03**

EcoMetric designed a two-phase approach to comprehensively assess all CFF Industrial programs, document existing processes, and identify opportunities for improvement. The evaluators conducted a total of 189 interviews and surveys with IESO IAP staff, energy managers, participants (in concert with the NTG interviews), nonparticipants, and partial participants. This was supplemented by document review and targeted analyses. The key findings by program include the following:

- PSUP: Subsequent evaluations will monitor the impact of the program redesign and CHP phase-out in subsequent evaluations. It is not clear to what extent the redesign lessened the customer pain point on the application review process.
- EM: The EM program is seen as an enabling program and drives participation and savings in other Save on Energy/IAP programs. It has the highest satisfaction ratings of the industrial programs and produces non-energy benefits for both the facilities and LDCs/IESO.
- IAP: Like PSUP, IAP went through multiple changes in the past year, which will be monitored in subsequent evaluations. The application review process is a major barrier for customers and the largest source of complaints.

- PES: This is a unique offering that is challenging to administer from an evaluation perspective due to an inability to account for free-ridership or perform more rigorous analysis on some projects.
- M&T: There are substantial barriers to participation for this program, resulting in low participation and savings.

The EcoMetric team identified 17 opportunities for process improvement through this effort. Findings and recommendations can be found throughout *Chapter 4* and *Chapter 5*. Figure 22 in *Appendix E* shows a diagram of the potential outcomes of implementing the process recommendations provided in this report.

1.2 KEY FINDINGS AND RECOMMENDATIONS

The findings and recommendations below represent the most impactful results and analysis from the impact and process evaluations of the industrial portfolio in PY2017. Greater detail on the data and analysis that lead to these key findings and recommendations can be found in the portfolio overview in *Chapter 4* and the respective program-specific sections in *Chapter 5*.

1.2.1 CROSS-CUTTING KEY FINDINGS & RECOMMENDATIONS

Finding 1: Tracking data and project documentation is generally accurate and comprehensive but can be improved to ensure an accurate estimations of verified savings. (Cross-cutting, Section 4.1.4)

Recommendation 1: Open a channel of communication between the evaluator and technical reviewer, facilitated by the IESO, to ensure tracking data and project documentation issues are understood and impactful and realistic solutions can be implemented.

- In Q42018, the IESO facilitated an in-person meeting between the technical reviewer and evaluation team to discuss each stakeholder's processes, tracking systems and methodology regarding the technical review and evaluation of the industrial portfolio. A channel of communication and bi-weekly meetings have been established to improve a mutually beneficial relationship based on continuous feedback and improvement throughout the implementation and evaluation of the CFF.

Finding 3: Behind-the-meter generation (BMG) projects account for 56% of gross verified energy savings and account for the majority of savings in both LDC-administered and IESO-administered programs evaluated in PY2017. (Cross-cutting, Section 4.1.5)

- All BMG projects in the PY2017 evaluation were CHP units. The Government of Ontario's 2017 Long-Term Energy Plan ended funding for CHP projects that burn fossil fuels in both the CFF and IAP. Effective July 1, 2018 the IESO is no longer accepting applications for CHP projects. While many CHP projects are currently in the application phase and will create significant energy savings over the next few years, the number of BMG projects and their impact on the Industrial Portfolio will surely decline in the future. CHP units that use non-fossil fuels, such as biogas, are still eligible for funding, so opportunities to encourage energy savings through CHP projects still exist.

Recommendation 3: Create a standing committee with the IESO, LDCs and partners to develop a plan to sustain participation in the Industrial Portfolio following the removal of a popular energy efficiency measure. Investigate the potential for biogas-fueled CHPs in Ontario, as well as other projects that were overshadowed by CHPs.

Finding 4: The cost of natural gas used to calculate avoided costs of natural gas consumption in the IESO's Cost Effectiveness Tool is not frequently updated to reflect current market conditions, resulting in inaccurate calculations that do not account for actual natural gas costs incurred in the fuel market. (Cross-cutting, Section 4.1.7)

Recommendation 4: Update the avoided cost of natural gas used in the CDM Cost Effectiveness Tool on an annual basis to reflect current market conditions. A comparison study of marginal natural gas costs in Ontario and other provinces with similar markets is recommended to ensure the avoided costs used reflect industry practices.

Process Finding 3: Nonparticipants are generally aware of the Save on Energy programs and offerings with the exception of the EM program. (Cross-cutting, Section 4.2.2)

Process Recommendation 3: Increase nonparticipant awareness of the EM program by raising the profile of the program.

Process Finding 4: Administrators described significant overlap between IESO energy conservation programs and the Industrial Conservation Initiative (ICI). (Cross-cutting, Section 4.2.4)

Process Recommendation 4: Leverage the ICI to spur conversations with customers and use it to market to their priorities without making the project explicitly about demand reduction.

1.2.2 PSUP KEY FINDINGS & RECOMMENDATIONS

Process Finding 5: The application review process remains a major customer pain point for PSUP. (PSUP, Section 5.1.6)

Process Recommendation 5 (PSUP/IAP): Develop measure-specific applications or accompanying guidance to limit the number of information requests (See also Recommendation 13, Section 5.3.6.2, for IAP).

1.2.3 ENERGY MANAGER KEY FINDINGS & RECOMMENDATIONS

Finding 9: **The peak demand savings estimates for non-incented Energy Manager projects are inconsistent or non-existent. Projects are often submitted without peak demand savings estimates. When projects have demand impacts recorded, they are frequently the change in connected load rather than an estimate of demand reduction coincident with the system peak. (EM, Section 5.2.3)**

Recommendation 12: Make the quality and completeness of peak demand tracking and reporting a performance metric for technical reviewers. Although goals are based on energy savings, peak demand impacts are a key factor in system planning and cost-effectiveness.

Process Finding 6: **The EM program is seen as an enabling program and drives participation and savings in other Save on Energy/IAP programs. (EM, Section 5.2.6)**

Process Recommendation 6: Consider ways to reward EMs for overachieving the 10% non-incented target, provided that they submit enough documentation for the technical reviewer to fully review and the savings persist to 2020.

1.2.4 PES KEY FINDINGS & RECOMMENDATIONS

Process Finding 12: **PES savings may accrue above and beyond spillover already captured by the NTG analysis conducted for other programs, but they could also be double counted if not calculated properly. (PES, Section 5.4.6)**

Process Recommendation 14: Investigate the potential for double-counting of spillover savings from PES claims. Consider providing the PES claims to each evaluation team (Retrofit Program, etc.) to reduce the possibility of double-counting spillover savings.

Process Recommendation 16: Discontinue the PES initiative. Encourage LDCs and participants to leverage IESO support through existing programs that historically influenced PES claims.

1.2.5 M&T KEY FINDINGS & RECOMMENDATIONS

Process Finding 13: **There are substantial barriers to participation for the current iteration of the M&T program, resulting in low participation and a small contribution to portfolio savings. (M&T, Section 5.5.1)**

Process Recommendation 17: Discontinue the M&T program and direct relevant new customers to other program offerings such as the Energy Performance Program (EPP) unless there is a compelling reason to redesign the program instead.

1.3 EVALUATION METHODOLOGY AND GOALS

Approaches used to conduct this evaluation include engineering analysis, on-site inspections and measurement, interval billing analysis, telephone surveys, program and project documentation review, best practice review, and interviews with IESO and LDC staff, implementation vendors, technical reviewers, and program participants. The process evaluation component seeks to understand the Conservation First Framework (CFF) industrial programs' effectiveness from multiple perspectives: the IESO's oversight, the LDCs' implementation, the program-by-program processes, and the individual customer experiences. The evaluation methodology is explained in more detail in *Section 3.1* and *Appendix C*.

In abbreviated form, goals of this evaluation include:

- Verify energy and summer peak demand savings by program
- Estimate the net change in greenhouse gas emissions from changes in electricity and natural gas consumption
- Estimate program attribution, including free-ridership, participant & non-participant spillover through net-to-gross analysis
- Evaluate the overall effectiveness and comprehensiveness of key program elements
- Analyze the cost-effectiveness of each Industrial program
- Analyze and make recommendations to improve the Industrial programs
- Determine participating customer satisfaction with the programs
- Estimate the net change in greenhouse gas emissions from changes in electricity and natural gas consumption

2 INDUSTRIAL PORTFOLIO OVERVIEW

2.1 INDUSTRIAL PROGRAM OVERVIEW

2.1.1 PROCESS & SYSTEMS UPGRADES PROGRAM (PSUP)

The Process & Systems Upgrades Program provides financial support for the implementation of energy efficiency projects and system optimization projects for facilities that are intrinsically complex and capital-intensive. 16 PSUP projects in-service starting in PY2017 were ready for evaluation and reporting. Another 14 projects from PY2016 and one from PY2015 have been carried over to this year's evaluation; these PY2017 and PY2016 and PY2015 adjustment projects are collectively referred to as the PY2017 sample frame.

The LDCs and IESO recently completed a program redesign process through the Business Working Group, which made a number of changes to PSUP in order to streamline and simplify it in response to LDC and customer feedback. The revised rules were posted on April 6, 2018 and went into effect one month later. The redesign of the program is detailed in *Section 5.1.6.1*.

2.1.2 ENERGY MANAGER NON-INCENTED MEASURES (EM)

The Energy Manager program subsidizes the salary of a trained energy manager to work directly with participating facilities to find energy savings, identify smart energy investments, secure financial incentives, and unleash competitive advantage. Energy managers can identify capital improvements that are eligible for incentive payments through PSUP, IAP Retrofit, or IAP Capital Incentives. Savings from these projects accrue to, and are evaluated in, the program that incents the improvement.

Energy managers are also expected to identify and implement *non-incented* improvements for the organizations they support. Since 2016, Energy Manager contracts require that 10% of the savings goal be achieved through non-incented improvements. This is a reduction from the 30% requirement in place previously. These non-incented projects are the focus of the Energy Manager evaluation conducted by the EcoMetric team. Embedded Energy Managers completed 281 non-incented measures that went into service in 2017 and were ready for evaluation, and another 157 measures were evaluated as 2016 adjustments.

2.1.3 INDUSTRIAL ACCELERATOR PROGRAM (IAP)

The Industrial Accelerator Program Initiative is administered directly by IESO, offered to transmission-connected customers, and provides incentives through three program streams: Capital Incentives (referred to interchangeably as IAP Process & Systems), Retrofit, and Energy Manager. Program delivery for each of these initiatives closely mimics the respective LDC-administered programs, and as discussed previously, for the Energy Manager program, the evaluation here is limited to the non-incented measures.

Between the three programs within the IAP Initiative, 58 IAP projects were completed in 2017. Table 3 below provides detail of the IAP reported savings from the PY2017 evaluation at the program-level. While the IAP Retrofit and IAP Energy Manager initiatives account for the largest number of projects, these projects are typically smaller in size and comprise a smaller portion of the IAP savings. The IAP Capital Incentives initiative is responsible for the majority (57%) of the IAP reported energy savings included in this evaluation.

Table 3: IAP Reported Savings

Program	2017 Projects Evaluated and Reported	2017 Reported Energy Savings (MWh)	2016 True-Up Projects Evaluated and Reported	2016 True-Up Reported Energy Savings (MWh)	2015 True-Up Projects Evaluated and Reported	2015 True-Up Reported Energy Savings (MWh)	PY2017 Evaluation Total Reported Energy Savings (MWh)	% of IAP Reported Savings
IAP (CI)	4	94,723	0	0	0	0	**94,723**	57%
IAP (Retrofit)	12	6,575	5	1,390	2	5,829	**13,794**	8%
IAP (EM)	42	39,956	7	19,416	0	0	**59,371**	35%
Total	**58**	**141,254**	**12**	**20,806**	**2**	**5,829**	**167,888**	

2.1.4 PROGRAM ENABLED SAVINGS (PES PSUP)

The Program Enabled Savings (PES) initiative provides an opportunity for LDCs to quantify savings generated through their customer interactions outside of the existing suite of efficiency programs. LDCs submit a PES claim form with substantiating documentation describing the project(s) and savings, which are credited to the appropriate efficiency program (PSUP, Retrofit or High Performance New Construction). The PES initiative is unique and does not exist in any North American jurisdiction with greater than $30M per year in annual CDM spending. The program design is deficient in several areas and it creates an alternative mechanism for LDCs to submit unsubstantiated savings claims.

Following a deep analysis of the PES initiative's design and processes, the EcoMetric team led a redesign of the initiative that was implemented by the IESO for the PY2017. As part of the redesign, projects applications and supporting data are scrutinized at the same level as all other programs in the Industrial Portfolio. Clear guidance as to the scope and level of detail required by the applicants to substantiate savings and IESO program influence was developed and has resulted in a marked improvement in the quality of claims submitted.

In PY2017, PES claims were approved and subject to an independent technical review process similar to other programs included in this evaluation. This is a change from PY2016, when PES claims did not go through an intermediate technical reviewer, rather; the claims were directly verified by the EcoMetric evaluation team.

Savings from PES claims are attributed to the industrial portfolio through PSUP. Four total PES claims were attributed to PSUP in the PY2017 evaluation, two going into service in 2017 and one going into service in 2016 and 2015 each. Meanwhile, savings from claims attributed to the Retrofit and High Performance New Construction (HPNC) are reported with their respective programs in the business portfolio. PES Retrofit claims were the most prevalent in the PY2017 evaluation with 46, while there were just three PES HPNC claims. Similarly to the IAP framework, retrofit projects were more plentiful but had lower per-project savings compared to PES claims attributed to PSUP and HPNC.

2.1.5 MONITORING AND TARGETING PROGRAM (M&T)

The Monitoring and Targeting (M&T) Program encourages industrial distribution customers to install or upgrade M&T systems to relate a facility's energy consumption data to the weather, production schedule, or other measures in such a way as to provide a better understanding of how energy is being used. M&T systems are expected to identify signs of avoidable energy waste or other opportunities to reduce consumption. Project eligibility is partly contingent on achieving a savings goal within 24 months of installation and sustaining these savings for the terms of the participant agreement, five years from the date the M&T system is installed.

Monitoring & Targeting had no projects in service starting in 2017 and ready for evaluation, therefore no verified impacts from the M&T program are included in this report. One project was technically ready for evaluation, but the supporting data used to verify savings was incomplete and out of date. Attempts to reach out to the participant did not result in sufficient data to support savings verification and projects were dropped from the evaluation. The two-year implementation schedule of M&T projects described above leads to a somewhat longer technical review phase. M&T program costs incurred in 2017 are included in the cost-effectiveness analysis.

2.2 REPORTED SAVINGS

IESO's Program Year (PY) 2017 industrial program portfolio comprises the programs and initiatives shown in Table 4 below. This table includes projects in-service starting in calendar year 2017 and ready for evaluation, meaning:

a) they have at least one quarter (3 months) of measurement and verification (M&V) data available (PSUP, IAP)

OR

b) they have been through the technical review process for the program and are not otherwise on hold for administrative reasons (Energy Manager non-incented, M&T).

Program Year 2017 evaluation activities also include PY2016 and PY2015 adjustments, defined as projects that went into service starting in calendar year 2016 or 2015 but did not have sufficient technical review to be ready for evaluation last year, or (less commonly) were otherwise incomplete as of April 1, 2018 due to contractual or administrative holds. Table 4 below shows reported savings and program contributions to the industrial portfolio including adjustment projects. The most notable adjustment contributions are to PSUP and PES PSUP.

Table 4: Completed Projects and Reported Savings for PY2017 Evaluation

Administrator	Program	2017 Projects Evaluated and Reported	2017 Reported Energy Savings (MWh)	2016 True-Up Projects Evaluated and Reported	2016 True-Up Reported Energy Savings (MWh)	2015 True-Up Projects Evaluated and Reported	2015 True-Up Reported Energy Savings (MWh)	PY2017 Evaluation Total Reported Energy Savings (MWh)	% of Industrial Sector Reported Savings
LDCs	PSUP	16	14,534	14	51,915	1	9,251	**75,701**	23%
	PES PSUP	2	430	1	18,568	1	17,337	**36,335**	11%
	EM*	281	31,243	157	12,302	0	0	**43,545**	13%
	M&T	0	0	0	0	0	0	**0**	0%
	Total LDCs	299	46,207	172	82,785	2	26,588	155,580	48%
IESO	IAP (CI)	4	94,723	0	0	0	0	**94,723**	29%
	IAP (Retrofit)	12	6,575	5	1,390	2	5,829	**13,794**	4%
	IAP (EM)*	42	39,956	7	19,416	0	0	**59,371**	18%
	Total IESO	58	141,254	12	20,806	2	5,829	167,888	52%
GRAND TOTAL		**357**	**187,461**	**184**	**103,591**	**4**	**32,416**	**323,468**	**100%**

3 EVALUATION METHODOLOGY

3.1 EVALUATION APPROACH

Methods used to conduct this evaluation include on-site inspections and measurement, engineering analysis, interval billing analysis, telephone surveys, documentation review, best practice review, and interviews with IESO and LDC staff, implementation vendors, technical reviewers, program participants, and non-participants. This section explains the evaluation approach in more detail, including the overall sample design and basic descriptions of the methods applied. More detailed descriptions of the methodology are included in *Appendix C*.

3.1.1 OVERALL SAMPLE DESIGN

This section outlines the statistical sample design across industrial programs. Sampling is employed for programs with greater volume of small to medium size projects, whereas a census-review (all projects) is conducted for programs with smaller population of large projects. This approach allows the evaluation team to balance evaluation cost and rigour. This section outlines the overall sample design across industrial programs. The program-specific sections include more detailed explanations of the sampling approaches for each program. One overarching theme that guided the sample design for the industrial programs is the limited population of program participants. Compared with other sectors, participation in the industrial programs consists of a relatively small number of large and unique projects. To accommodate this, a census of PSUP and IAP CI projects were included in project-level analysis and verification activities, providing a high level of certainty to the methods used to analyze a heterogeneous population. Other key elements of the sample design include the following:

1. EcoMetric utilized a single sample of program participants for the gross impact, net impact, and process evaluation. The net impact and process evaluations include multiple interviews/surveys in the same organization where appropriate.
2. For the Energy Manager non-incented projects, where the project volume is higher and per-project savings are smaller, sampling was utilized to accurately estimate savings without individually analyzing every project.
3. For the Industrial Accelerator Program Capital Incentive program, a census of projects and participants was evaluated. Sampling was utilized in the IAP Energy Manager and IAP Retrofit programs due to the higher number of projects in these initiatives.
4. For the Program Enabled Savings (PES) claims, sampling was also utilized.
5. A census evaluation of the Monitoring and Targeting program was planned, but no projects were ready for evaluation or had sufficient supporting documents to verify savings in PY2017.

Table 5 includes participant sample sizes for impact evaluation (gross and net) and process evaluation based on the target confidence levels/precision (margin of error) ranges shown. 90% confidence and 10% precision was the target sampling requirement for the EM non-incented, IAP EM, IAP Retrofit and PES initiatives.

Table 5: PY2017 Sample Design

Program/Initiative	PY2017 Projects Completed[3]	Target Confidence/ Precision	Sample Size			
			PY2017	PY2016 Adjustments	PY2015 Adjustments	Total
PSUP	27	census	16	14	1	**31**
EM Non-Incented[4]	294	Sample (90%/10%)	281	92	0	**373**
IAP Capital Incentive	4	census	4	0	0	**4**
IAP EM	47	Sample (90%/10%)	28	4	0	**32**
IAP Retrofit	20	Sample (90%/10%)	16	3	1	**20**
Monitoring & Targeting	0	census	0	0	0	**0**
PES[5]	27	Sample (90%/10%)	16	9	5	**28**
TOTAL	**419**	**-**	**361**	**122**	**7**	**488**

3.2 GROSS SAVINGS VERIFICATION

Program-specific methodologies for verifying gross savings are described in more detail in *Sections 5.1* through *5.5*. Data sources and methods of data collection and review, including retrieval of tracking system and program documentation, telephone interviews, and on-site data gathering, are explained in more detail in *Appendix C.*

3.3 NET SAVINGS ANALYSIS

Net Savings and net-to-gross (NTG) ratios were calculated to incorporate free-ridership and spillover factors for the projects evaluated. Free-ridership accounts for any reductions to gross savings due to what the customer would have done absent the program's influence. The condition of what the customer

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[3] Several projects completed in 2017 did not have at least one quarter of M&V data, so they will be evaluated in PY2018 as adjustment projects.

[4] EM program participation and sample are reported in measures.

[5] Includes PES savings claims attributable to PSUP, as well as the Retrofit and HPNC programs in the Business Portfolio. Savings from the Retrofit and HPNC claims are reported with their respective programs.

would have done is commonly referred to as the counterfactual condition in NTG analyses. As in the past, the basis of free-ridership analysis for IESO's industrial programs was direct query (interviews with past participants) about the theoretical counterfactual condition. This method is considered best practice for programs with large savings per project, unique applications, and low participant counts.

More information on the net savings methodology, including data collection details, questionnaire design, can be found in *Appendix C*.

3.4 SUMMER PEAK DEMAND ANALYSIS

EcoMetric verified summer coincident peak demand impacts for each project based on the IESO-defined peak periods included in *Appendix A*. High-resolution energy savings load shapes, vital for calculating on-peak demand savings, were developed for each project and used to account for the seasonal, daily, and hourly variations in operating schedules and energy consumption. In cases where an accurate project-specific load shape could not be developed, existing IESO load shapes were selected based on measure and premise type.

3.5 COST-EFFECTIVENESS ANALYSIS

The IESO Conservation and Demand Management (CDM) Cost-Effectiveness tool was used to estimate measure-level costs and benefits, which were then aggregated to program- and portfolio-level cost effectiveness. Program administrative costs were provided to EcoMetric by IESO. Other key inputs for the cost effectiveness analysis include lifetime electric energy and demand savings, gas savings where applicable, measure lives, and energy savings load shapes. Program-specific cost effectiveness results are included in *Chapter 5*.

3.6 AVOIDED GREENHOUSE GAS EMISSIONS ESTIMATION

EcoMetric estimated net greenhouse gas (GHG) impacts for each project and program by utilizing measure-level energy savings load shapes based on metered data, natural gas consumption meter data, and emissions factors (EFs) provided by the IESO at the annual and hourly level and aggregated to the eight IESO peak periods as defined in the Conservation and Demand Management Energy Efficiency Cost Effectiveness Tool. In the industrial portfolio where behind-the-meter generation projects are commonplace, natural gas usage for combustion-based electricity production can significantly counteract emissions savings from avoided electricity consumption, resulting in a net increase in GHG emissions. More information on the GHG emissions impacts is included in *Chapter 4.*

3.7 PROCESS EVALUATION APPROACH

The PY2017 process evaluation is the second of a two-phase project to systematically assess the CFF industrial programs, document existing processes, and identify improvements. The team sought to understand the CFF industrial programs' effectiveness from multiple perspectives: the IESO's oversight, the LDCs' implementation, the program-by-program processes, and the individual customer experiences.

The first phase of research centered around developing a detailed overview of the programs from interviews with IESO staff and a sample of LDCs, and preliminary findings and recommendations from that effort were presented in a series of program snapshots in the PY2016 evaluation report. Phase 2 built off that effort by delving into areas that warranted a deeper look and supplemented the original observations with data from a wider group of stakeholders. Specifically, the second phase aimed to:

- Gather additional perspectives from stakeholders and program documentation to add depth and color to the preliminary observations and findings from the first phase.
- Study the specific program processes that were unclear to participants or the evaluators.
- Solicit feedback on participation experiences from a much broader range of stakeholders (participants in all programs, energy managers, partial and nonparticipants).
- Deliver a final comprehensive report with data from both phases and a full set of findings and recommendations, as well as details on progress made towards implementing Phase 1 preliminary recommendations.
- Identify further targeted research studies focusing on specific aspects of the programs that can be performed over the next three years.

Overall, the evaluation team conducted 189 interviews and surveys for the Phase 2 research, as shown in Table 6 below:

Table 6: Process Interview and Survey Counts

Interview/Survey Target	Count
IAP staff interviews	4
LDC surveys	39
EM interviews	10
Participant interviews	**48**
PSUP	24
EM - LDC	10
IAP	4
IAP Retrofit	5
EM - IAP	5
Nonparticipant surveys	**75**
Large	17
Medium	26
Small	32
Partial participant surveys	**13**
EM	6
M&T	4
IAP	3
Total	**189**

The EcoMetric team analyzed each group of interviews and surveys separately, and then grouped the data into programs and topics within each program. To best organize this data, the team has split the findings into two areas:

- Cross-cutting areas that focus on the overall portfolio and the aspects that exist across all programs, such as coordination and marketing
- Program-specific areas that delve into the performance of each program

Cross-cutting data, findings, and recommendations can be found in *Chapter 4*; all program-specific data can be found in each program's section in *Chapter 5*. More detailed descriptions of the methodology are included in *Appendix C.*

4 PORTFOLIO EVALUATION RESULTS

This chapter contains evaluation results for the entire industrial portfolio. Each sub-section contains impact results, related findings, and recommendations in the following areas:

- Tracking System and Program Documentation Review
- Gross Verified Savings
- Net Verified Savings
- Cost Effectiveness Results
- Greenhouse Gas Impact Results
- Process Evaluation Results

4.1 INDUSTRIAL PORTFOLIO IMPACT RESULTS OVERVIEW

Table 7 below summarizes verified savings from the 2017 impact evaluation. These results include projects from both the *Conservation First Framework (CFF)* and *the 2011 - 2014 + 2015 Extension Legacy Green Energy Act Framework (Legacy)*. The program-specific sub-sections in *Chapter 5* include more detailed breakdowns of verified savings.

4.1.1 GROSS SAVINGS OVERVIEW

The overall energy realization rate (RR), a ratio of *gross verified* (ex-post) savings to *reported* (ex-ante) savings, is 98.5% for the industrial portfolio, confirming a generally high level of accuracy of the technical review and ex-ante reporting. Program-specific energy RRs are close to 100% for all programs.

4.1.2 NET SAVINGS OVERVIEW

The portfolio net-to-gross (NTG) ratio, is 85.3%. The highest program-level NTG ratio belongs to PSUP (91.7%), while the lowest is Energy Manager (75.8%). The PES program has an NTG ratio of 100% by design, as the program was created to capture spillover and has no free-ridership.

4.1.3 PERSISTENCE TO 2020 OVERVIEW

A significant portion of first-year energy and demand savings (85%) across the PY2017 portfolio persist through 2020. Savings from the Energy Manager non-incented measures are the only savings where a significant portion does not persist through 2020 (64% of LDC Energy Manager non-incented savings persist through 2020, and only 68% of IAP Energy Manager savings persist).

Table 7: Industrial Portfolio Impacts Summary

Program	# of Projects Evaluated & Reported	Target Confidence/ Precision	Energy RR	Energy RR Relative Precision	Gross Verified Energy Savings (MWh)	Demand RR	Gross Verified Summer Peak Demand Savings (MW)	NTG Ratio[6]	Net Verified Energy Savings (MWh)	Net Verified Summer Peak Demand Savings (MW)	Persistence of Savings in 2020
LDC-Administered Programs											
Process & Systems Upgrades (PSUP)	31	census	102%	n/a	77,140	158.4%	11	91.7%	70,433	9.95	100%
Program Enabled Savings (PES)[7]	4	Sample (90%/10%)	100%	±9.1%	36,185	n/a	-	100.0%	36,185	-	59%
Energy Manager Non-Incented (EM)*	438	Sample (90%/10%)	95%	±0.2%	41,503	104.5%	6.05	75.8%	31,442	4.63	64%
Monitoring & Targeting (M&T)	0	census	n/a	n/a	0	n/a	0	n/a	0	0	n/a
Total LDC	**473**		**99%**		**154,828**	**112.7%**	**17.05**	**86.4%**	**138,060**	**14.58**	**81%**
IESO-Administered Programs											
IAP Capital Incentives	4	census	100.7%	n/a	95,415	100.1%	10.92	83.9%	80,066	9.16	100%
IAP Retrofit	19	Sample (90%/10%)	103.8%	±6.5%	14,316	111.3%	2.04	88.4%	12,654	1.8	100%
IAP Energy Manager Non-Incented*	53	Sample (90%/10%)	90.8%	±0.2%	53,932	89.2%	4.9	76.0%	40,982	3.77	68%
Total IESO	**76**		**97.5%**		**163,663**	**97.9%**	**17.86**	**81.7%**	**133,702**	**14.74**	**90%**

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[6] Program-level NTG ratios are for illustration purposes only. NTG ratios are calculated each program year for the evaluation sample and applied to the population of each program. For the PSUP and IAP CI programs, each project received its own NTG ratio.

[7] Includes only PES claims attributed to PSUP.

GRAND TOTAL	549		98.5%		318,491	112.7%	34.92	85.3%	271,762	29.31	85%

4.1.4 PORTFOLIO TRACKING SYSTEM & PROGRAM DOCUMENTATION REVIEW RESULTS

Most tracking data and other program/project documentation was provided to EcoMetric by IESO's technical reviewer. The technical reviewer works with industrial program participants from project inception through M&V, reporting the status of industrial customer applications, contracts, projects, and M&V plans to IESO through approximately 15 related data sets.

The list of findings and recommendations below includes a few opportunities for improvement to tracking systems that can mitigate reporting errors, whereby the reported savings or status of a given project or measure does not reflect actual conditions. Reporting errors not only present challenges for IESO and the evaluation teams, but more importantly, without rigourous review, these errors can lead to inaccurate estimates of verified/ex-post savings. Where applicable, these issues are described in more detail in the program-specific sections that follow.

Finding 1: Tracking data and project documentation is generally accurate and comprehensive but can be improved to ensure precise estimations of verified savings.

- "Lower-priority" project parameters are sometimes not reported at all. This can potentially impact verified savings, cost effectiveness, etc., especially when many projects prevent individual verification of each parameter.
- In some cases, unique project and measure level IDs were not consistently recorded across databases. For instance, several iCon IDs, a unique project identifier used by the IESO and technical reviewer, were different for the same projects between the Energy Manager Measure Extract Database and Application Tracking Database.

Recommendation 1: Open a channel of communication between the evaluator and technical reviewer, facilitated by the IESO, to ensure tracking data and project documentation issues are understood and impactful and realistic solutions can be implemented.

- In Q42018, the IESO facilitated an in-person meeting between the technical reviewer and evaluation team to discuss each stakeholder's processes, tracking systems and methodology regarding the technical review and evaluation of the industrial portfolio. A channel of communication and bi-weekly meetings have been established to improve a mutually beneficial relationship based on continuous feedback and improvement throughout the implementation and evaluation of the CFF.

4.1.5 PORTFOLIO GROSS VERIFIED SAVINGS RESULTS

Table 8 includes a summary of all projects evaluated in PY2017 for gross verified savings by program and framework from the PY2017 Evaluation. Most energy realization rates are close to 100%. Where they vary from 100%, it is usually attributable to changes in the baseline assumptions used.

Table 8: PY2017 Gross Verified Savings Detail

Program/Year	# of Projects Evaluated & Reported	Realization Rate (%)	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)[8]	Persistence of Savings in 2020
Process & Systems Upgrades (PSUP)					
2017	16	107.2%	15,586	2.81	100%
2016 Adjustments	14	99.9%	51,863	7.40	100%
2015 Legacy Adjustments	1	104.8%	9,691	0.79	100%
PSUP TOTAL	**31**	**101.9%**	**77,140**	**11.00**	**100%**
Program Enabled Savings (PES) PSUP					
2017	2	99.6%	428	-	100%
2016 Adjustments	1	99.6%	18,491	-	100%
2015 Legacy Adjustments	1	99.6%	17,265	-	13%
PES PSUP Total	**4**	**99.6%**	**36,185**	**-**	**59%**
Energy Manager Non-Incented (EM)					
2017	281	94.4%	29,476	3.98	56%
2016 Adjustments	157	97.8%	12,027	2.07	81%
EM TOTAL	**438**	**95.3%**	**41,503**	**6.05**	**63%**
IAP Capital Incentives					
2017	4	100.7%	95,415	10.92	100%
IAP CI Total	**4**	**100.7%**	**95,415**	**10.92**	**100%**
IAP Retrofit					
2017	12	103.8%	6,824	0.79	100%
2016 Adjustments	5	103.8%	1,443	0.35	100%
2015 Legacy Adjustments	2	103.8%	6,049	0.90	100%

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[8] No demand savings are reported for the PES initiative because demand savings were not verified by the technical reviewer.

Program/Year	# of Projects Evaluated & Reported	Realization Rate (%)	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)[8]	Persistence of Savings in 2020
IAP Retrofit Total	**19**	**103.8%**	**14,316**	**2.04**	**100%**
IAP Energy Manager Non-Incented					
2017	42	93.7%	37,442	3.10	55%
2016 Adjustments	11	84.9%	16,491	1.80	91%
IAP EM Total	**53**	**90.8%**	**53,932**	**4.90**	**66%**
GRAND TOTAL	**549**	**98.5%**	**318,491**	**34.92**	**85%**

The relative precision[9] of the energy savings realization rates for the EM and IAP EM programs was 0.2% at the 90% confidence level. With more variation in the amount of energy savings per project, the relative precision of the energy RRs for IAP Retrofit and the PES initiative were 6.5% and 9.1%[10] at the 90% confidence level, respectively. PSUP and IAP CI were evaluated as a census with each project receiving an individual energy realization rate.

Finding 2: The technical review process generally yielded accurate energy savings calculations but could benefit from a more uniform methodology.

- Metered data provided by the technical reviewer is inconsistent, subject to issues such as duplicate or missing hourly data due to daylight savings time and leap years.
- For projects evaluated with one quarter of post-project data, the technical reviewer did not forecast annual savings using consistent methodology. Several annual savings values were forecasted by simply multiplying quarterly savings by four while others were extrapolated based on annual expected operating days compared to operating days in the metered period. Multiple projects extrapolated one quarter of metered data to one year of savings by applying the average of the metered period to all non-metered hours. However, some measures are expected to vary based on season, month, weekday, hour, etc.

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[9] Relative precision represents the uncertainty of the calculated realization rate for the program's population relative to the value of the program's realization rate for the sample at the 90% confidence level.

[10] Relative precision metric is for all projects in the PY2017 PES evaluation, including PES projects attributed to the Retrofit and HPNC programs as part of the IESO Business Portfolio.

- Measure and baseline classifications and calculations were not consistent between evaluation years. For example, during the PY2016 evaluation, CHP projects were classified as a lost opportunity with an Industry Standard Practice (ISP) baseline instead of a retrofit with preexisting conditions as the baseline as was used by the technical reviewer in the PY2017 evaluation. Differing baseline calculation methodologies can result in vastly different savings results for similar projects between program years.

Recommendation 2: Create a standard procedure or similar guidance for the technical review process, including baseline classifications and calculations based on measure type. Require the technical reviewer to consider seasonal variations and other correlations when forecasting annual savings and encourage the technical reviewer to provide clear explanations of the methods used to extrapolate partial-year results to annual results.

As shown in Table 9 below, **56% of Industrial portfolio energy savings in PY2017 came from behind-the-meter generation (BMG) projects.** BMG projects account for the majority of energy savings in both LDC-administered and IESO-administered programs.

Table 9: PY2017 Portfolio Gross Verified Savings by Project Type

Program/Type	Gross Energy Savings (MWh)	% of Savings	Gross Demand Savings (MW)	% of Savings
LDC-Administered Programs				
BMG	87,552	57%	6.34	37%
EE	67,276	43%	10.72	63%
Total LDC	**154,828**		**17.05**	
IESO-Administered Programs				
BMG	90,581	55%	10.35	58%
EE	73,083	45%	7.51	42%
Total IESO	**163,663**		**17.86**	
All Industrial Programs				
BMG	**178,133**	**56%**	**16.69**	**48%**
EE	**140,358**	**44%**	**18.23**	**52%**
Grand Total	**318,491**		**34.92**	

Finding 3: **Behind-the-meter generation (BMG) projects account for 56% of gross verified energy savings and account for the majority of savings in both LDC-administered and IESO-administered programs evaluated in PY2017.**

- All BMG projects in the PY2017 evaluation were CHP units. The Government of Ontario's 2017 Long-Term Energy Plan ended funding for CHP projects that burn fossil fuels in both the CFF and IAP. Effective July 1, 2018 the IESO is no longer accepting applications for CHP projects. While many CHP projects are currently in the application phase and will create significant energy savings over the next few years, the number of BMG projects and their impact on the industrial portfolio will surely decline in the future. CHP units that use non-fossil fuels, such as biogas, are still eligible for funding, so opportunities to encourage energy savings through CHP projects still exist.

Recommendation 3: Create a standing committee with the IESO, LDCs and partners to develop a plan to sustain participation in the Industrial Portfolio following the removal of a popular energy efficiency measure. Investigate the potential for biogas-fueled CHPs in Ontario, as well as other projects that were overshadowed by CHPs.

4.1.5.1 Total CFF Gross Savings

In PY2016, EcoMetric carried out the impact evaluation for the industrial portfolio, including projects in-service in 2016 under the *Conservation First Framework* (CFF) and projects in service in 2015 under the *2011 - 2014 + 2015 Extension Legacy Green Energy Act Framework* (Legacy). Total industrial portfolio gross verified energy savings were 345,417 MWh in the PY2016 evaluation. Verified net first-year energy savings were 297,303 MWh, or 86.1% of gross verified savings, with 57% of savings coming from the LDC-administered programs. Nearly all first-year PY2016 savings across the portfolio (95.3%) persist through 2020.

Solely focusing on the current CFF framework, consisting of projects in service starting in 2016 and later, the industrial portfolio achieved 444,125 MWh of gross first-year energy savings and 111.2 MW of gross summer peak demand savings. The IAP CI program, despite having only 14 of the 704 CFF projects evaluated and reported, accounted for 47% of the CFF industrial portfolio's total gross energy savings.

Projects completed in 2016 in the industrial portfolio achieved 258,954 MWh of gross verified energy savings and 89.6 MW of demand savings. 158,640 MWh of these energy savings and 78.0 MW demand savings were verified as part of the PY2016 evaluation, while 100,314 MWh of energy savings and 11.6 MW of demand savings were verified in the PY2017 evaluation as adjustments. Projects completed in 2017 totaled 185,171 MWh of gross verified energy savings and 21.6 MW of demand savings. Detailed savings by program and implementation year are summarized in Table 10 below.

Table 10: CFF Gross Savings Detail

Project Implementation Year	Evaluation Year	# of Projects Evaluated & Reported	Realization Rate (%)	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)[11]	Persistence of Savings in 2020
Process & Systems Upgrades (PSUP)						
2017	PY2017	16	107.2%	15,586	2.81	100%
2016	PY2017	14	99.9%	51,863	7.40	100%
2016	PY2016	4	101.6%	14,026	2.05	100%
PSUP TOTAL		**34**	**101.5%**	**81,475**	**12.27**	**100%**
Program Enabled Savings (PES)						
2017	PY2017	2	99.6%	428	-	100%
2016	PY2017	1	99.6%	18,491	-	100%
2016	PY2016	1	100.5%	339	0.02	100%
PES PSUP Total		**4**	**99.6%**	**19,259**	**0.02**	**100%**
Energy Manager Non-Incented (EM)						
2017	PY2017	281	94.4%	29,476	3.98	56%
2016	PY2017	157	97.8%	12,027	2.07	81%
2016	PY2016	123	97.9%	19,026	1.76	82%
EM Total		**561**	**96.1%**	**60,529**	**7.81**	**69%**
IAP Capital Incentives						
2017	PY2017	4	100.7%	95,415	10.92	100%
2016	PY2017	0	-	0	0.00	-
2016	PY2016	10	97.6%	111,958	16.31	100%
IAP CI Total		**14**	**99.0%**	**207,373**	**27.23**	**100%**
IAP Retrofit						
2017	PY2017	12	103.8%	6,824	0.79	100%
2016	PY2017	5	103.8%	1,443	0.35	100%
2016	PY2016	10	104.5%	1,293	0.14	100%
IAP Retrofit Total		**27**	**103.9%**	**9,560**	**1.28**	**100%**
IAP Energy Manager Non-Incented						
2017	PY2017	42	93.7%	37,442	3.10	55%
2016	PY2017	11	84.9%	16,491	1.80	91%

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[11] No demand savings are reported for the PES initiative because demand savings were not verified.

Project Implementation Year	Evaluation Year	# of Projects Evaluated & Reported	Realization Rate (%)	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)[11]	Persistence of Savings in 2020
2016	PY2016	11	116.6%	11,997	57.70	100%
IAP EM Total		**64**	**94.6%**	**65,929**	**62.60**	**72%**
Industrial Portfolio Total						
2017	PY2017	**357**	**98.8%**	**185,171**	**21.60**	**84%**
2016	PY2017	**188**	**96.8%**	**100,314**	**11.63**	**96%**
2016	PY2016	**159**	**99.2%**	**158,640**	**77.98**	**98%**
GRAND TOTAL		**704**	**98.5%**	**444,125**	**111.21**	**92%**

4.1.6 PORTFOLIO NET VERIFIED SAVINGS RESULTS

Table 11 includes a summary of net verified savings by program and framework from the PY2017 evaluation. **Net savings for the industrial portfolio evaluated in PY2017 are 85.3% of gross verified savings, indicating low levels of free-ridership, on average, across the programs**. PSUP has the highest NTG ratio at 91.3%. The Energy Manager program has the lowest NTG ratio at 75.8%. The CFF is clearly meeting is goal of creating long-lasting energy savings, as 85% of the PY2017 industrial portfolio's first year energy savings verified in this evaluation persist through 2020. This is typical of programs in the industrial sector, where projects tend to have longer effective useful lives. **There is no spillover attributed to the industrial programs across the portfolio.**

Table 11: PY2017 Net Verified Savings Detail

Program/Year	# of Projects Evaluated & Reported	NTG Ratio (%)[12]	Net Energy Savings (MWh)	Net Summer Peak Demand Savings (MW)	Persistence of Savings in 2020
Process & Systems Upgrades (PSUP)					
2017	16	95.0%	14,774	2.64	100%
2016 Adjustments	14	90.5%	46,647	6.57	100%
2015 Legacy Adjustments	1	93.0%	9,013	0.73	100%
PSUP TOTAL	**31**	**91.3%**	**70,433**	**9.95**	**100%**
Program Enabled Savings (PES)					
2017	2	100.0%	428	-	100%
2016 Adjustments	1	100.0%	18,491	-	100%
2015 Legacy Adjustments	1	100.0%	17,265	-	13%
PES PSUP Total	**4**	**100.0%**	**36,185**	**-**	**59%**
Energy Manager Non-Incented (EM)					
2017	281	71.6%	21,099	2.85	56%
2016 Adjustments	157	86.0%	10,343	1.78	81%
EM TOTAL	**438**	**75.8%**	**31,442**	**4.63**	**63%**
IAP Capital Incentives					
2017	4	83.9%	80,066	9.16	100%
IAP CI Total	**4**	**83.9%**	**80,066**	**9.16**	**100%**
IAP Retrofit					
2017	12	88.4%	6,032	0.70	100%
2016 Adjustments	5	88.4%	1,275	0.31	100%
2015 Legacy Adjustments	2	88.4%	5,347	0.79	100%
IAP Retrofit Total	**19**	**88.4%**	**12,654**	**1.80**	**100%**
IAP Energy Manager Non-Incented					
2017	42	71.6%	26,800	2.22	55%
2016 Adjustments	11	86.0%	14,182	1.55	91%
IAP EM Total	**53**	**76.0%**	**40,982**	**3.77**	**66%**

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[12] Program-level NTG ratios are for illustration purposes only. NTG ratios are calculated each program year for the evaluation sample and applied to the population of each program. For the PSU and IAP CI programs, each project received its own NTG ratio.

GRAND TOTAL	**549**	**85.3%**	**271,762**	**29.31**	**85%**

4.1.6.1 Total CFF Net Savings Results

The total verified net savings for the industrial portfolio under the CFF (PY2017 and PY2016) are summarized in Table 12 below.

Table 12: CFF Net Savings Detail

Implementation Year	Evaluation Year	# of Projects Evaluated & Reported	NTG Ratio (%)[13]	Net Energy Savings (MWh)	Net Summer Peak Demand Savings (MW)[14]	Persistence of Savings in 2020
Process & Systems Upgrades (PSUP)						
2017	PY2017	16	94.8%	14,774	2.64	100%
2016	PY2017	14	89.9%	46,647	6.57	100%
2016	PY2016	4	81.3%	11,397	1.63	100%
PSU TOTAL		**34**	**89.4%**	**72,818**	**10.85**	**100%**
Program Enabled Savings (PES)						
2017	PY2017	2	100.0%	428	-	100%
2016	PY2017	1	100.0%	18,491	-	100%
2016	PY2016	1	100.0%	339	-	100%
PES PSU Total		**4**	**100.0%**	**19,259**	**-**	**100%**
Energy Manager Non-Incented (EM)						
2017	PY2017	281	71.6%	21,099	2.85	56%
2016	PY2017	157	86.0%	10,343	1.78	81%
2016	PY2016	123	86.0%	16,363	1.51	82%
EM Total		**561**	**79.0%**	**47,804**	**6.14**	**69%**
IAP Capital Incentives						
2017	PY2017	4	83.9%	80,066	9.16	100%
2016	PY2017	0	-	0	0.00	-
2016	PY2016	10	98.3%	110,042	16.07	100%

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[13] NTG ratios are calculated each program year for the evaluation sample and applied to the population of each program. For the PSU and IAP CI programs, Program-level NTG ratios are for illustration purposes only, each project received its own NTG ratio.

[14] No demand savings are reported for the PES initiative because demand savings were not verified by the technical reviewer.

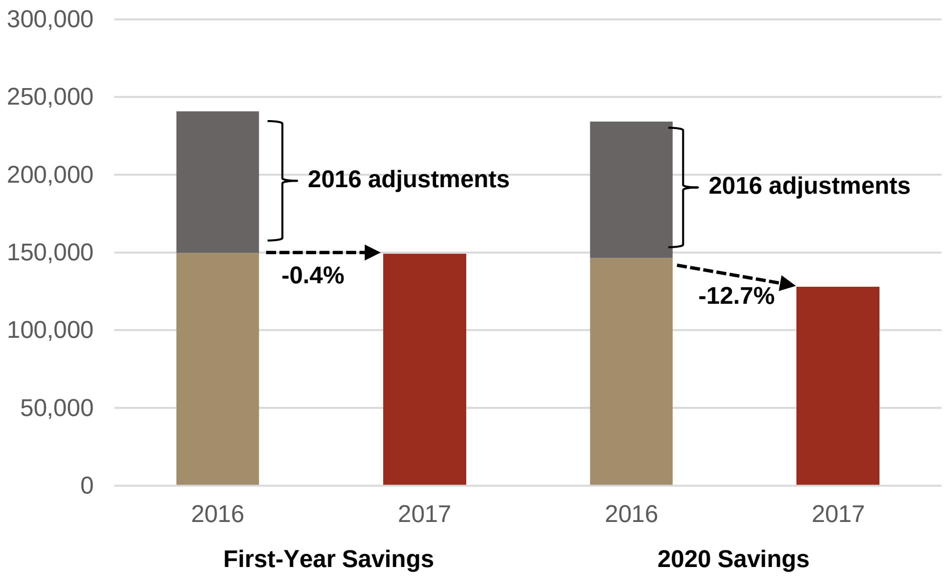
Implementation Year	Evaluation Year	# of Projects Evaluated & Reported	NTG Ratio (%)[13]	Net Energy Savings (MWh)	Net Summer Peak Demand Savings (MW)[14]	Persistence of Savings in 2020
IAP CI Total		**14**	**91.7%**	**190,108**	**25.23**	**100%**
IAP Retrofit						
2017	PY2017	12	88.4%	6,032	0.70	100%
2016	PY2017	5	88.4%	1,275	0.31	100%
2016	PY2016	10	77.0%	1,293	0.11	100%
IAP Retrofit Total		**27**	**90.0%**	**8,600**	**1.12**	**100%**
IAP Energy Manager Non-Incented						
2017	PY2017	42	71.6%	26,800	2.22	55%
2016	PY2017	11	86.0%	14,182	1.55	91%
2016	PY2016	11	86.0%	10,363	67.60	100%
IAP EM Total		**64**	**77.9%**	**51,345**	**71.3.7**	**72%**
Industrial Portfolio Total						
2017	PY2017	**357**	**80.6%**	**149,199**	**17.57**	**84%**
2016	PY2017	**188**	**90.7%**	**90,939**	**10.21**	**96%**
2016	PY2016	**159**	**94.2%**	**149,797**	**86.92**	**98%**
GRAND TOTAL		**704**	**87.8%**	**389,935**	**114.70**	**92%**

As part of the CFF framework, **the industrial portfolio has achieved 389,935 MWh of net first-year energy savings, representing 87.8% of gross verified first-year energy savings during PY2016 and PY2017 and indicating relatively low levels of free-ridership overall**. Growth in the portfolio's net first-year energy savings was relatively flat in PY2017 compared to the 149,797 MWh net first-year energy savings achieved and evaluated in PY2016.

Figure 4 below depicts the CFF industrial portfolio net first-year and persistent energy savings. **Total net first-year energy savings decreased just 0.4% YOY in PY2017, compared to PY2016 results without 2016 adjustment savings.** 2016 adjustment projects, those that were implemented in 2016 but evaluated in PY2017, account for 90,939 MWh of net first-year energy savings—23% of the total portfolio net energy savings achieved through the CFF to date.

In total, 362,153 MWh of industrial portfolio net energy savings achieved under the CFF persist to 2020—93% of net first-year energy savings. The industrial portfolio projects implemented in PY2017 and evaluated in PY2017 had 127,945 MWh of net 2020 energy savings—84% of net first-year energy savings. Compared to PY2016 projects without 2016 adjustments from the PY2017 evaluation, total portfolio net 2020 energy savings decreased 12.7% YOY. The main driver for this decline in savings persistence was the decrease in persistent savings from the IAP Energy Manager non-incented and Energy Manager non-incented programs which experienced an uptick in PY2017 of Operations and Maintenance (O&M) measures that have shorter Effective Useful Lives (EULs).

Figure 4: CFF Industrial Portfolio Total First-Year and 2020 Net Energy Savings (MWh)



4.1.7 COST EFFECTIVENESS RESULTS

EcoMetric utilized the IESO Conservation and Demand Management (CDM) Energy Efficiency Cost-Effectiveness Tool to calculate multiple measures of cost-effectiveness, including the Total Resource Cost Test, the Program Administrator Test, and levelized cost per kWh.

Table 13 includes select program and portfolio cost effectiveness results. Cost-benefit assumptions by program are included in *Appendix D*.

Table 13: PY2017 Cost Effectiveness Results

Admin	Program	TRC Costs	TRC Benefits	TRC Ratio	PAC Costs	PAC Benefits	PAC Ratio	LC $/kWh
LDCs	PSUP	$18,945,012	$10,213,369	0.54	$7,951,054	$12,518,751	1.57	0.05
	PES[15]	-	$51,335	-	-	$818,153	-	-
	EM	$8,492,766	$7,518,719	0.89	$2,459,290	$6,538,017	2.66	0.02
	M&T	$213,180	$0	-	$213,180	$0	-	-
	Total LDCs	**$27,650,959**	**$17,783,422**	**0.64**	**$10,623,524**	**$19,874,920**	**1.87**	**0.04**
IESO	IAP (CI)	$28,022,350	$103,850,375	3.71	$23,516,402	$66,699,817	2.84	0.03
	IAP (Retrofit)	$1,319,671	$4,264,297	3.23	$470,445	$3,708,085	7.88	0.01
	IAP (EM)	$1,856,058	$7,979,385	4.30	$0	$6,938,596	-	-
	Total IESO	**$31,198,079**	**$116,094,058**	**3.72**	**$23,986,847**	**$77,346,497**	**3.22**	**0.02**
PORTFOLIO TOTAL		**$58,849,038**	**$133,877,481**	**2.27**	**$34,610,371**	**$97,221,417**	**2.81**	**0.03**

Overall the Industrial Portfolio was cost effective in PY2017 according to program administrator cost (PAC) test and the total resource cost (TRC) test using a threshold of 1.0. IESO-administered industrial programs in PY2017 had a TRC ratio of 3.72 while LDC-administered Industrial Programs had a TRC ratio of just 0.64. The TRC ratio for LDC-administered industrial programs was brought down by the high natural gas costs of the CHP projects prevalent in PSUP.

Only 2 of 22 CHP projects met the TRC threshold of 1.0 at the project-level. The vast majority of CHP units evaluated in PY2017 resulted in net increased natural gas consumption. The cost of supply for natural gas outweighed the avoided cost of electricity generated by the units.

Finding 4: The cost of natural gas used to calculate avoided costs of natural gas consumption in the IESO's Cost Effectiveness Tool is not frequently updated to reflect current market conditions, resulting in inaccurate calculations that do not account for actual natural gas costs incurred in the fuel market.

- The cost of avoided gas is set at $8.80/MMBtu in the CE Tool, which was first used in 2014 and developed leveraging data from 2007. Since January 1, 2017, the spot market price of natural gas (Henry Hub) has fallen 10%. Market prices for natural gas are extremely sensitive to ever-changing

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[15] PES claims' costs and benefits are included in their respective programs. PES PSUP CE analysis is included in the PSUP CE results in Section 5.1.4.

supply and demand dynamics, as well as unpredictable weather events. The fuel's price volatility is depicted below in Figure 5.

Figure 5: Henry Hub Spot Price for Natural Gas[16]

Recommendation 4: *Update the avoided cost of natural gas used in the CDM Cost Effectiveness Tool on an annual basis to reflect current market conditions. A comparison study of marginal natural gas costs in Ontario and other provinces with similar markets is recommended to ensure the avoided costs used reflect industry practices.*

- The price of natural gas is seasonal, increasing in the winter in the Northern Hemisphere when demand is high for heating. Using just one avoided natural gas cost across the whole year does not account for this seasonality, penalizing projects that create natural gas savings during winter when prices are higher and projects that result in increased natural gas consumption during the summer when prices are lower.

Recommendation 5: *Develop functionality in the Cost Effectiveness tool to account for the seasonality of natural gas prices. Seasonal avoided cost prices of electricity are utilized in the CDM CE tool by leveraging hourly electric load profiles, which should serve as an example for seasonal avoided cost of natural gas.*

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[16] Source: EIA; https://www.eia.gov/dnav/ng/hist/rngwhhdM.htm

4.1.8 PORTFOLIO GREENHOUSE GAS EMISSIONS RESULTS

Net greenhouse gas (GHG) emissions impacts of the industrial portfolio in PY2017 are positive, resulting in net first year emissions reductions of approximately 27,018 metric tonnes (t) of CO_2 equivalent (CO_2e). The largest contributor to GHG reductions is IAP Capital Incentives, resulting first-year GHG reduction of 28,591 tonnes. However, the PSUP and PES PSUP projects in PY2017 increase first-year GHG emissions by a total of 16,083 tonnes due to the considerable increase in natural gas consumption attributable to combined heat and power (CHP) installations.

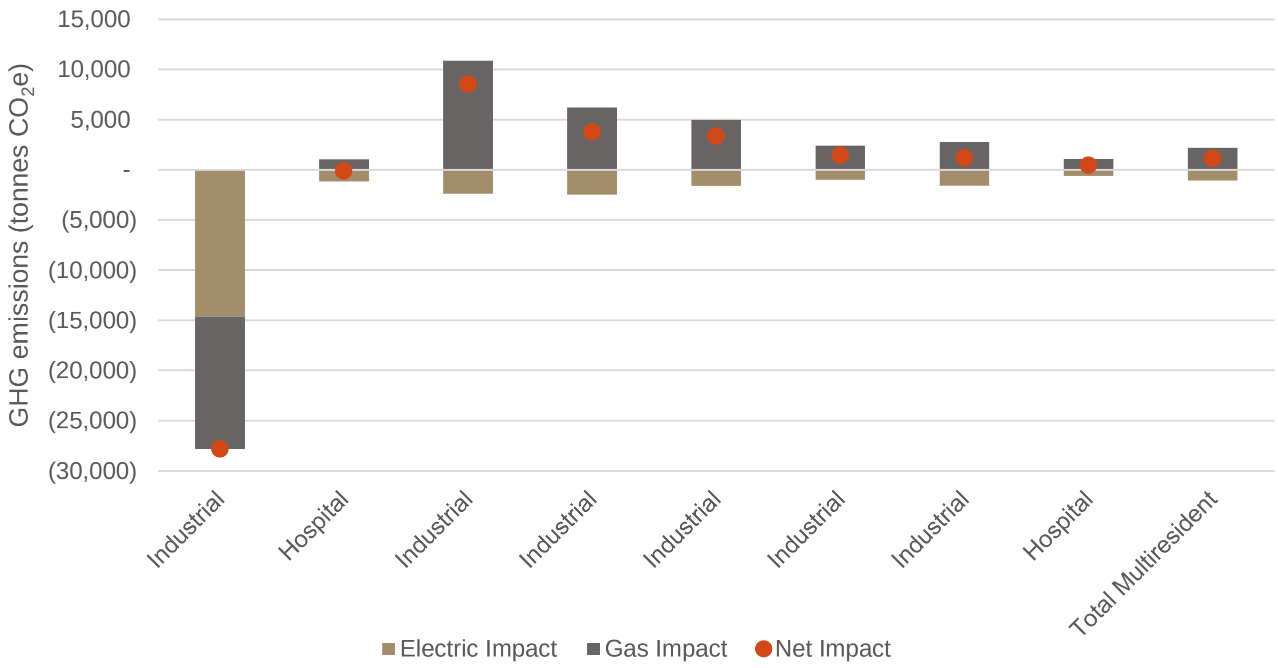
The entire portfolio resulted in a reduction of 45,351 tonnes of GHG emissions from electric savings but increased natural gas consumption created 18,333 tonnes of GHG emissions. As the IESO stopped accepting applications for natural gas-powered CHP units in July 2018, emissions impacts for the industrial portfolio will likely improve through the remainder of the CFF. Cost per tonne of avoided emissions varies significantly among programs, as show in Table 14. The costs presented here are TRC, including both the participants' and the administrator's costs.

Table 14: PY2017 Greenhouse Gas Emissions Impacts

Administrator	Program	First Year GHG Impacts (tonnes CO_2e)			First Year GHG Reduction Costs ($/tonne CO_2e) (Total Resource Costs)
		Electric	Gas	**Total**	
LDCs	PSU	10,551	-14,342	**-3,790**	(15,156)
	PES PSU	4,894	-17,187	**-12,293**	-
	EM	5,476	0	**5,476**	2,277
	M&T	0	0	**0**	-
	Total LDCs	20,922	-31,529	-10,607	(6,592)
IESO	IAP (CI)	15,395	13,196	**28,591**	1,013
	IAP (Retrofit)	2,141	0	**2,141**	1,303
	IAP (EM)	6,894	0	**6,894**	279
	Total IESO	24,430	13,196	37,626	895
PORTFOLIO TOTAL		**45,351**	**-18,333**	**27,018**	**3,835**

As shown in Figure 6, behind-the-meter generation (BMG) projects have complex emissions impacts, where avoided GHG emissions from electric savings are often counteracted by increased GHG emissions resulting from more natural gas consumption. Out of 39 total PSUP, PES PSUP and IAP Capital Incentive projects evaluated in PY2017, 22 are BMG—specifically CHP units. CHP units typically reduce electric consumption at the expense of increased consumption of natural gas. The negative numbers in the "Gas" column of Table 14 show these increases.[17] Due to the prevalence of CHP units in the LDC-administered programs and their increased natural gas consumption, the 31,529 tonnes of GHG emissions created by the natural gas consumption outweigh the 20,922 tonnes of GHG emissions reduced by electric savings.

Figure 6: BMG Project GHG Emissions



Out of 22 CHP units evaluated, only two resulted in a net decrease in GHG emissions. One of these units was implemented through the IAP CI program at a large industrial refining facility, resulting in major GHG reductions of 27,809 tonnes from both electric and natural gas savings. This project was the only CHP unit in the PY2017 evaluation that resulted in natural gas savings, as it was designed to offset a highly inefficient natural gas-fired steam generation supply. The other CHP that resulted in a net decrease of GHG emissions was implemented at a hospital where the unit's electric savings resulted in enough GHG reductions to outweigh the GHG emissions created by the increased natural gas consumption.

The most common implementation of CHP units in the PY2017 evaluation was at multiresident housing to generate electricity and offset loads for space and water heating. All 14 of the CHP units implemented at multiresident facilities resulted in increased natural gas consumption and increased net GHG

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[17] The Conservation and Demand Management Energy Efficiency Cost Effectiveness Tool calculates the GHG emissions of projects as "impacts" where a positive number represents savings or reduced emissions in tonnes and a negative number represents emissions increases in tonnes.

emissions. However, these units are much smaller than industrial and hospital applications and the combined net emissions increased only 16 tonnes.

4.2 INDUSTRIAL PORTFOLIO PROCESS EVALUATION RESULTS OVERVIEW

There are structures, procedures, and components that exist across all programs in the IESO portfolio and are most efficient to view as cross-cutting elements. This includes the broader environment – such as policy drivers or LDC delivery strategies – or components like data tracking or marketing. There are four findings for this section related to four topics:

- Variation in LDC implementation
- Program awareness
- Portfolio customer experience
- Program overlap and competition

Each of these are described in more detail below.

4.2.1 VARIATION IN LDC IMPLEMENTATION

Smaller LDCs with fewer resources and less experience with the complex industrial programs often feel less comfortable explaining them to customers. They often rely heavily on the Technical Reviewer to help them understand the rules. LDCs vary in the size of their customer base, internal resources, and time spent with the industrial programs, all of which impact how they promote and deliver these offerings:

- **Customer base**: LDCs can have as few as one or as many as several hundred customers eligible to participate in the industrial programs. Nearly 80% of the LDCs surveyed had fewer than 50 customers, but there were many at the extremes: 13% had over 100 customers, and 18% had just one to four.
- **Internal resources**: LDCs tend to have small teams focused on the industrial programs. Roughly 30% of respondents fell in each of the three smallest categories: less than one employee (i.e., shared with other commercial programs or even with other LDCs), one employee, or two to three employees. Only one LDC had more than five people on their industrial team.
- **Time spent on industrial programs**: While 82% of LDC respondents had an industrial program participant in the last year, such large projects may be few and far between for some LDCs.
- **Role in the CDM portfolio**: Since industrial projects tend to be quite large, they also play a key role for many of the LDCs. Nearly a third of the respondents stated that the industrial programs are extremely important to meeting their CDM goals (a 10 rating on a 0–10 scale). A total of 57% said they were important (eight and above). This leaves 43% of LDCs for whom the industrial programs

do not represent a major focus due to their customer base, assessment of savings potential, or internal resources.

These inherent differences in population and resources inevitably lead to some variations in implementation practices as well, mostly to match the LDCs' effort around the programs to their abilities:

- **Management**: LDCs use a variety of internal data tracking systems and processes to track leads, projects, and savings, ranging from large Customer Resource Management (CRM) tools to internally developed databases, or Excel or Google Drive spreadsheets. Many rely on receiving project data directly from the Technical Reviewer or IESO.
- **Marketing**: Availability of internal resources plays a big role into how proactive the LDC can be in reaching out to customers to explain the program. In addition, just over a third of LDCs have some form of channel partner network to assist in bringing in projects. The LDC's ability to offer value-added services like trainings or technical advice and support are also dependent on staff time and funding.
- **Program understanding**: Smaller LDCs that do not have as much experience with customers participating in the industrial programs tended to feel less comfortable with their ability to walk customers through the rules and process. They often rely heavily on the Technical Reviewer to provide education on the program rules to both the LDC staff and to the customer, and they appreciate the support. Over a third of LDCs mentioned the high quality of their communication with the Technical Reviewer, particularly when there was a question on program rules. Four small LDCs requested additional materials and training that would help them more quickly get up to speed on the programs when a customer became interested. Though these LDCs are small, they still represent roughly 20-40 industrial customers between them and two had industrial program participants in the last year. Two of the four considered the industrial programs very important (a 9 on a scale of 10) to hitting their CDM goals (the others were a 5 and a 1). Program rules "refresher" training was also mentioned by two of the ten LDCs (one medium, one small) interviewed during the Phase 1 evaluation in PY2016.

Process Finding 1: Smaller LDCs are often less confident in their understanding of the complex industrial programs.

Process Recommendation 1: Develop training for the PSUP, EM, and M&T programs, given to the LDCs, that cover their rules, processes, and the LDC responsibilities.

- Smaller LDCs with less experience in the industrial programs – generally because they have fewer large customers and thus less chance to go through the participation process – requested resources that would help them quickly become acquainted with the program and help customers who might be interested. This is also helpful for LDCs with recent turnover.

- The LDCs requesting materials are small and have a smaller impact on the program portfolio; however, they still represent a not insignificant number of customers and potential participants.
- Given the recent PSUP redesign, the timing is good to ensure that all LDCs understand the program, the changes, and the LDC's role in customer projects. Likewise, the EM program was the least recognized of the industrial offerings (see Process Finding #2, below) and may be less promoted than PSUP. Finally, depending on what is decided for the M&T program, IESO should either provide a training that explains how customers can use alternative programs to achieve similar ends or a training after the program is redesigned.

Although the programs are intended to be largely identical in terms of the rules and incentives across LDCs, there were two examples of places where the LDCs had some discretion in how they provide funding: engineering studies and EMs. The motivating factor behind these was the shift in program fiscal responsibility from the IESO to the LDCs at the start of the CFF, and some LDCs wanted to ensure that their funding for these enabling initiatives would result in actual energy savings. As a result, they increased the level of upfront screening and/or modified the incentives to promote additional project work.

When asked if they were aware of other LDCs implementing the programs differently from them, the most common response was around funding the engineering studies. Interestingly, there were a total of nine different funding mechanisms mentioned, from 0% funded to 100% funded:

- Do not fund engineering studies
- Do not fund engineering studies for CHP
- Rarely fund studies – case-by-case basis only
- Determination of study funding is on a case-by-case assessment
- Do not accept studies for the maximum incentive amounts, as consultants often try to max out the incentive regardless of need
- 50% funded
- 50% funded when the study is complete, and the rest is funded once the project is complete
- 100% funded but only once project is complete
- 100% funded (this is the original funding mechanism; the incentive amount would be deducted from the project incentive)

The recent PSUP redesign process adopted the “50% funded after the study, 50% funded after the project” mechanism for engineering studies and did away with the incentive deduction in the original rules. The evaluators will continue to monitor the impact of the PSUP redesign and whether the new funding mechanism eliminates most differences in how studies are funded.

There is also some evidence that a few LDCs have eliminated the salary-based option for EMs and only offer the performance-based option, similar to how IAP incentivizes its EM facilities. This does not represent a concern; other LDCs seem to use the salary-based option as a way to give more unsure facilities a taste of the program before encouraging them to move to the potentially more lucrative performance-based option.

Although LDCs may have unique considerations that they tailor their efforts to, they often run into similar challenges and successes implementing the CFF programs. Many LDCs are part of joint CDM plans, where several LDCs pool their goals and funding to more efficiently offer the programs and receive additional collaboration funding. These joint plans are particularly attractive for small LDCs. Some LDCs also have formed consortiums where they can meet to discuss the programs or meet through other industry organizations such as AESP. Since the LDCs are not competing and have similar experiences, the LDCs will often share findings; the smaller LDCs often rely on the largest LDCs for their expertise in running less-used, more complex offerings like the Industrial programs.

LDC program differences tend to reflect healthy functional tailoring of the programs to needs and resource constraints rather than unintended disconnects between them. Most variations in how the LDCs implement the programs stem from their unique characteristics, including the size of their customer base, internal resources, and time spent with the industrial programs. The two examples of LDCs tailoring the programs themselves come from places where they were given discretion to determine how to handle funding.

4.2.2 PROGRAM AWARENESS

Before a customer can participate in a program, a key contact at the business must become aware of the program and be motivated to pursue it for his or her facility. Due to the complex nature of the facilities and the projects that could fit into the industrial programs, both the LDCs and IAP use direct outreach to customers through calls, emails, and in-person meetings. This is both effective and appreciated, with many participants commenting in interviews on the level of support they received. The long-term upkeep of those relationships is very important to both LDCs and IAP – all 10 LDCs interviewed in Phase 1 stated they try to meet with their largest accounts at least once a year, and the IAP staff likewise try to meet with their far-flung customers in-person whenever possible. This helps the program staff gain rapport as an energy advisor to the customer. **Direct outreach is the primary method for raising awareness of the program offerings.** The overwhelming majority of LDCs use direct outreach to connect with their industrial customers – 95% of LDCs stated that they use direct outreach, and 68% said it was their primary technique. However, this is not the only technique used. Channel partners and events/trade shows were the next most commonly used techniques by 76% and 71% of LDCs, respectively. For primary methods, it was LDC general account managers (13%), followed by channel partners (11%).

The importance of channel partners, and how engaged the LDC is with them, varies widely. Also known as trade allies, channel partners are energy technology vendors that sell the efficient products or study services that can receive incentives. Since they are already meeting with customers and trying to close deals, they are often valuable in educating customers about programs and helping them through the process. While 76% of LDCs use channel partners to help drive projects, only 37% have some form of channel partner/trade ally network to engage these vendors. These networks range from formalized efforts with training sessions and an annual awards ceremony to an infrequent email distribution list and are used to increase vendor awareness and engagement (and therefore participation) through information sharing, training, and recognition. While larger LDCs were more likely to have a channel partner network, there is still room for network building at all LDC size ranges as shown in Table 15.

Table 15: LDCs with Channel Partner Networks by Size

Size - number of eligible customers[18]	**Number of LDCs**	**Number with channel partner networks**	**Percentage with channel partners**
100+	5	4	80%
50-99	2	1	50%
20-49	11	5	45%
10-19	8	2	25%
5-9	5	1	20%
1-4	7	1	14%
Total	**38**	**14**	

A few LDCs noted that their channel partner networks were focused on the Retrofit program; three had even observed their channel partners trying to steer customers away from PSUP to Retrofit so that they didn't have to deal with the complex requirements. Interestingly, two LDCs said they did not have a channel partner network because they wanted to remain impartial with vendors in their territory – this may represent an education opportunity, as such networks are generally open to all interested vendors.

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[18] LDCs were asked to estimate the number of customers that would likely be large enough to be eligible for one of the industrial programs.

Process Finding 2: Only a little over a third of LDCs have some form of channel partner network, and several commented that their vendors tend to focus on either CHP or Retrofit projects.

Process Recommendation 2: Encourage and help LDCs without channel partner networks to develop them. Conduct further research to identify the appropriate channel partner networks to develop and leverage into increased program participation. Compare with trade ally networks established in other markets.

- Some LDCs already have robust networks and utilize regular email updates, meetings, events, and even awards to build relationships with channel partners. Highlighting existing successes from those LDCs or giving them the opportunity to briefly explain their structure as part of a presentation would provide good examples for other LDCs to implement and more motivation to do so.
- As a related effort, the LDCs and IESO IAP staff should collaborate on developing a list of channel partners with demonstrated experience and knowledge with process efficiency projects for PSUP/IAP. Some LDCs commented that their trade ally networks tend to have vendors focused on Retrofit; most vendors with PSUP experience are CHP vendors and can no longer bring those projects to the program. LDCs and the IESO IAP staff should make a concerted effort to engage the vendors who can still participate in PSUP/Process & Systems with large efficiency projects, which may also help in meeting savings goals after the phase-out of natural gas fired CHP.

Most LDCs believed that their outreach efforts were working: 79% of LDCs said that 70% or more of their industrial customers were aware of the program offerings. That was backed up by the nonparticipant surveys, where 75% of respondents had heard of the Save on Energy programs. When asked about specific offerings, 76% knew about Retrofit options (lighting, HVAC) and 64% knew about process efficiency/equipment upgrades through PSUP.[19] Nonparticipants were also segmented into three groups by their savings potential – large, medium, and small – and perhaps unsurprisingly, the large group had the greatest awareness of all five Save on Energy offerings, as shown in Figure 7 below.

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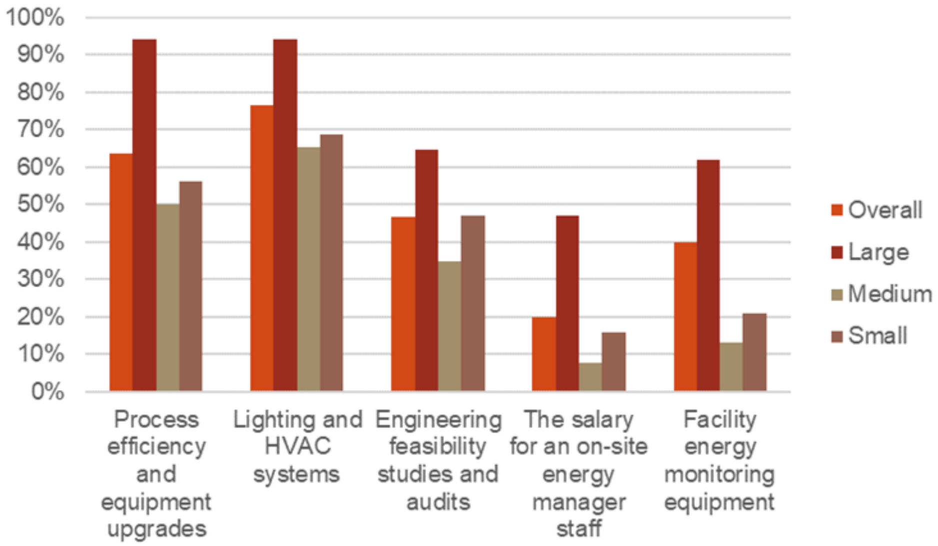
[19] Seven nonparticipants said they hadn't heard of Save on Energy, but later stated that they were aware of incentives available for particular measures, which explains how the overall awareness for measures could be higher than for the umbrella program. Other respondents who had heard of Save on Energy were unaware of the specific offerings.

Figure 7: Nonparticipant Awareness of Save on Energy Industrial Program Offerings



Almost all large facilities are aware of the PSUP and Retrofit offerings; over 60% are also aware of the incentives for studies and monitoring equipment. Overall, the EM program had the lowest awareness from all three segments - only 20% of respondents knew about it, half as many as the next category. The large segment, which would be best suited for the EM program, still only had a 47% awareness of it. This dropped dramatically to 8% and 16% for the medium and small facilities, respectively. As only half of large nonparticipants, and just two of 26 medium nonparticipants, knew about the EM program, this represents an opportunity for additional promotion of the offering.

Interestingly, the medium category had lower awareness than the small facilities for all offerings. It is unclear what is driving this discrepancy.

Process Finding 3: Nonparticipants are generally aware of the Save on Energy programs and offerings with the exception of the EM program.

Process Recommendation 3: Increase nonparticipant awareness of the EM program by raising the profile of the program.

- Despite the EM program's excellent satisfaction scores and role as an enabling program, only 50% of large nonparticipants and much smaller percentages of medium and small nonparticipants know about the Energy Manager program. This could be due to fewer marketing materials, less attention paid to it in LDC outreach to potential customers, less of an understanding/interest of the program for some smaller LDCs resulting in little outreach, and/or facilities not knowing to look for an incentive (it's plausible that a customer might think, "I'm performing this project – I wonder if any rebates are available?" due to the prevalence of equipment rebates, but it is far more unlikely they would think, “I’m hiring a facility manager – I wonder if any incentives are available?”) There are many ways to go after increasing awareness; here are two suggestions:

- Include more EM case studies and success stories on the Save on Energy website, and make it very clear which facilities have EMs, what the EM’s role is, and the successes they worked to bring about. While six case studies on the Save on Energy website list “Energy Management” as one of the facility’s efforts, few describe the EM’s role beyond their involvement in the main project that the brief highlights. LDCs should also host case studies from their customers on their own websites where possible.
- Many LDCs do not have EMs and/or do not appear to actively promote the program (at least four small LDCs did not offer it to customers). Some of that is due to a lack of understanding or experience with the program, which should be helped by Process Recommendation #1. IESO – or LDC collaboration groups – might also consider creating a “toolkit” on best practices on promoting and managing the program based on successful LDC experiences (i.e. a factsheet, one-page printable case studies, even outreach talking points).

4.2.3 PORTFOLIO CUSTOMER EXPERIENCE

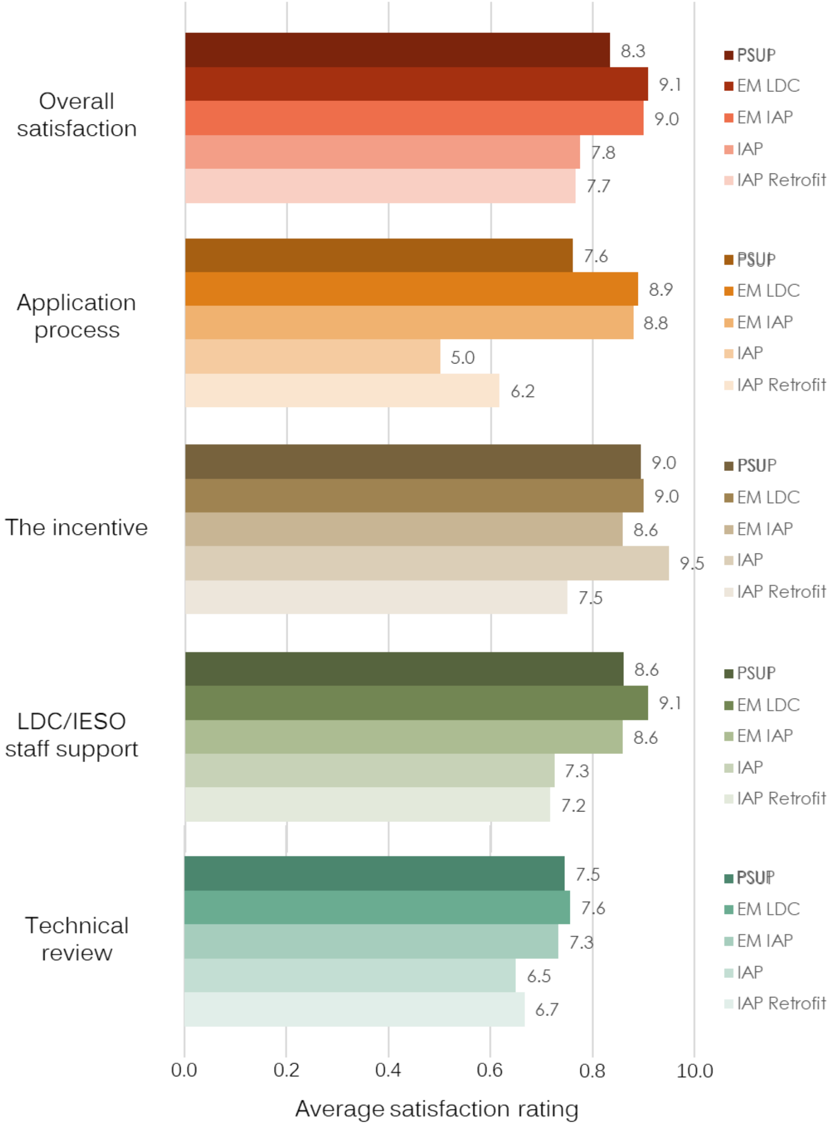
The participant interviews conducted with the NTG evaluation include a short battery of satisfaction questions regarding the customer’s experience with the program. In PY2017, a total of 48 interviews were conducted, as shown in Table 16 below.

Table 16: Completed Participant Interviews by Program

Participant interviews	Interviews
PSUP	23
EM - LDC	10
IAP	4
IAP Retrofit	6
EM - IAP	5
Total	**48**

The questions asked on a scale of 0 to 10, with 0 as very unsatisfied and 10 as very satisfied, how satisfied customers were with various aspects of the program (overall, the application process, the incentive, IESO/LDC support, and the technical review). Figure 8 shows the average satisfaction scores for each program and aspect from the participant interviews.

Figure 8: Satisfaction Ratings by Program and Aspect



These scores are fairly similar to the ones seen in the PY2016 evaluation; the evaluators will continue to monitor satisfaction ratings to look for longer-term trends. Some of the key takeaways:

- **Participants generally were satisfied with their experiences with the industrial programs.**
- The EM program received the highest satisfaction scores for almost all program aspects, including overall (see discussion, Section 5.2.6.1).
- IAP participants reported the highest satisfaction of any of the programs for the IAP Process & Systems incentive (referred to in this report as IAP Capital Incentive or IAP CI); however, in all other

aspects, IAP CI and IAP Retrofit received lower satisfaction ratings than other programs (see discussion, Section 5.3.6.1 and 5.3.6.2).

- The aspects generally receiving the highest satisfaction scores were the incentive, IESO/LDC support for PSUP and EM, and the application process for the two EM programs.
- The aspects receiving the lowest satisfaction scores were the technical review, the application process for IAP CI and IAP Retrofit, and the IESO support for IAP CI and IAP Retrofit (see discussion, Section 5.3.6.1 and 5.3.6.2).

Each program section features a callout box with the satisfaction scores for that program.

4.2.4 PROGRAM OVERLAP AND COMPETITION

The Save on Energy and IAP offerings operate within a larger environment of incentive programs to optimize customers' energy choices. Arguably, these programs are all variations on a theme to make Ontario's energy systems more efficient, but they can overlap and even compete with each other for customer attention and funding. This topic has been elevated in the past year, with both IESO and LDC staff requesting research into the impact the program overlap has on the CFF industrial programs.

There are three sets of programs that significantly overlap with the CFF industrial programs:

1. **Gas utility incentive programs**: Some of the major natural gas utilities in Ontario (such as Union Gas and Enbridge Gas) also offer conservation funding for energy efficiency projects, overseen by the Ontario Energy Board (OEB).

2. **The Industrial Conservation Initiative (ICI)**: ICI is a program developed by the Ontario government in 2010 to allow Class A customers (those above 1 MW of demand) to pay their portion of the Global Adjustment (GA) – part of the electricity commodity price – based on their load contribution to the five days with highest peak load rather than as a flat rate. The intent was to encourage conservation from the largest energy users on those days, and users have the ability to decrease the amount they pay on an annual basis by reducing their load. Customers over 5 MW are automatically enrolled and can choose to opt out; all customers between 1 and 5 MW and industrial customers between 500 kW and 1 MW can choose to opt in.

3. **Greenhouse gas (GHG) reduction programs**: In addition to cap-and-trade, which many industrial customers participated in, there were several programs funded primarily from cap-and-trade proceeds offering incentives for GHG reductions. GreenON Industries and TargetGHG were two of these programs. Cap-and-trade, GreenON, and several other initiatives were disbanded as of early July 2018.

The gas utility incentive programs have long existed in the same space. The competition here is generally seen as minor, and some LDCs and IESO staff have expressed a desire to work together more frequently. Currently, there is little formal collaboration with the gas utilities and the CFF programs, though individual LDCs may do joint pilot programs or joint site visits for CHP projects. To be able to collaborate on a project, the entities must figure out how to stack incentives without allowing double-counting, and without muddying the attribution evaluation results.

The ICI and GHG reduction programs, on the other hand, had become a subject of concern for program managers by the start of the PY2017 evaluation. While overlap with the GHG programs were included in the research, interview/survey questions, and analysis, the data collected is now out-of-date and is not included here. The remainder of this section focuses on overlap with the ICI.

Industrial Conservation Initiative

At least one question on ICI was included on every interview and survey conducted for the process evaluation this year, for a total of 189 open-ended data points. Just over a third had an opinion on whether ICI affected conservation projects for their customers or facilities. Their opinions fell into four groups: positive, negative, neutral, or no impact, as shown in Table 17.

Table 17: Viewpoints on ICI's Impact on Conservation Projects

Arguments	Proponents
Positive: ICI helps conservation projects.	
1. Conservation projects often reduce demand, so the GA reduction provides an added motivating factor to the project. 2. Conversely, customers looking to reduce on the 5 peaks often look to conservation projects - it's a reason for them to start considering efficiency. (This was especially true as an interest in CHP drove many to PSUP). 3. Some customers prefer permanent demand reductions caused by conservation projects over short-term curtailments to meet the 5 peaks for several reasons: a. They cannot interfere with operations (such as for hospitals) b. They realize that permanent demand reductions are more sustainable for the business than production curtailment c. They are wary of the difficulties in forecasting the peaks: ICI was recently opened to a smaller class of customers and the influx of new participants contributing to the peaks have made them harder to forecast. d. They are concerned that ICI may not be continued in the future 4. One customer noted that having someone to go after GA avoidance projects was the primary reason they got an EM.	LDCs: 10 (37%) Participants: 2 (15%)
Negative: ICI hurts conservation projects.	
1. Conservation is competing for limited capital funding and staff time at a facility, and often loses because ICI is more lucrative and requires less paperwork. 2. Customers that are successful in reducing their GA have much lower electricity costs – this hurts the payback for conservation measures and weakens the business case. 3. Many customers curtail production or shut down parts of their operations to avoid the 5 peaks. This reduces run hours for energy/demand savings calculations and weakens the business case. This also means that if the equipment will be off during the 5 peaks, the customer will be less interested in upgrading it. 4. Customers that are close to the size cutoff for ICI eligibility don't want to drop below the cutoff, as their electricity bills could increase substantially.[20] 5. Many customers came to PSUP looking for incentives for CHP to reduce their GA contribution. Now that CHP has been phased out, there will be fewer customers driven to PSUP. 6. Projects that are explicitly to reduce peak demand are not eligible for PSUP incentives.	LDCs: 12 (44%) IAP staff: 2 (67%)
Neutral: ICI has an impact on conservation projects, but how much is not clear.	
1. Participants, partial participants, and nonparticipants tended to note that the ICI was very important to them and that it had an impact on their decision-making/project selection but provided no evidence on whether the projects were conservation (i.e. process upgrades) or non-conservation (i.e. batteries, demand response).	Participants: 9 (69%) Partial participants: 3 (60%) Nonparticipants: 4 (31%)
No impact: ICI is not related to conservation projects.	

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[20] There was an example of this in the participant interviews: one PSUP participant managed to reduce their facility's load from 5 MW to 2.5 MW, dropping them from Class A and costing the facility an additional $300,000 in electricity costs. Five LDCs listed the ICI eligibility threshold as a barrier for conservation projects.

1. ICI is not a big motivating factor for some facilities, even ones that are required to go through it – they would rather pay the bill than impact operations or prioritize avoidance over other efforts. 2. ICI is not the reason conservation projects don't go through – other barriers are far more important.	LDCs: 5 (19%) IAP staff: 1 (33%) Participants: 2 (15%) Partial Participants: 2 (40%) Nonparticipants: 9 (69%)

The LDCs had mixed opinions on whether ICI helped promote conservation projects or hindered them, with a plurality (44%) voting that the effect was negative. IESO IAP staff (the program manager and business advisors) likewise tended to believe the impact of ICI on their project pipeline was negative. Customers – participants, partial participants, and nonparticipants – mostly conveyed that ICI was very important and had made a big impact on their decision-making and the types of projects they were looking into. However, it was impossible to tell from most responses whether they would eventually support conservation projects or divert resources elsewhere, such as to batteries or demand response.

The customer interviews/surveys also yielded robust statistics that provide a sense of the magnitude of ICI participation:

- 73% of LDC participants and 100% of IAP participants participate in ICI. 95% of LDC EMs are also in ICI.
- 31% of nonparticipants participate in ICI (this could be skewed by the fact that the nonparticipant survey population likely included smaller industrial facilities than the participant population).
- Out of the 68 participant and nonparticipant facilities in ICI, 57% curtail at least part of their production to avoid the 5 peaks. This could support the "negative" view, as curtailment could hurt the value proposition for a conservation measure.
- 55% of LDC participants in ICI and 69% of IAP participants in ICI responded that the project included in the NTG interviews was part of their strategy for ICI. This could support the "positive" view, as there appears to be substantial overlap between the projects, or the "negative" view if those projects were CHP.

While there was no consensus on how much ICI was impacting the CFF programs, it was clear that ICI participation is prevalent and important to most customers. This is an area that the evaluators will continue to monitor in future years.

Process Finding 4: Administrators described significant overlap between IESO energy conservation programs and the Industrial Conservation Initiative (ICI).

- Program staff and participants report mixed opinions on whether the ICI helps or hinders Save on Energy/IAP projects; some believe that the ICI helps prompt conversations on conservation projects, while others feel that the ICI is prioritized for funding and effort within facilities.

Process Recommendation 4: *Leverage the ICI to spur conversations with customers and use it to market to their priorities without making the project explicitly about demand reduction.*

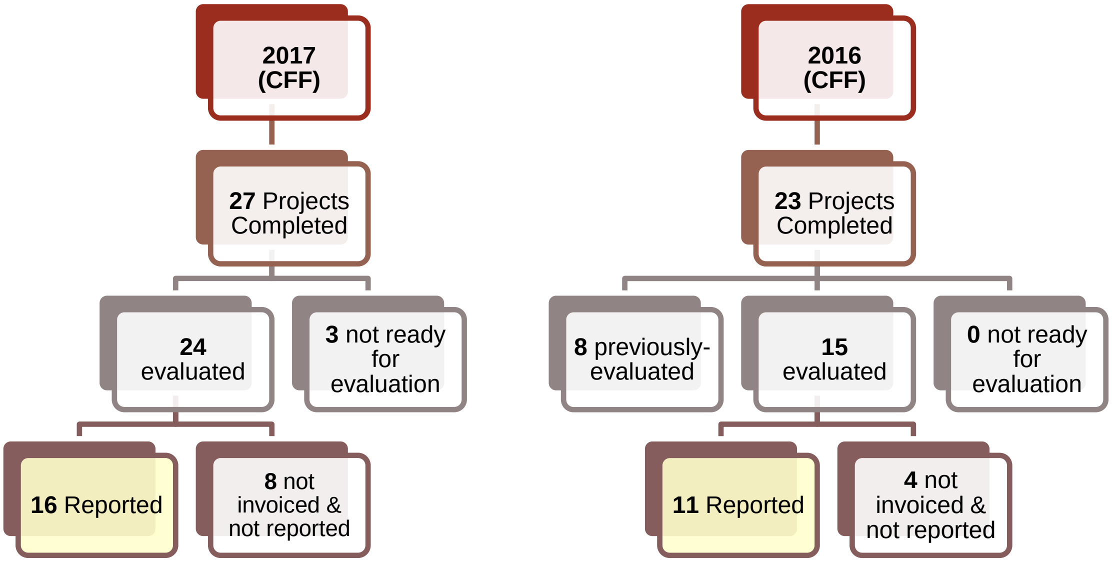
- For example, the permanent reductions in demand caused by an energy efficiency project could reduce their load during the peaks, help the facility even if the ICI program changes, and enable the facility to spend less effort trying to forecast the peaks. An EM could also be used to identify other load-reducing projects.

5 PROGRAM SPECIFIC EVALUATION RESULTS

5.1 PROCESS AND SYSTEMS UPGRADES PROGRAM (PSUP) RESULTS

The Process & Systems Upgrades Program (PSUP) provides financial support for the implementation of energy efficiency projects and system optimization projects for facilities that are intrinsically complex and capital-intensive. Twenty-seven industrial customers completed PSUP projects in PY2017. Twenty-four of these projects had undergone technical review and were ready for evaluation when the sample frame for this evaluation was established on April 1, 2018. Eight of these 24 projects are not included in this report because they have not been invoiced to IESO by the LDCs. Completing the invoicing process for a project is a requirement for savings to be reported. Projects completed and evaluated in PY2017 but did not get invoiced will be reported in the PY2018 results once invoiced. Another 11 projects from PY2016 and one from PY2015 have been carried over to this year's evaluation. In this report, these PY2017 projects and PY2016 and PY2015 adjustment projects are collectively referred to as the PY2017 sample frame. Figure 9 below shows how the PSUP sample frame comprises projects from PY2015 through PY2017.

Figure 9: PY2017 PSUP Sample Frame



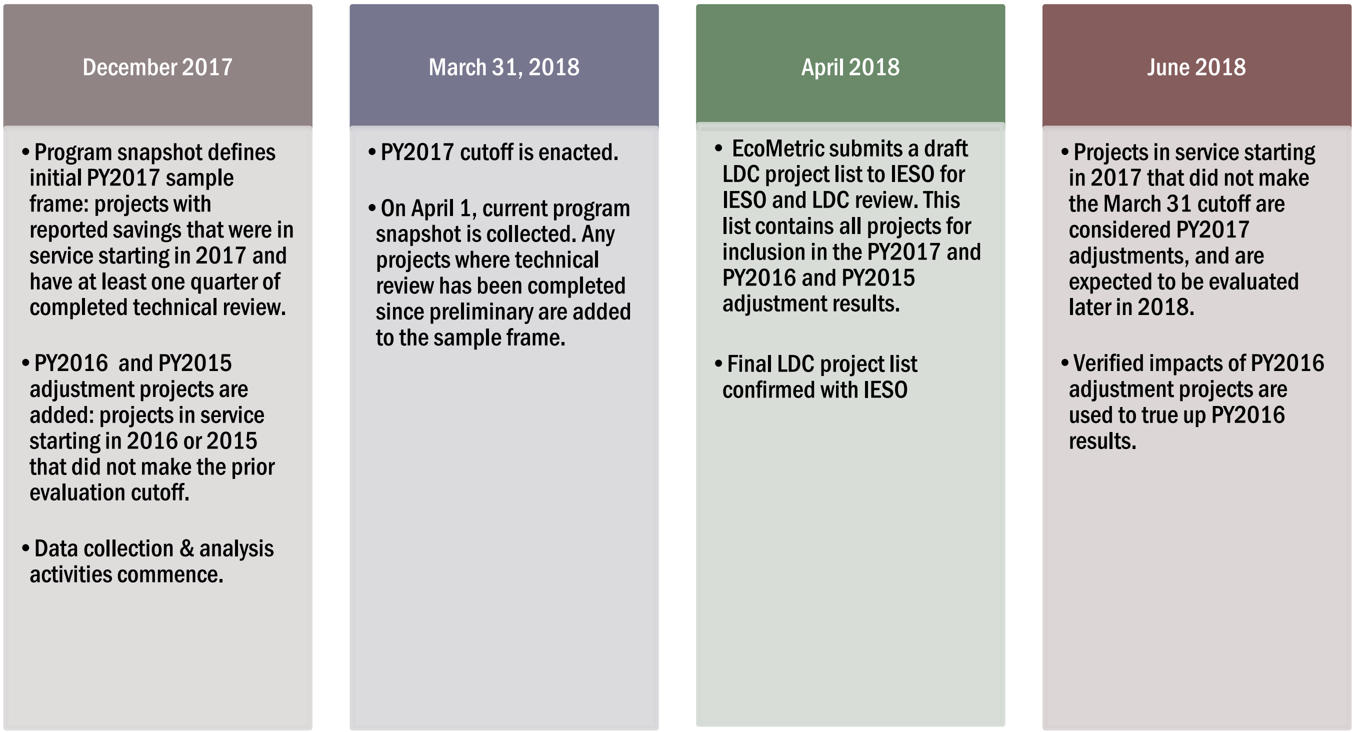
5.1.1 PSUP PROGRAM EVALUATION APPROACH

5.1.1.1 PSUP Sampling

A census of all projects was conducted for PSUP. This program warrants the census approach because of the relatively small number of projects, each with high reported contribution to overall Industrial portfolio savings. However, participation in PSUP has continued to grow throughout the CFF and the increasing number of projects will likely require the gross and net evaluation to utilize sampling in future evaluations.

Figure 10 illustrates the process of defining the PY2017 sample frame for the PSUP Program.

Figure 10: Process for Process & Systems Upgrades Sampling & Program Year Cutoff



December 2017

- Program snapshot defines initial PY2017 sample frame: projects with reported savings that were in service starting in 2017 and have at least one quarter of completed technical review.
- PY2016 and PY2015 adjustment projects are added: projects in service starting in 2016 or 2015 that did not make the prior evaluation cutoff.
- Data collection & analysis activities commence.

March 31, 2018

- PY2017 cutoff is enacted.
- On April 1, current program snapshot is collected. Any projects where technical review has been completed since preliminary are added to the sample frame.

April 2018

- EcoMetric submits a draft LDC project list to IESO for IESO and LDC review. This list contains all projects for inclusion in the PY2017 and PY2016 and PY2015 adjustment results.
- Final LDC project list confirmed with IESO

June 2018

- Projects in service starting in 2017 that did not make the March 31 cutoff are considered PY2017 adjustments, and are expected to be evaluated later in 2018.
- Verified impacts of PY2016 adjustment projects are used to true up PY2016 results.

When projects receive annual M&V only (instead of quarterly), an in-service date late in calendar year 2017 resulted in M&V being unavailable until after the evaluation sample frame was finalized on April 1, 2018, as illustrated in the graphic above. These projects are scheduled for PY2017 adjustment evaluation in Q4 2018.

5.1.1.2 PSUP Data Collection

The primary data source for Process & Systems Upgrades projects was M&V reports, equipment logs, analysis workbooks, and other data and documentation submitted by the technical reviewer in support of reported savings estimates. EcoMetric carefully reviewed the application and annual and/or quarterly M&V reports prepared for each project and facility. This review of project documentation provided an initial understanding of the efficiency upgrades implemented, and just as importantly, how savings from these upgrades have been estimated.

A thorough review of the measurement and verification completed by IESO's technical reviewer enabled EcoMetric to assess the key assumptions and potential areas of uncertainty for each PSUP project. In the rare instances where assumptions were undocumented or appeared inconsistent, EcoMetric flagged them for further investigation. Similarly, if key parameters that would affect the observed savings of the project were not included in established savings estimates, EcoMetric gathered these values and incorporated them into the gross verified savings calculation.

5.1.1.3 PSUP Gross Savings Verification

Gross savings verification methods largely depended on the technology types included in the PSUP efficiency project and were customized on a project-by-project basis. EcoMetric first determined if the savings claim was valid based on information gathered during the data collection stage, including on-site visits. EcoMetric re-calculated savings using the parameter inputs validated or adjusted during the data collection phase. For projects where less than a full year of M&V had been conducted at the time of analysis, EcoMetric annualized savings according to the project parameters and available M&V data.

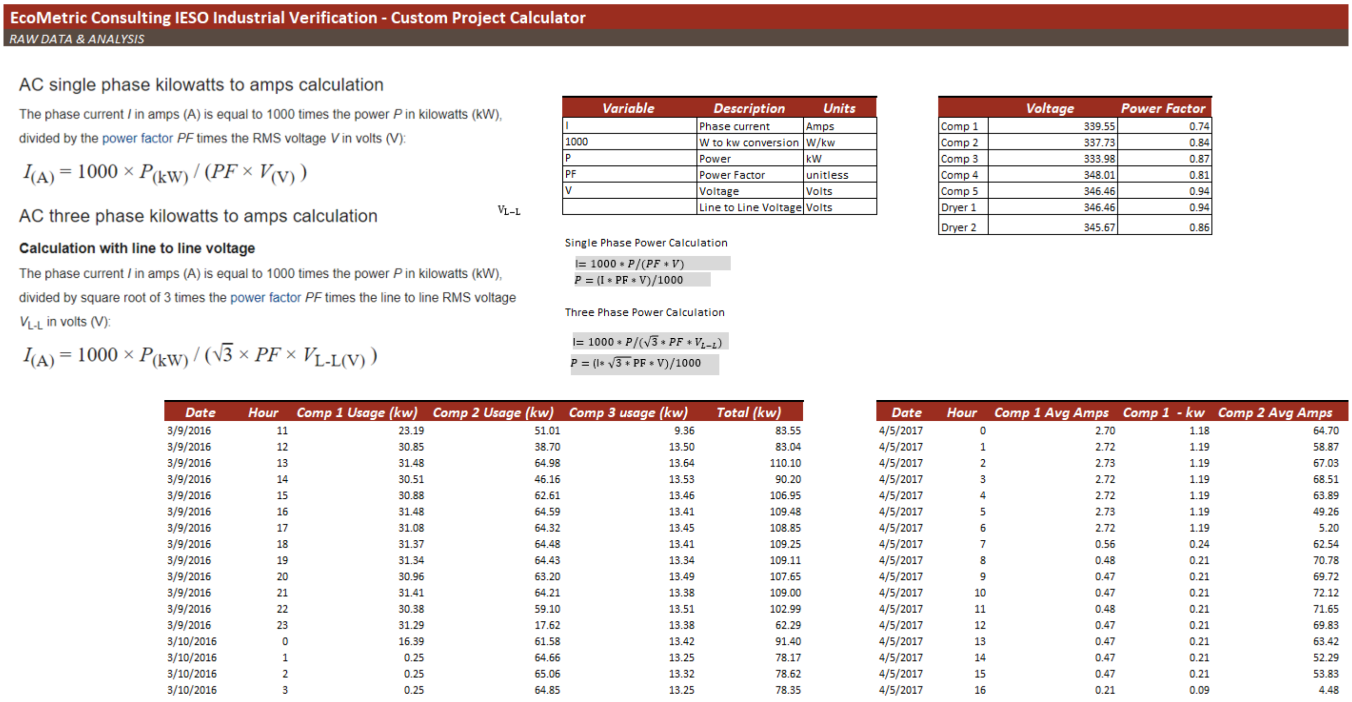
5.1.1.3.1 Gross Savings Verification for CHP projects

The CHP projects had a fairly consistent approach to the analyses. It was established whether the installation of the CHP offset the electrical consumption of any equipment. In almost all cases, the baseline was zero due to there being no difference in the facility operation after the installation. There were a few instances of the baseline being positive due to a piece of equipment being taken offline or replaced due to the CHP installation. Such was the case for a project that replaced a standard mechanical chiller with an adsorption chiller which ran its vapor compression cycle off waste heat produced by the CHP instead of an electric compressor. There was at least a full quarter of data for each of the CHP projects, oftentimes more. For projects that did not have a full year of M&V data, the quarterly data was extrapolated into an annual year, and then adjustments were made based on planned shutdowns.

5.1.1.3.2 Gross Savings Verification for other projects

PSUP projects evaluated outside of CHPs included: compressed air, air conditioners, controls, and VFD projects. Most projects contained at least a quarter of baseline measurement data, and a quarter of post retrofit metered data. Non-routine adjustments included making changes to the power consumption based on changes in production, changes in occupancy, or building additions that would affect the load. Oftentimes metered data was already collected as a power measurement, negating the necessity of applying an average power factor and voltage to the interval data. Metered power measurements are preferential to interval amperage measurements given their higher accuracy of true interval power consumption of a piece of equipment. The process of applying equations to convert amperage to power can be seen in Figure 11 below, a screenshot of one of EcoMetric's custom project calculators. This specific calculator was taken from the evaluation of a PSUP project that installed new compressors and updated sequences of operations for existing compressors.

Figure 11: EcoMetric Custom Project Calculator



EcoMetric Consulting IESO Industrial Verification - Custom Project Calculator

RAW DATA & ANALYSIS

AC single phase kilowatts to amps calculation

The phase current *I* in amps (A) is equal to 1000 times the power *P* in kilowatts (kW), divided by the power factor *PF* times the RMS voltage *V* in volts (V):

$$I_{(A)} = 1000 \times P_{(kW)} / (PF \times V_{(V)})$$

AC three phase kilowatts to amps calculation

V_{L-L}

Calculation with line to line voltage

The phase current *I* in amps (A) is equal to 1000 times the power *P* in kilowatts (kW), divided by square root of 3 times the power factor *PF* times the line to line RMS voltage V_{L-L} in volts (V):

$$I_{(A)} = 1000 \times P_{(kW)} / (\sqrt{3} \times PF \times V_{L-L(V)})$$

Variable	Description	Units
I	Phase current	Amps
1000	W to kw conversion	W/kw
P	Power	kW
PF	Power Factor	unitless
V	Voltage	Volts
	Line to Line Voltage	Volts

	Voltage	Power Factor
Comp 1	339.55	0.74
Comp 2	337.73	0.84
Comp 3	333.98	0.87
Comp 4	348.01	0.81
Comp 5	346.46	0.94
Dryer 1	346.46	0.94
Dryer 2	345.67	0.86

Single Phase Power Calculation

$I = 1000 * P/(PF * V)$

$P = (I * PF * V)/1000$

Three Phase Power Calculation

$I = 1000 * P/(\sqrt{3} * PF * V_{L-L})$

$P = (I * \sqrt{3 *} PF * V)/1000$

Date	Hour	Comp 1 Usage (kw)	Comp 2 Usage (kw)	Comp 3 usage (kw)	Total (kw)
3/9/2016	11	23.19	51.01	9.36	83.55
3/9/2016	12	30.85	38.70	13.50	83.04
3/9/2016	13	31.48	64.98	13.64	110.10
3/9/2016	14	30.51	46.16	13.53	90.20
3/9/2016	15	30.88	62.61	13.46	106.95
3/9/2016	16	31.48	64.59	13.41	109.48
3/9/2016	17	31.08	64.32	13.45	108.85
3/9/2016	18	31.37	64.48	13.41	109.25
3/9/2016	19	31.34	64.43	13.34	109.11
3/9/2016	20	30.96	63.20	13.49	107.65
3/9/2016	21	31.41	64.21	13.38	109.00
3/9/2016	22	30.38	59.10	13.51	102.99
3/9/2016	23	31.29	17.62	13.38	62.29
3/10/2016	0	16.39	61.58	13.42	91.40
3/10/2016	1	0.25	64.66	13.25	78.17
3/10/2016	2	0.25	65.06	13.32	78.62
3/10/2016	3	0.25	64.85	13.25	78.35

Date	Hour	Comp 1 Avg Amps	Comp 1 - kw	Comp 2 Avg Amps
4/5/2017	0	2.70	1.18	64.70
4/5/2017	1	2.72	1.19	58.87
4/5/2017	2	2.73	1.19	67.03
4/5/2017	3	2.72	1.19	68.51
4/5/2017	4	2.72	1.19	63.89
4/5/2017	5	2.73	1.19	49.26
4/5/2017	6	2.72	1.19	5.20
4/5/2017	7	0.56	0.24	62.54
4/5/2017	8	0.48	0.21	70.78
4/5/2017	9	0.47	0.21	69.72
4/5/2017	10	0.47	0.21	72.12
4/5/2017	11	0.48	0.21	71.65
4/5/2017	12	0.47	0.21	69.83
4/5/2017	13	0.47	0.21	63.42
4/5/2017	14	0.47	0.21	52.29
4/5/2017	15	0.47	0.21	53.83
4/5/2017	16	0.21	0.09	4.48

In this example, the compressors were metered for a year prior to the installation of new variable speed compressors, and a year after the new compressors were installed. Spot measurements were taken to determine the instantaneous power factors and voltages. The metering data was collected in amps, and using the average power factor and voltage, converted to hourly power consumption.

5.1.2 PSUP TRACKING SYSTEM & PROGRAM DOCUMENTATION REVIEW RESULTS

Tracking system data and program/project documentation for the PSUP program was provided by the Technical Reviewer. In general, the documentation was thorough and allowed for a robust verification of energy and summer peak demand savings.

5.1.3 PSUP GROSS VERIFIED SAVINGS RESULTS

PSUP projects can be divided into two general categories: behind-the-meter generation (BMG) projects and energy efficiency (EE) projects. **Realization rates across PSUP project categories are relatively close to 100%, ranging between 98.8% (2016 BMG) and 111.2% (2017 EE).** PSUP project-level energy RRs range from 168.5% to 93.5%. PSUP project-level peak demand RRs range from 283.8% to -379.0%. The project with the -379% demand realization rate was reported to have a demand increase but was verified to have significant demand savings.

Table 18: PY2017 PSUP Gross Verified Savings Results

Framework/Project Type	# of Projects Evaluated	Energy Realization Rate (%)	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)	Persistence of Savings in 2020
2017					
BMG	10	99.2%	4,749	0.57	100%
EE	6	111.2%	10,837	2.25	100%
2017 Total	**16**	**107.2%**	**15,586**	**2.81**	**100%**
2016 Adjustments					
BMG	7	98.8%	37,034	4.98	100%
EE	7	102.7%	14,829	2.42	100%
2016 Adj. Total	**14**	**99.9%**	**51,863**	**7.40**	**100%**
2015 Legacy Adjustments					
BMG	1	104.8%	9,691	0.79	100%
EE	0	n/a	-	-	n/a
2015 Adj. Total	**1**	**104.8%**	**9,691**	**0.79**	**100%**
GRAND TOTAL	**31**	**101.9%**	**77,140**	**11.00**	**100%**

PY2017 PSUP gross verified energy savings are 101.9% of reported savings. Measurement and verification activities and technical reviews are generally resulting in highly accurate estimates of energy savings.

Finding 5: Two PSUP projects were reported to have summer peak demand *increases* following the technical review stage but were verified to have summer peak demand *savings* in the savings audit.

- It was unclear how the technical reviewer reached the conclusion of a summer peak demand increase for these projects.

Recommendation 6: Ensure the technical reviewer accurately calculates and reports summer peak demand savings as defined by the IESO for all PSUP projects.

- While the focus of the CFF is on energy savings more so than demand savings, accurate demand savings are integral for cost effectiveness analyses, as well as bulk system and local planning.

Finding 6: Several PSUP projects relied on spot measurements as short as 90 minutes to extrapolate a year of data.

- Spot measurements were a program requirement on equipment that used current transducers instead of kw meters to collect the instantaneous power factors and voltages. There were instances throughout the program where a piece of equipment did not have a metering period and spot measurements were used. A day or less of spot measurement data can be insufficient as a basis of extrapolation if the equipment being metered would have a seasonal or even daily variations such as a chiller pump.

Recommendation 7: In the case where measurement data is unavailable, interviews with the participant should be conducted and nameplate data should be recorded to inform the technical reviewer and allow the development of an annual profile with inputs from the spot measurements, in lieu of extrapolation of brief spot measurement data.

Recommendation 8: The implementer should always meter equipment using kW meters.

- KW meters would save both the implementers and evaluators time in converting amperage reading into power readings and would be more accurate as the power factor and voltage for a piece of equipment will vary with different modes of operation. Applying an average voltage and average power factor to interval amperage data will not have the same reliability as true power measurements.

BMG projects are typically larger in size, and account for 94% of verified gross energy savings in the PSUP program. The average energy RR for PSUP BMG projects (99.5%) is slightly lower than for EE projects (106.1%), as shown in Table 19 below. For demand savings, EE projects have a significantly higher average RR (1,196.8%) where BMG projects have an average RR of (99.6%). The average demand RR for EE PSUP projects is extremely high due to two projects that had reported demand increases that were verified to have demand savings.

Table 19: PSUP Realization Rates by Project Type

Project Type	Average Energy RR	Average Demand RR
BMG	99.9%	96.6%
EE	106.1%	1,196.8%

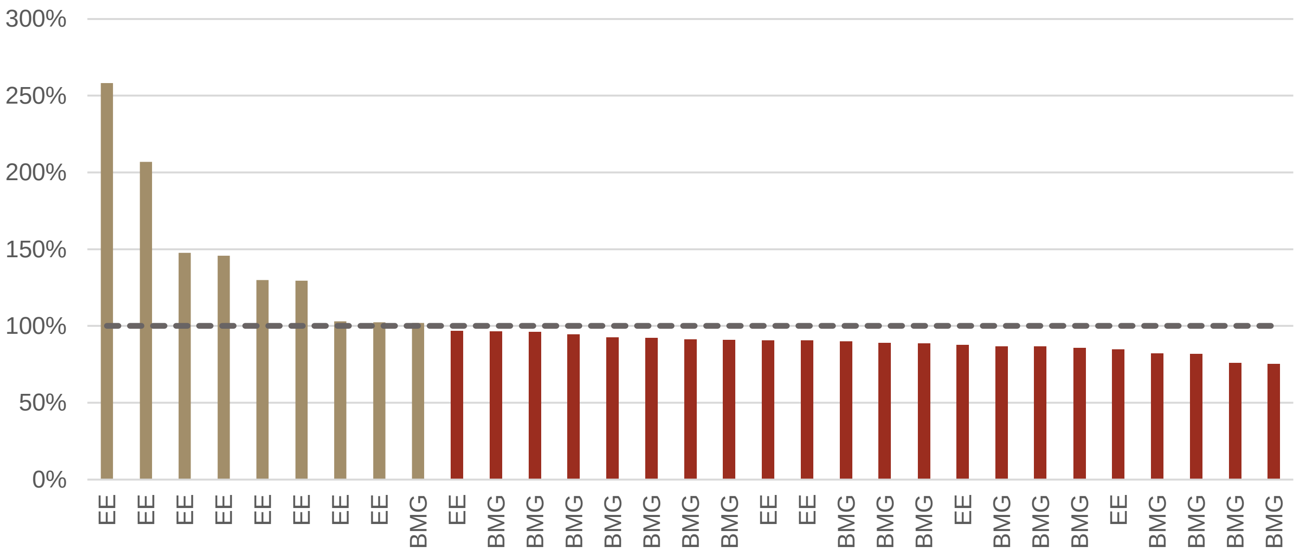
5.1.3.1 PSUP Performance against Anticipated Savings

PSUP program rules specify that project incentives are recalculated following the project's actual performance after one year of M&V against anticipated savings calculated before the project is installed. As shown in Figure 12, **9 out of 31 PSUP projects exceeded or met their anticipated savings**. **Of the 18 BMG projects in the PSUP program, only one project exceeded its anticipated savings.** Meanwhile, eight of the 13 PSUP EE projects exceeded anticipated savings, with several far exceeding anticipated savings. **Overall, the PSUP projects evaluated in PY2017 achieved 91% of their combined anticipated savings**. This suggests success in calculating anticipated savings, as well as strong performance of the projects once in service.

BMG PSUP projects that failed to meet anticipated savings fell short for reasons including:

- Lower than expected facility electrical demand for a CHP system in the performance period, resulting in much lower than expected operational hours at peak capacity; and
- Several unexpected shut-down periods after the in-service date for a CHP system

Figure 12: PSUP Savings Performance Results



5.1.4 PSUP NET VERIFIED SAVINGS RESULTS

Total net first-year energy savings for PSUP projects evaluated in PY2017 are 70,433 MWh, 91.7% of gross verified savings. Net demand savings for PSUP total 9.95 MW. Free-ridership is 8.3% and spillover directly attributable to the program is 0%. These components of NTG are described below Table 20.

Table 20: PY2017 PSUP Net Verified Savings Results

Framework/Project Type	# of Projects Evaluated	NTG Ratio[21]	Net First-Year Energy Savings (MWh)	Net Summer Peak Demand Savings (MW)
2017				
BMG	10	94.0%	4,458	0.53
EE	6	95.5%	10,316	2.11
2017 Total	**16**	**95.0%**	**14,774**	**2.64**
2016 Adjustments				
BMG	7	94.3%	34,916	4.70
EE	7	76.0%	11,731	1.87
2016 Adj. Total	**14**	**90.5%**	**46,647**	**6.57**
2015 Legacy Adjustments				
BMG	1	93.0%	9,013	0.73
EE	0	n/a	-	n/a
2015 Adj. Total	**1**	**93.0%**	**9,013**	**0.73**
GRAND TOTAL	**31**	**91.7%**	**70,433**	**9.95**

Free-ridership - BMG projects on the whole had larger average savings than EE projects, but they varied widely from small multifamily projects to large-scale installations in excess of 10,000 MWh. Especially for the larger BMG projects, interviews revealed that the decision-making is more likely to be made independent of IESO/LDC program incentives. While the energy cost reductions and program benefits were viewed favourably by the BMG project interviewees, these large projects were, on average, more likely to be implemented without program incentives.

Spillover – While there was no spillover credited to PSUP through the interviews, there was significant spillover identified during the PSUP interviews. Overall, 30 out of the 31 PSU interviewees indicated that they have completed or plan to complete additional projects through the PSU or other LDC programs. However, in all cases the customers expect to receive program incentives from their LDCs for these

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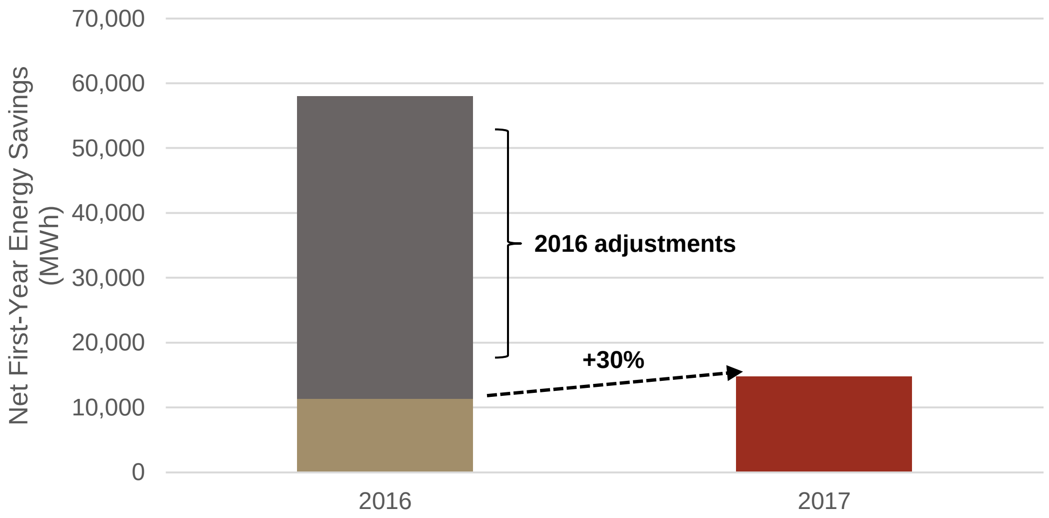
[21] BMG and EE ratios are for illustration purposes only. NTG ratios are calculated each program year for the evaluation sample and applied to the population of each program. For the PSU program, each project received its own NTG ratio.

projects. While this cannot be counted as spillover for PSUP, it shows the value that PSUP plays in encouraging continued project activity for its customers.

5.1.4.1 Total CFF PSUP Net Savings

Figure 13: Total CFF PSUP Net First-Year Energy Savings



As part of the CFF framework, the PSUP program has achieved 72,818 MWh of net first-year energy savings, representing 89.4% of gross verified first-year energy savings. Eighteen PSUP projects that were implemented in 2016 have been evaluated and reported through PY2017, totaling 58,044 MWh net first-year energy savings. 2016 adjustment projects, those that were implemented in 2016 but evaluated in PY2017, account for 46,647 MWh of net energy savings—80% of the total PSUP net energy savings achieved through the CFF to date. PSUP projects tend to be large and complex, often demanding more time to be technically reviewed and made ready for evaluation than projects in the rest of the industrial portfolio.

The 16 PSUP projects implemented in PY2017 and evaluated in PY2017 had 14,774 MWh of net first-year energy savings. **PSUP net first-year energy savings increased 30% YOY in PY2017 compared to the 11,397 MWh net first-year energy savings achieved and evaluated in PY2016.** Only 4 PSUP projects were implemented and evaluated in PY2016, compared to 16 in PY2017. While the net savings per project has declined YOY, participation in the program has increased.

100% of energy savings achieved through the PSUP under the CFF persist through 2020.

5.1.5 PSUP COST EFFECTIVENESS RESULTS

As shown in Table 21, PSUP is cost effective in PY2017 from the PAC test perspective using a benefit/cost threshold of 1.0[22]. However, the PSUP program fails to meet the benefit/cost threshold of 1.0 under the TRC test. Cost-benefit assumptions are included in *Appendix F: Cost-Effectiveness Assumptions.*

Table 21: PY2017 PSUP Cost Effectiveness Results

TRC Costs	TRC Benefits	TRC Ratio	PAC Costs	PAC Benefits	PAC Ratio	LC $/kWh
$18,945,012	$10,264,703	**0.54**	$7,951,054	$12,775,809	**1.61**	0.05

At the project-level, the average TRC of BMG projects in the PY2017 PSUP was just 0.16. Fourteen of the 21 CHP projects that were installed through the PSUP were in multifamily residential apartments. The CHPs in these apartments were mainly installed to offset the domestic hot water thermal load. This is not an ideal situation to utilize a CHP system. Ideally, a CHP by nature of the system increases in usefulness when there is a large thermal and power load to fulfill. Such was the case for the lone CHP project in IAP described in *Section 5.3.5*.

The total present value of avoided natural gas benefits for PSUP BMG projects implemented in PY2017 is -$4.05M. CHP projects, which made up the majority of the program's energy savings, resulted in increased natural gas consumption and the high cost of supply for the gas outweighed the avoided cost of electricity generated by the units. As such, "avoided natural gas benefits" were actually negative, representing the additional costs incurred to power the CHP units with natural gas. The cost of natural gas supplied to these units proved detrimental to the TRC ratio of PSUP. These costs are inflated due to the out of date avoided costs of natural gas in the current CE Tool. (See Recommendation #4).

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[22] PSUP cost effectiveness analysis includes benefits and costs from PY2017 PES PSUP claims.

5.1.6 PSUP PROCESS EVALUATION RESULTS

EcoMetric observed two findings for this program, related to two topics:

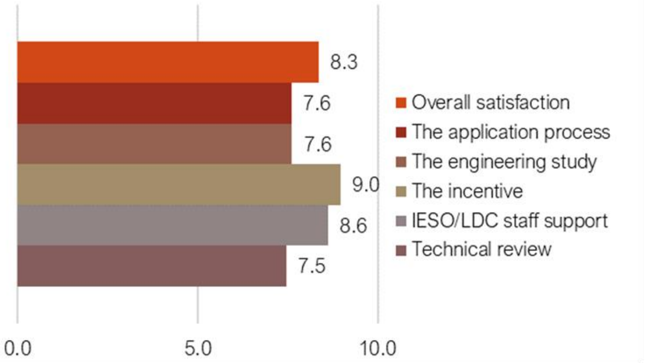
- Program redesign
- CHP phase-out

Each of these are described in more detail below.

PSUP Participant Perceptions

Number interviewed: **23**
Percentage that intend to participate with a Save on Energy program in the future: **91%**

Satisfaction scores
(0 = very unsatisfied, 10 = very satisfied)



5.1.6.1 Program Redesign

The LDCs and IESO recently completed a program redesign process through the Business Working Group, which made a number of changes to PSUP in order to streamline and simplify it in response to LDC and customer feedback. The revised rules were posted on April 6, 2018 and went into effect one month later.

Major changes from the program redesign include:

1. The project type was simplified to either energy efficiency or generation, and small capital projects were eliminated. Projects must deliver 300 MWh of savings (revised from 100 MWh for small and 350 MWh for standard projects). This increase is due in part to the acknowledgement that many EE projects can go through Retrofit – this keeps PSUP to the largest projects.

2. An opportunity for overperformance was added – the incentive is the lower of 70% of eligible costs or "the product of the Electricity Savings multiplied by $200/MWh *capped at 120% of the Approved Amount*." The Approved Amount is the estimated participant incentive when the application is approved.

3. The preliminary and detailed engineering studies are collapsed to a single Engineering Feasibility Study, which is still required to do a project.

4. The contract length is shortened to four years for energy efficiency, four years for generation worth less than $1M in incentives and kept at 10 years for generation more than $1M in incentives.

5. The M&V period is shortened to one year, but the customer must maintain data for the duration of their contract for the LDCs' right to audit.

6. The engineering study funding is revised so that 50% of the incentive is paid when the study is completed, and the remaining 50% (up to $50,000) is paid if the project is submitted for implementation within 12 months of the study being approved.
7. The upfront process for calculating incentives is revised. Originally, the savings and the incentive were estimated upfront during the application review process; as long as the project kept within 80% of the estimate, it received the incentive. Now, while savings and the incentive are estimated upfront, the actual incentive amount is determined based on the first year of M&V.

The rules were also reorganized to be easier to follow; the overall effort had the effect of reducing the rules document from 50 pages to 25. In addition to the program rules, there were several periphery documents also revised after the redesign, including:

- The customer contract (called the participation agreement), which was revised with the new rules and streamlined substantially, bringing the page count from over 70 to around 20.
- The application workbook
- Several LDC-facing materials, including a program guide and customer selling points.

Several of these adjustments were also discussed in the Phase 1 process evaluation[23], including revising the engineering study funding mechanism (Preliminary Recommendation #2), adding an overperformance incentive, and shortening the participation agreement (Preliminary Recommendation #4).

Since this evaluation covers projects completed in PY2017, the customers did not experience the effects of the redesign, and thus the interviews and satisfaction represent perspectives on the original set of program rules. IESO is allowing existing PSUP applications (either submitted or approved, but before contracting) to be converted to the new program rules.[24] After May 7, 2018, all new studies or projects followed the new program rules. While it is possible that the PY2018 evaluation will start to see the effects of the redesign – particularly with the two-step NTG surveys, which will interview the customer shortly after contracting – projects submitted in mid-2018 are unlikely to complete the required M&V to be

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[23] Please find the Phase 1 Process Evaluation Results in the PY2016 IESO Industrial Evaluation Report here: http://www.ieso.ca/-/media/files/ieso/document-library/conservation/emv/2016/2016-industrial-programs-evaluation-report.pdf?la=en

[24] "Program and Systems Upgrades Program Rules Implementation Update," Conservation E-Blast, April 18, 2018. Accessed at: http://www.ieso.ca/en/sector-participants/conservation-delivery-and-tools/conservation-e-blasts/2018/04/program--systems-upgrades-program-rules-implementation-update

included in the evaluation until PY2019. As a result, it may be several years before the full effects can be felt.

Some of the indicators IESO expects to see and the evaluators can study in future work include:

- An increase in large efficiency PSUP applications relative to pre-redesign
- Decreased administrative costs for the LDCs
- An increase in study-to-project conversion rates
- An increase in customer satisfaction

The evaluators will continue to monitor the effects of the redesign throughout the remaining years of the CFF. The redesign is intended to remove or reduce several major customer pain points, such as with the participation agreement. One of the largest customer complaints is around the application review process, and it is not yet clear to what extent this process has been streamlined by the changes (particularly #7 in the list above). The crux of the issue is not the application requirements themselves – those seem to be at least mostly understood and accepted – but the amount of time and effort spent with information requests (IRs) to provide the Technical Reviewer with enough data. If an application does not have enough data for the Technical Reviewer to estimate savings within a certain degree of confidence, the reviewer will request additional data in the form of IRs. This could be because an application itself was deficient, or the project is unique enough that the data was not included as a requirement on the application.

The subsequent back-and-forth can take a substantial amount of time; anecdotes from interviews suggest that a fair number of PES claims originate from projects where the customer pulled out if the application process was taking too long. The application review barrier is an even larger source of customer complaints for IAP, where the projects may be more complex, there are fewer CHP projects, and the facility is more likely to put together the application rather than relying on a consultant or vendor. This is covered in more detail in *Section 5.3.6.2*.

Process Finding 5: The application review process remains a major customer pain point for PSUP.

Process Recommendation 5 (PSUP/IAP): Develop measure-specific applications or accompanying guidance to limit the number of information requests (See also Recommendation 13, Section 5.3.6.2, for IAP).

- The technical reviewer should determine what types of data they often request in IRs and whether the data was missing or not requested in the application.

- IESO should then consider revising the application, developing an application amendment, or including more detailed guidance as an accompaniment to the application based on this review. Making the applications or guidance measure-specific for the most common 4-5 measures would also ensure that relevant information is captured upfront for each. This would ultimately save both Technical Reviewer and customer time from having to track down additional unexpected information.
- The PSUP and IAP application processes are similar; this recommendation is repeated for IAP in *Section 5.3.6.2*.

5.1.6.2 CHP Phase-Out

Natural gas-fired CHP was phased out as an eligible measure for PSUP and IAP incentives on July 1, 2018. The definition of BMG was adjusted to exclude fossil fuel-fired CHP, leaving BMG based on by-product heat of fuel from the facility, in a ministry directive released October 26, 2017.[25] The motivation was the increase in GHG emissions due to increased natural gas use at facilities implementing CHP; the PY2016 impact evaluation found that PSUP resulted in a net increase of 20,322 tonnes CO2e from its CHP projects.

Interviews from the Phase 1 process evaluation, which occurred before the phase-out was announced, revealed that IESO and the LDCs were already aware of rumors that CHP would no longer be incentivized. At the time, four LDCs stated that the majority or entirety of their industrial pipelines were CHP and losing that as a measure would effectively eliminate their chances of hitting their goals. When the announcement was made, the evaluators added a question to this year's LDC survey that assessed how concerned the LDC was with hitting their CDM goals without CHP. The wide range of responses is shown in Figure 14; an answer of one meant that the phase-out was not a concern at all, and 10 meant that it was a large concern.

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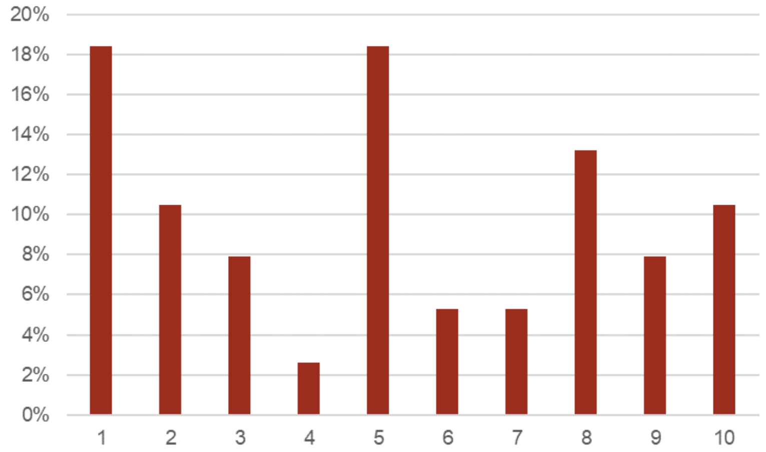
[25] "Amendments to Ministerial Directions Arising from the Long-Term Energy Plan 2017," October 26, 2017. Accessible at: http://www.ieso.ca/corporate-ieso/ministerial-directives

Figure 14: Degree of Concern from CHP Phase-Out to Hitting LDC Goals



Looking at the responses in rough thirds – not much of a concern (1–3), somewhat of a concern (4–7), and a large concern (8–10) – there are slightly more respondents in the first category (37%) than the other two (31%–32%). While the LDCs less concerned about CHP tended to be the smaller ones that either have little opportunity for CHP or are already ahead on their goals, those stating it was a moderate or large concern were a mix of small, medium, and large LDCs.

LDCs for which the phase-out did represent a concern must develop alternative strategies to meet their goals. When asked about their strategies, doing more projects through Retrofit was the most common response followed by efforts to promote specific measures (i.e., compressed air, refrigeration, and other energy-intensive equipment). Other responses included focusing more on the EM or M&T programs, promoting non-gas behind-the-meter generation, or accelerating the timelines for CHP projects to get them in while still eligible. Although only two LDCs mentioned accelerating CHP as a key strategy, the massive uptick in applications just before the July 1, 2018, deadline indicates that this was a tool employed by more.

A small number of program participants mentioned the phase-out during their interviews this year. Four asked that the deadline be extended when asked “how could the program improve”; one respondent said their company did not plan to participate again in the future (compared to 92% of their PSUP peers) because CHP was no longer eligible. Two participants seemed to think that the entire PSU program was being terminated, not just the natural gas-fired CHP. One nonparticipant also mentioned the CHP phase-out.

The CHP phase-out affected LDCs differently; some are taking steps to make up an anticipated savings shortfall, while others did not view it as a challenge. Several participants – and even nonparticipants –

mentioned the phase-out; however, a small number of participants seemed to think that the entire PSUP was being terminated.

5.2 ENERGY MANAGER NON-INCENTED MEASURES (EM) RESULTS

5.2.1 EM NON-INCENTED MEASURES DESCRIPTION AND EVALUATION APPROACH

The Energy Manager program subsidizes the salary of a trained energy manager to work directly with participating facilities to find energy savings, identify smart energy investments, secure financial incentives, and unleash competitive advantage. Energy managers can identify capital improvements that are eligible for incentive payments through PSUP, IAP Retrofit, or IAP Capital Incentives. Savings from these projects accrue to, and are evaluated in, the program that incents the improvement.

Energy managers are also expected to identify and implement *non-incented* improvements for the organizations they support. Since 2016, Energy Manager contracts require that 10% of the savings goal be achieved through non-incented improvements. This is a reduction from the 30% requirement in place previously. These non-incented projects are the focus of the Energy Manager evaluation conducted by the EcoMetric team. Non-incented Energy Manager projects from commercial LDC accounts, industrial LDC accounts, and transmission-connected accounts were evaluated together. This section of the report discusses the evaluation methodology and findings across all types of accounts because the EcoMetric team did not calculate separate realization rates for LDC participants and transmission-connected accounts. The gross and net verified savings values presented in this section of the report focus on LDC accounts.

5.2.1.1 EM Program Observations

The number of Energy Managers with non-incented savings claims and the aggregate energy savings claimed both increased significantly from PY2016 to PY2017. Many of the Energy Managers added in 2017 did not record any non-incented savings in PY2017 because of the timing of their contract start date so we expect program volume will continue to increase in PY2018. The measures implemented in PY2017 were as diverse as the industry across the province and included upgrades to compressed air systems, mining equipment, chilled water plants, fans, pumps, lighting, and refrigeration. Energy Managers and the program technical reviewer classify non-incented measures into different category types. Table 22 shows the distribution of projects and reported energy savings by measure type. The prevalence of operation and maintenance (O&M) and optimization measures is an important theme in the gross verified savings calculations and estimates of measure life.

Table 22: Distribution of Non-Incented EM Projects and Savings by Measure Type

Measure Type	Measure Quantity[26]	Reported Savings (%)
Optimization	98	50%
Equipment Upgrade	105	28%
O&M	47	14%
Other	13	5%
Behavioural	59	2%
Missing (Unclassified)	13	1%
Conservation	1	1%
2017 EM TOTAL	**336**	**100%**

The evaluation team noted an increase in the level of complexity of the non-incented projects completed by Energy Managers in 2017. The 2016 non-incented projects included a fair amount of "low-hanging fruit" measures such as conversion of High-Intensity Discharge (HID) lighting to LED or changing schedules to avoid lighting and ventilating empty areas. In 2017, we observed an increase in optimization and O&M projects where EMs made adjustments to the core business process to reduce energy intensity.

5.2.1.2 EM Sampling

The sample frame for the 2017 impact was all participating organizations with reported kWh savings in the implementer program tracking data on April 1st (n=58). EcoMetric used the participating organization as the sampling unit for the non-incented Energy Manager gross impact evaluation. EcoMetric selected a sample of 17 participating organizations for the impact evaluation. Each of the organizations with over 1,000 MWh of reported savings (n=14) were placed into a certainty stratum and a random sample (n=3) of the remaining organizations (n=44) with reported savings less than 1,000 MWh were selected to complete the sample. For each sampled organization, EcoMetric reviewed all completed non-incented measures with reported kWh savings – both those that received a technical review and ones that did not receive a technical review. The reviewed measures in the sample accounted for 68.2% of the first-year energy savings in the sample frame and the measures that did not receive a technical review accounted for the remaining 31.8% of the reported energy savings in the sample. The evaluation sample included

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[26] Includes all measures completed in PY2017. Measures that were not technically reviewed or invoiced before the sample cutoff date are not included in the savings reported in this evaluation report.

79.4% of all reported PY2017 non-incented savings. Because such a large share of the program savings was evaluated the sampling error was limited. The reported and verified gross energy savings were also well-aligned so the relative precision of the energy realization rate was just ±0.6% at the 90% confidence level.

5.2.1.3 EM Data Collection

The primary data source for non-incented Energy Manager projects in the gross impact evaluation sample were the program tracking data, calculation workbooks, and other supporting documentation submitted by the participating organization's energy manager. This information was supplemented with interviews and supplemental data requests to the energy managers in the sample. No site inspections were conducted for the PY2017 evaluation.

IESO retains an independent implementer to perform technical reviews of a subset of non-incented savings claims and track the progress of Energy Managers towards their goals. The implementer reviews at least 30% of the non-incented projects submitted by each Energy Manager annually and typically focuses their reviews on projects with the largest energy savings. For projects receiving a technical review, the technical reviewer's calculations, notes, and adjustments were also key inputs as they are the source of the reported savings estimates. EcoMetric also reviewed the quarterly and annual term reports prepared by the implementer for each sampled participant. The intent of this initial review is to gain a detailed understanding of each upgrade and how it saves the facility energy.

For projects that were not technically reviewed, no supporting calculations or documentation had been submitted to the implementer, the LDC, or to IESO. In these cases, EcoMetric requested the supporting documents directly from the Energy Manager for review. For the most part, energy managers were able to provide the requested information and were very responsive to technical questions about project details. In a few cases, supporting documentation from the technical review was not available until very late in the evaluation period. This left only a matter of days for the EcoMetric team to interface with the energy managers and limited the depth of review possible by the evaluation team.

The EcoMetric team noted a definite improvement in the quality and transparency of the energy manager and technical reviewer savings calculations. Compared to PY2016, more projects utilized data driven methods in the spirit of IPMVP Options A, B, or C and fewer projects relied on engineering calculations based on equipment sizes and estimated operating conditions. Billing analysis projects were almost all completed using the RETScreen software packages as opposed to the mixture of Excel models observed in PY2016.

For many projects in the evaluation sample, the fact that the verified savings analysis occurred 3-6 months after the technical review afforded the EcoMetric team with additional consumption and trend data that was not available to the implementer during the technical review (because it hadn't happened yet). EcoMetric worked with Energy Managers and LDC representatives to gather the latest billing data, production data, and other key parameters measured by facility energy management systems for use in the savings analysis. In some cases, EcoMetric could gather more granular data (hourly or daily) than was used in the EM or technical reviewer calculations, which allowed for more accurate estimates of the summer and winter peak demand impacts.

5.2.1.4 EM Gross Savings Verification

Each of the 144 measures completed by the 17 participating organizations in the non-incented sample were analyzed separately. The level of rigour of the EcoMetric analysis was consistent with project size. Many of the larger projects were completed using regression analysis to compare the facility loads or loads from a specific process within the facility. Weather was used as an independent variable for several upgrades to military and educational organizations.

5.2.2 EM TRACKING SYSTEM & PROGRAM DOCUMENTATION REVIEW RESULTS

The establishment of ex-ante savings for the non-incented Energy Manager projects required careful communication between EcoMetric, IESO, the implementer, and the LDCs. *Section 5.2.1.2* discusses the development of the sample frame for the impact evaluation activities. EcoMetric relied on the program tracking data maintained by the implementer as the system of record for the reported savings on a project basis. Key elements of the program tracking data are listed below along with observations and recommendations. It's important to note that the intended purpose of the technical review and tracking process is to assess each Energy Manager's performance towards their contractual obligations, which does not perfectly align with programmatic reporting needs of IESO.

Finding 7: Energy Manager program tracking data for PY2017 was very similar to PY2016. It is somewhat less reliable than the data tracked for the other Industrial programs and showed minimal improvements in PY2017.

- The reported kWh savings values for non-incented Energy Manager projects were generally reasonable. In some cases, EcoMetric interviews with EMs and technical reviewers revealed that the savings claims were deliberately conservative to ensure that estimates were not over-stated.
- Peak demand savings claims were less reliable. For many projects with kWh savings, the peak demand impact was reported as 0 kW. For some projects, the savings profile of the measure was exclusively off-peak so zero was the correct value. More often, it appears that peak demand savings just was not calculated by the EM or the technical reviewer. For other EM projects, the peak demand savings estimate stored in the tracking data was equal to the change in the connected load and was not discounted to reflect coincidence with the system peak.

- The ‘Project Costs’ field in the program tracking data was populated inconsistently. Some projects involved capital upgrades but were assigned $0 of project cost. Other projects were just changes to equipment settings, so the only real cost was the Energy Manager salary, which is tracked elsewhere. The difference between zero and missing is important because participant cost is included as cost in the TRC test. If participant cost is not recorded it can’t be included in the TRC costs and the TRC ratio for the program will be overstated. For some projects in the evaluation sample, EcoMetric obtained more accurate cost information, but this data collection really needs to be a point of emphasis for energy managers and technical reviewers
- Several issues were identified with unique identifiers (iConID) for participating organizations. Measures were recorded twice under both Alectra and EnerSource due to the acquisition. We also found energy managers with measures recorded under different iConID values because of transposed digits.
- Measures were recorded as non-incented, but also showed incentive amounts.

Recommendation 9: *Energy Managers and technical reviewers should include participant cost information as this information is critical for program tracking and evaluation purposes. This information should be entered into tracking databases and supported with invoices and other documentation.*

Recommendation 10: *Require that all key tracking parameters (in-service date, project cost, kWh, kW, and EUL) are completed for all measures and that zero values actually reflect the absence of participant cost or peak demand savings.*

5.2.3 EM GROSS VERIFIED SAVINGS RESULTS

EcoMetric reviewed the available documentation and prepared questions prior to reaching out to the Energy Managers in the sample. For 16 of the 17 organizations in the evaluation sample, EcoMetric conducted an engineering phone interview with the Energy Manager – or Energy Managers in the case of organizations who had different EMs across different facilities. For one organization the original Energy Manager had left the company and no new Energy Manager yet hired so the discussion was with a supervisor in the organization who was familiar with the measures. These meetings were used to ask questions about the savings calculations and request updated or additional trend data for the verified savings analysis.

Table 23 shows gross verified energy savings for the LDC Energy Manager non-incented measures in PY2017. **Overall the measures achieved an energy realization rate of 95.3% and resulted in 41,503 MWh of first-year energy savings.** Measurement and verification activities and technical reviews are generally resulting in highly accurate estimates of energy savings in the program. **About 63% of these savings had**

an EUL of enough years for the measure to persist to 2020. The sections below include detailed descriptions of verified results.

Table 23: Energy Manager Gross Verified Savings Results

Program Year	# of Measures Evaluated	Realization Rate (%)[27]	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)	Persistence of Savings in 2020
Energy Manager Non-Incented (EM)					
2017	281	94.3%	29,476	3.98	56%
2016 Adjustments	157	97.8%	12,027	2.07	81%
EM TOTAL	**438**	**95.3%**	**41,503**	**6.05**	**63%**

Table 24 provides the realization rates by stratum for the non-incented Energy Manager projects completed in PY2017.

Table 24: PY2017 Non-Incented Energy Manager Realization Rates by Stratum

Stratum	Energy RR	Demand RR
No Technical Review	91.2%	129.9%
Technically Reviewed	95.3%	92.1%

Figure 15 shows the project-level savings results for the two strata of non-incented Energy Manager projects. The reported savings estimate from the program tracking data is on the x-axis and the verified savings estimate is on the y-axis. The plots on the left side of the figure look at energy and the plots on the right look at summer peak demand. The realization rate can be thought of as the slope of a fitted line through these points. Figure 15 shows that that the correlation between reported and verified energy savings were generally quite good for non-incented Energy Manager projects. The peak demand impacts exhibited significantly more variation between the measure-level reported and verified savings estimates. Peak demand savings from technically reviewed measures showed the same poor correlation as measures that were not technically reviewed.

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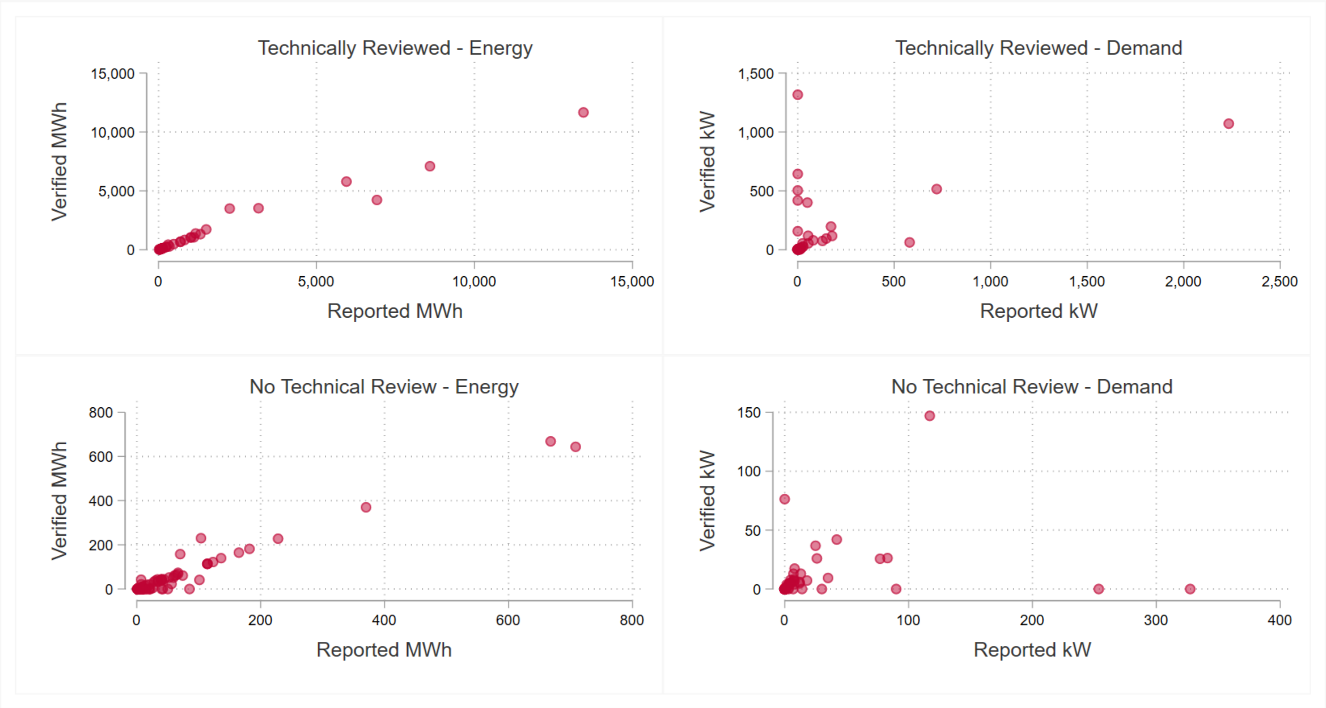
[27] RR is reported at a confidence interval of +/- 2%

Figure 15: Scatter Plot of Reported and Verified LDC Energy Manager Savings Estimates by Stratum



The energy realization rates by stratum were applied to the reported gross savings for each LDC project to calculate the verified gross savings shown in Table 23. Projects that are expected to reach the end of their effective useful life before December 31, 2020 are assigned first-year kWh savings, but no 2020 persistent savings.

Embedded Energy Managers continue to identify and implement successful improvements. The evaluation team observed a transition from “low-hanging fruit” projects to more complex projects in PY2017 compared to PY2016.

Finding 8: The annual energy savings estimates produced by Energy Managers are generally very accurate. There is a tendency for Energy Managers to be overly conservative in their estimates once they have met their contractual obligations.

Recommendation 11: Consider a mechanism to reward Energy Managers for exceeding their required amount of non-incented energy savings. One possibility would be a “carry-over” calculation whereby savings more than the contractually required minimum could be applied to future years in the event of a shortfall. Designing a proper incentive would eliminate the conservative behavior of EMs to target the required minimum savings.

Finding 9: The peak demand savings estimates for non-incented Energy Manager projects are inconsistent or non-existent. Projects are often submitted without peak demand savings estimates. When projects have demand impacts recorded, they are

frequently the change in connected load rather than an estimate of demand reduction coincident with the system peak.

Recommendation 12: Make the quality and completeness of peak demand tracking and reporting a performance metric for technical reviewers. Although goals are based on energy savings, peak demand impacts are a key factor in system planning and cost-effectiveness.

Finding 10: The evaluation team observed Energy Managers using LDC meter data in savings calculations that was adjusted for transmission and distribution losses.

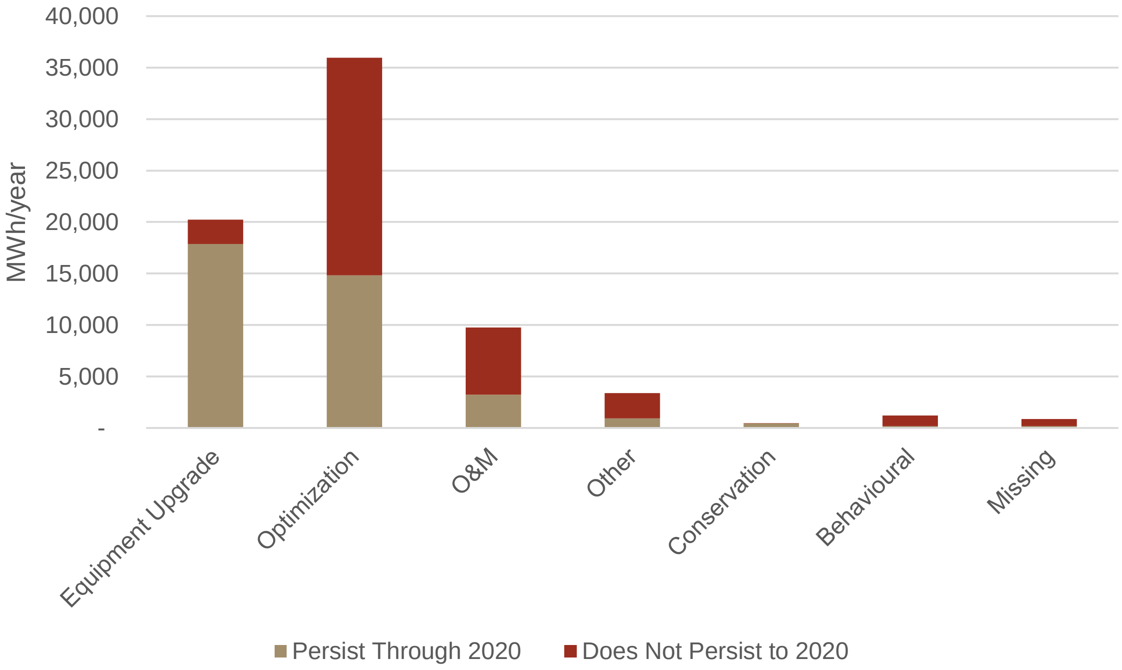
Recommendation 13: All project savings calculations should be performed at the meter-level for goal assessment. Impacts are grossed up for T&D losses as part of cost-effectiveness calculations.

5.2.3.1 EM Savings Persistence to 2020

The persistence of non-incented Energy Manager savings to 2020 varied by LDC. The policy decision to assess progress towards goals via the measurement of 2020 persistent savings places a lot of importance on the estimated measure life of non-incented Energy Manager projects. Consider a project with an in-service date of July 2017 with a three-year EUL. That project would reach the end of its useful life in July 2020 and contribute no savings towards goals. If the same project were installed in July 2018, the savings would persist to July 2021 and savings would count towards goals. The two hypothetical projects would save the same number of kWh, and have virtually the same cost-effectiveness ratio, but have vastly different contribution towards goals. Measuring goals via persistent savings is designed to encourage the installation of long-lasting measures but can have an unintended consequence of discouraging the installation of short-lived options like O&M or behavioural measures early in a program cycle. Some jurisdictions have moved away from persistent savings goals to avoid creating a disincentive for program administrators to install efficiency measures with shorter measure lives.

Figure 16 shows the share of first-year energy savings that persist to 2020 across the 2017 Energy Manager population (LDC and transmission-connected) by measure type**. Overall 52.4% of the 2017 non-incented Energy Manager savings will persist to 2020 and the other 47.6% will expired before 2020**. A large share of the non-incented Energy Manager projects would be categorized as behavioral, process optimization, or retro-commissioning. While successful and low-cost, these types of projects have limited persistence. Persistence considerations will have less impact in 2018 when measures with a 3-year EUL are persistent to 2020. The default EUL assumption of O&M measures is three years.

Figure 16: Energy Manager Non-Incented Measure Persistence through 2020



For projects outside of the sample, the EcoMetric team largely relied on the measure life assumptions supplied by the Energy Managers and technical reviewers. For a small number of projects where equipment was installed, EcoMetric increased the EUL from less than four years to greater than or equal to four years. Similarly, EcoMetric reduced the measure life assumption from greater than or equal to four years to less than four years for a handful of projects where the upgrades consisted of changes to equipment settings or re-commissioning of equipment controls. Where no measure life was reported in the tracking data, EcoMetric estimated an EUL based on the type of project implemented. EcoMetric provides the following findings and recommendations regarding measure life assumptions for non-incented Energy Manager projects.

5.2.4 EM NET VERIFIED SAVINGS RESULTS

Table 25 summarizes the EM non-incented net savings below. **The program-level NTG for the EM non-incented measures was 71.6% for 2017 projects, comprised of a free-ridership score of 28.4% and spillover of 0%.** Total net first-year energy savings for EM projects evaluated in PY2017 was 31,442 MWh and net peak demand savings were 4.63 MW.

Table 25: EM Non-Incented Net Savings

Program/Status/ Framework	# of Measures Evaluated	NTG Ratio (%)[28]	Net Energy Savings (MWh)	Net Summer Peak Demand Savings (MW)
Energy Manager Non-Incented (EM)				
2017	281	71.6%	21,099	2.85
2016 Adjustments	157	86.0%	10,343	1.78
EM TOTAL	**438**	**75.8%**	**31,442**	**4.63**

Free-ridership – Generally, energy managers were perceived by customers as key players in project identification, analysis, and documentation. While in some cases the customers indicated they would likely have pursued the projects in question regardless of whether they had an energy manager, in most cases the interviewees felt that energy managers were instrumental in speeding up project implementation and ensuring that all required documentation and savings estimates were accounted for.

Spillover – While there was no spillover credited to the EM program through the interviews, there was significant spillover identified during the energy manager interviews. All except one interviewee indicated that they have completed or plan to complete additional projects through the energy manager or other LDC programs. However, in all cases the customer expects that the program-supported energy manager will continue to have an instrumental role in project identification, savings estimation, and implementation either as non-incented energy manager projects or incented under Retrofit or PSU. While this cannot be counted as spillover for the program, it is a testament to the overall strength of the Energy Manager program.

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[28] The EM total NTG ratio is for illustrative purposes only, representing total net verified savings divided by total gross verified savings.

5.2.4.1 Total CFF EM Net Savings Results

Figure 17: Total CFF EM Net First-Year Energy Savings (MWh)

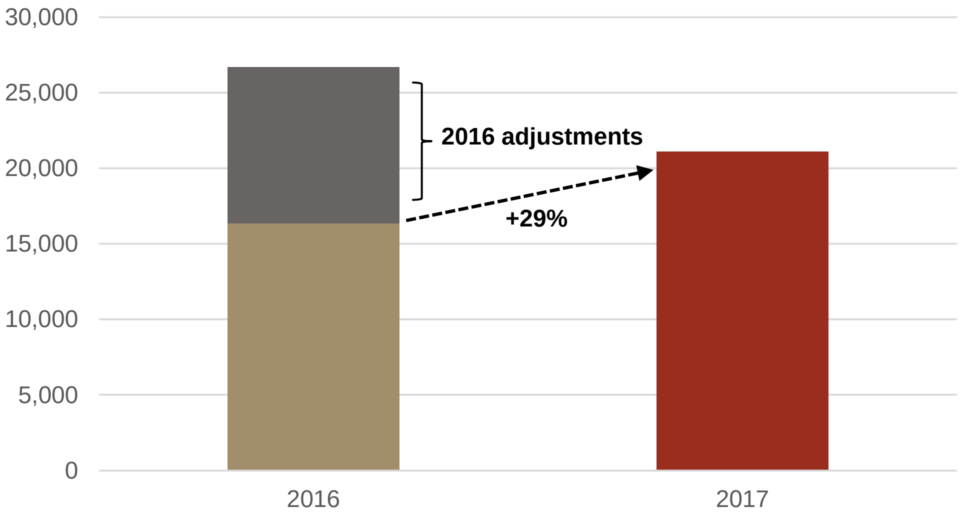


Figure 17 above depicts the EM program's total CFF net first-year energy savings achieved through non-incented projects. **As part of the CFF framework, the EM non-incented program has achieved 47,804 MWh of net first-year energy savings, representing 79.0% of gross verified first-year energy savings.** EM projects that were implemented in 2016 and have been evaluated and reported through PY2017 total 26,705 MWh of net first-year energy savings. 2016 adjustment projects, those that were implemented in 2016 but evaluated in PY2017, account for 10,343 MWh of net energy savings—22% of the total EM net energy savings achieved through the CFF to date.

The EM projects implemented in PY2017 and evaluated in PY2017 had 21,099 MWh of net first-year energy savings. **EM net first-year energy savings increased 29% YOY in PY2017 compared to the 16,363 MWh net first-year energy savings achieved and evaluated in PY2016.** Only 123 EM measures were implemented and evaluated in PY2016, compared to 281 in PY2017.

5.2.5 EM COST EFFECTIVENESS RESULTS

As shown in Table 26, the EM program is cost effective in PY2017 from the PAC test perspective using a benefit/cost threshold of 1.0. However, the EM program fails to meet the benefit/cost threshold of 1.0 under the TRC test. Cost-benefit assumptions are included in *Appendix D*.

Table 26: EM Non-Incented Cost Effectiveness Results

TRC Costs	TRC Benefits	TRC Ratio	PAC Costs	PAC Benefits	PAC Ratio	LC $/kWh
$8,492,766	$7,518,719	**0.89**	$2,459,290	$6,538,017	**2.66**	0.02

Average incremental cost of EM measures increased 97% YOY in PY2017. The average incremental life cycle cost of the EM measures evaluated in PY2017 was $29,997, nearly twice as much as the $15,175 average for PY2016 EM measures. Projects implemented in PY2017 tended to be larger and slightly more complex, resulting in higher per project savings as well as costs.

5.2.6 EM PROCESS EVALUATION RESULTS

There are three key findings for this section, related to three topics:

- Role in the industrial portfolio
- EM success factors
- Program support & resources

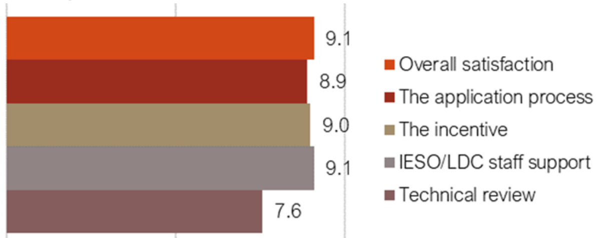
Each of these are described in more detail below.

EM Participant Perceptions (LDC)

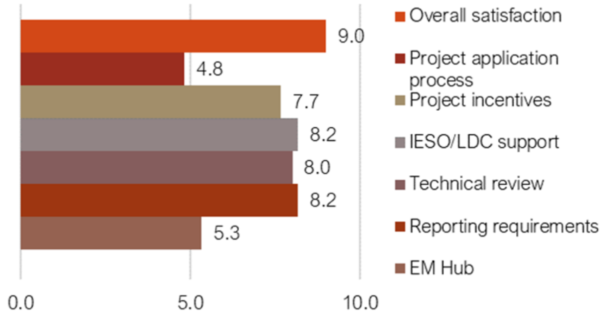
Number interviewed: **10 supervisors, 6 participants**
Percentage that intend to participate with a Save on Energy program in the future: **90%**

Satisfaction scores – supervisors
(0 = very unsatisfied, 10 = very satisfied)

EM Supervisors



Energy Managers

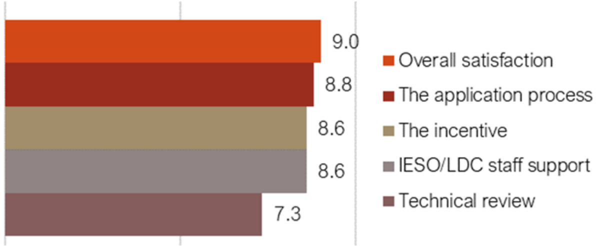


EM Participant Perceptions (IAP)

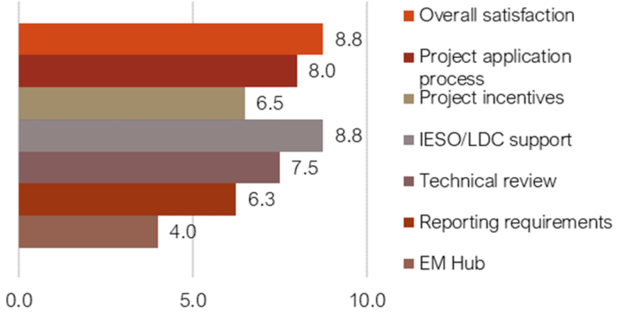
Number interviewed: **5 supervisors, 4 participants**
Percentage that intend to participate with a Save on Energy program in the future: **100%**

Satisfaction scores – supervisors
(0 = very unsatisfied, 10 = very satisfied)

EM Supervisors



Energy Managers



5.2.6.1 Role in the Industrial Portfolio

The EM program inhabits a unique role in the industrial portfolio. Rather than providing an incentive for a piece of equipment, it provides an incentive for a person – a dedicated, embedded resource at a customer facility. The program, in turn, receives the savings from the projects that each EM identifies and implements. The savings that accrue directly to the program result from any non-incented projects, which must account for at least 10% of each EM's annual savings goal. Most of each EM's savings result from projects performed through Retrofit, PSUP, M&T, IAP, or other programs, and those savings are counted as part of the relevant program. As a result, the EM program provides a small portion of the industrial portfolio savings directly. However, as an enabling initiative, it drives savings in other programs; there are also a variety of non-energy benefits that the EM program provides.

EM-Driven Savings and Projects

EMs drive measurable impacts at their sites in the form of energy savings and cost reductions. Their influence can also be assessed at the portfolio level. The EcoMetric team performed two separate analyses to determine the proportion of portfolio savings and projects attributable to facilities with EMs. The first used verified net savings data from several programs to assess the percentage that could be attributed to EM activities. The second used industrial program and Retrofit application trackers from PY2015-2017 to determine whether EMs submitted more projects than their non-EM counterparts during these three years. Both of these analyses are described in detail in *Appendix C.*

Facilities with EMs represent about 6% of the estimated industrial population and 15% of facilities that have submitted an application for any of the industrial programs (referred to as the "active" population).[29] This small group has an outsized effect on the portfolios in terms of savings, as shown in Table 27. In PY2017, EMs contributed a total of 56,733 MWh of net first-year energy savings in the Retrofit, PSUP and PUMPsaver programs—accounting for 8.4% of the total net energy savings in those programs. The clear majority of EM-enabled savings were in the Retrofit program where EMs contributed nearly 75,000 measures resulting in 50,264 MWh of net first-year energy savings (7.8% of the program total). The magnitude of savings from EMs is much lower in the PSUP and PUMPsaver programs; however, the EMs contribution to the programs' total net energy savings is greater at 17.2% and 24.6%, respectively. The

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[29] For the nonparticipant surveys, the evaluators developed a list of facilities that were likely to be large enough to participate in the industrial programs from a list of all commercial facilities in Ontario. The possible participant list was then segmented into large, medium, and small groups based on their estimated energy usage (calculated from their square footage and industry). The estimated industrial population mentioned here only includes the large and medium facilities; adding the small facilities doubles the population and puts EMs at 3% of the total.

PSUP projects enabled by EMs were major upgrades to a compressed air system and chiller, with just two projects accounting for over 17% of the net savings achieved by all PSUP projects completed in 2017.

Table 27: PY2017 Energy Manager Incented Savings Results

Program	Measures Evaluated and Reported	Net First-Year Energy Savings (MWh)	% of Total Energy Savings	Net Summer Peak Demand Savings (MW)	% of Total Peak Demand Savings
Retrofit					
EM Incented	74,938	50,264	7.8%	7.50	7.1%
Other	1,680,918	598,235	92.2%	98.74	92.9%
Total	**1,755,856**	**648,500**		**106.24**	
PSUP					
EM Incented	2	2,544	17.2%	0.70	26.6%
Other	14	12,229	82.8%	1.94	73.4%
Total	**16**	**14,774**		**2.64**	
PUMPSaver					
EM Incented	41	3,924	24.6%	0.51	25.1%
Other	245	12,024	75.4%	1.51	74.9%
Total	**286**	**15,948**		**2.02**	
Portfolio Total					
EM Incented	**74,981**	**56,733**	**8.4%**	**8.71**	**7.9%**
Other	**1,681,177**	**622,489**	**91.6%**	**102.19**	**92.1%**
Grand Total	**1,756,158**	**679,221**		**110.90**	

The second analysis revealed that EM facilities overall submitted just slightly more projects per facility as their non-EM counterparts, which also suggests that EMs were responsible for larger projects. Other findings from this 2015-2017 project analysis include the following:

- **EMs represent a substantial number of facilities**. There have been 98 facilities with EMs over the past three years – 76 LDC ones and 22 IAP ones. LDC EMs represent 15% of the active population of distribution-connected industrial facilities submitting projects, whereas the IAP EMs represent an impressive 48% of transmission-connected ones.
- **EM facilities overall submitted roughly the same number of projects as their non-EM counterparts**. LDC EM facilities represent 15% of the active population and 15% of its submitted projects (studies, PSUP, M&T, Retrofit). IAP EM facilities represent 48% of the population and 49% of its submitted projects (studies, P&S, Retrofit).
- **EM facilities were better at leveraging Retrofit than non-EM counterparts**. Both the LDC and IAP EM populations completed more Retrofit projects per facility, as shown in Table 28 below.

- **EM facilities completed fewer studies than non-EM counterparts**. LDC EMs also completed fewer industrial projects through PSUP projects, but IAP EMs completed more through Process & Systems.
- **EM facilities cancelled fewer projects**. This was especially true for the LDC participants, where non-EM facilities cancelled five times more projects than facilities with EMs.
- **The M&T program was more favored by facilities with EMs**. This stands to reason as having an EM is a program requisite.[30] There were no M&T projects submitted by EM facilities in either 2015 or 2016, but in 2017, that jumped to nearly half of all M&T applications. No EM facility cancelled any of its M&T projects; however, fully half of non-EM M&T projects were cancelled within the three years of this analysis.

Table 28: Average Projects Per Facility for EM and Non-EM Participants

Average Projects per Facility	LDC (Distribution-Connected)		IAP (Transmission-Connected)	
	EM	Non-EM	EM	Non-EM
Completed/In Progress Projects				
Avg successful projects per facility	20.21	20.07	4.72	4.50
Avg studies per facility	0.44	0.79	1.00	1.15
Avg PSUP/IAP P&S per facility	0.30	0.45	0.61	0.45
Avg M&T per facility	0.09	0.03	N/A	N/A
Avg Retrofit per facility	19.38	18.81	3.11	2.90
Cancelled Projects				
Avg cancelled projects per facility	0.04	0.22	0.86	1.00
Avg cancelled PSUP per facility	0.04	0.19	0.14	0.13
Avg cancelled M&T per facility	0.00	0.03	N/A	N/A
Avg cancelled Retrofit per facility	N/A	N/A	0.73	0.88

It's also very possible that this facility-level analysis understates EM achievements, as the data is segmented by calendar year, but EMs must submit projects within one year of their start date. As a result, some 2017 EMs starting later in the year may not have submitted any projects since they have until mid-2018 to plan and implement them. This phenomenon is clear when looking at EMs that did not submit any projects: 13% of EM facilities had no projects between 2015–2017; focusing just on 2017, this number jumps to 26%. While it's possible that some EM facilities were ultimately unable to conduct any

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[30] The M&T program requires a designated on-site EM to participate, but it is not necessary that EM be IESO-sponsored.

incented projects (about 11% of non-EM active facilities have submitted projects but never completed one), at least a few of those facilities just have not needed to comply with their deadline yet.

In addition to the savings driven by participation in other programs, each EM must meet at least 10% of their annual goal through non-incented savings projects. In PY2017, these non-incented projects represented 21,009 MW of net verified savings (see Section 5.2.4), or about 27% of the savings EMs contribute to the portfolio. These projects tend to be ones with very low payback periods, operations and maintenance adjustments, behavioral programs for other employees, and corporate policy changes (such as influencing purchasing). However, there are two paradoxes with non-incented projects:

- **While non-incented savings are more cost-effective for IESO and LDCs, the EM has no incentive to overachieve the 10% limit.** Because the customer cannot apply for additional incentive money for these savings, they generally try to minimize the amount of non-incented projects. Projects that go over the savings threshold do not provide any additional value to the customer for the purposes of complying with program requirements. The impact evaluation team noticed this from the tracking data: once targets had been met, participants became extremely conservative in their savings estimates so that the technical reviewer did not ask questions. One participant told the evaluator in PY2016 that if they'd known that they would have to do extra work to gather data for the evaluation, they wouldn't have submitted an extra non-incented project in the first place.
- **While the EM can use short-term behavioral or maintenance projects to meet their goals, the LDCs/IAP often cannot.** Persistence is often an issue with these types of projects. Although the EM can utilize those projects to meet their goal based on reported-first year savings, the LDCs can only claim savings persisting to 2020.

Future process evaluation work could be used to explore non-incented projects and the data behind them in more detail.

Process Finding 6: The EM program is seen as an enabling program and drives participation and savings in other Save on Energy/IAP programs.

- Although only non-incented savings accrue directly to the EM program for reporting, EMs are also responsible for a good percentage of savings and projects in other programs, such as PSUP and Retrofit.

Process Recommendation 6: Consider ways to reward EMs for overachieving the 10% non-incented target, provided that they submit enough documentation for the technical reviewer to fully review and the savings persist to 2020.

- Future evaluation work could consider ways of motivating EMs to perform projects where the savings will persist, including program tweaks where the EM could be encouraged to create a long-term plan for maintenance or behavioral programs that states how often the effort will be refreshed and in what format. The effort could also explore the types of non-measure projects done by EMs, how the savings are estimated, and the benefits they have on their facilities.
- This is based on a preliminary recommendation from the PY2016/Phase 1: Process Evaluation Recommendation #7.

While the above discussion focuses on the portfolio-level, there is a large variation in how much each EM contributes. Although this evaluation did not focus on performance on an EM level, each EM does have a built-in key performance indicator in the form of their annual savings goal.[31] Technical Reviewer data from the legacy framework suggests that two-thirds of EMs were successful in hitting their targets in their first year; EMs that stayed on for subsequent years were more likely to meet their goals.[32] LDCs likewise reported a range of success levels for their EMs. Out of the ten LDCs surveyed with active EMs, five stated that 100% of their EMs had met their goals, another four estimated that between 60 and 90% of their EMs did, and one that 0% had. This does not take into account the number of EMs each LDC had, however.

Assessing individual EM performance has not historically been included within the evaluation because the data does not readily overlap (EMs are assessed based on their reported savings one year from the contract start date; the evaluation uses calendar year data and evaluates a sample of EM non-incented projects). However, understanding how many and under what circumstances EMs meet their targets is a topic of interest to program stakeholders and may be included in future targeted evaluation studies.

Process Finding 7: EMs vary considerably on their achievement of annual goals, though further research is needed to understand the factors involved.

Process Recommendation 7: Consider including further research of EM goal achievement as a targeted study item for the PY2018 process evaluation.

- In addition to establishing a percentage of EMs that achieve their goals, which may or may not already be determined by the Technical Reviewer, the evaluation team can also look at EM

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[31] This annual savings goal is 2,000 MWh for salary-based EMs and 1,000 MWh for performance-based EMs, though they can receive incentives for up to 3,750 MWh of savings. If a salary-based EM does not meet their goal, the shortfall is added to their subsequent year target.

[32] "Energy Manager Initiative Review," prepared by the implementer for IESO, April 17, 2017.

performance by incentive type (salary-based vs. performance-based), the EM's term, the LDC, the industry, the facility size, or other key factors.

EM Non-Energy Benefits

Table 29 lists the key benefits to the implementers and to the participants of the EM program.

Table 29: Benefits of the Energy Manager Program

Benefits to IESO/the LDCs	Benefits to the EM's facility
Direct savings from non-incented measures	A dedicated resource to help optimize energy use and drive projects forward
Indirect savings due to EM participation in other incented programs	Energy and bill savings from EM-implemented projects
A key contact and energy champion inside the customer's facility that helps in building and maintaining a relationship	An internal champion to educate others, lobby management for projects, and orchestrate campaigns
Appreciation and goodwill from customers	Technical expertise from the EM
Perception of the program staff as an advisor or even partner to the EM	Additional capacity on staff
"Market transformation" – helping promote the concept that having an EM is a vital resource to a company	Credibility from the LDC involvement
	The incentive itself[33]

The EM program continues to have the highest satisfaction of all SaveONenergy/IAP programs.

While the savings aspect of the program is critical, it is hard to overstate how important the non-energy benefits of the EM program are, especially as culture shifts and market transformation can in turn lead to more energy savings. The EM program receives consistently high satisfaction scores from both LDC and IAP participants, much higher than any other program in the industrial portfolio (see *Section 4.2.1.3*).

This is due to a variety of factors: the program process is straightforward, there are many resources from the LDCs and IESO available to the EM to support them, and the incentive is good. Beyond that, it's clear from the responses that the participants can see the positive impacts (energy, cost, effort, etc.) from having their EM on-site – and from having them on the team. There is a personal aspect to this program that does not exist with any other. This helps both the customer and the LDC or IAP staff, who now have a contact and energy champion to work with at the facility.

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[33] Note: the incentive was not mentioned by participants as a benefit of the program. The perceived benefit is what the incentive allows for.

Having a dedicated resource or additional capacity on staff to worry about energy use was mentioned frequently as a key benefit of the program. Supervisors saw the EM as a key force on-site to oversee projects and do all the associated work to get them done, including pitches to get approval. They were clear about the value of the program:

- "Most people [here] are not worried about energy. The EM does a great job of working with the personnel and convincing them that the energy conservation is the best thing to do."
- "Without the EM [program], we would have moved our EM to a different engineering role, and we wouldn't be getting nearly as much done."
- "Without the EM you don't optimize your benefits. He keeps this organized, gets us incentives to do studies and projects, and works with internal staff. It's critical."

It's fair to say that these managers would also view the EM program as an enabling initiative – it enables them to complete work that would not have been done otherwise.

5.2.6.2 EM Success Factors

Although the EM is a single individual, it is clear that to be successful they must involve and motivate many others around, above, and below them. This is important when identifying projects, pitching ideas to and seeking approval from upper management, implementing measures, promoting behavior changes, and going beyond to change company culture. The EM's ability to gain the company's support – through their own actions and depending on whether the company is truly committed to taking action – is seen by EMs, their supervisors, and the LDCs as the single largest determinant of the EM's success. Some of the findings from interviews include the following:

- **It takes time for the EM to build rapport at his or her company**. All the EM supervisors interviewed for this evaluation had their EMs on staff for at least two years; most of the interviewed EMs had been there for between one and two years, with some as long as four. Several LDCs commented that newly hired EMs often take a while to start implementing projects as they must get to know the facility or facilities, understand the company policies, and start identifying efforts (the IAP version of the EM program has a two-year contract, recognizing that it can be challenging for some EMs to hit their first-year goals if the project lead times are long).
- **Having an internal network is often key to identify projects and support for the project through the approval process**. This could come in the form of multiple EMs or other internal networks. About seven to eight distribution-connected facilities have multiple IESO-sponsored EMs, depending on the year (only one transmission-connected facility has multiple). This could be split by administrative unit – i.e., EMs at different facilities or divisions – or EMs working in teams. For example, one EM interviewed noted that he did most of the on-site work since he was an

electrician, and his partner did most of the reporting. However, this support may not come from another company-designated EM. Three other EMs mentioned during the interviews that they instead have internal networks that are key to their work:

  - One formed an EM working group with experts from each sector of the company. The company allows him to utilize up to a certain portion of their hours to help with energy projects.
  - One noted there is a voluntary energy champion in every department and around 50 embedded EMs at other locations worldwide. The EMs meet monthly to discuss progress, best practices, and savings goals; the energy champions help identify projects at their facility.
  - One was part of an energy management committee and mentioned that the company also had 24 designated energy champions.

- **The approval process is one of the biggest hurdles EMs face and a key place to have allies**. Companies that can participate in the industrial programs tend to be very large – often multinational – and have complex internal processes. Seven of the ten EMs interviewed discussed the need to send projects through the corporate management offices; five mentioned that this process was at best long and at worst a project-killer. One EM said that they must plan all projects one to two years in advance given the need to set aside a budget in the capital plan, get a designated PM, and get approval from the corporate office outside of Canada. This process becomes easier if the company is on board and committed to saving energy, and if they have key stakeholders involved and engaged.

Overall, his ability to get the company to "buy in" to the EM's projects is seen as the biggest success factor for EMs hitting their goals and changing company culture, and also the biggest barrier. Said simply, EMs that do well have the support of upper management and colleagues at their facilities; EMs that do poorly often do not. This cause and effect is bidirectional – the EM must be able to earn respect within the facility, and the company must also be willing to engage with them on projects. Both are needed to be successful. There are at least two examples of LDCs revoking EM contracts when the EM was unable to gain the support of his or her company:

- The company was not focused on energy reductions and would not approve any projects
- The EM had excellent technical credentials but lacked the ability to sell the projects internally.

Four of the ten EMs interviewed said that getting company buy-in was the biggest challenge they faced on a daily basis; however, when they did, they were able to accomplish much more.

One EM provided a striking example of this phenomenon at work. Their company won an external award for the efforts of the EM and their energy champion network; the award was prestigious enough to lead to a major shift in the company. "It became a lot easier to get corporate approval for projects since everyone wants to be part of the success story," the EM said. It also helped provide a motivator for the energy champions at the facility, though the EM wishes s/he could do more for the champions – the success wouldn't have been possible without them.

Process Finding 8: The ability to get buy-in and commitment from the rest of the company is one of the most important determining factors of an EM's success.

- This is bidirectional: the EM must win the respect and support of others, and the company must be willing to commit to energy-saving projects. The two recommendations below correspond to each piece of this equation.

Process Recommendation 8: On a regular basis, offer training sessions on the communication skills that allow EMs to pitch projects, network internally, and convince both facility and corporate staff of the benefits of conservation projects.

- One example of a popular "soft skills" training mentioned several times in Phase 1 interviews was Mark Jewell's "Learning to Sell Efficiency Effectively" training, offered through IESO to the LDCs and then in turn to the EMs.
- If not already performed, a basic primer on pitching projects to upper management should be included in the onboarding training for all new EMs.
- Archive past trainings and resources so that EMs that start between training offerings can still access the information.

Process Recommendation 9: Continue to highlight the successes of EMs in case studies, presentations, and awards, and consider additional venues or methods to do so.

- This is important not only to market to facilities without EMs that might be considering it, but also to create positive feedback loops in the facilities with EMs. Apart from the striking example of an EM award changing company culture as explained above, multiple EMs commented on the semi-annual workshops IESO hosts to bring the EMs together. This method is clearly working and appreciated by attendees and should be continued.
- Requests for more case studies or success stories are also common (see also Process Recommendation #8).

5.2.6.3 Program Support & Resources

The EM program continues to be the highest rated of all Save on Energy/IAP programs. Apart from the overall program, support from the LDC/IESO was the program aspect that consistently receives the highest satisfaction ratings. EMs and their supervisors are appreciative of the support provided by the EM program implementer, the LDCs, and IESO in the form of frequent training opportunities and check-ins. Two EMs noted that they spoke with their IESO/LDC contact as much as once per week; most others were monthly or quarterly, though all felt well-connected to their contacts. "[Our LDC contact] is a fantastic resource," one said. "They offer all the support we need and are very proactive in reaching out." Some LDCs with many EMs in their territories may hold quarterly or semi-annual events to gather their local EMs together.

There are ample opportunities for trainings provided to EMs through the program implementer and sometimes IESO or the LDCs. The program onboarding trainings were seen as particularly valuable by the EMs, as were the workshops offering opportunities for sharing successes with other EMs. The implementer offers trainings to the EMs on a quarterly basis, usually held in three to four locations around the province and featuring a mix of technical and sales/business topics. Most of the interviewed EMs indicated that they attended these trainings whenever they could, and they provided a few suggestions on how future trainings could be more beneficial:

- **Industry-specific trainings**: Nearly 40% of the EMs interviewed thought that some of the trainings could be too general and would like to see more presentations targeted to their most common measures, even if it meant some were not applicable to them and others were. For example, one EM noted that there are multiple EMs in the mining sector (especially in IAP), where the key measures are ventilation, compressed air, and dewatering.
- **Regional meetings**: While far-flung EMs realize the difficulty in scheduling in-person events that attract the greatest number of EMs, they are appreciative of attempts to include them. For example, one mentioned an upcoming training that was conducted several times in different areas of Ontario. The EM also asked if there was a way to create smaller regional groups, so s/he could find more local EMs for possible collaboration.
- **Scheduling**: One EM asked that the program implementer be more mindful of scheduling the presentations – the next quarterly training was on the same day that a government report was due, a Northern Industrial Electricity Rate (NIER) Program report was due, and an industry energy group was meeting.

Some LDCs also offer trainings about technologies or other topics for energy professionals that EMs can attend; there were examples of EMs attending presentations or events by other nearby LDCs if the topics were relevant.

Process Finding 9: EMs and their supervisors are appreciative of the support provided by the program implementer, the LDCs, and IESO in the form of frequent training opportunities and check-ins.

Process Recommendation 10: Conduct industry-specific training sessions that cover relevant technology measures for that industry.

- Around 40% of the EMs interviewed thought that some of the trainings are too general. Since the quarterly trainings are designed to be applicable to as many EMs as possible, this could either be done as industry-specific applications within a training or separately.
- If done separately, the implementer should consider partnering with the LDCs and/or IAP with customers in that industry to put on the trainings.

Process Recommendation 11: Develop an online schedule listing all relevant training sessions and events.

- Coordinating a calendar between the implementer, the LDCs, and IESO would minimize any duplicative or conflicting trainings and allow customers to see all relevant trainings and events. This should also contain, to the extent possible, information on major government report deadlines and events from other key energy industry groups that would affect participation from multiple EMs.
- This could be hosted on the EM Hub, the Save on Energy website, or a more informal, publicly-available calendar linked from the other sites if preferred.

One resource frequently discussed as part of the support offered to EMs is the EM Hub, an online portal run by the program implementer. This website, open to all EMs, contains a monthly newsletter archive, project lists, a forum for EMs to discuss various topics, and other resources. In addition, there is a dashboard for each EM that shows progress against their annual goals. Although the concept is excellent, the EM Hub was generally seen as time-consuming to sort through and was not widely used by the EMs interviewed. This was also reflected in the satisfaction ratings, where the average rating was 5.3 for LDC EMs, and 4.0 for IAP EMs (see the callout box at the beginning of *Section 5.2.6*). Of the ten EMs interviewed, six use it infrequently and four do not use it at all. Those who do visit the site mentioned using it to get training notifications, ask industry-specific questions of the other EMs via the forum, and read some of the articles. One of the more frequent comments was that the articles and resources could be difficult to navigate and thus not a widely used resource. Two EMs suggested that grouping the topics by industry would be very helpful, so they could quickly see the information relevant to them. Another EM asked for more success stories and case studies. There was also some confusion regarding the dashboard; one EM noted that none of their projects for the year were showing up on the portal.

Process Finding 10: The EM Hub was not widely used by the EMs interviewed.

Process Recommendation 12: *Survey all EMs on their use of the EM Hub and use the responses to update its functionalities.*

- The EM Hub provides data and a valuable platform to exchange information between EMs and between the program implementer and EMs. Nonetheless the survey responses were clear that it is underutilized by EMs.
- While a sample of EMs were interviewed in this evaluation, a short survey for all EMs that focuses primarily on the EM Hub, how often they use it, and what functions they use would provide better information on how to curate it.
- The program implementer should use the results of the survey to assess what changes could be made to the EM Hub to better engage the EMs and decrease time spent on functionalities that do not provide as much benefit to EMs.
- In the meantime, the program implementer could consider adding industry tags to articles or making those industry groupings more prominent if they already exist, per one of the most common comments.

Finally, when asked what kinds of support would be most valuable, many EMs took the opportunity to ask for a replacement for the iCon system used to submit applications. The shortfalls of the iCon system – it is very slow and can often crash – are widely recognized by IESO, the LDCs, and participants; it was brought to the attention of the evaluators last year and mentioned an additional seven times by EMs, EM supervisors, and EM partial participants this year. For EMs, this challenge comes mainly in submitting Retrofit projects, as LDCs must manually upload PSUP applications on the back end of the system. One EM stated he sometimes would wake up at 5am to submit the application before any others would be on the system. Another three stated that they had sometimes skipped incentives because of the difficulty of submitting the application and implemented the project anyway.

5.3 INDUSTRIAL ACCELERATOR PROGRAM (IAP) RESULTS

5.3.1 IAP PROGRAM DESCRIPTION AND EVALUATION APPROACH

The Industrial Accelerator Program is administered directly by the IESO, offered to transmission-connected customers, and provides incentives through three program streams or initiatives: Capital Incentives (referred to interchangeably as IAP Process & Systems), Retrofit, and Energy Manager. Program delivery for each of these initiatives closely mimics the respective LDC-administered programs.

Between the three initiatives, 58 IAP projects were completed in 2017. 12 IAP projects were evaluated as 2016 adjustments and another two were evaluated as 2015 adjustment projects. While the IAP Retrofit and IAP Energy Manager initiatives account for the largest number of projects, these projects are typically smaller in size and comprise a smaller portion of the IAP savings. The IAP Capital Incentives initiative is responsible for the majority (67%) of the IAP reported energy savings included in this evaluation. 42 IAP Energy Manager non-incented measures with 2017 in-service dates were included in this evaluation and seven measures with 2016 in-service dates were included as adjustments. The IAP Retrofit program had 12 projects with 2017 in-service dates ready for evaluation and five projects completed in 2016 and two completed in 2015 were included as adjustments. The IAP Retrofit program, consisting of smaller projects, accounted for just 5% of PY2017 IAP reported energy savings.

5.3.2 IAP TRACKING SYSTEM & PROGRAM DOCUMENTATION REVIEW RESULTS

IAP Capital Incentives projects and savings are tracked in tandem with PSUP and are scarcely differentiated from the perspective of the technical reviewer. This is generally appropriate given the similarity between these program streams: they comprise a small number of large, capital-intensive, complex energy savings projects that commonly involve generation components. Tracking for IAP Capital Incentives is slightly simpler given the lack of LDC involvement in invoicing and other program tracking functions.

IAP Retrofit and IAP Energy Manager Non-Incented Measures are also tracked by the technical reviewer and tended to very accurately represent project statuses and estimated savings.

5.3.3 IAP GROSS VERIFIED SAVINGS RESULTS

Table 30 shows gross verified savings for the IAP Capital Incentives, Retrofit, and Energy Manager Non-Incented Measures. **All energy realization rates are very close to 100%, apart from the IAP Energy Manager Non-incented measures (90.8%).** The overall large amount of savings coming from IAP Capital Incentives with an energy RR of 100.7% results in a combined IAP/IESO-administered RR of 97.5%. Most IAP savings (93%) persist through 2020, reflective of the longer measure lives typical of these projects.

Table 30: PY2017 IAP Gross Verified Savings Results

Program/Project Type	# of Projects Evaluated & Reported	Realization Rate (%)	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)	Persistence of Savings in 2020
IAP Capital Incentives*					
BMG	1	101.2%	90,581	10.35	100%
EE	3	92.1%	4,834	0.57	100%
IAP CI Total	**4**	**100.7%**	**95,415**	**10.92**	**100%**
IAP Retrofit					
2017	12	103.8%	6,824	0.79	100%
2016 Adj.	5	103.8%	1,443	0.35	100%
2015 Legacy Adj.	2	103.8%	6,049	0.90	100%
IAP Retrofit Total	**19**	**103.8%**	**14,316**	**2.04**	**100%**
IAP Energy Manager Non-Incented					
2017	42	93.7%	37,442	3.10	55%
2016 Adj.	11	84.9%	16,491	1.80	91%
IAP EM Total	**53**	**90.8%**	**53,932**	**4.90**	**66%**
GRAND TOTAL	**76**	**97.5%**	**163,663**	**17.86**	**93%**

Total PY2017 IESO-administered program gross verified energy savings are 97.5% of reported savings. Among the three IAP initiatives, energy RRs range from 90.8% (IAP EM non-incented) to 103.8% (IAP Retrofit). Measurement and verification activities and technical reviews are generally resulting in highly accurate estimates of energy savings. However, several of the technical reviews for IAP Retrofit prescriptive lighting measures used baseline and post-retrofit wattages instead of IESO's prescriptive savings to calculate energy and demand savings.

Finding 11: Baseline assumptions for behind-the-meter generation projects are typically poorly documented.

Recommendation 14: Require that measurement and verification plans for BMG projects include a discussion of the assumed baseline condition and explain the technical alternatives participants had other than installing generation equipment.

- The information on baseline alternatives will provide a cleaner audit trail for the NTG evaluation.

Average energy realization rates by project type vary only slightly across the IAP program, as shown below in Table 31. The one BMG projects had an RR of 101.2%, while EE projects are lower at 93.2%. Average peak demand RRs follow a similar pattern, averaging 100.4% for BMG projects and 94.8% for EE Projects.

Table 31: IAP Realization Rates by Project Type

Project Type	Average Energy RR	Average Demand RR
BMG	101.2%	100.4%
EE	93.2%	94.8%

The single CHP project in the IAP CI program was the only CHP unit out of the 22 evaluated in the Industrial Portfolio in PY2017 that resulted in net natural gas savings. The CHP unit was installed at a large industrial corn refining plant. The corn refining process involves energy intensive (electricity and steam) equipment, which include cleaning, soaking and milling of corn using cyclone separators, grinders, and centrifuges. The facility on average used 80,000 pounds of steam per hour. The participant's total steam supply was delivered by a neighboring plant operated by a third-party. A 15 MW natural gas turbine generator was designed to offset over 96% of the electricity purchased from the grid, while a heat recovery steam generator, would supply an unfired full load steam output of 62,000 pounds of steam per hour supplementing when needed with a gas fired duct burner. The factors that contributed the high cost effectiveness of this project were the steep steam consumption of the facility and the inefficiency of the boiler used by the third-party plant to supply steam to the participant. A non-condensing 80% efficient boiler was supplying steam to the facility before the project. With the installation of the CHP system, steam generation was a byproduct of electrical generation, and line losses were avoided with steam now being generated onsite. **This particular CHP represents an ideal BMG project with high potential for cost-effective energy and natural gas savings meeting the main criteria of high thermal loads and inefficient thermal production.**

5.3.3.1 IAP CI Anticipated Savings Threshold

As shown in Figure 18, **four out of five IAP Capital Incentives measures meet the 90% actual-to-anticipated savings threshold as required in the IAP program rules.**[34] Two of the EE measures occurred at the same facility with the same in-service date, so they are counted as one project. The one EE IAP CI project that did not meet the savings threshold fell short by 7% due to lower than expected utilization of the VFD-controlled fan units that were upgraded through the program. The annual gross savings for this

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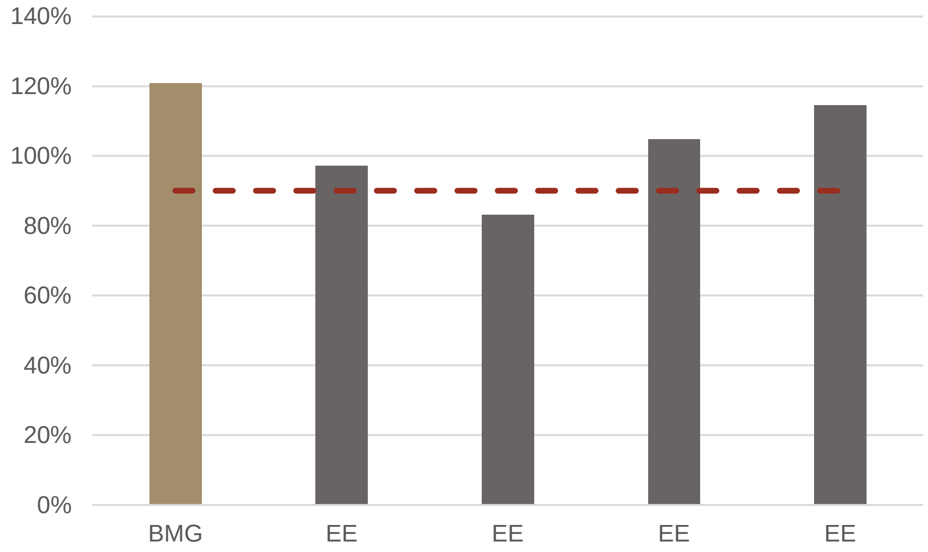
[34] http://www.ieso.ca/en/sector-participants/energy-efficiency-for-large-consumers/industrial-accelerator-program

project relied on an extrapolation of one quarter of M&V data, which could also contribute to the project’s failure to meet the anticipated savings threshold.

Figure 18: IAP Savings Threshold Results



5.3.4 IAP NET VERIFIED SAVINGS RESULTS

The average NTG for the IAP programs was 81.7%, as shown in Table 32 below**. IAP projects demonstrated low levels of free-ridership and no attributed spillover.** The IAP Retrofit had the highest NTG ratio (88.4%), followed by IAP Capital Incentives (83.9%) and IAP Energy Manager non-incented (76.0%). The IAP Energy Managers non-incented net-to-gross analysis was assessed in tandem with the LDC-administered Energy Managers and comprises two components: 2017 projects with an NTG ratio of 71.6%, and 2016 true-up projects that were given the 2016 result of 86%.

Table 32: IAP Net Verified Savings Results

Program/Project Type	# of Projects Evaluated	NTG Ratio[35]	Net Energy Savings (MWh)	Net Summer Peak Demand Savings (MW)
IAP Capital Incentives*				
BMG	1	83.9%	76,009	8.69
EE	3	83.9%	4,057	0.48
IAP CI Total	**4**	**83.9%**	**80,066**	**9.16**
IAP Retrofit				
2017	12	88.4%	6,032	0.70
2016 Adj.	5	88.4%	1,275	0.31
2015 Adj.	2	88.4%	5,347	0.79
IAP Retrofit Total	**19**	**88.4%**	**12,654**	**1.80**
IAP Energy Manager Non-Incented				
2017	42	71.6%	26,800	2.22
2016 Adj.	11	86.0%	14,182	1.55
IAP EM Total	**53**	**76.0%**	**40,982**	**3.77**
GRAND TOTAL	**76**	**81.7%**	**133,702**	**14.74**

As shown in Table 33 below, **energy NTG ratios for the IAP programs are high for both BMG (101.2%) and EE (93.2%) projects.** Demand NTG ratios, on the other hand, were lower for both BMG (84.2%) and EE (76.4%) projects.

Table 33: IAP NTGs by Project Type

Project Type	**Energy NTG[36]**	**Demand NTG**
BMG	101.2%	84.2%
EE	93.2%	76.4%

Free-ridership – The free-ridership score for the IAP CI and Retrofit programs was largely influenced by the IAP projects' high savings numbers and the interviewees indications that IESO was instrumental in assisting project implementation and timing.

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[35] BMG, EE and Program Total NTG Ratios are for illustrative purposes only.

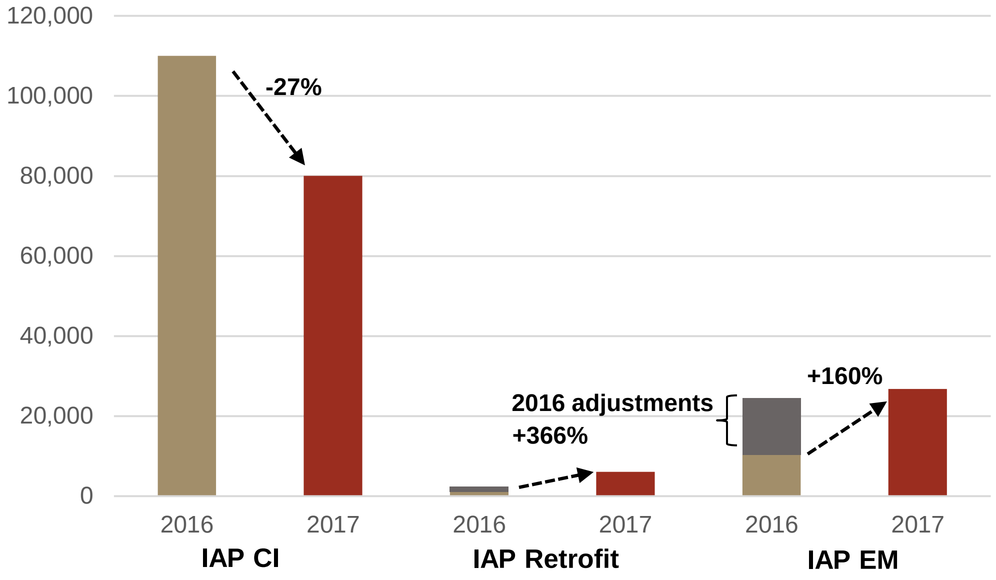
[36] BMG and EE NTG ratios are for illustrative purposes only, representing total net verified savings divided by total gross verified savings.

Spillover – No spillover was attributable to the program, but 22 of the 23 interviewees indicated that they have pursued or are pursuing additional projects influenced by the specific projects under review during the interview. In all cases, these customers plan to or already have submitted these projects for IESO incentives.

5.3.4.1 Total CFF IAP Net Verified Savings Results

Total net first-year energy savings for the CFF IAP programs are 250,054 MWh, 88.4% of gross verified savings. Net demand savings for IAP projects under the CFF total 97.7 MW. **Overall, total net first-year energy savings for IAP programs decreased 13% YOY in PY2017, compared to IAP projects implemented and evaluated in PY2016.** Net verified results for the CFF IAP programs are summarized in Figure 19 below.

Figure 19: Total CFF IAP Net First-Year Energy Savings (MWh)



The IAP CI program has achieved 190,108 MWh of net first-year energy savings in the CFF, accounting for 76% of total IAP net savings and 49% of the industrial portfolio. Compared to projects implemented and evaluated in PY2016, net first-year energy savings declined 27% YOY. The IAP CI program is characterized by a small number of very large projects resulting in major energy savings. As such, a few projects can make a major impact on total savings from year to year. While the participation in the program has remained fairly steady since PY2016, projects completed in the IAP CI program in PY2016 averaged over 18,600 MWh of net first-year energy savings compared to just over 16,000 MWh in PY2017.

IAP Retrofit accounts for just 8,303 MWh of net first-year energy savings—3% of total IAP net energy savings achieved during the CFF. However, net energy savings increased over 500% YOY, due to a greater number of non-lighting projects implemented in PY2017 that generally result in higher energy savings. Generally, IAP Retrofit projects mostly consist of engineered and custom lighting retrofit measures and tend to be smaller in size and savings when compared to those of IAP CI and IAP EM.

Net first-year energy savings are 51,300 MWh for the IAP EM program in the CFF, representing 21% of total IAP net savings. In PY2017, net energy savings totaled 26,800 MWh for IAP EM projects implemented in PY2017, a 160% increase YOY compared to the net energy savings achieved and implemented in PY2016. IAP EM net savings increased YOY due to increased participation in the program.

5.3.5 IAP COST EFFECTIVENESS RESULTS

As shown in Table 34, the IESO-administered IAP programs are cost effective in PY2017 from the TRC and PAC test perspectives using a benefit/cost threshold of 1.0. Cost-benefit assumptions are included in *Appendix D*.

Table 34: IAP Cost-Effectiveness Results

Program	TRC Costs	TRC Benefits	TRC Ratio	PAC Costs	PAC Benefits	PAC Ratio	LC $/ kWh
IAP (CI)	$28,022,350	$103,850,375	3.71	$23,516,402	$66,699,817	2.84	0.03
IAP (Retrofit)	$1,319,671	$4,264,297	3.23	$470,445	$3,708,085	7.88	0.01
IAP (EM)	$1,856,058	$7,979,385	4.30	$0	$6,938,596	-	-
Total IAP	**$31,198,079**	**$116,094,058**	**3.72**	**$23,986,847**	**$77,346,497**	**3.22**	**0.02**

The CHP project in the IAP CI program, an example of a highly cost-effective BMG project, contributed $102M TRC benefits to the program and had a project-level TRC ratio of 4.10. The project resulted in 76,099 MWh net first-year energy savings that persist to 2020, as well as 235,280 MMBtu of natural gas savings. These strong savings results provide a massive amount of benefits from the avoided costs for electricity and natural gas.

5.3.6 IAP PROCESS EVALUATION RESULTS

There are two key findings for this section, related to two topics:

- Program updates
- Customer experience and pain points

Each of these are described in more detail below.

5.3.6.1 Program Updates

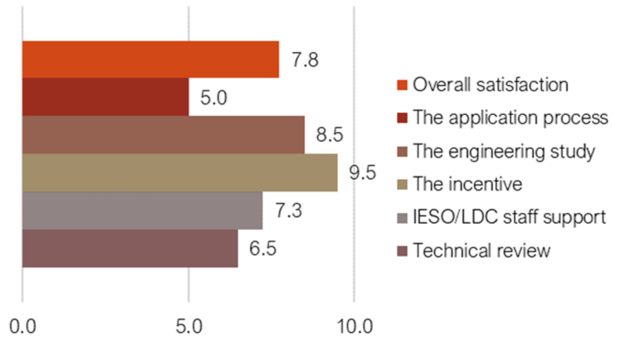
IAP has undergone several changes since last year, some of which are policy-driven and some internal:

1. The IAP CFF target was reduced to 1.3 TWh (from its original goal of 1.7 TWh).[37]
2. As with the LDC programs, CHP has been phased out as of July 1, 2018.
3. Per a Ministry directive in December 2016, transmission-connected customers were allowed to use IAP for all of their projects (including at distribution-connected facilities) to create a one-stop shop; PY2017 was the first year that customers could choose this option.
4. A new, streamlined contract was introduced in August 2017.

IAP Process & Systems Participant Perceptions

Number interviewed: **4**
Percentage that intend to participate with a Save on Energy program in the future: **100%**

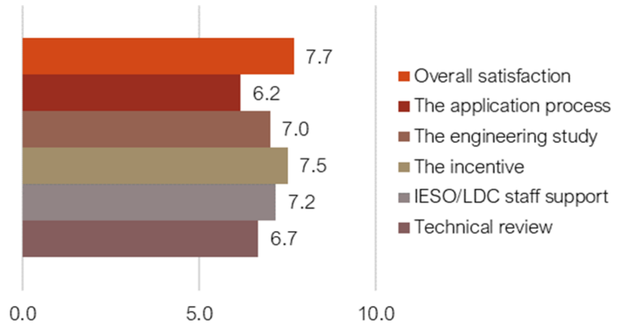
Satisfaction scores
(0 = very unsatisfied, 10 = very satisfied)



IAP Retrofit Participant Perceptions

Number interviewed: **6**
Percentage that intend to participate with a Save on Energy program in the future: **100%**

Satisfaction scores
(0 = very unsatisfied, 10 = very satisfied)



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[37] This 0.4 TWh target was transferred from IAP to other IESO-delivered programs (“centrally-delivered programs and province-wide distributor CDM programs delivered by the IESO.”) In the same ministerial directive, IESO was directed to establish a new budget for IAP and these programs without increasing the overall IESO budget. See “Reallocation of Targets from the Industrial Accelerator Program to the 2015-2020 Conservation First Framework and Delivery of Programs Targeted to On-Reserve First Nations Communities,” February 8, 2018. Accessible at: http://www.ieso.ca/corporate-ieso/ministerial-directives

5. IESO added two sales support contractors to help customers scope projects, answer questions, and provide application support.
6. The number of IAP business advisors increased from one to three, with roughly a third of the 59 transmission-connected customer accounts apiece.
7. IAP will also make several adjustments to its Process & Systems subprogram to reflect the PSUP redesign, including reducing the M&V period to one year, but has not yet.

The IAP program manager and business advisors note that the effects of the CHP phase-out and the inclusion of some distribution facilities per the Ministry directive have been minimal to date and are expected to stay that way. Regarding the CHP phase-out, IAP Process & Systems has tended to have more process efficiency and less CHP than its LDC counterpart; moreover, IAP had already been focusing on waste energy recovery opportunities. The Ministry directive, likewise, did not dramatically change the program's implementation. To date, it has not created an increase in IAP applications from transmission customers bringing their distribution-connected facilities into the program. The IAP staff explained that they offered this option to streamline the process for customers that might be interested, but they do not actively target those distribution-connected customers. This is both out of deference to the LDC relationships and because savings from those distribution-connected customers accrue to the LDCs, rather than IAP.

Improving the customer experience has been a stated goal of the IAP staff for some time, and several of the program updates were done for this reason. In particular, they wanted to reach customers with poor experiences of older versions of the program and help change their perceptions. These customer experience challenges were demonstrated by the participant interviews, where IAP and IAP Retrofit received the lowest satisfaction ratings of all CFF programs. Customer complaints focused on the overall length of time it took to finish the project, the application process, and a lack of support from IESO.

The program took several major steps toward that goal of improving the customer experience with several of its revamps this year, including the streamlined contract, the sales support contractors, and increased business advisor staff. While the long lead times for project completion mean that the participants this year did not experience the new process, a few were already aware of the changes, especially with the sales support.

The IAP program manager explained that adding more resources in the form of the sales support team to be available for customers – to identify opportunities, fill out applications, or explain M&V – had been a customer request. The two contractors will also help the IAP team develop leads, provide weekly reports of the project pipeline, and even help identify opportunities for projects to go through PES (IAP submitted its first two PES claims this year). The two sales support contractors each have a specific geographic territory (roughly north and south Ontario) and work closely with the business advisors for their accounts in each area. One IAP customer that had not participated recently mentioned that he had been in touch with the IESO and knew about the third-party team to help prepare the application and technical review. Most notably, one EM used their interview to thank IAP for the sales support: “I want the IESO to know how excited I am to have the extra help and am thrilled that they considered my feedback. Less time reporting means more time to achieve savings.”

Due to the long lead times for project completion, the full impact of these changes was not reflected in the participant interviews this year as many of them have not yet experienced the updated contract and process. The evaluators will continue to monitor how customers perceive the program process, the support they receive, the barriers they encounter, and their overall satisfaction with the process to see how the IAP team’s efforts manifest themselves in future satisfaction scores.

IAP has undergone several changes in the past year to improve the customer experience, which will be monitored in subsequent evaluations.

- Other policy changes, such as the CHP phase-out or the Ministry Directive allowing transmission-connected customers with distribution-connected facilities to use IAP for all their projects, are not expected to substantially impact the program, but will likewise be monitored.

5.3.6.2 Customer Pain Points

Overall customer satisfaction for IAP CI and Retrofit participants rose slightly from the PY2016 data, though they still have the lowest satisfaction of the CFF industrial programs (they were also substantially lower than IAP EMs, who gave an overall satisfaction rating of 9.0, compared to IAP CI’s 7.8 and Retrofit’s 7.7).[38] As noted above, the program staff expects satisfaction to increase as more customers experience the program’s updates. Perhaps unsurprisingly, the incentive was where participants most frequently praised their experience, especially for the more lucrative P&S program. Two participants said the incentives were the main enabler of their projects.

When asked to comment on barriers, places the program could improve, or why they were not satisfied with a particular program aspect, there was one thing that participants had in mind: the application process. Out of 19 comments made by the four IAP CI and six Retrofit participants, 13 were related to the application requirements or the review. Although the application review requirements are the same as for PSUP and participants raised similar comments, their IAP counterparts brought up the challenges more frequently and with stronger language. There are a few potential reasons for this:

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[38] IAP Process & Systems overall satisfaction rose by 0.1 points and Retrofit by 0.3 points.

- More IAP projects are focused around process efficiency or very customized measures, which are more challenging to review, and the TR will have less experience with them
- PSUP is currently dominated by CHP; CHP vendors tend to be better versed in the program requirements and may be more likely to complete the application on behalf of the customer
- PSUP is dominated by CHP, where the bigger headaches are likely to be around interconnection issues
- PSUP facilities are smaller and are less likely to have the resources to complete the application themselves; they may request the vendor to do it.

Whatever the reason, IAP customers seemed to be more frustrated with the application review process than their LDC counterparts. There were three main challenges brought up with the application review, all of which were also raised in the Phase 1 participant interviews:

- **Time required**: The number one complaint was simply on the amount of time and effort to wait for approval and/or answer information requests (IRs). As with the PSUP comments, the application itself did not appear to be a barrier, just what occurred after it was submitted. Comments were similar for both IAP CI and Retrofit participants, though Retrofit participants that had also participated in IAP seemed to think that Retrofit required an outsized amount of work compared to the incentive level. One Retrofit participant stated that the approval timeframe had prevented them for applying for incentives, as they needed to proceed faster than what the program could allow for. All three business advisors also commented on the amount of time it took to get applications completed and approved. Two noted that solid projects with submitted applications could get “shelved” as time wore on, and the third noted that if a customer was on the fence – if electricity costs were less of a priority – then the administrative time could tip them towards not going through with the incentive.
- **Additional documentation required**: Participants seemed particularly confused about the information requests, which often asked for information that was not in the application or was seemingly irrelevant.
- **Explaining technical details**: There were a few comments made by participants who felt that their technical reviewer lacked the technical understanding needed for a particular project and

required hand-holding. This would have to be repeated each time there was reviewer turnover (which four of the ten participants brought up as a frustration).[39]

The later-stage M&V can also be a challenge for some customers as the participants supply and calibrate their own metering equipment. While this can be very important for large IAP CI projects (leading to a disagreement between the participant and the technical reviewer in one case), it can also be a challenge for smaller Retrofit projects. Two participants brought up that Retrofit requires metering for lighting projects and are not sure why; one participant deliberately batches lighting projects so that they are under the M&V threshold.

On the other hand, not all participants had a poor experience; there was one IAP CI participant who stated they had been through the programs enough times now that they were familiar with the process, and an IAP Retrofit participant who thought it was well organized and not overly cumbersome.

Process Finding 11: The application review process is a major barrier for IAP and the long timeframe can cause customers to shelve projects.

- Although similar comments were raised in the PSUP interviews, they occur more frequently and with stronger language in the IAP interviews.

Process Recommendation 13 (PSUP/IAP): Develop measure-specific applications or accompanying guidance to limit the number of information requests.

- The Technical Reviewer should determine what types of data they often request in IRs and whether the data was missing or not requested in the application.
- IESO should then consider revising the application, developing an application amendment, or including more detailed guidance as an accompaniment to the application based on this review. Making the applications or guidance measure-specific for the most common 4-5 measures would also ensure that relevant information is captured upfront for each. This would ultimately save both Technical Reviewer and customer time from having to track down additional unexpected information.

5.4 PROGRAM-ENABLED/SPILLOVER SAVINGS (PES) RESULTS

5.4.1 PES DESCRIPTION AND EVALUATION APPROACH

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[39] These two issues – regarding technical experience and staff turnover – were also raised in PSUP and EM interviews, though less frequently.

The Program Enabled Savings (PES) initiative provides an opportunity for LDCs to quantify savings generated through their customer interactions outside of the existing suite of efficiency programs. LDCs submit a PES claim form with substantiating documentation describing the project(s) and savings, which are credited to the appropriate conservation program (PSUP, Retrofit or High Performance New Construction). The PES initiative is unique and does not exist in any North American jurisdiction with greater than $30M per year in annual CDM spending.

In PY2017, PES claims were approved and were subject to an independent technical review process similar to other programs included in this evaluation. This is a change from PY2016, when PES claims did not go through an intermediate technical review; rather, the claims were directly verified by the EcoMetric Evaluation team.

Savings from PES claims are attributed to the Industrial Portfolio through the PSUP program. Four total PES claims were attributed to the PSUP program in the PY2017 evaluation, two going into service in 2017 and one going into service in 2016 and 2015. Meanwhile, savings from claims attributed to the Retrofit and High Performance New Construction (HPNC) are reported with their respective programs in the Business Portfolio. PES Retrofit claims were the most prevalent in the PY2017 evaluation with 46, while there were just three PES HPNC claims.

5.4.2 PES TRACKING SYSTEM & DOCUMENTATION REVIEW RESULTS

The evaluation team's review of the Program-Enabled Saving/Spillover (PES) tracking system and project documentation found that savings documentation and data for submitted claims is often incomplete and lacking key parameters to verify savings and/or spillover. Out of 142 PES claims submitted to IESO over the past two years, 24 claims continue to not include sufficient information to both a) substantiate the energy savings claims, and b) attribute the savings to a Save on Energy program. Many claims that were lacking sufficient documentation did not include adequate evidence of pre-project/baseline conditions, transparency in calculation of energy savings, and/or information on post-project equipment specifications and operating parameters. While several projects were able to provide the missing information following a request by the evaluator or technical reviewer, the process to request and obtain the missing data and information often took several months to resolve.

Finding 12: Tracking and technical review documentation data does not include project cost data.

- Project cost data for PES claims remains unverified, with the only cost data available coming from the participant in the PES claim application.

Recommendation 15: Engage the technical reviewer to track and verify the participant's project costs associated with their PES claim. Require that documentation supporting the project costs be provided by the participant at the application stage for the claim to be eligible.

5.4.3 PES GROSS VERIFIED SAVINGS RESULTS

The PES initiative had a total of 62,386 MWh of gross energy savings in PY2017. Over 58% of the verified spillover savings from the PES initiative (36,185 MWh) are attributed to the PSUP program from just four evaluated claims. Meanwhile, 46 claims for the Retrofit program, where projects tend to be smaller in scale, resulted in 22,757 MWh of gross verified energy savings. Just three claims attributable to the Business High Performance New Construction (HPNC) program were evaluated, accounting for 3,445 MWh of verified energy savings.

The technical reviewer did not verify demand savings, so no summer peak demand savings were reported. The evaluation team did calculate demand savings for all PES claims in the PY2017 evaluation, however.

Table 35: PES Gross Verified Savings

Program Claim Attributed To	# of Claims Evaluated	Realization Rate (%)	Gross Energy Savings (MWh)	Gross Summer Peak Demand Savings (MW)	Persistence of Savings in 2020
PSUP	4	99.59%	36,185	-	59%
Retrofit	46	99.59%	22,757	-	82%
HPNC	3	99.59%	3,445	-	100%
PES Total	**53**	**99.59%**	**62,386**	**-**	**69%**

Total PES Initiative gross verified energy savings are 99.6% of reported savings. Despite issues with a lack of documentation in the savings claims, the energy realization rate was nearly 100%. However, several large and complex projects would have greatly benefited from improved M&V data and supporting documentation to ensure accurate savings calculations.

69% of total first-year energy savings from the PES Initiative persist through 2020. Only 59% of energy savings from the PES claims attributed to the PSUP program persist through 2020. This is due to a large BMG CHP project that was verified to have reduced future savings following major operational changes at the facility.

Finding 13: The Evaluation Team was unable to evaluate demand savings as only energy savings were verified.

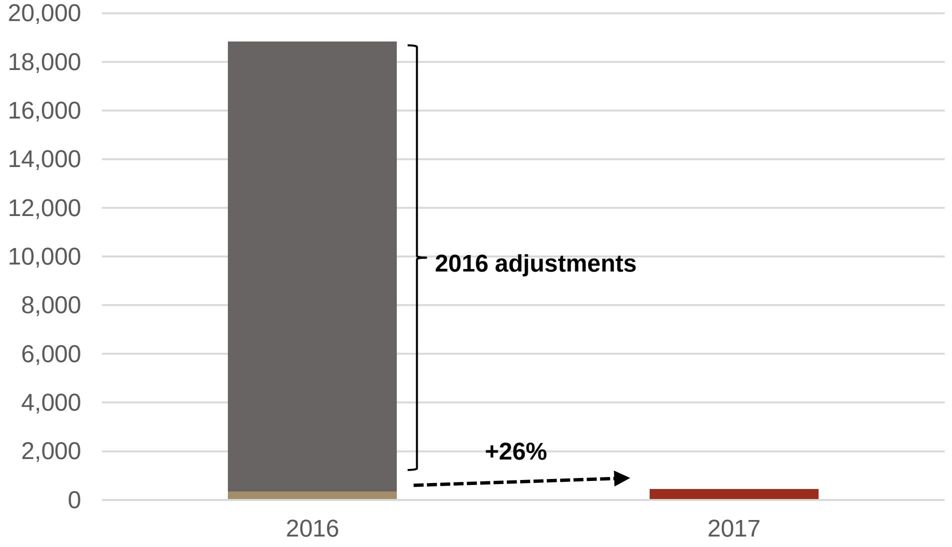
Recommendation 16: Require the technical reviewer to verify summer peak demand savings as is done in all other industrial programs.

5.4.4 PES NET VERIFIED SAVINGS RESULTS

The enabling nature of the PES initiative means that for savings to be verified, they must be clearly attributed to another program, therefore *net savings are equal to gross savings*. If a PES claim lacked attribution, more information was requested, or it was deemed ineligible.

Net verified results for the PES Initiative are summarized in Figure 20. **Total net first-year energy savings for the PES PSUP program in the CFF are 19,259 MWh. Overall, total net first-year energy savings for the PES PSUP program increased 26% YOY, compared to PES PSUP projects implemented and evaluated in PY2016.** 2016 adjustments, PES PSUP projects implemented in 2016 but evaluated in PY2017, represent 98% of PES PSUP net energy savings achieved in the CFF due to a very large CHP project.

Figure 20: Total CFF PES PSUP Net First-Year Energy Savings (MWh)



5.4.5 PES COST EFFECTIVENESS RESULTS

PES costs and benefits are included in the respective programs to which the spillover savings are attributed and are not estimated separately.

5.4.6 PES PROCESS EVALUATION RESULTS

As described above, the M&V guidelines for the PES initiative were revised in 2017, which the LDCs and the Technical Reviewer are now using. LDCs that had reviewed the revised guidance agreed that it provided more structure and certainty. Although a few LDCs reported challenges collecting the level of data required as if the customer was a standard program participant, only 17% of the 142 PES claims from 2016 and 2017 were stopped because they were unable to provide enough documentation to meet the level of rigor required.

The PES initiative is a unique offering, allowing very large projects to be claimed as program enabled spillover savings without direct participation in the IESO's conservation programs. However, this unique initiative does create several serious challenges. Participants in the PES initiative almost always participate in at least one of the IESO's other conservation programs that go through net-to-gross analysis. In the NTG surveys for these programs, participants are asked about spillover and are credited for completing EE projects beyond those being evaluated in the program. As such, this creates a challenge for the PES initiative to ensure that spillover credited to one program is not double-counted through a PES claim. To ensure spillover savings are not double-counted, technical reviewers and evaluators of IESO's programs must work together to review the PES claims and verify the savings from these claims have not already been counted as spillover in another program.

Process Finding 12: PES savings may accrue above and beyond spillover already captured by the NTG analysis conducted for other programs, but they could also be double counted if not calculated properly.

Process Recommendation 14: Investigate the potential for double-counting of spillover savings from PES claims. Consider providing the PES claims to each evaluation team (Retrofit Program, etc.) to reduce the possibility of double-counting spillover savings.

Another challenge the PES initiative creates is accounting for intention as part of free-ridership. There are two core components of free-ridership: 1) intention to implement the energy efficiency project(s) in the absence of program funds, and 2) influence of the program in the decision to carry out the energy efficiency project. For a PES claim to be approved, it must prove the project in the claim was influenced by an IESO program. Once a PES claim meets this standard of influence, 100% of the gross verified savings are considered net verified savings, giving the project a de facto NTG ratio of 100%. However, intention is not investigated as part of the PES claim review. Claims that are submitted to the PES initiative are for EE projects that the organization completed without receiving funds directly from the IESO program that was proven to influence the project. Although the initiative captures spillover, approved PES claims are rewarded 100% of their gross verified savings without taking into consideration the organization's intent—resulting in the reward for savings with an element of unknown free-ridership.

Process Recommendation 15: Investigate the potential for free-ridership in the PES initiative and how to account for participants intention scores in the calculation of net verified savings.

Projects of unprecedented sizes, including large industrial CHPs, have been counted as spillover through the initiative. Many projects of this size and complexity were completed several years before their claim was evaluated, creating a challenge for the technical reviewer and evaluator to obtain an accurate baseline to verify savings.

These serious challenges in administering the PES initiative create an opportunity for LDCs to be rewarded for energy savings that could possibly be double-counted or would have been achieved absent any IESO funds. **Considering the size of these claims and the complexities in verifying their savings, the IESO should seriously consider discontinuing the PES initiative**. The IESO should encourage LDCs and participants to leverage IESO support and funding through existing programs that historically influenced PES claims including: Retrofit, PSUP and HPNC.

Process Recommendation 16: *Discontinue the PES initiative. Encourage LDCs and participants to leverage IESO support through existing programs that historically influenced PES claims.*

5.5 MONITORING & TARGETING (M&T) PROGRAM RESULTS

The Monitoring and Targeting (M&T) Program encourages industrial distribution customers to install or upgrade M&T systems to relate a facility's energy consumption data to the weather, production schedule, or other measures in such a way as to provide a better understanding of how energy is being used. M&T systems are expected to identify signs of avoidable energy waste or other opportunities to reduce consumption. Project eligibility is partly contingent on achieving a savings goal within 24 months of installation and sustaining these savings for the terms of the participant agreement, five years from the date the M&T system is installed.

Monitoring & Targeting had no projects in service starting in 2017 and ready for evaluation, therefore no verified impacts from the M&T program are included in this report. The two-year implementation schedule of M&T projects described above leads to a somewhat longer technical review phase. M&T program costs incurred in 2017 are included in the cost-effectiveness analysis.

Only one M&T project was ready for evaluation in PY2017, but energy consumption and production data were outdated and unreliable. The EcoMetric team and the technical reviewer were not able to obtain updated information from the customer to support the savings calculations.

5.5.1 M&T PROCESS EVALUATION RESULTS

The M&T program pays for a facility to install energy monitoring equipment in its facility, with half of the incentive paid upfront and the remainder disbursed based on facility savings as documented through two years of M&V. As described above, although five M&T projects were completed in PY2017, none of them could be evaluated. The program's very low participation is caused by a variety of barriers, discussed more below.

5.5.1.1 Barriers to Participation

The M&T program remains a bit of an enigma to customers, LDCs, and the evaluators. There are few customers who can meet its requirements, a handful of successful participants, a small number of LDCs that understand the program rules, and scant projects for which the evaluators can study impacts and the customer processes. There have been 55 companies that have submitted 72 applications to the M&T program since 2012; about half were submitted since 2015 in the new framework. Only 5 of these M&T projects have completed the two years of M&V needed to receive the final incentive as of January 2018. Because of the long lead times, all 5 of these projects were submitted between 2012 and 2014, before the CFF started. To provide a sense of the magnitude of M&T, 338 engineering studies and 195 PSUP projects have been completed since 2015. Out of the 32 applications submitted since 2015, zero have finished the required M&V timeline. Twelve of these projects were supposed to have submitted the second-year report in either 2016 or 2017, but only 8 have; the remainder are listed as having outstanding information requests.

The NTG team did attempt to conduct interviews for those 5 projects, but since the projects had been started so long ago, none of the decisionmakers or site contacts could be reached for interviews. This was likewise true for the gross impact evaluation, where missing data and an inability to find good contacts hamstrung the team's ability to evaluate any of the projects. Although participants could not be reached, the evaluators were able to contact four M&T "partial" participants, or those who had stopped after their application had been approved. Only one said they had stopped – they found a better program but couldn't remember the name – two were still participating (and had missed a deadline by several months, placing them on the "partial participant" list), and one didn't know if they were still in the program or not. Their responses to follow-up questions about the program – any challenges or barriers, or ways that the M&T program could be improved – were very vague and referenced the general LDC programs rather than M&T, again possibly reflecting how long ago the projects had started.

The difficulty in reaching participants to learn about their experience or gather enough data to evaluate their projects illustrates some of the challenges in working with the program. The LDC interviews during the Phase 1 process evaluation provided an overview of the obstacles, so a question on the barriers to participation for M&T was added to the LDC survey this year. Only 59% of the LDCs were comfortable enough with the program to answer, but they managed to list eleven different barriers to participation, as shown in Table 36.

Table 36: Barriers to Participation in the M&T Program

#	Barrier	Description	Number of mentions
1	Savings requirements	Participants must meet two savings targets - 0.2 MW in peak demand reduction and the energy equivalent of that 0.2 MW based on the facility load factor. The savings target is very specific, ambitious, and some facilities might have difficulty meeting both metrics. One LDC suggested that a percentage reduction would be more beneficial than a specified one. Also, if the facility has an EM, the M&T target is added to their EM one.	5
2	Reporting	The facility must provide five years of annual reports on what opportunities have been identified and implemented. M&V is also required for 2 years with the facility providing the data for technical review.	4
3	Long-term commitment	There is a 5-year contract for the program. As stated above, there are also 2 years of M&V requirements before the incentive is paid, and 5 years of annual reporting.	4
4	Complexity	The program is limited to customers that are sophisticated enough to understand the many requirements and their implications.	4
5	Retrofit more attractive	While M&T offers a potentially higher incentive, Retrofit has none of the savings, reporting, or M&V requirements.	3
6	Obligation to implement	The customer must implement all capital measures identified that have less than a 1-year payback and may be uninterested or unable to commit to that.	2
7	Lack of LDC knowledge	Few LDCs have experience with the program. There is also little literature on the program; one LDC asked for a manual or training.	2
8	Uncertain outcome	Customers are skeptical that they can meet their savings targets through software.	2
9	Only works for large customers	The program is only set up for customers large enough to meet both savings metrics and the other requirements.	2
10	Services not supported	Costs of support and monitoring services by the consultant or vendor are not considered eligible costs under M&T.	1
11	Perception of costs	Historically the high cost of M&T equipment has been a barrier to the program. Although costs have dropped significantly, customers may still believe that costs are prohibitive.	1
12	EM required[40]	The facility must have a dedicated EM to participate in M&T, though they do not need to be incented through the EM program.	0

The key takeaway of this list is that there is a barrier for everyone. Even if some customers are large enough to meet the savings requirements, they may not be able to sign contracts longer than four years (a challenge for the automotive industry) or prefer to invest in capital projects with more certain paybacks than monitoring software. Even if there is a customer that would be a great fit for the program, their LDC

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[40] Note: while no LDC mentioned having an onsite EM as a barrier, it's plausible that requirement could also prove challenging for some facilities and is included for the sake of comprehensiveness.

may not be able to identify them as a good use-case or be comfortable enough to promote the program more broadly. Over 40% of LDCs were not even able to comment on the barriers; even several that did mention that they did not advertise the program. As a result, the program continues to have low participation and low savings.

Process Finding 13: There are substantial barriers to participation for the current iteration of the M&T program, resulting in low participation and a small contribution to portfolio savings.

- The current iteration of the M&T program is seen as not workable for the vast majority of industrial customers.

Process Recommendation 17: Discontinue the M&T program and direct relevant new customers to other program offerings such as the Energy Performance Program (EPP) unless there is a compelling reason to redesign the program instead.

- EPP includes a whole-building performance aspect and pay-for-performance incentives and Retrofit offers incentives for the installation of energy management systems. Depending on the customer, they could be directed to either program in lieu of M&T.
- The evaluators did not get a clear sense of the original goal of the M&T program; it is possible that this goal cannot be fulfilled through a combination of other programs. IESO should convene a meeting with relevant stakeholders from the program design team and the LDCs to discuss the program's goals.

6 FINDINGS AND RECOMMENDATIONS

6.1 IMPACT EVALUATION FINDINGS AND RECOMMENDATIONS

Table 37: Impact Evaluation Findings and Recommendations

Findings		Recommendations		Actionable Audience
Portfolio Tracking System & Program Documentation Review Results (Section 4.1.4)				
1	Tracking data and project documentation is generally accurate and comprehensive but can be improved to ensure precise estimations of verified savings.	1	Open a channel of communication between the evaluator and technical reviewer, facilitated by the IESO, to ensure tracking data and project documentation issues are understood and impactful and realistic solutions can be implemented.	IESO, Technical Reviewer
Portfolio Gross Verified Savings Results (Section 4.1.5)				
2	The technical review process generally yielded accurate energy savings calculations but could benefit from a more uniform methodology.	2	Create a standard procedure or similar guidance for the technical review process, including baseline classifications and calculations based on measure type. Require the technical reviewer to consider seasonal variations and other correlations when forecasting annual savings and encourage the technical reviewer to provide clear explanations of the methods used to extrapolate partial-year results to annual results.	IESO, Technical Reviewer
3	Behind-the-meter generation (BMG) projects account for 56% of gross verified energy savings and account for the majority of savings in both LDC-administered and IESO-administered programs evaluated in PY2017.	3	Create a standing committee with the IESO, LDCs and partners to develop a plan to sustain participation in the Industrial Portfolio following the removal of a popular energy efficiency measure. Investigate the potential for biogas-fueled CHPs in Ontario, as well as other projects that were overshadowed by CHPs.	IESO
Cost Effectiveness Results (Section 4.1.7)				

Findings		Recommendations		Actionable Audience
4	The cost of natural gas used to calculate avoided costs of natural gas consumption in the IESO's Cost Effectiveness Tool is not frequently updated to reflect current market conditions, resulting in inaccurate calculations that do not account for actual natural gas costs incurred in the fuel market.	4	Update the avoided cost of natural gas used in the CDM Cost Effectiveness Tool on an annual basis to reflect current market conditions. A comparison study of marginal natural gas costs in Ontario and other provinces with similar markets is recommended to ensure the avoided costs used reflect industry practices.	IESO
		5	Develop functionality in the Cost Effectiveness tool to account for the seasonality of natural gas prices. Seasonal avoided cost prices of electricity are utilized in the CDM CE tool by leveraging hourly electric load profiles, which should serve as an example for seasonal avoided cost of natural gas.	IESO
PSUP Gross Verified Savings Results (Section 5.1.3)				
5	Two PSUP projects were reported to have summer peak demand increases following the technical review stage but were verified to have summer peak demand savings in the savings audit.	6	Ensure the technical reviewer accurately calculates and reports summer peak demand savings for all PSUP projects.	IESO, Technical Reviewer
6	Several PSUP projects relied on spot measurements as short as 90 minutes to extrapolate a year of data.	7	In the case where measurement data is unavailable, interviews with the participant should be conducted and nameplate data should be recorded to inform the technical reviewer and allow the development of an annual profile with inputs from the spot measurements, in lieu of extrapolation of brief spot measurement data.	Technical Reviewer
		8	The implementer should always meter equipment using kW meters.	Technical Reviewer
EM Tracking System & Program Documentation Review Results (Section 5.2.2)				
7	Energy Manager program tracking data for PY2017 was very similar to PY2016. It is somewhat less reliable than the data tracked for the other Industrial programs and showed minimal improvements in PY2017.	9	Energy Managers and technical reviewers should include participant cost information as this information is critical for program tracking and evaluation purposes. This information should be entered into tracking databases and supported with invoices and other documentation.	Technical Reviewer, Energy Managers

Findings		Recommendations		Actionable Audience
		10	Require that all key tracking parameters (in-service date, project cost, kWh, kW, and EUL) are completed for all measures and that zero values actually reflect the absence of participant cost or peak demand savings.	Technical Reviewer
EM Gross Verified Savings Results (Section 5.2.3)				
8	The annual energy savings estimates produced by Energy Managers are generally very accurate. There is a tendency for Energy Managers to be overly conservative in their estimates once they have met their contractual obligations.	11	Consider a mechanism to reward Energy Managers for exceeding their required amount of non-incented energy savings. One possibility would be a “carry-over” calculation whereby savings more than the contractually required minimum could be applied to future years in the event of a shortfall. Designing a proper incentive would eliminate the conservative behavior of EMs to target the required minimum savings.	IESO
9	The peak demand savings estimates for non-incented Energy Manager projects are inconsistent or non-existent. Projects are often submitted without peak demand savings estimates. When projects have demand impacts recorded, they are frequently the change in connected load rather than an estimate of demand reduction coincident with the system peak.	12	Make the quality and completeness of peak demand tracking and reporting a performance metric for technical reviewers. Although goals are based on energy savings, peak demand impacts are a key factor in system planning and cost-effectiveness.	IESO, Technical Reviewer
10	The evaluation team observed Energy Managers using LDC meter data in savings calculations that was adjusted for transmission and distribution losses.	13	All project savings calculations should be performed at the meter-level for goal assessment. Impacts are grossed up for T&D losses as part of cost-effectiveness calculations.	Technical Reviewer
IAP Gross Verified Savings Results (Section 5.3.3)				
11	Baseline assumptions for behind-the-meter generation projects are typically poorly documented.	14	Require that measurement and verification plans for BMG projects include a discussion of the assumed baseline condition and explain the technical alternatives participants had other than installing generation equipment.	IESO, Technical Reviewer
PES Tracking System & Documentation Review Results (Section 5.4.2)				

Findings		Recommendations		Actionable Audience
12	Tracking and technical review documentation data does not include project cost data.	15	Engage the technical reviewer to track and verify the participant's project costs associated with their PES claim. Require that documentation supporting the project costs be provided by the participant at the application stage for the claim to be eligible.	IESO, Technical Reviewer
PES Gross Verified Savings Results (Section 5.4.3)				
13	The Evaluation Team was unable to evaluate demand savings as only energy savings were verified.	16	Require the technical reviewer to verify summer peak demand savings as is done in all other industrial programs.	IESO, Technical Reviewer

6.2 PROCESS EVALUATION FINDINGS AND RECOMMENDATIONS

Table 38: Process Evaluation Findings and Recommendations

Findings		Recommendations		Actionable Audience
Variation in LDC Implementation (Section 4.2.1) Cross-cutting				
1	Smaller LDCs are often less confident in their understanding of the complex industrial programs.	1	Develop training for the PSUP, EM, and M&T programs, given to the LDCs, that cover their rules, processes, and the LDC responsibilities.	IESO, LDCs
Program Awareness (Section 4.2.2) Cross-cutting				
2	Only a little over a third of LDCs have some form of channel partner network, and several commented that their vendors tend to focus on either CHP or Retrofit projects.	2	Encourage and help LDCs without channel partner networks to develop them. Conduct further research to identify the appropriate channel partner networks to develop and leverage into increased program participation. Compare with trade ally networks established in other markets.	IESO, LDCs
3	Nonparticipants are generally aware of the Save on Energy programs and offerings with the exception of the EM program.	3	Increase nonparticipant awareness of the EM program by raising the profile of the program.	IESO
Program Overlap and Competition (Section 4.2.4) Cross-cutting				
4	Administrators described significant overlap between IESO energy conservation programs and the Industrial Conservation Initiative (ICI).	4	Leverage the ICI to spur conversations with customers and use it to market to their priorities without making the project explicitly about demand reduction.	IESO
PSUP Process Evaluation Results (Section 5.1.6)				
5	The application review process remains a major customer pain point for PSUP.	5	Develop measure-specific applications or accompanying guidance to limit the number of information requests (See also Recommendation 13, Section 5.3.6.2, for IAP).	IESO

Findings		Recommendations		Actionable Audience
EM Process Evaluation Results (Section 5.2.6)				
6	The EM program is seen as an enabling program and drives participation and savings in other Save on Energy/IAP programs.	6	Consider ways to reward EMs for overachieving the 10% non-incented target, provided that they submit enough documentation for the technical reviewer to fully review and the savings persist to 2020.	IESO
7	EMs vary considerably on their achievement of annual goals, though further research is needed to understand the factors involved.	7	Consider including further research of EM goal achievement as a targeted study item for the PY2018 process evaluation.	IESO
8	The ability to get buy-in and commitment from the rest of the company is one of the most important determining factors of an EM's success.	8	On a regular basis, offer trainings on the communication skills that allow EMs to pitch projects, network internally, and convince both facility and corporate staff of the benefits of conservation projects.	IESO
		9	Continue to highlight the successes of EMs in case studies, presentations, and awards, and consider additional venues or methods to do so.	IESO
9	EMs and their supervisors are appreciative of the support provided by the program implementer, the LDCs, and IESO in the form of frequent training opportunities and check-ins.	10	Conduct industry-specific training sessions that cover relevant technology measures for that industry.	IESO
		11	Develop an online schedule listing all relevant trainings and events.	IESO
10	The EM Hub was not widely used by the EMs interviewed.	12	Survey all EMs on their use of the EM Hub and use the responses to update its functionalities.	IESO
IAP Process Evaluation Results (Section 5.3.6)				

Findings		Recommendations		Actionable Audience
11	The application review process is a major barrier for IAP and the long timeframe can cause customers to shelve projects.	13	Develop measure-specific applications or accompanying guidance to limit the number of information requests.	IESO
PES Process Evaluation Results (Section 5.4.6)				
12	PES savings may accrue above and beyond spillover already captured by the NTG analysis conducted for other programs, but they could also be double counted if not calculated properly.	14	Investigate the potential for double-counting of spillover savings from PES claims. Consider providing the PES claims to each evaluation team (Retrofit Program, etc.) to reduce the possibility of double-counting spillover savings.	IESO
		15	Investigate the potential for free-ridership in the PES initiative and how to account for participants intention scores in the calculation of net verified savings.	IESO
		16	Discontinue the PES initiative. Encourage LDCs and participants to leverage IESO support through existing programs that historically influenced PES claims.	IESO
M&T Process Evaluation Results (Section 5.5.1)				
13	There are substantial barriers to participation for the current iteration of the M&T program, resulting in low participation and a small contribution to portfolio savings.	17	Discontinue the M&T program and direct relevant new customers to other program offerings such as the Energy Performance Program (EPP) unless there is a compelling reason to redesign the program instead.	IESO

APPENDIX A: PEAK DEMAND DEFINITIONS

Table 39: IESO EM&V Protocol Peak Period Definitions

Definition Source	Months	Days and Hours	Calculation of Demand Savings
EM&V Protocols: Standard Peak Calculation	Summer: Jun-Aug	Weekdays 1pm-7pm	Average over entire peak period
	Winter: Jan-Dec	Weekdays 6pm-8pm	
EM&V Protocols: Alternative Peak Protocols for Weather-Dependent Measures	Summer: Jun-Aug	Weekdays 1pm-7pm	Weighted average of the top hour in each of 3 months per IESO weights
	Winter: Jan-Dec	Weekdays 6pm-8pm	

APPENDIX B: PHASE 1 PROCESS EVALUATION PROGRAM SNA

Appendix B contains the Phase 1 Process Evaluation Program Snapshots completed for the PY2016 Evaluation.

B.1 CROSS-CUTTING PHASE 1 PROCESS EVALUATION SNAPSHOT

Certain program components like data tracking or marketing are more efficiently delivered when managed across programs than when each program team does each separately. The programs are also affected by the broader structure and environment, including policy, the IESO's oversight processes, and coordination between LDCs. This snapshot presents initial observations and further research for cross-cutting program aspects organized by five overarching program steps.

Initial Observations	**Further Research**
Program Design	
- LDCs have flexibility to allocate and adjust their portfolio funding and savings targets to individual programs to achieve overall assigned goals. - LDCs have responsibility over budgets and must maintain a TRC cost-effectiveness ratio of at least 1 in new CFF. - There are opportunities for collaboration with gas utilities and integrating/cross-marketing greenhouse gas elements.	- Study potential areas for gas collaboration and greenhouse gas integration.
Management	
- IESO input is needed early on during program redesign process. - The mid-term incentive for LDCs puts a large focus on hitting interim savings targets by the end of 2017. - Clarity or additional guidance is needed on several processes, including invoicing timelines, reporting, and program rule waivers. - Decision-making authority and responsibility is not always clear. - Training opportunities are extensive and valued.	- Assess all unclear processes, and search for places where streamlining can help, or additional guidance is needed. - Develop responsibility and accountability matrix for IESO staff. - Gather information on trainings offered across IESO, LDCs, TR, and other stakeholders to assess what works and opportunities for collaboration or cross-marketing.

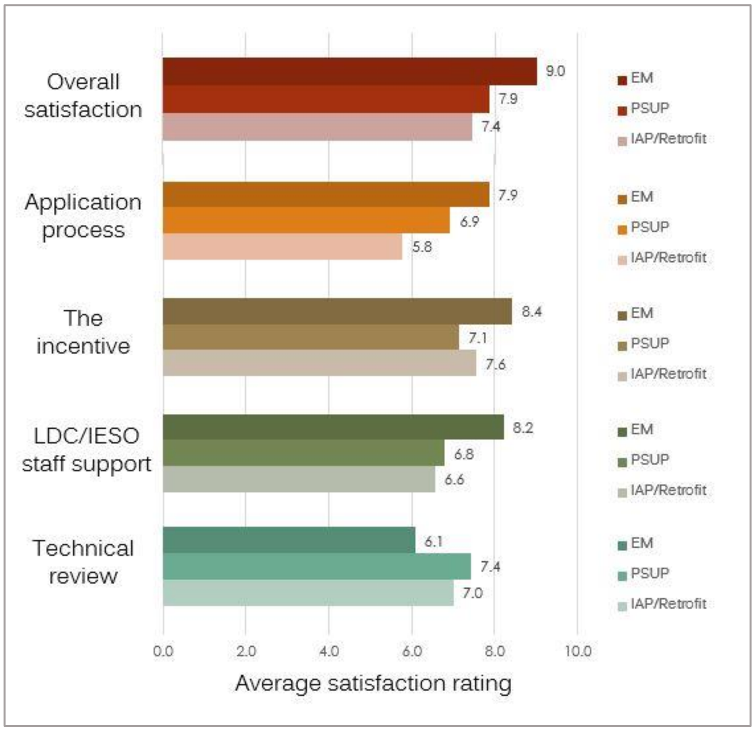
Delivery/Execution	
- Data systems are not adequate for program tracking. - Reporting data flows are unclear. - Marketing is done primarily by direct outreach to customers. - Channel partners are important to promote the programs. - Anecdotal evidence suggests variation in LDC implementation of the programs.	- Review existing systems and data exchange architecture. Assess what additional functionalities new systems should have. - Create process diagram for reporting. - Study the formality of existing channel partner networks and opportunities to better leverage them. - Analyze variation in LDC implementation to identify successful features for sharing and unnecessary differences for eliminating.
Customer Experience	
- Different industries have different priorities and program experiences. - Reducing energy bills, avoiding future energy price volatility, and furthering corporate sustainability policies are customers' most important motivators. - An overwhelming majority of participants had previously participated in IESO/LDC programs and even more planned to participate again.	- Develop industry-specific profiling. - Continue to monitor customer motivations and satisfaction by program.
Technical Review/Evaluation	
- There are no systematically reported savings for Industrial programs. - Technical review is discussed in greater detail in program sections.	- Develop a template for reported savings.

Largest Successes	Largest Opportunities
▸ Ample training opportunities on technical and sales topics ▸ Healthy collaboration between LDCs ▸ Direct outreach model to reach customers ▸ Popularity of programs from repeat customers ▸ Program "maturing" from previous framework	▸ Clarifying processes for LDCs and participants ▸ Program redesigns to be responsive to the market ▸ Limited-function data systems ▸ IESO organizational complexity ▸ Gas utility and greenhouse gas integration ▸ Leveraging channel partners

B.2 CUSTOMER PERSPECTIVES PHASE 1 PROCESS EVALUATION SNAPSHOT

All participants in PSU and IAP were interviewed along with a sample of EM participants. The process part of the interview asked about the customer's satisfaction with parts of the program and their experience, while the NTG portion gathered perspectives on their motivations for performing the project.

Customer Satisfaction

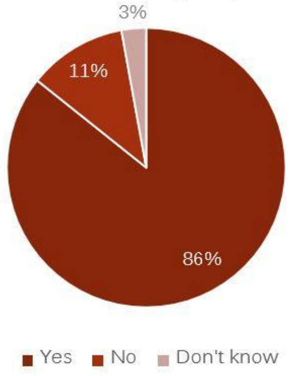


Note: a total of 37 participants were interviewed. Counts for each program can be found in *Section 3* of the PY2016 Report.

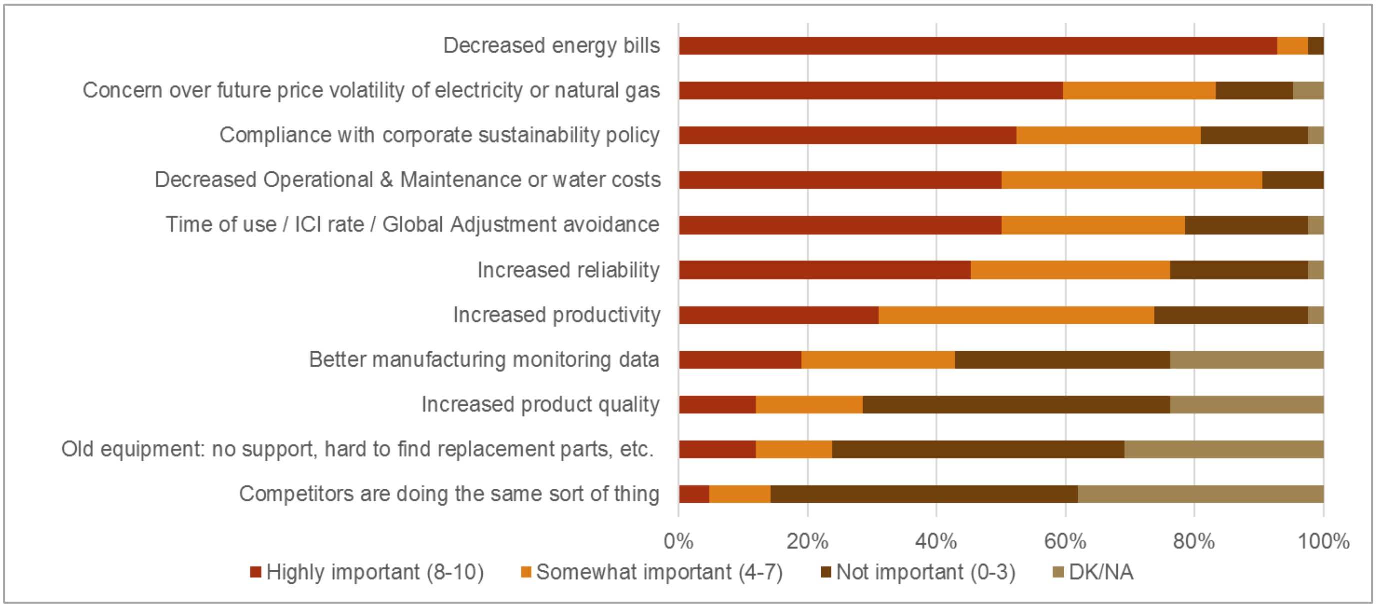
Participation Perspectives

74%	Respondents that had participated in a CFF program previously	
91%	Percentage that said their experience with past conservation projects influenced them to do additional ones	
78%	IAP/Retrofit participants	that said they planned to participate in another CFF program in the future.
86%	PSUP participants	
100%	EM participants	

Did program involvement affect your confidence in the project's likelihood of achieving the predicted savings?



Customer Motivations



B.3 PSUP PHASE 1 PROCESS EVALUATION SNAPSHOT

PSUP provides incentives for customers to install large energy efficiency or behind-the-meter generation (BMG) projects. There are several different program pathways depending on the type and size of the project. All projects require a detailed engineering study to proceed into the program. This snapshot presents initial observations and further research for PSUP organized by four overarching program steps.

Initial Observations	Further Research
Program Design	
- While PSUP incentives are high, contracting and M&V are seen to be burdensome, which inhibits participation and push projects to Retrofit and/or Program-Enabled Savings. - The “clawback” funding mechanism for engineering studies, where the study incentive is deducted from the project incentive, may discourage customers from PSUP participation. - There is an ongoing question about CHP eligibility as it is often a net emitter of greenhouse gases. However, it comprises the majority of past project	- Review peer Industrial program structures, including engineering study incentive and design, contracting processes, M&V requirements, and incentives to inform PSUP working group. - Additional research as appropriate to support implementation of the preliminary recommendations for this section.

savings and the future program pipeline. There is no mechanism for rewarding over-performance of savings.	
Delivery/Execution	
LDCs are funding fewer engineering studies under new framework due to impacts on program cost-effectiveness if the study does not convert into a project. LDCs indicated that engineering studies often don’t leave customers “shovel-ready.” PSUP application review and contracting stages are two major barriers. BMG was not considered during the initial program design. This creates confusion regarding interconnection and process requirements.	Deep dive into engineering study process to identify barriers and propose mitigation approaches. Develop process flow diagrams to help clarify key processes and responsibilities, building on overall program logic models.
Customer Experience	
Customer confusion and frustration with application and TR processes is common. Participants gave the program relatively high satisfaction ratings in the initial interviews despite the pain points.	Peer program review of M&V practices regarding timing, scope, and level of rigour. Additional PSUP customer interviews in Phase 2 to explore process bottlenecks.
Technical Review/Evaluation	
LDCs and customers feel that TR M&V and documentation requirements are overly burdensome, resulting in project delays and customers pursuing alternate programs.	Assess options for and effects of reducing M&V rigour during both application review and M&V period. Review project documents and work with TR firm to inform checklists.

Largest Successes	Largest Opportunities
High satisfaction ratings Attractive incentives Detailed engineering study helpful for customers	Engineering study process revisions to encourage conversions Participation agreement/approval process Requirement checklists to guide data collection/documentation M&V extent and rigour BMG-specific materials and process

B.4 EM PHASE 1 PROCESS EVALUATION SNAPSHOT

The EM program pays for a full-time resource at a large facility. In return, the EM must achieve a certain amount of energy savings per year (1,000–2,000 MWh per year, with at least 10% of the savings coming from non-incented projects). This snapshot presents initial observations and further research for the EM program organized by four overarching program steps.

Initial Observations	Further Research
Program Design	
- LDCs are very supportive of the performance-based payment option. - There is no mechanism to reward overperformance on non-incented savings.	- Analyze performance against goals by EM, including trends by salary/ performance payment, industry, and LDC. - Study impact of EM on the facility.
Delivery/Execution	
- Non-incented projects are often O&M or behavioral programs – important but hard to measure the impact of. - The EM Hub is seen as having a lot of potential to be more widely utilized.	- Delve into EM process, including reporting. - Gain EM perspectives on the Hub, how they use it, and how it can help them. - Assess training and collaboration opportunities.
Customer Experience	
- The EM program was widely praised by stakeholders and customers alike. - The main customer benefit is having a dedicated resource to drive projects. - Very high satisfaction ratings – average of 9 on a 0–10 scale from EM supervisors.	- Interview a sample of EMs to understand their experience.
Technical Review/Evaluation	
- Persistence of O&M/behavioral projects is controversial – EMs are tracked on first-year savings, but LDCs have to deliver savings persisting to 2020. - Project supporting documentation varies widely in detail and analysis methods.	- Explore opportunities to better leverage the non-incented savings aspect and what data fields must be collected.

Largest Successes	Largest Opportunities
- Very high satisfaction ratings - Good support for EMs – TR, LDC trainings; EM Hub; LDC monitoring - Generally high performance by EMs discussed in interviews (to be researched in Phase 2)	- Non-incented projects – use of O&M and behavioral savings - Non-incented projects – motivation to overachieve 10% - Gathering enough data from EMs

B.5 IAP PHASE 1 PROCESS EVALUATION SNAPSHOT

IAP is administered by IESO to all transmission-connected customers to provide the same opportunities as the LDC programs. IAP has several sub-programs that mirror the LDC offerings: Retrofit, Process and Systems, Energy Manager, and High Performance New Construction. This snapshot presents initial observations and further research for IAP organized by four overarching program steps.

Initial Observations	Further Research
Program Design	
- Programs are very similar to LDC-led ones. - IAP has not participated in the program redesign process (i.e., PSUP working group). - The Dec 2016 directive allowing companies with at least 1 transmission-connected facility to use IAP for all of their facilities will increase the eligible population and change their characteristics.	- Interview team members; understand plan for reaching additional facilities made eligible for IAP by the Dec 2016 directive. - Assess the impact the PSUP working group proposed changes would have on IAP and if further changes are warranted.
Delivery/Execution	
- Processes differ by program subpart, though are similar to LDC program rules. - The vertically-integrated team at IESO has the potential to work quickly, though it may be understaffed for the amount of work.	- Interview team members to assess responsibilities, workload, and data flows; review processes that impact project timing and customer experience.
Customer Experience	
- IAP staff noted this is an area they want to continue to improve. - The average satisfaction rating was 7.4 on a 0-10 scale, lower than PSUP (7.9) or EM (9.0). - Customer pain points were around the amount of work required, especially with TR, and on IESO/TR	- Survey customers on an ongoing basis; run additional interviews with nonparticipants and past participants who have had little involvement since their original project. - Consider ways that the program staff can remedy the program perceptions.

staff turnover.	
Technical Review/Evaluation	
TR is run the same for IAP as it is for the LDC-led programs. Customer grievances on data requests are similar to PSUP.	Assess effects of reducing M&V rigour during both application review and M&V period. Review project documents and work with TR firm to inform checklists.

Largest Successes	Largest Opportunities
Very high participation rate More flexibility for program design Attractive incentives	Customer experience and support PSUP working group proposed changes and impact on IAP if implemented Customer effort required for application/reporting

B.6 PES PHASE 1 PROCESS EVALUATION SNAPSHOT

Initial Observations	Further Research
Overall Process	
There was a large jump in PES claims, with more than 90 received for PY2016. LDCs see PES as an attractive option to claim savings without paying direct incentives. PES guidelines were developed for the prior program framework, and LDCs are unclear on documentation requirements to reach appropriate levels of rigour with claims.	In support of the impact recommendations above, conduct a detailed review of PES program guidelines to inform IESO in updating content regarding claim documentation requirements, data needs, and customer interface procedures.

B.7 M&T PHASE 1 PROCESS EVALUATION SNAPSHOT

Initial Observations	Further Research
Overall Process	
- The evaluators had limited insight into this program due to low participation rates. - Few LDCs had direct experience with the program. - LDCs suggested that the program's complexity and extensive M&V requirements are primary factors in underutilization. - LDCs noted that the Retrofit M&T program has much more achievable requirements, making it more attractive to customers.	- Research program guidelines and barriers to participation to develop program design or marketing recommendations. - Explore components of Retrofit M&T program for potential application to M&T, or to combine programs. - Consider what future collaboration opportunities may exist to incorporate continuous improvement and SEM principles into the M&T program design, and to work more directly with gas utilities.

APPENDIX C: SELECT METHODOLOGY DETAILS

This appendix contains details about the evaluation methodology that are excluded from the body of the report for brevity. An overview of the evaluation methodology can be found in *Section 3*.

C.1 GROSS SAVINGS DATA COLLECTION AND REVIEW

C.1.1 DATA SOURCES

Table 40 below contains a list of the data sources used from verifying gross savings.

Table 40: Data & Information Sources Used for Impact Evaluation

Item	Description	Source
Reported (Ex-Ante) participation & savings	Savings by program, project, & measure	Technical Reviewer
Participant contact information	For project-specific interviews and site visit coordination	Technical Reviewer & IESO
Project files	Including M&V data & documentation	Technical Reviewer & IESO
Reporting template(s)	For impact reporting	IESO
Cost-effectiveness parameters	Avoided costs, admin costs, discount rate	IESO

EcoMetric used several distinct data-collection techniques to fulfill evaluation objectives, explained below.

C.1.2 GROSS SAVINGS VERIFICATION METHODS

C.1.2.1 Project Documentation Review

Project documentation was mostly provided by IESO's technical reviewer, and in some cases, by the customer or IESO program staff. Project files utilized for review and analysis included project incentive applications, engineering workbooks, equipment cut sheets, invoices, email exchanges, technical drawings, M&V plans and reports, and digital photos.

C.1.2.2 Project Audits

Project audits verify the accuracy of savings calculations, assumptions, and M&V conducted by the technical reviewer, contractors, customers, and any other parties involved in the application, implementation, and technical review process. Audits were performed for each project in the sample, utilizing technology-specific methods and tools, and testing the calculations and assumptions used to estimate reported savings for each project.

Level 1 audits consist of a desk review of project documentation and supporting calculations, including applications, savings worksheets, M&V plans, M&V reports, engineering studies, metered data, invoices, and any other documents made available.

Level 2 audits expand upon the work conducted in the Level 1 audits, and as stated above, in many cases, included an on-site review of the equipment installation and operating parameters.

C.1.2.2.1Analysis Approach & Methods

Data collected from the Level 1 and 2 audit activities enabled EcoMetric to verify energy and demand savings for each sampled project (gross verified savings). Ratios of gross verified to reported savings are *realization rates (RR)*.

For the Energy Manager Non-Incented measures, where a sample was used, the weighted-average sample realization rate for each stratum (technically-reviewed, non-technically-reviewed) was applied to the population of eligible Energy Manager projects to derive the overall program gross verified savings. The same approach was conducted for IAP Retrofit, IAP Energy Manager and PES programs.

For PSU and IAP CI, a census of projects was analyzed, resulting in a unique realization rate (or adjustment factor) for each project. In these cases, the program-level RRs are equal to *total verified savings* divided by *total reported savings*. Program- and stratum-level realization rates are included and explained in detail in *Section 4: Portfolio Evaluation Results*.

C.2 NET SAVINGS ANALYSIS

C.2.1 NET SAVINGS DATA COLLECTION

C.2.1.1 Verification Methods (NTG Questionnaire Design)

EcoMetric created a new NTG questionnaire for analysis of PY2016 sites, retaining the structural tenets of the prior method but adding additional factors and questions on timing, context, and influences to help the analysts' ability to triangulate and crosscheck responses. These enhancements were originally planned to be implemented in future years of the evaluation but after review and discussions with IESO evaluation staff, many of these changes were accelerated and incorporated into the PY2016 surveys. The resulting questionnaire consisted of a common core set of questions and unique program-specific sections and response choices depending on the program. The questionnaire required a longer interview than what has been used in the past, but one that considered complex decision-making in context and is highly defensible.

The PY2017 questionnaire leveraged the changes made for PY2016, with some minor enhancements, including:

- **Survey multiple decision-makers where appropriate.** For larger and more complex projects, multiple people are often involved in decision-making. Where possible and desirable, the EcoMetric team will seek to interview multiple decision-makers to develop more informed NTG estimates. This approach was used in a few cases during PY2016 and was expanded to ensure that the right decision-maker(s) are interviewed for NTG purposes.
- **Integrate modeled partial net (MPN) approach where appropriate.** For a subset of projects – primarily generation projects and/or unique, complex measures with a range of efficiency alternatives – the EcoMetric team estimated net savings using a modeled partial net (MPN) methodology.

  The traditional free-ridership approach first establishes a gross baseline (e.g. industry standard practice) and then conducts a free-ridership interview to determine the degree of influence the program had in moving the customers from the gross baseline to the high efficiency alternative that was installed. This is an excellent approach for straightforward measures, for those where only two efficiency options are available (the binary choice of the high or low efficiency options), when the questionnaire must be written to cover diverse technologies, when non-technical interviewers are used, or when the study cannot afford individual project analysis. Most measures fit in one of these categories.

  In contrast, the MPN method uses a series of questions to identify specifically what technology the customer would have installed without the program. This data is then used to directly estimate a project-specific net (not gross) baseline using engineering recalculations. The MPN approach is based on obtaining details about the exact other option the customer would have installed absent the program. This is considered “direct to net” because it skips the gross baseline step. Gross baseline must be established as well to express the net effect in the context of the free rider convention, but it is of secondary importance. The “partial” in “modeled partial net” recognizes that technique does not account for most spillover.

  While MPN can be used as the primary free-ridership method, due to its higher cost of implementation and our interest in preserving methodological continuity, the evaluation team leveraged MPN for only a subset of projects.

  For both the traditional and MPN methods, the result will be the direct free-ridership estimate, which is then subject to the same influence and contextual considerations.

C.2.1.2 Net-to-Gross/Attribution Interviews

The primary data collection method for NTG data was through in-depth self-report interviews. This approach was consistent with the PY2016 approach and is allowed by the Conservation First Framework 2015-2020 EM&V Protocols and Requirements. The general NTG process is as follows:

C.2.1.3 Survey Development

The NTG surveys addressed two discrete components of net savings analysis: free-ridership and spillover. For free-ridership, the questionnaire used a consistent approach to PY2016, calculating both a direct free-ridership score and an indirect score that incorporates questions about program influence and any other factors that possibly influenced the decision to implement the project.

C.2.1.4 Training and Testing

Prior to roll-out of the NTG survey instruments, EcoMetric conducted training exercises to ensure that the team has the appropriate training and expertise to conduct the interviews. This included a refresher session on interviewing tone, follow-up questions, time management, and avoiding leading questions, as well as pre-tests of interview scripts and pilot testing with initial recruited participants.

C.2.1.5 Recruitment

EcoMetric takes considerable steps to ensure that interviews are conducted with the primary decision-maker(s) involved in the decision-making, or at the very least, aware of the decision-making criteria for the project. The EcoMetric team works with IESO and LDCs to identify the primary decision-makers for each project by first reviewing the project files and customer contact information.

Once likely decision-makers are identified, IESO and LDC staff send personalized recruitment emails to these contacts notifying them of the upcoming interview. EcoMetric then contacts the customers directly, screening them prior to starting the interview to confirm that they were the decision-maker or involved/aware of the decision-making process. The Evaluation Team leverages a combination of email and phone messages to customers at different times of day and week, and logs each contact attempt (time, date, target, result), in a contact tracking system.

Table 41 below presents the disposition report, a table summarizing EcoMetric's recruitment activities for the PY2017 activities.

Table 41: Disposition Report of NTG Recruitment

Disposition	PSU	IAP/Retrofit	EM	Total
Population[41]	31	25	20	76
Sampling Method	census	Census	stratified sample with certainty stratum	
Total Individuals Contacted (multiple contacts for some customers)	42	24	22	88
Total Contact Attempts	91	52	44	187
Interviews Completed (individuals)	28	19	16	63
Dropped Interview	0	0	0	0
Not Recruited	3	2	3	8

Interview Preparation – In preparation for the interviews, the EcoMetric staff reviewed the project files for each customer to understand the projects completed, timelines, and any other unique characteristics of each customer. For customers that implemented multiple projects during the study year, EcoMetric investigated the two projects with the largest electricity savings to capture most savings without creating an excessive burden on the interviewee.

Post-processing – After completing each interview, the interviewer reviewed and clarified notes and submitted the interview results for quality control (QC). During the QC, results were reviewed for completeness and consistency.

C.2.2 NTG ANALYSIS APPROACH & METHODS

The collected free-ridership data was analyzed first by computing a direct query-based free-ridership from responses on the likelihood of implementing the project absent the program, and likely size, efficiency, and timing of implementation. After estimating free-ridership using this direct method, EcoMetric analysts calculated a probable free-ridership range based on a series of questions about program influence and other factors that possibly influenced the decision to implement the project. The

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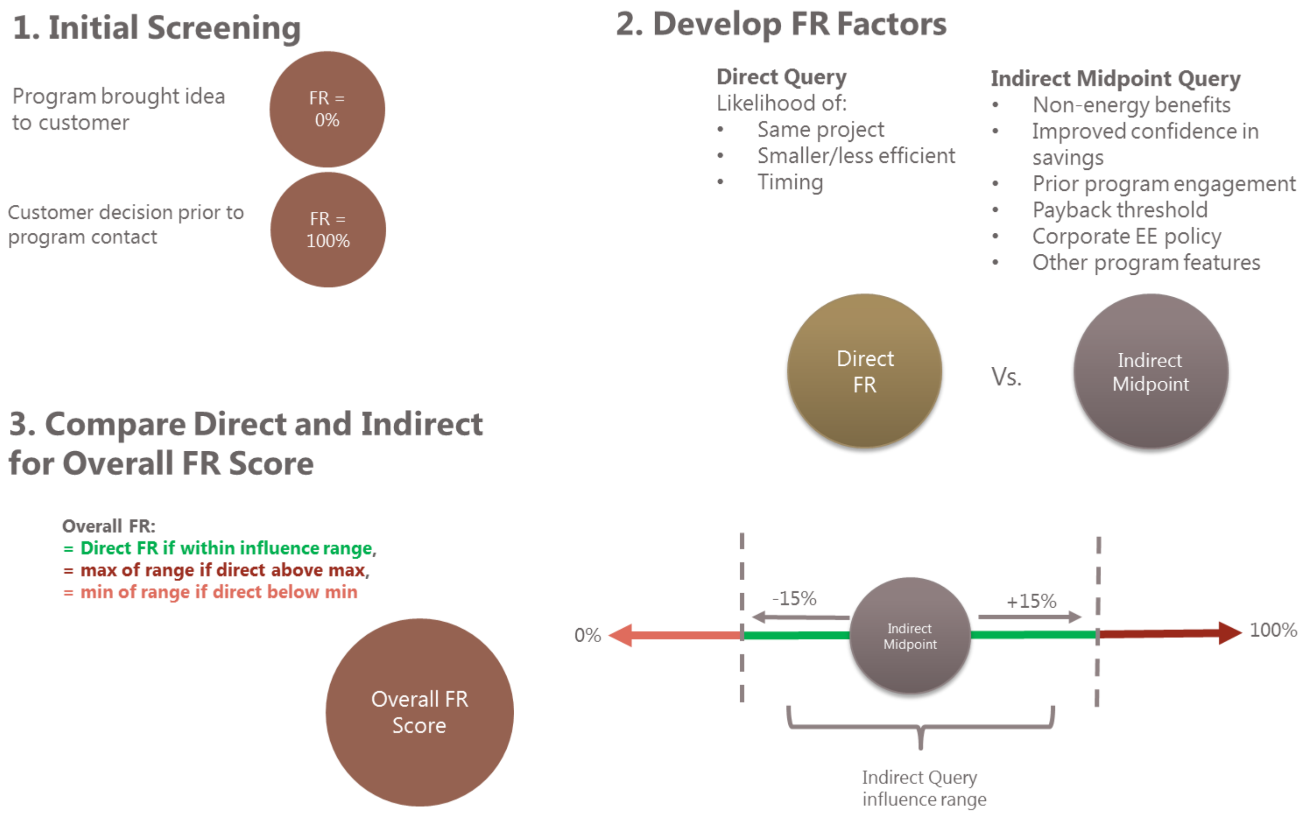
[41] Population shown here is different than overall evaluation count due to three PSU projects that were evaluated by another evaluation team (Nexant) during the transitional period.

final project free-ridership was then computed by considering the direct query and the range. Figure 21 presents a graphical representation of the calculation approach.

Figure 21: Free-ridership Methodology



To estimate spillover as well as any potential influence of participation on subsequent projects that received incentive funding, the interviewers asked about influenced projects, the degree of program influence, the project sizes, and whether they received program support. As noted above, both completed and planned projects were considered with a discounted presumed effect for planned projects.

EcoMetric computed the free-rider (FR) and spillover (SO) factors to estimate net savings as shown in the following formula:

$$\text{Net savings} = \text{verified gross savings} * (1 - FR + SO)$$

For example, an individual project with 1,000,000 kWh/year of tracking savings, a 95% realization rate, 10% free-ridership, and 1% spillover would have verified gross savings of 950,000 kWh/year, an NTG ratio of 0.91 (1-FR+SO = 1 - 0.10+0.01) and verified net savings of 864,500 kWh/yr.

C.3 PROCESS METHODOLOGY

The second phase of the process evaluation, conducted as part of the PY2017 evaluation, built off the first phase in order to complete the comprehensive evaluation of all CFF industrial programs. The PY2017 work featured interviews with a broader set of targets, nonparticipant surveying, document review, and targeted analyses to dive more deeply into the topics identified during the first phase. There were five goals of the second phase:

- Gather additional perspectives from stakeholders and program documentation to add depth and color to the preliminary observations and findings from the first phase.
- Study the specific program processes that were unclear to participants or the evaluators.
- Solicit feedback on participation experiences from a much broader range of stakeholders (participants in all programs, energy managers, partial and nonparticipants).
- Deliver a final comprehensive report with data from both phases and a full set of findings and recommendations, as well as details on progress made towards implementing Phase 1 preliminary recommendations.
- Identify further targeted research studies focusing on specific aspects of the programs that can be performed over the next three years.

These goals were met using a variety of data collection activities, including interviews, surveys, document review, and targeted data analyses where applicable. Each of these are described in more detail below.

C.3.1 PRIMARY DATA COLLECTION: INTERVIEWS AND SURVEYS

In-depth interviews and surveys were the major data source for the Phase 2 research. The research also drew from the Phase 1 research, which likewise centered around interviews. Interviews are typically longer and led by a trained evaluator; they usually feature more open-ended responses and may include follow-up probing questions to understand more about a particular topic or process. Surveys are shorter and consist mostly of close-ended questions. They are often self-administered (i.e., through a web form) or conducted by a survey firm with dedicated staff. The participant interviews are a hybrid: while they consisted mostly of close-ended questions asked to calculate the free-ridership and spillover scores for the NTG study, they were much longer (generally 45 minutes to an hour) and were conducted by evaluation staff trained to ask specific questions about the particular project if needed.

Table 42 shows the primary data collection counts for Phase 2, with the Phase 1 interviews included for comprehensiveness. More detail about sampling and methods for each Phase 2 activity is described below.

Table 42: Process Interview and Survey Counts

Interview/Survey Target	Phase 1	Phase 2
IESO staff overseeing LDC implementation	4	
IAP staff interviews	2	4
Technical Reviewer interviews	2	
EM interviews		10
LDC interviews	10	
LDC surveys		39
Participant interviews	36	48
PSUP	13	23
EM - LDC	13	10
IAP	3	4
IAP Retrofit	6	6
EM - IAP	1	5
Nonparticipant surveys		75
Large		17
Medium		26
Small		32
Partial participant surveys		13
EM		6
M&T		4
IAP		3
Total	**54**	**189**

C.3.1.1 Stakeholder Interviews

The evaluation team conducted interviews with the IAP program manager (a follow-up from Phase 1), all three IAP business advisors, and a sample of 10 EMs. This EM sample was not intended to be representative of the entire EM population, but to provide a breadth of perspectives from EMs for the process evaluation. EMs were selected out of the sample drawn for the gross and NTG evaluations to leverage communication with each EMs to accomplish multiple evaluation needs and minimize administrative time alerting the LDC and EM that they could be contacted. From this sample, the process evaluation team selected 10 EMs, plus three back-ups, with the following considerations:

- Mix of LDC CFF and IAP EMs: Six interviews were conducted with LDC EMs and four with IAP EMs.
- Range of customer types and industries: The sample was selected to include mining, metals manufacturing, food and beverage processing, automotive manufacturing, and a municipal wastewater treatment plant, among others.
- Range of project counts and sizes: The sample was selected to include facilities that generated a large amount of savings or conducted many non-incented projects in PY2017, and facilities that conducted only a single project and comparatively small savings.

- **Multiple EMs at a facility**: Two facilities selected had multiple EMs, though only one completed the interview.

Three facilities did not respond to the request for interview, so all three facilities in the backup sample were used to complete the interviews.

C.3.1.2 LDC Surveys

The Phase 1 evaluation included interviews with program managers from 10 LDCs representing a mix of sizes and geographic locations. To allow all LDCs with industrial programs to provide feedback and gain quantitative data about how different LDCs manage their programs, the EcoMetric team designed an online survey emailed to all LDC program managers with industrial programs. EcoMetric received a list of contacts for all 68 LDCs from IESO, which was adjusted to 58 contacts to reflect duplicate contacts for LDCs in group CDM plans. The survey was emailed to these contacts, with several reminder emails over the following weeks for nonresponsive LDCs. Thirty-nine LDCs, including all of the largest ones, completed the survey.

C.3.1.3 Participant Interviews

Participant interviews were conducted as part of the NTG evaluation surveys to best leverage each customer touchpoint. The interviews therefore had a dual purpose in asking the customers attribution questions and assessing their program experience. The targeted individual at each customer facility was the decisionmaker involved in the project or, in the case of an EM, the EM's supervisor or manager who was most involved in the decision to apply for an EM. Please see *Section 3.7* for a description of the sampling techniques utilized in conducting these interviews. While questions were designed for the M&T program participants, the EcoMetric team was unable to get in contact with any of the M&T participants.

C.3.1.4 Non- and Partial-Participant Surveys

In addition to understanding the perspectives of those directly served by the programs, the evaluators also gathered data from industrial or institutional customers who have not yet participated in the CFF industrial programs or who started but did not complete a project.

Since there are only 59 transmission-connected IAP customers and the IAP staff was already reaching out to its few nonparticipants, the nonparticipant aspect of the survey focused wholly on distribution-connected nonparticipants for the LDC programs. The first step was to create a list of the population of facilities that were likely to be eligible for the LDC programs (i.e., large enough to produce a project that saved enough energy to meet the programs' requirements) and that had not yet participated. Although each LDC may have a list of its eligible customers and their participation status, the number of data requests to each LDC that this would entail made producing a list by that method unrealistic. Instead, the IESO provided a list of all 104,000 nonparticipating businesses in Ontario that had been purchased from a market research firm. IESO had already removed all businesses that had participated in PSUP, Retrofit, or Small Business Lighting from the list. To determine which facilities were likely to be good targets for the industrial programs, the EcoMetric team used two pieces of data – the NAICS code and square footage fields – and another publicly available dataset to estimate the energy use of each facility. The steps were as follows:

- **Filter by facility type**: The team selected a set of 2- and 4-digit NAICS codes representing industries that would likely be large enough based on past participation (e.g., all manufacturing codes, mining, hospitals, universities, wastewater treatment plants, etc.)
- **Integrate energy use intensity data**: The team used web research to find robust data on energy use intensity (i.e., kWh per square foot) by NAICS code for industrial and commercial facilities. The industrial data came from the U.S. Department of Energy's Industrial Assessment Center (IAC) database, featuring data from each of the 18,000 industrial audits that the centers have performed. The team removed outliers and averaged the values for energy use intensity for each 6-digit NAICS code, then used a weighted average to determine energy use intensity for each 4-digit NAICS code. The commercial data came from a summary dataset of the U.S. Energy Information Administration's (EIA) Commercial Buildings Energy Consumption Survey (CBECS).
- **Calculate energy usage at each facility**: The evaluators assigned an energy use intensity from the IAC or EIA datasets to each facility based on its 4-digit NAICS code, then multiplied by the facility's square footage to determine its estimated MWh usage at the facility. To estimate the energy savings potential for project eligibility (100 MWh for a PSUP small capital project), the team assumed that a project could save around 5% of a facility's energy use on average.
- **Remove the smallest facilities**: Any facility that was less than 15,000 square feet, had 10 employees or fewer, or was estimated to save 50 MWh or less per project was removed from the dataset.

Stratify by energy savings potential: The EcoMetric team stratified the population into three groups (large, medium, and small) using the total savings potential. The facilities were arranged from large to small according to their energy savings potential and then segmented into three groups so that the cumulative total of each represents a third of the potential energy savings. The totals for each segment, along with the number of completed surveys, are shown in Table 43.

Table 43: Nonparticipant Population and Survey Completes

Type	Population size	Survey Completes	Response Rate
Nonparticipant - Large	191	17	9%
Nonparticipant - Med	621	26	4%
Nonparticipant - Small	1,668	32	2%
	2,480	**75**	**3%**

While the goal was to reach 25 completes for each segment, the number of facilities in the large segment made this difficult to achieve. Nielsen, the survey firm retained by EcoMetric for this survey, called all

2,480 facilities in this population, including the maximum number of attempts (six) for all large and medium facilities. The remaining quota was instead completed with small facilities.

For partial participants, the EcoMetric team determined the number of cancelled projects for each program using the Technical Reviewer's overall application tracker and a M&T-specific spreadsheet. Due to the pending PSUP redesign, IESO asked the team to focus on the EM and M&T programs for the LDC programs. The evaluation team pulled a list of EM and M&T applications that had been cancelled in 2016 or 2017. This list was then provided to the Technical Reviewer, who manually sorted through PDF copies of the applications to find the contact information, as that field is not included in the database and non-sampled project files were not provided to the evaluators.

For IAP, the IAP program manager requested that we survey former participants – i.e. companies that had done IAP projects in the past but none recently. There were eight of these companies, for which the business advisors provided any contact information they had.

The resulting population is shown in Table 44 along with the completes.

Table 44: Partial and Former Participant Population and Survey Completes

Type	Population size	Completes	Response Rate
EM partial participant	21	6	29%
M&T partial participant	12	4	33%
IAP former participant	8	3	38%
	41	**13**	**32%**

As with the nonparticipants, Nielsen called all 41 partial and former participants the maximum number of times, with nearly a third of the sample completing the survey – a very high response rate, especially for companies that had not received incentives.

Nielsen provided the raw results to the EcoMetric team, which was split by nonparticipant/partial participant and then into size or program segments where applicable.

C.3.2 DOCUMENT REVIEW

The primary data collection activities were supplemented by document review. Documents were requested and reviewed as needed to supplement the observations made during interviews and surveys, and to aid in understanding program developments. These documents included:

- Ministry directives
- Program rules documents
- PSUP redesign straw proposals and the draft business case
- The prior industrial evaluation report
- Relevant program-level reports, including from the Technical Reviewer

- The Save on Energy webpages for the industrial programs
- Case studies available on the Save on Energy website
- Websites for ICI and various GHG programs

Where applicable, information from these documents are referenced in the findings and cited with the website where the information is available.

C.3.3 TARGETED ANALYSIS

The EcoMetric team also completed several targeted analyses to provide data in support of specific research questions:

- **Energy Manager Cross-Program Participation**: Is there any difference in other CFF program participation between facilities that have an EM and those that do not? Do facilities with EMs better leverage the full suite of CFF offerings?
- **Variance in LDC Implementation**: How consistent is the Industrial Program delivery across LDCs? What strategies have LDCs implemented that were effective, and how can those be shared with other LDCs to improve their performance?

The largest of these was the assessment of EM participation across the suite of IESO programs. The main effort was an analysis built around the Technical Reviewer's application tracker to determine the number and type of projects EM facilities performed compared to non-EM facilities. Later on, the impact evaluation team also performed an independent assessment of the percentage of the savings from each program attributable to EM facilities. Both of these are described below.

C.3.3.1 Energy Manager Cross-Program Participation Analysis

To determine whether facilities with EMs participated more frequently than facilities without, the EcoMetric team had to aggregate all applications submitted by a single customer and determine when EMs were present at each facility. This was all completed with data from the Technical Reviewer's application tracker and an accompanying record of all Retrofit applications from the iCon system provided by IESO. The steps for the analysis are as follows:

- **Filter for CFF applications only**: Application records created before January 1, 2015 were removed from both datasets.
- **Split by LDC/IAP and then by specific programs**: Most of the analysis was conducted directly in the industrial application tracker and was done twice: once for the LDC programs for distribution-connected customers, and once for the IESO IAP programs for transmission-connected customers. After the dataset had been divided into these two groups, the applications were then clearly marked with the program (i.e., PSUP, study, EM, M&T, IAP P&S, IAP Retrofit), the application year, and their status (i.e., completed, in progress, or cancelled). These fields were created as

simplifications of the existing data in the tracker, which included two status fields with different stages and statuses depending on the program and use of the tracker and multiple date fields.

- **Add in multi-year EMs:** Participants that retain their EM for more than one year do not fill out a second application, so the application tracker only has a record of the EM's first year. The evaluation team manually created "applications" for all second- and third-term EMs so that it was clear which years the participant had an EM on site.
- **Create unique participant and facility IDs**: The industrial application tracker is arranged by the application ID and does not have any way to connect projects completed at the same facility. The evaluators therefore create participant and facility IDs to collapse the dataset to the facility-level. To complicate matters, the participant names were often spelled differently (a company could be referred to as its short name, a longer name, or its full legal name with "Inc." or "LLC" appended), and the address field often included different pieces of information or could be misspelled. To create the unique IDs, the evaluators used formulas to match the participant names and the first few digits of the address after the street number. A participant ID was assigned to unique companies or customers (e.g., 3M) while a facility ID was assigned to buildings with unique addresses (e.g., 3M – London, 3M – Milton).
- **Collapse to the participant level**: The team then created a new sheet where each row represented a unique participant and the columns represented the number of EM, Study, PSUP, etc. projects completed each year from 2015-2017. Note that the evaluators chose to organize the data on the participant rather than the facility level, as many facilities are run out of a corporate or main office; a review of the data also showed that enough facility addresses were spelled differently enough to be treated as separate facilities although they seemed to be the same one. The participant level provided a better platform for viewing the grouped data.
- **Merge in Retrofit data**: The evaluators used the same name-plus-numerical-address method described above to match Retrofit projects with the participants and facilities in the industrial programs. The number of Retrofit projects that each facility completed each year from 2015-2017 was summed and added to the dataset.
- **Analyze participation by year**: The EcoMetric team then aggregated the data to view the number of facilities participating and the number of projects completed each year and in each program by EM and non-EM facilities. The results from this analysis are discussed in *Section 5.2.6*.

There is one limitation of this analysis, which likely underestimates the contribution of EMs to the portfolio. While this analysis uses calendar-year increments to simplify the analysis, EMs can be hired at any time during the year and have one year from when they start to complete their projects. As a result, a 2017 EM starting in August would have until August 2018 to meet their annual goal and may not have submitted any projects by the end of 2017. It is also possible that a 2016 EM submitted their projects in 2017 but did not stay on for a second year; the 2017 projects would be counted as projects for a non-EM facility. To counter this, the evaluators also calculated participation and project totals for the 2015-2017 period. This still may underestimate EM contributions, as there was only 1 distribution-connected facility and zero transmission-connected facilities with an EM in 2015.

C.3.3.2 Variation in LDC Implementation

The assessment of variation in LDC implementation was carried out through the LDC survey described above. An enhanced variant, finding and interviewing customers with facilities in multiple LDC territories about their different experiences, is an option for PY2018 if matching starts by January 2019.

C.3.4 FINAL ANALYSIS AND SYNTHESIS

Once all interviews, surveys, document review, and targeted analyses had been completed, the evaluation team organized the summary data by the relevant program covered and into sub-topics within each. This allowed the team to identify any trends appearing across datasets and start to formulate findings and recommendations for the key topics. A memo featuring the key findings and recommendations was presented to the IESO evaluation team a month before the final report was due, allowing IESO to provide additional information and feedback. Their comments were incorporated into the writing of this report.

APPENDIX D: COST-EFFECTIVENESS ASSUMPTIONS

D.1 PSUP COST-EFFECTIVENESS ASSUMPTIONS

- Project costs and benefits are included for projects in-service starting in 2017 and included in PY2017 reported impacts.
- Engineering study costs are included for all 2017 studies listed in the LDC Comprehensive Report.
- Engineering Study costs are the sum of "Project Incentive ($)" from the LDC Comprehensive Report where *Program* equals Process & Systems Upgrades, *IESO Reporting Period* equals 2017, and *AppType* equals PS (Preliminary Study) or DS (Detailed Study). *AppTypes* are indexed from the technical reviewer's Application Tracking database.
- Program admin costs (CE Tool Budget Inputs) are aggregated from 2017 Verified LDC CDM Program Costs worksheets as provided by IESO, including CFF costs and CFF CDM Plan Development costs. Aggregate LDC incentives reported in the CFF costs worksheets are not included, as the incentives are included on a per-project basis in the measure inputs.
- Central Services costs are not included.
- Per-unit incentive amounts are the actual incentive amounts paid for each project. Each project is entered as a custom measure in the CE tool, therefore each measure quantity is equal to 1 and the incentive is only included once.
- Custom measure-specific load shapes are utilized for PSUP cost effectiveness analysis.

D.2 EM COST-EFFECTIVENESS ASSUMPTIONS

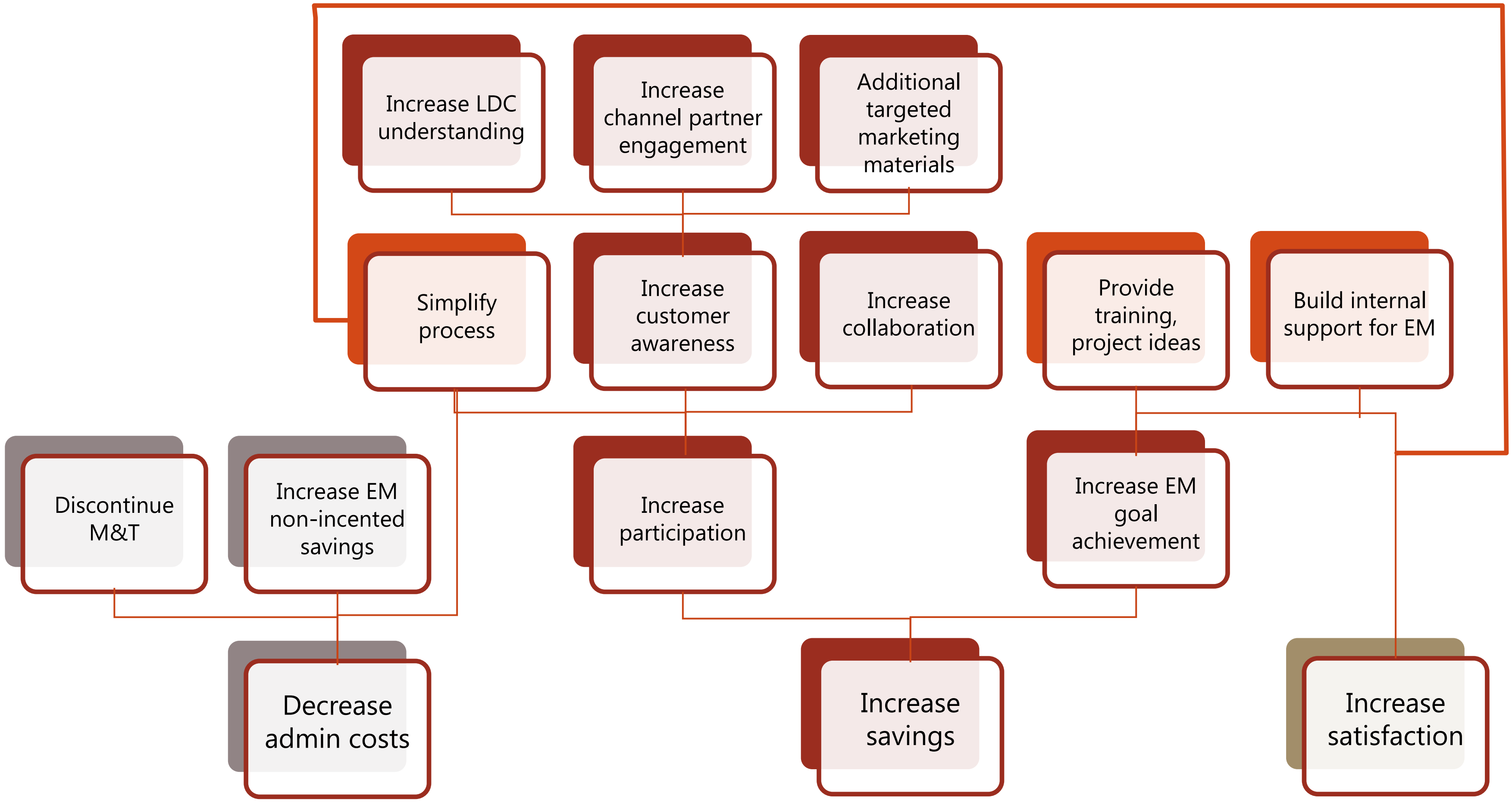
- Project costs and benefits are included only for non-incented Energy Manager measures in-service starting in 2017 and included in PY2017 reported impacts. This includes only those measures invoiced in the LDC Comprehensive Report (281 measures).
- Incentives are not included for Energy Manager measures, as the only measures included in this analysis are non-incented. Incremental lifecycle measure costs (when provided) are included at a measure-specific level, as are administrative costs as provided in the CFF Costs workbooks. The inconsistent reporting of participant cost in the EM tracking data means that incremental measure costs are likely understated, which means the TRC ratio is overstated.
- Central Services costs are not included.
- Custom measure-specific load shapes are utilized for Energy Manager cost effectiveness analysis where possible to improve the accuracy of the avoided cost calculations. Where custom load shapes are unavailable, the most appropriate IESO-provided load shape is utilized based on measure technology and premise type.

D.3 IAP COST-EFFECTIVENESS ASSUMPTIONS

- Project costs and benefits are included for projects in-service starting in 2017 and included in PY2017 reported impacts.
- Engineering Study costs are included for all 2017 studies listed in the LDC Comprehensive Report.
- Engineering Study costs are the sum of "Project Incentive ($)" from the LDC Comprehensive Report where *Program* equals IAP, *IESO Reporting Period* equals 2017, and *AppType* equals PS (Preliminary Study) or DS (Detailed Study). *AppTypes* are indexed from the technical reviewer's Application Tracking database.
- Incentives are not included for IAP Energy Manager measures, as the only measures included in this analysis are non-incented. Incremental lifecycle measure costs (when provided) are included at a measure-specific level, as are administrative costs as provided in the CFF Costs workbooks. The inconsistent reporting of participant cost in the EM tracking data means that incremental measure costs are likely understated, which means the TRC ratio is overstated.
- Custom measure-specific load shapes are utilized for IAP cost effectiveness analysis.

APPENDIX E: BENEFITS OF PROCESS EVALUATION RECOMMENDATIONS

Figure 22: Benefits of Process Evaluation Recommendations



Note that there are often effects beyond the simple pathways shown above; for example, increasing customer satisfaction may in turn mean increased participation form the facility or others to whom they might mention the program offerings and their experience.

Appendix 7 – IRM Check List

2023 IRM Checklist

Oakville Hydro

EB-2022-0055

Date: August 3, 2022

Filing Requirement Section/Page Reference	IRM Requirements	Evidence Reference, Notes
3.1.2 Components of the Application Filing		
2	Manager's summary documenting and explaining all rate adjustments requested	Page 1, Section 1
2	Contact info - primary contact may be a person within the distributor's organization other than the primary license contact	Page 2, Section 2
3	Completed Rate Generator Model and supplementary work forms in Excel format	Excel models filed - Rate Generator, GA Workform, LRAMVA.
3	Current tariff sheet, PDF	Appendix 3
3	Supporting documentation (e.g. relevant past decisions, RRWF etc.)	Not Applicable
3	Statement as to who will be affected by the application, specific customer groups affected by particular request	Page 3, Section 6
3	Distributor's internet address	Page 2, Section 2
3	Statement confirming accuracy of billing determinants pre-populated in model	Page 3, Section 4
3	Text searchable PDF format for all documents	Yes
3	2023 IRM Checklist	Appendix 7 and Excel Model
3	Include a certification by a senior officer that the evidence filed, including the models and appendices, is accurate, consistent and complete to the best of their knowledge, a certification that the distributor has processes and internal controls in place for the preparation, review, verification and oversight of account balances being disposed, as well as a certification regarding personal information	Page 2, Section 3
3.1.3 Applications and Electronic Models		
4	Confirm the accuracy of the data. If a distributor has revised any RRR data after it has been incorporated into the model, this change should be disclosed in the application	Page 3, Section 4
4	File the GA Analysis Workform.	Appendix 4 and Excel Model
4	A distributor seeking a revenue-to-cost ratio adjustment due to a previous OEB decision must continue to file the OEB's Revenue-to-Cost Ratio Adjustment Workform in addition to the Rate Generator model.	Not applicable
4	For an Incremental or Advanced Capital Module (ICM/ACM) cost recovery and associated rate rider(s), a distributor must file the Capital Module applicable to ACM and ICM.	Not applicable
5	A distributor seeking to dispose of lost revenue amounts from conservation and demand management activities, during an IRM term, must file the Lost Revenue Adjustment Mechanism Variance Account (LRAMVA) Workform.	Excel model
5	The models and workforms be used by all distributors. If a distributor makes any changes to OEB models or workforms to address its own circumstances, it must justify such changes in the manager's summary.	Not applicable
3.2.2 Revenue to Cost Ratio Adjustments		
6 - 7	Revenue to Cost Ratio Adjustment Workform, if distributor is seeking revenue to cost ratio adjustments due to previous OEB decision	Not Applicable
3.2.3 Rate Design for Residential Electricity Customers	**Applicable only to distributors that have not completed the residential rate design transition**	

Filing Requirement Section/Page Reference	IRM Requirements	Evidence Reference, Notes
7	A plan to mitigate the impact for the whole residential class or indicate why such a plan is not required, if the total bill impact of the elements proposed in the application is 10% or greater for RPP customers consuming at the 10th percentile	Not Applicable
7	Mitigation plan if total bill increases for any customer class exceed 10%	Not Applicable
3.2.4 Electricity Distribution Retail Transmission Service Rates	**No action required at filing - model completed with most recent uniform transmission rates (UTRs) approved by the OEB**	
3.2.5 Review and Disposition of Group 1 DVA Balances		
8	Justification if any account balance in excess of the threshold should not be disposed	Not applicable
8	Completed Tab 3 - continuity schedule in Rate Generator Model	Excel model
9	Explanation of variance between amounts proposed for disposition and amounts reported in RRR for each account	Page 6, Section 11.3
9	Statement as to whether any adjustments have been made to balances previously approved by the OEB on a final basis; If so, explanations provided for the nature and amounts of the adjustments and supporting documentation under a section titled "Adjustments to Deferral and Variance Accounts"	Page 7, Section 11.4
10	Rate riders proposed for recovery or refund of balances that are proposed for disposition. The default disposition period is one year. Justification with proper supporting information is required if distributor is proposing an alternative recovery period	Page 5, Section 11.1
3.2.5.1 Wholesale Market Participants		
10	Separate rate riders established to recover balances in RSVAs from Wholesale Market Participants, who must not be allocated balances related to charges for which WMPs settle directly with the IESO	Pages 5-6, Section 11.1
3.2.5.3 Commodity Accounts 1588 and 1589		
11	Confirmation of implementation of the OEB's February 21, 2019 guidance effective from January 1, 2019 when requesting final disposition for the first time following implementation of the Accounting Guidance	Page 8, Section 12.3
11	Confirmation that historical balances that have yet to be disposed on a final basis have been considered in the context of the Accounting Guidance, summary provided of the review performed. Distributors must discuss the results of review, whether any systemic issues were noted, and whether any material adjustments to the account balances have been recorded. A summary and description is provided for each adjustment made to the historical balances	Not applicable
11 - 12, 4	Populated GA Analysis Workform for each year that has not previously been approved by the OEB for disposition, irrespective of whether seeking disposition of the Account 1589 balance as part of current application. If adjustments were made to an Account 1589 balance that was previously approved on an interim basis, the GA Analysis Workform is required to be completed for each year after the distributor last received final disposition for Account 1589	Page 8, Section 12.2, Appendix 4 and Excel model
3.2.5.4 Capacity Based Recovery (CBR)		
12	Disposition proposed for Account 1580 sub-account CBR Class B in accordance with the OEB's CBR Accounting Guidance. - Embedded distributors who are not charged CBR (therefore no balance in sub-account CBR Class B) must indicate this is the case for them - In the Rate Generator model, distributors must indicate whether they had Class A customers during the period where Account 1580 CBR Class B sub-account balance accumulated - For disposition of Account 1580 sub-account CBR Class A, distributors must follow the OEB's CBR accounting guidance, which results in balances disposed outside of a rate proceeding - The Rate Generator model allocates the portion of Account 1580 sub-account CBR Class B to customers who transitioned between Class A and Class B based on consumption	Page 8, Section 11.5
3.2.5.5 Disposition of Account 1595		
14	Confirmation that residual balances in Account 1595 Sub-accounts for each vintage year have only been disposed once	Page 5, Section 11.1
14	Detailed explanations provided for any significant residual balances attributable to specific rate riders for each customer rate class, including for example, differences between forecast and actual volumes	Not applicable
3.2.6 Lost Revenue Adjustment Mechanism Variance Account		

Filing Requirement Section/Page Reference	IRM Requirements	Evidence Reference, Notes
15	The 2021 CDM Guidelines require distributors filing an application for 2023 rates to seek disposition of all outstanding LRAMVA balances related to previously established LRAMVA thresholds	Page 9, Section 13.2
17	Completed latest version of LRAMVA Workform in a working Excel file when making LRAMVA requests for remaining amounts related to CFF activity	Excel Model
17	Final Verified Annual Reports if LRAMVA balances are being claimed from CDM programs delivered in 2017 or earlier. Participation and Cost reports in Excel format, made available by the IESO, provided to support LRAMVA balances for programs for the period of January 1, 2018 to April 15, 2019. These reports should be filed in Excel format, similar to the previous Final Verified Annual Reports from 2015 to 2017. To support savings claims for projects completed after April 15, 2019, distributors should provide similar supporting evidence	Excel File
17	File other supporting evidence with an explanation and rationale should be provided to justify the eligibility of any other savings from a program delivered by a distributor through the Local Program Fund that was part of the Interim Framework after April 15, 2019.	Not Applicable
17	Meet the OEB's requirements related to personal information and commercially sensitive information as stated in the Filing Requirements	Page 2, Section 3
18	Statement identifying the year(s) of new lost revenues and prior year savings persistence claimed in the LRAMVA disposition	Page 9, Section 13.2
18	Statement confirming LRAMVA based on verified savings results supported by the distributors final CDM Report and Persistence Savings Report (both filed in Excel format) and a statement indicating use of most recent input assumptions when calculating lost revenue	Page 9, Section 13.2
18	Summary table with principal and carrying charges by rate class and resulting rate riders	Page 10, Table 7
18	Statement confirming the period of rate recovery	Page 10, Section 13.3
18	Statement providing the proposed disposition period; rationale provided for disposing the balance in the LRAMVA if significant rate rider is not generated for one or more customer classes	Page 10, Section 13.3
18	File details related to the approved CDM forecast savings from the distributor’s last rebasing application	Excel Model Complete
18	Rationale confirming how rate class allocations for actual CDM savings were determined by class and program (Tab 3-A of LRAMVA Work Form)	Excel Model Complete
18	Statement confirming whether additional documentation was provided in support of projects that were not included in distributor's final CDM Annual Report (Tab 8 of LRAMVA Work Form as applicable)	Not Applicable
18	File in support of a previous LRAMVA application, distributors should provide Participation and Cost Reports and detailed project level savings files made available by the IESO and/or other supporting evidence to support the clearance of energy- and/or demand-related LRAMVA balances where final verified results from the IESO are not available. These reports should be filed in Excel format, similar to the previous Final Verified Annual Reports from 2015 to 2017	Not Applicable

Filing Requirement Section/Page Reference	IRM Requirements	Evidence Reference, Notes
18 - 19	For a distributor's streetlighting project(s) which may have been completed in collaboration with local municipalities, the following must be provided: Explanation of the methodology to calculate streetlighting savings; Confirmation whether the streetlighting savings were calculated in accordance with OEB-approved load profiles for streetlighting projects; Confirmation whether the streetlighting project(s) received funding from the IESO and the appropriate net-to-gross assumption used to calculate streetlighting savings. For the recovery of lost revenues related to demand savings from street light upgrades, distributors should provide the following information: o Explanation of the forecast demand savings from street lights, including assumptions built into the load forecast from the last CoS application o Confirmation that the street light upgrades represent incremental savings attributable to participation in the IESO program, and that any savings not attributable to the IESO program have been removed (for example, other upgrades under normal asset management plans) o Confirmation that the associated energy savings from the applicable IESO program have been removed from the LRAMVA workform so as not to double count savings (for example, if requesting lost revenue recovery for the demand savings from a street light upgrade program, the associated energy savings from the Retrofit program have been subtracted from the Retrofit total) o Confirmation that the distributor has received reports from the participating municipality that validate the number and type of bulbs replaced or retrofitted through the IESO program o A table, in live excel format, that shows the monthly breakdown of billed demand over the period of the street light upgrade project, and the detailed calculations of the change in billed demand due to the street light upgrade project (including data on number of bulbs, type of bulb replaced or retrofitted, average demand per bulb)	Not Applicable
19	For the recovery of lost revenues related to demand savings from other programs that are not included in the monthly Participation and Cost Reports of the IESO (for example Combined Heat and Power projects), distributors should provide the following information: o The third party evaluation report that describes the methodology to calculate the demand savings achieved for the program year. In particular, if the proposed methodology is different than the evaluation approaches used by the IESO, an explanation must be provided explaining why the proposed approach is more appropriate o Rationale for net-to-gross assumptions used o Breakdown of billed demand and detailed level calculations in live excel format	Not Applicable
19 - 20	For program savings for projects completed after April 15, 2019, distributors should provide the following: o Related to CFF programs: an explanation must be provided as to how savings have been estimated based on the available data (i.e. IESO's Participation and Cost Reports) and/or rationale to justify the eligibility of the program savings. o Related to programs delivered by the distributor through the Local Program Fund under the Interim CDM Framework: an explanation and rationale should be provided to justify the eligibility of the additional program savings.	Page 9, Section 13.1
3.2.6.2 Continuing Use of the LRAMVA for New CDM Activities		
20	Statement whether it is requesting an LRAMVA for one or more of these activities, if this request has not been addressed in a previous application.	Not Applicable
3.2.7 Tax Changes		
21	Tabs 8 and 9 of Rate Generator model are completed, if applicable	Excel Model Complete
21	If a rate rider to the fourth decimal place is not generated for one or more customer classes, the entire sharing tax amount is be transferred to Account 1595 for disposition at a future date	Page 11, Section 14
3.2.8. Z-Factor Claims		

Filing Requirement Section/Page Reference	IRM Requirements	Evidence Reference, Notes
21	Eligible Z-factor cost amounts are recorded in Account 1572, Extraordinary Event Costs. Carrying charges are calculated using simple interest applied to the monthly opening balances in the account and recorded in a separate sub-accounts of this account	Not Applicable
21	To be eligible for a Z-factor claim, a distributor must demonstrate that its achieved regulatory return on equity (ROE), during its most recently completed fiscal year, does not exceed 300 basis points above its deemed ROE embedded in its base rates	Not Applicable
3.2.8.1 Z-Factor Filing Guidelines		
22	Evidence that costs incurred meet criteria of causation, materiality and prudence	Not Applicable
22	In addition, the distributor must: - Notify OEB by letter of all Z-Factor events within 6 months of event - Apply to OEB for any cost recovery of amounts in the OEB-approved deferral account claimed under Z-Factor treatment - Demonstrate that distributor could not have been able to plan or budget for the event and harm caused is genuinely incremental - Demonstrate that costs incurred within a 12-month period and are incremental to those already being recovered in rates as part of ongoing business exposure risk - Provide the distributor’s achieved regulatory ROE for the most recently completed fiscal year	Not Applicable
3.2.8.2 Recovery of Z-Factor Costs		
22	Description of manner in which distributor intends to allocate incremental costs, including rationale for approach and merits of alternative allocation methods	Not Applicable
22	Specification of whether rate rider(s) will apply on fixed or variable basis, or combination; length of disposition period and rational for proposal	Not Applicable
22	Residential rate rider to be proposed on fixed basis	Not Applicable
22	Detailed calculation of incremental revenue requirement and resulting rate rider(s)	Not Applicable
3.2.9 Off-Ramps		
22 - 23	If a distributor whose earnings are in excess of the dead band nevertheless applies for an increase to its base rates, it needs to substantiate its reasons for doing so	Not Applicable
23	A distributor is expected to file its regulated ROE, as was filed for 2.1.5.6 of the RRR. However, if in the distributor’s view this ROE has been affected by out-of-period or other items (for example, revenues or costs that pertain to a prior period but recognized in a subsequent one), it may also file a proposal to normalize its achieved regulated ROE for those impacts, for consideration by the OEB.	Not Applicable
3.3.1 Advanced Capital Module		
4	Capital Module applicable to ACM and ICM, for an incremental or pre-approved Advanced Capital Module (ICM/ACM) cost recovery and associated rate rider(s)	Not Applicable
24	Evidence of passing "Means Test"	Not Applicable
24	Information on relevant project's (or projects') updated cost projections, confirmation that the project(s) are on schedule to be completed as planned and an updated ACM/ICM module in Excel format	Not Applicable
3.3.2 Incremental Capital Module		
25	If proposed recovery differs significantly from pre-approved amount, a detailed explanation is required	Not Applicable
25	If updated cost projects are 30% greater than pre-approved amount, distributor must treat project as new ICM, re-filed business case and other relevant material required	Not Applicable
26	Evidence of passing "Means Test"	Not Applicable
3.3.2.1 ICM Filing Requirements		
	The following should be provided when filing for incremental capital:	Not Applicable
4	Capital Module applicable to ACM and ICM, for an incremental or pre-approved Advanced Capital Module (ICM/ACM) cost recovery and associated rate rider(s)	Not Applicable

Filing Requirement Section/Page Reference	IRM Requirements	Evidence Reference, Notes
26	An analysis demonstrating that the materiality threshold test has been met and that the amounts will have a significant influence on the operation of the distributor	Not Applicable
27	Justification that the amounts to be incurred will be prudent - amounts represents the most cost-effective option (but not necessarily the least initial cost) for ratepayers	Not Applicable
27	Justification that amounts being sought are directly related to the cause, which must be clearly outside of the base upon which current rates were derived	Not Applicable
27	Evidence that the incremental revenue requested will not be recovered through other means (e.g., it is not, in full or in part, included in base rates or being funded by the expansion of service to include new customers and other load growth)	Not Applicable
27	Details by project for the proposed capital spending plan for the expected in-service year	Not Applicable
27	Description of the proposed capital projects and expected in-service dates	Not Applicable
27	Calculation of the revenue requirement (i.e. the cost of capital, depreciation, and PILs) associated with each proposed incremental capital project	Not Applicable
27	Calculation of each incremental project's revenue requirements that will be offset by revenue generated through other means (e.g. customer contributions in aid of construction)	Not Applicable
27	Description of the actions the distributor would take in the event that the OEB does not approve the application	Not Applicable
27	Calculation of a rate rider to recover the incremental revenue from each applicable customer class. The distributor must identify and provide a rationale for its proposed rider design, whether variable, fixed or a combination of fixed and variable riders. As discussed at section 3.2.3, any new rate rider for the residential class must be applied on a fixed basis	Not Applicable
3.3.2.3 ICM Filing Requirements		
28	Calulate the maximum allowable capital amount	Not Applicable
3.3.2.6 ACM/ICM Accounting Treatment		
30	Record eligible ICM amounts in Account 1508 - Other Regulatory Asset, Sub-Account Incremental Capital Expenditures, subject to assets being and useful	Not Applicable
30	Record actual amounts in the appropriate sub-accounts of Account 1508 – Other Regulatory Assets in accordance with the OEB's APH Guidance	Not Applicable
30	The applicable rate of interest for deferral and variance accounts for the respective quarterly period is prescribed by the OEB and published on the OEB's website	Not Applicable
30	At the time of the subsequent rebasing application, a distributor is required to provide the funding true-up calculation, if material, comparing the recalculated revenue requirement based on actual capital spending relating to the OEB-approved ACM/ICM project(s) to the rate rider revenues collected in the same period. Distributors should note assumptions used in the calculation (e.g. half-year rule). If the OEB determines that a true-up of variances is required, the variance will be refunded to (or collected from) customers through a rate rider	Not Applicable