ENERGY PROFILES LIMITED

Draft Evaluation Plan:

Business Outreach and Education

Prepared for Toronto Hydro-Electric System Limited

April 2011

Contents

1.0 INTRODUCTION

Energy Profiles Limited has prepared this report at the request of Toronto Hydro-Electric System Limited (THESL). The intent of the report is to provide a clear basis on which to evaluate the success of the proposed Business Outreach and Education Program, and to fulfill the OPA EM&V Protocol requirements for a "Draft Evaluation Plan".

2.0 PROGRAM DESCRIPTION

2.1 Description

The Business Outreach and Education program (the Program) will broadly target stakeholders operating within the commercial and institutional sectors across medium to large size businesses and multi-residential buildings, as well as the industrial sector with influence on energy efficiency projects. Due to the size, dispersion, and multiple facings, this is a challenging community to reach and educate about CDM, beyond simple awareness-raising marketing and messaging efforts. Subsequently, this program will educate the business community by reaching out to stakeholders at key events where they congregate. In addition, this program provides for focused on-site educational sessions and workshops at the workplace or other designated locations of influential organizations.

Between 2011 and 2014, THESL estimates that this outreach and education effort can provide tangible training to approximately 7,000 participants, as well as direct engagement with over 5,000 people on a one-on-one basis.

2.1 Program Theory

With the launch of the new CDM programs THESL must reach out and educate the business community on program details including eligibility rules, potential opportunities, the requirements for completing application forms and overall process. Participants will need to distinguish between the new and previous generation of programs, including new OEB approved programs as these are launched in turn and blended into the mix of CDM program options. This requirement extends beyond simple awareness-raising marketing and messaging efforts.

The building services audience itself is varied and comprised of many stakeholders including:

- Building owners and property managers
- Tenants and facility managers
- Consulting and engineering firms
- Builders, contractors and tradespeople
- Distributors, suppliers, and original equipment manufacturers
- Non-governmental agencies and advocates
- Government, institutions and private sectors
- Key decision makers, technical buyers, influencers, and budget managers

The Business Outreach and Education program will broadly target stakeholders within the commercial and institutional sectors across medium to large businesses and multi-residential buildings, as well as the industrial sector.

The Toronto business community serving this segment is a large, segmented, highly dispersed sector that is generally hard to reach at any one time, or through any single media channel. Past experience indicates that THESL will need to engage and educate business audiences directly and interactively as a follow-up to the messaging conveyed through conventional marketing forms. This can be accomplished at a general level on a larger scale, as well as a customized level on smaller scale.

To maximize efficiency and reach, outreach educational activities can leverage large stakeholder assemblies such as business association meetings, special events and tradeshows to great effect.

Whereas, a more focused approach involving smaller or single-interest groups can usefully accommodate deeper or more focused training. Both of these approaches will be pursued under this program.

2.2 Key Program Elements

The training and education delivery model would depend on the nature of the event.

2.2.1 Major Events

Significant training and education opportunities coincide with major high traffic volume events such as key business association conferences and industry tradeshows. In these cases, THESL can reach and engage a broad audience of key decision makers, technical buyers, and budget holders very efficiently.

For a major event, THESL would provide key-note or panel speakers for plenary-type sessions focusing on CDM programs. In addition, and depending on the focus of the event, a menu of session topics would be sponsored and generally include:

- CDM Program specific training
- Online application training
- Technology and case study review

Concurrently, THESL participation would typically include a physical presence in the form of a staffed booth or display area with marketing information made available in order to raise awareness, respond to follow-up and “pedestrian” enquiries.

2.2.2 Association Meetings

A less formal but still important outreach activity involves active membership and participation in business association forums used to inform the membership about CDM programs, advocate for CDM programs within the context of their typical participation, and to review case studies and customer experiences. This type of involvement would also provide secondary benefits such as establishing supportive stakeholder relationships, and securing future project or

customer referrals.

The engagement model for this type of educational outreach would involve active membership in the form of keynote speaking opportunities, provision of information displays at association meetings, information packages, and guided sessions.

2.2.3 On-Site Seminars and Workshops

Another outreach tactic involves visiting key stakeholders at their workplace (or other designated locations) to offer on-site seminars as a convenient, time-efficient and inexpensive engagement model for small and medium-sized groups of important stakeholders with relevant or customized CDM program information.

Outreach and education topics on CDM programs would be flexible and delivered as simple presentations, seminars, workshops, case study presentations, technology clinics to suit the particular organization. These outreach events could be delivered by account managers, program managers, measurement and verification professionals, and project engineers. These sessions would be focused on organizations with multiple customer contacts such as engineering consultants and architects, builders, and contractors.

2.3 Goals and Objectives

The objectives of this educational program are to:

- Introduce the various business stakeholders on the availability and benefits of the commercial and industrial CDM programs and the applicability of potential energy efficiency applications. This includes consideration of new OEB approved programs as these are launched in turn and blended into the mix of CDM program options.
- Train the various business stakeholders on the process and practicalities of applying for incentives and of the processes involved including online registration, eligibility, rules, measurement and verification.
- Maximize participation in CDM programs

2.3.1 Marketing Objectives

- Build understanding of CDM programs
- Drive participation in the programs

2.3.2 Primary Target Market

- Building owners and property managers
- Tenants and facility managers
- Consulting and engineering firms

- Builders, contractors and tradespeople
- Distributors, suppliers, and original equipment manufacturers
- Non-governmental agencies and advocates
- Government, institutions and private sectors
- Key decision makers, technical buyers, influencers and budget managers
- Commercial and institutional trade associations

2.4 Program Logic Model

See Appendix A for the program logic model.

2.5 Program Timing

The Program will operate between program approval and December 31, 2014.

2.6 Estimated Participation and Results

The projected number of participants in educational events, as well as the number of people or pedestrians engaged in less formal one-on-one interactions is displayed in the table below, based on the estimated number of events and participation rates:

Engagement Model	Annual Engagements	Total Estimated Participants	Total Estimated Engaged Pedestrians
Association Membership	20		864
Key Event Education Sponsorship	20	1,200	
Show Booth Outreach	4		800
On-site Seminars	120	960	
Misc. Materials			
Total Annual		**2,160**	**1,664**
Total 2011-2014		**7,560**	**5,824**

Note:

- “Engagements” refers to a presence at a key event or conference.
- “Participant” refers to someone enrolling in a seminar or workshop.
- “Engaged Pedestrian” refers to unscheduled walk-in traffic at trade show events or industry association general meetings.

2.6.1 Projected MW and MWh Savings

Not applicable.

2.7 Budget

The 2011-2014 budgeting plan for the Program is summarized in the following table:

Description	2011	2012	2013	2014	Total
Marginal Costs					
Fixed Costs					
Legal Cost	$15,000	$15,000	$15,000	$7,500	$52,500
Program EMV	$15,000	$15,000	$15,000	$20,000	$65,000
Total Fixed Costs	**$30,000**	**$30,000**	**$30,000**	**$27,500**	**$117,500**
Variable Costs					
Operation Cost	$424,345	$424,345	$424,345	$212,173	$1,485,208
Total Variable Costs	**$424,345**	**$424,345**	**$424,345**	**$212,173**	**$1,485,208**
Total Marginal Cost	**$454,345**	**$454,345**	**$454,345**	**$239,673**	**$1,602,708**
Total Allocable Cost	$12,722	$12,722	$12,722	$6,711	$44,877
Total Program Costs	**$467,067**	**$467,067**	**$467,067**	**$246,384**	**$1,647,585**
Total Incentives	$0	$0	$0	$0	$0
Total Budget	**$467,067**	**$467,067**	**$467,067**	**$246,384**	**$1,647,585**

3.0 CONSERVATION MEASURES

This program promotes conservation measures that qualify for existing and future commercial CDM programs offered by THESL. This includes Tier 1, 2 and 3 programs.

4.0 EVALUATION GOALS AND OBJECTIVES

Program evaluation will be carried out by a certified independent third-party M&V Professional based on the OPA EM&V Protocol, as applicable. It will focus on the following areas to assess the cost-effective delivery of the program:

Process Design Effectiveness:	Participation rates; perceived value of time invested
Program Administration Effectiveness:	Perceived effectiveness of the training delivery and program organization
Estimate Program Cost Effectiveness:	Effectiveness of the program delivery in terms of marketing/sales activities in signing up future participants
Ensure Level of Customer Satisfaction:	Perceived importance of information received

5.0 EVALUATION DELIVERABLES

The following documents shall be delivered over the course of program implementation

1. Draft EM&V Plan
2. Final EM&V Plan
3. Annual Report
4. Final Report

6.0 EVALUATION DESCRIPTION

The success of the Program will be evaluated primarily on the quantity and quality of the engagement models used to promote CDM programs, and the resulting participation levels and participant satisfaction.

The evaluation elements are anticipated to include (but are not limited to) those listed in the corresponding sections below. It is expected that these elements will be reviewed, discussed, evaluated or analyzed as appropriate and according to the OPA's EM&V Protocols to ensure that they meet the Program Evaluation Goals and Objectives during the Draft Evaluation Plan development phase. Review of these elements will assist THESL in determining and/or validating the appropriateness of the program design, administration and measures assumption elements and whether adjustments are necessary in order to successfully deliver the Initiative and to achieve the anticipated goals and objectives and estimated participation and results.

Program evaluation will be carried out by a certified independent third-party EM&V Professional based on the OPA EM&V Protocol. It will focus on the following areas to assess the cost-effective delivery of the Program.

Program evaluation will be end-to-end, from program design, through delivery, to the final financial settlement of each project completed.

7.0 EVALUATION ELEMENTS

7.1 Program Event Quality and Quantity

Program events / engagements shall be evaluated as follows:

1. Overall quantity of events in each category of "Engagement Model" as described in Section 2.6.
2. Number/percentage of attendees at each event that fall into the primary and secondary target market groups as discussed in Section 2.3.

7.2 Program Participation

Program participation shall be evaluated based on the number of "Engaged Participants" as compared to the volume proposed in Section 2.6.

Furthermore, customer feedback from Tier 1, 2, and 3 CDM programs promoted by the Business Outreach and Education program shall be used to understand the impact on enrollment in those CDM programs.

7.3 Cost Effectiveness

The cost effectiveness of the program shall be evaluated based on

1. Verification of program expenditures versus budget
2. Verification of incurred payments

7.4 Participant Feedback

Participant feedback shall be compiled from participants in Tier 1, 2, and 3 CDM programs to determine the impact of the Program on enrollment. The following types of feedback will be solicited:

1. Perceived value of information provided
2. Clarity on the various programs and incentives available to Toronto Hydro customers
3. Quality of materials provided

7.5 Effectiveness of Program Administration Organization

The effectiveness of program administration shall be evaluated based on all aspects of the program, as discussed in this Section 7, with a focus on the following criteria as per OPA Evaluation Protocol 5-A:

- ***Program Design -*** *an assessment of program design and theory;*

- ***Program Administration*** *- an assessment of program administration including identification of staffing requirements and training needs, and review of program tracking systems;*
- ***Program Implementation and Delivery*** *– an assessment of program implementation and delivery including identifying process issues, assessing program targeting and marketing efforts, and quality control methods;*
- ***Market Feedback*** *– an assessment of market satisfaction with program elements and identification of market effects (intended and unintended)*[1]

[4] OPA CDM Evaluation Protocols 5-A

8.0 DATA COLLECTION RESPONSIBILITIES TO SUPPORT PROGRAM EVALUATION

Data collection will be completed with the assistance of a third-party certified EM&V consultant to ensure complete and appropriate collection of data to support Program evaluation. Data collection required shall include but not be limited to the following:

Event statistics:

1. Event name, date, type, etc.
2. Target audience, major target markets in attendance
3. Number of participants and/or engaged pedestrians, as applicable

Participant satisfaction information:

- Participant satisfaction survey results
- Program implementation survey results (from affected CDM programs)

9.0 EVALUATION SCHEDULE AND BUDGET

The schedule will be established by the Third-Party certified EM&V consultant in conjunction with THESL.

Deliverable	Delivery Timeline
Draft Evaluation Plan	Included in program application
Final Program Evaluation Plan	Prior to program start
Annual Reports	Following each year of program operation
Final Report	Following conclusion of program in 2014

The budget for EM&V activities is estimated at $15,000 per year for 2011 – 2013, and $20,000 for 2014.

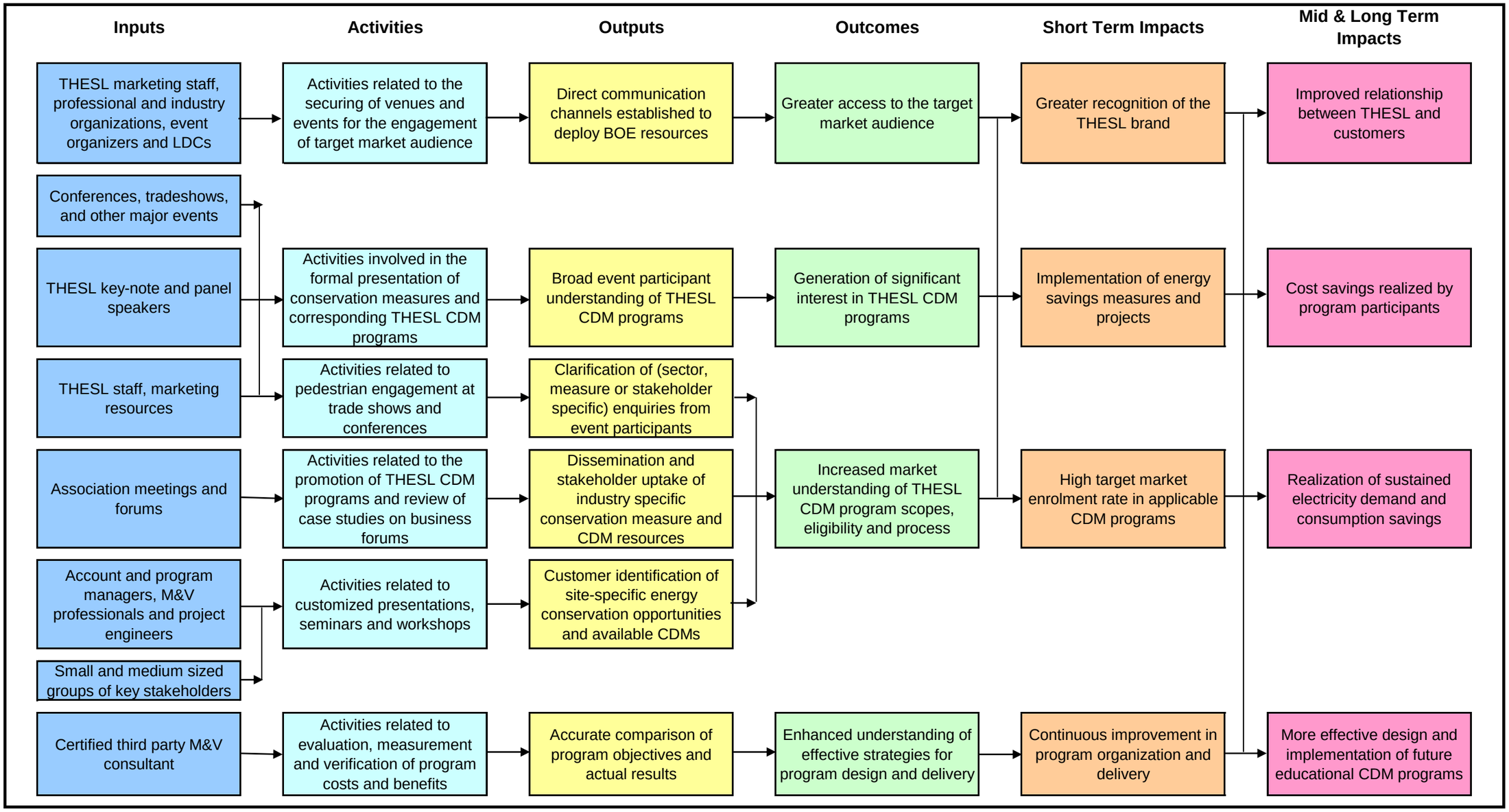
10.0 EVALUATION TEAM

A third-party certified M&V consultant team, with support from THESL CDM personnel, shall be responsible for Evaluation of the Program.

APPENDIX A PROGRAM LOGIC MODEL

ENERGY PROFILES LIMITED

Business Outreach and Education Program Logic Model

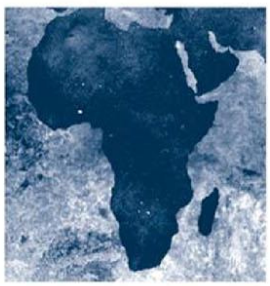


Toronto Hydro-Electric System Limited
EB-2011-0011
Exhibit K
Tab 2
Schedule 2
Filed: 2011 Apr 21
(23 pages)

TORONTO HYDRO-ELECTRIC SYSTEM LIMITED

COMMERCIAL ENERGY MANAGEMENT & LOAD CONTROL

Draft Evaluation Plan Development
- April 2011 -


ECONOLER

ABBREVIATIONS AND ACRONYMS

CDD	Cooling Degree Day
CDM	Conservation Demand Management
CEMLC	Commercial Energy Management and Load Control
CMVP	Certified Measurement and Verification Professional
EMS	Energy Management System
EM&V	Evaluation Measurement and Verification
HDD	Heating Degree Day
IPMVP	International Performance Measurement and Verification Protocol
M&V	Measurement and Verification
OEB	Ontario Energy Board
OPA	Ontario Power Authority
THESL	Toronto Hydro-Electric System Limited

TABLE OF CONTENTS

LIST OF TABLES

1 PROGRAM DESCRIPTION AND OBJECTIVES

The Commercial Energy Management and Load Control (CEMLC) program is designed to reduce energy use and the peak summer demand in the office, retail, institutional and hospitality sectors in facilities with an average monthly demand less than 200 kW.

This market sector is an important target group for Conservation Demand Management (CDM) programs for the following reasons:

- There has been only limited application of energy savings measures beyond lighting upgrades, not to mention that this class of facility has typically not adopted building automation technology.
- The identified market for this program represents 21,350 customers that have a cooling load that is estimated to represent 7% (309 MW) of the Toronto Hydro-Electric System Limited (THESL) summer peak demand.
- Current demand response capacity is negligible in both the category of customers with average demands between 50 kW-200 kW and small commercial facilities that are under 50 kW (less than 2% participation in *peaksaver®*).

The objectives of the CEMLC program are to:

- Provide the small and mid-sized commercial and institutional sectors with an Energy Management System (EMS) that will allow participants to manage their energy use while allowing THESL to control electricity loads during periods of high system demand.
- Contribute 6.3 GWh in cumulative net electricity savings and 6.7 MW in demand response capacity by the end of the program on December 31, 2014.

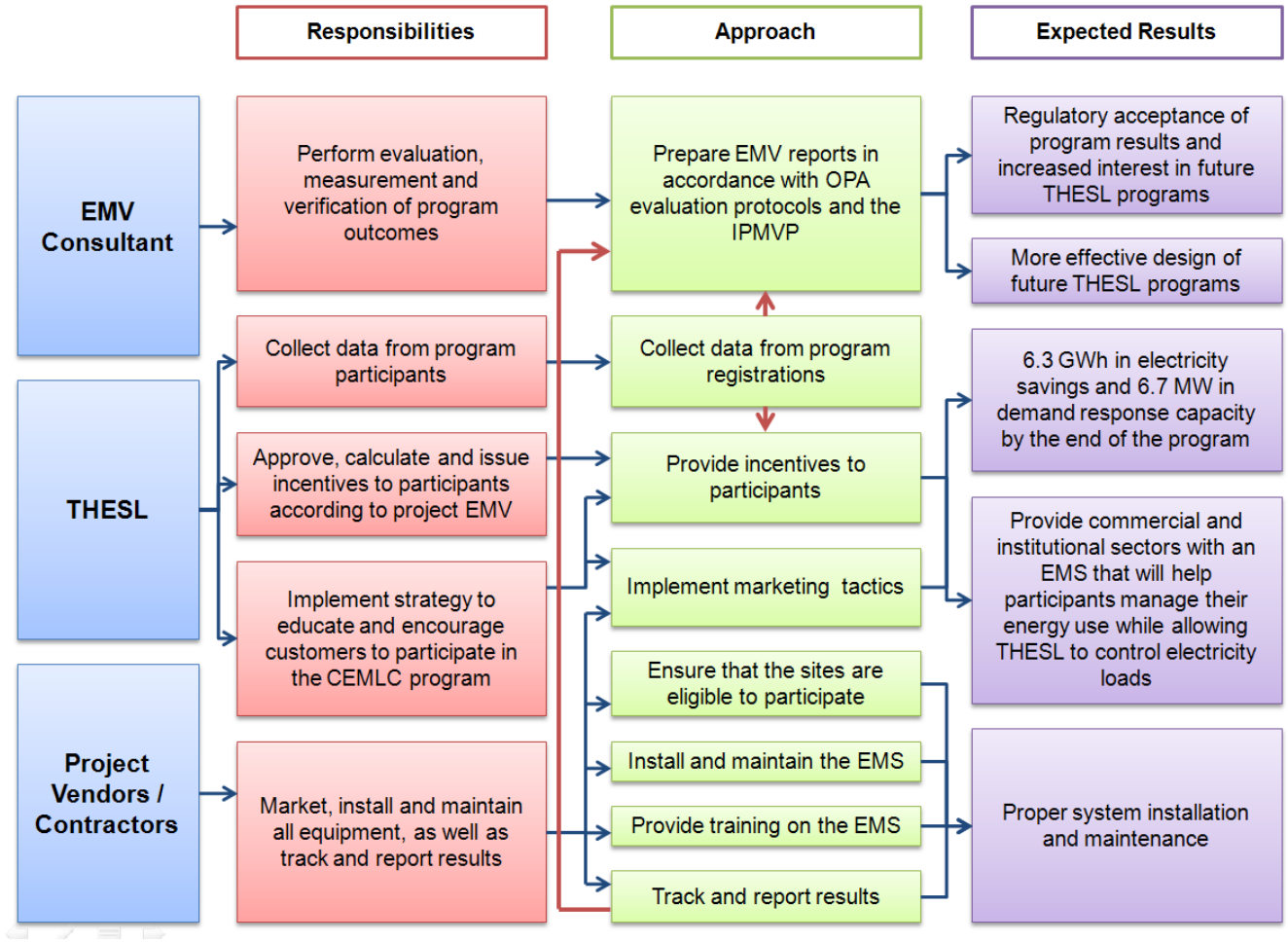
2 PROGRAM THEORY

The CEMLC program will provide eligible participants with an EMS that will control the cooling load of rooftop units and potentially other discretionary electrical loads in the participating facility.

The EMS will be installed on a turnkey basis by a vendor that will be selected via an RFP process, on behalf of THESL and possibly in conjunction with other utilities deploying the same program. The vendor will also maintain the customer interface, provide maintenance services and deliver training.

A key success factor for this program is the selection and implementation of a viable system capable of both demand response for the provincial electricity grid and energy management for the participants in terms of functionality, system reliability and robustness. System functional requirements and technical specifications will be prepared and RFP responses will undergo a rigorous evaluation process to ensure that such a system is selected and implemented for program deployment.

3 PROGRAM LOGIC MODEL



4 TARGETED ENERGY AND PEAK SAVINGS ESTIMATES

4.1 TECHNICAL SAVINGS POTENTIAL

An analysis of eligible participants in the program, and their estimated cooling electricity demand, allowed identifying a potential for load control of 309 MW or 7% of the total electrical summer peak claimed by THESL customers, as shown below. This value represents the total rooftop load in the identified market and would only be achievable if all rooftop units were controlled, with no diversity in or over-sizing of units. The estimated electricity consumption in this sector attributable to cooling equipment is 657 GWh or 3% of the total electricity consumed by THESL customers.

Table 1: Estimated Electricity Demand and Consumption

Sector	Sites	RTU Demand (MW)	RTU Consumption (GWH)
Office	1,305	46	67.0
Retail	1,390	52	137.3
Hospitality	729	18	56.1
Institutional	1,124	19	74.6
Other	1,410	29	64.2
kWh Metered <50kw	15,392	145	258.1
Total	21,350	309	657.3
THESL Total		4,592	24,050
		7%	3%

4.2 ELECTRICITY DEMAND SAVINGS

The following table details the electricity demand and consumption savings associated with each category of facility within the target market based upon the expected market penetration and upon expected demand and consumption savings. Electricity consumption savings were determined by using an 11% reduction in cooling use and a 13% reduction in heating energy use based on improved scheduling and control of set-points in a manner based on Independent Electric System Operator (IESO) ***peaksaver®*** activation protocols. These values were determined using the U.S. Department of Energy (DOE) setback calculator[1] (using Buffalo weather data).

[1] Life-Cycle Cost Estimate for 1 Programmable Thermostat.

Table 2: Electricity Demand and Consumption Savings per Sector

Sector	Sites	Demand Savings (MW)	Electricity Consumption Savings (GWh)	Natural Gas Consumption Savings (000 m^3)
Office	261	2.3	1,327	218
Retail	278	2.5	2,718	233
Hospitality	36	0.2	278	17
Institutional	56	0.2	369	20
Other	71	0.4	318	34
kWh Metered <50kw	462	1.2	766	110
Total	1,164	6.7	5,777	633

4.3 SAVINGS SUMMARY

The projected net electricity demand and consumption savings expected over the four-year duration of the program are summarized in the following table:

Table 3: Electricity Demand and Consumption Savings per Year

	2011	2012	2013	2014	Total
# of Participants	175	349	407	233	1,164
Projected MW DR Capacity	1.0	2.0	2.3	1.3	6.7
Projected MWH Savings	867	1,733	2,022	1,155	5,777
Cumulative MWH Savings	867	3,466	8,087	13,864	13,864
Avg. kW Reduction/Site	6.4				
Avg. kWh Reduction/Site	5,515				

5 KEY RESEARCH OBJECTIVES AND RESPONSIBLE PARTIES

5.1 KEY RESEARCH OBJECTIVES

The program's key objectives are to verify:

- Gross energy and demand savings: 7.4 MW summer demand reduction and 13.8 GWh electricity savings over the four years of the program;
- Net energy and demand savings: 6.7 MW summer demand reduction and 6.3 GWh electricity savings over the four years of the program;
- Free ridership: 10%;
- Total Resource Cost and Program Administrator Cost:

Table 4: Total Resource Cost and Program Administrator Cost

Name of Test	Benefits	Cost	Net Benefit	Ratio
TRC	$ 15,026,152	$ 8,839,316	$ 6,186,836	1.7
PAC	$ 13,152,630	$ 3,196,973	$ 9,955,657	4.1

- Introduce Toronto Hydro's CEMLC program to approximately 21,350 prospective customers by middle of 2011 with a take up rate of 1,100 customers by the end of 2014;
- Operating life: 13 years.

5.2 RESPONSIBLE PARTIES

Table 5: Responsible Parties

Parties	Identification
Program Manager	THESL
EM&V Consultant	Third party
Project Vendors/Contractors	To be determined

6 SCHEDULE FOR EVALUATION DELIVERABLES

Table 6: Deliverables Schedule

Deliverables	Frequency
Draft Evaluation Plan	Program application.
Final Evaluation Plan Development	Prior to program start.
Annual Reports	Following each year of program operation.
Final Reports	Following program conclusion in 2014

7 SUMMARY OF DATA COLLECTION EXPECTED FROM PROGRAM ADMINISTRATORS/DELIVERY AGENTS

Savings will be calculated initially based on estimates consistent with acceptable engineering practices and reasonable energy monitoring and tracking practices. These savings estimates will be verified through a program Evaluation Measurement and Verification (EM&V) process based on the International Performance Measurement and Verification Protocol (IPMVP) and on the OPA EM&V Protocol. THESL will require supporting data from program participants to substantiate the claimed savings. Documentation archives will be maintained and will be used for governance, reference and audit purposes.

THESL employs a comprehensive financial and work order system to keep track of CDM-related expenditures. After validation and verification of participant and third party invoices, payments will be made and recorded in the system. Each invoice will be substantiated by supporting documents.

Internal operational reports will be prepared and reviewed monthly subject to THESL's corporate governance rules and policies, including those established to govern Ontario Power Authority (OPA) programs. Annual reports consisting of financial and operational results as well as energy and demand savings (based on project Measurement and Verification (M&V) and program EM&V results from independent third party reports) will be submitted to the Ontario Energy Board (OEB).

THESL is committed to delivering CDM programs that have a cost/benefit ratio greater than one. Total resource cost and program administrator cost calculations will be performed annually and at the end of the program. They will be included in the OEB reports.

All data collection efforts will be in conformance with the OEB CDM Code as well as with any other instruction received. The program administrator is expected to collect and provide to the EM&V Consultant the following data:

- Number of sites;
- Cost of installation;
- Applications;
- Building size and use.

8 PROPOSED METRICS TO TRACK PROGRAM PROGRESS

Evaluation of program progress is performed in accordance with IPMVP standards and OPA EM&V protocols. Therefore, the following aspects must be addressed in the evaluation plan:

- Measurement option and boundaries selected;
- Baseline: period, energy and conditions;
- Reporting period;
- Basis for adjustments;
- Budget;
- Specifications of meters used;
- Other key elements measured;
- Quality assurance.

Within the EM&V process, the combination of demand response and energy conservation of this program will require special attention to the two very different aspects of CDM. The demand response, or load control will require extensive effort in the selection of a representative sample to properly assess the program load reduction capacity achieved. Rigorous statistical analysis will be required to process the interval data collected to isolate the load reduction resulting from the demand response activations.

The assessment of energy saved from the participants' energy management activities will require a different approach and methodology. Given the dependence of energy management on operational as well as behavioural changes on the part of the participants, the M&V assessment will not only have to isolate and determine the program energy savings achieved, it will also have to evaluate the persistence of the conservation measure.

8.1 MEASUREMENT OPTION AND BOUNDARIES SELECTED

8.1.1 Energy savings

The option selected to determine savings
Option C Based on Volume 1 of the IPMVP, EVO 10000-1: 2007 (En)

Justification for the option selection, gain/reporting period ratio
The whole building measurement option was selected because the meters of the energy suppliers are used to evaluate the whole facility's energy performance. This option determines the collective savings of all energy conservation measures implemented. This option is suited to projects for which the projected savings are large in relation to the unpredictable energy variations that occur on site.

Measurement boundaries
The measurement boundary should be a sample of 64 participants to achieve a 90 % confidence level (whereas the population is 1,164 and the coefficient of variance used as an initial estimate is 0.5). For each participant in the sample, the whole building energy consumption will be measured. Because this sample size is determined using an assumed coefficient of variance, it is critical to remember that the actual coefficient of variance of the population being sampled may be different. Therefore a different actual sample size may be needed to meet the precision criterion. As sampling continues, the mean and standard deviation of the readings should be computed. The actual coefficient of variance and required sample size should be recomputed. This re-computation may allow early curtailment of the sampling process. It may also lead to a requirement to conduct more sampling than originally planned. To maintain EM&V costs within budget it may be appropriate to establish a maximum sample size. If this maximum is actually reached after the above re-computations, the savings reports should note the actual precision achieved by the sampling.

8.1.2 Load control events

Load control events effectiveness will be determined by using the interval data from a statistically valid cross-section of customers. The sample size should be determined according Volume 1 of the IPMVP, EVO 10000-1: 2007 (En) appendix B-3. Sampling error can be minimized by increasing the fraction of the population that is sampled. However, increasing the sample size increases cost.

The option selected to determine savings
Option A: Load control events isolation Based on Volume 1 of the IPMVP, EVO 10000-1: 2007 (En)

Justification for the option selection, gain/reporting period ratio
This option determines the effectiveness of the load control events on system demand for the various maximum day temperatures and hours of the day.

Measurement boundaries
The measurement boundary should be a sample of 64 participants to achieve a 90 % confidence level (whereas the population is 1,164 and the coefficient of variance used as an initial estimate is 0.5). For each participant in the sample, the whole building demand will be measured during periods of high demand. Because this sample size is determined using an assumed coefficient of variance, it is critical to remember that the actual coefficient of variance of the population being sampled may be different. Therefore a different actual sample size may be needed to meet the precision criterion. As sampling continues, the mean and standard deviation of the readings should be computed. The actual coefficient of variance and required sample size should be recomputed. This re-computation may allow early curtailment of the sampling process. It may also lead to a requirement to conduct more sampling than originally planned. To maintain EM&V costs within budget it may be appropriate to establish a maximum sample size. If this maximum is actually reached after the above re-computations, the savings reports should note the actual precision achieved by the sampling.

8.2 BASELINE: PERIOD, ENERGY AND CONDITIONS

To measure energy savings, the baseline period must be established to represent a full operating cycle from maximum to minimum energy use in order to fairly represent all operating conditions of a normal operating cycle. The baseline should also include only time periods for which all fixed and variable energy-governing facts are known about program participants. Moreover, the baseline should coincide with the period immediately before commitment to undertake the retrofit. Periods further back in time would not reflect the conditions existing before the retrofit and may therefore not provide a proper baseline for measuring the effect of the program.

For demand savings measurement, the baseline must be established to represent periods of high demand.

8.2.1 Identification of the Baseline Period

For energy savings, the baseline period is established according to the billing of natural gas and electrical energy consumption for the whole building sample for a full year prior to program implementation**.**

For demand savings, the measurement is limited to the various maximum day temperatures and hours of the days over the whole baseline period.

8.2.2 Independent Variable Data

Independent variables include factors that can affect building use and which will be systematically taken into consideration to establish the reference year calculation or simulation during the reporting period. The factors likely to be chosen in this case are the following:

For energy consumption and electrical demand adjustments:

- Heating Degree Day (HDD)
- Cooling Degree Day (CDD)

8.2.3 Static Factors Corresponding to Energy Usage Data

Static factors include equipment and operations that are considered fixed during the preparation of the measurement plan. No current adjustment calculation is considered for these factors in the M&V plan. However, in the event of a change in data and parameters, a non-routine adjustment could be made to the baseline simulation or calculation. The following list presents some events that could result in changes in static factors. This list is not exhaustive and any other modification made that changes energy needs could be added.

- Changes to the use of the buildings or part of the buildings;
- Transformation of the buildings;
- Changes to the buildings' use or occupancy;
- Expansion of the buildings;
- Number and capacity of HVAC mechanical systems;
- Ventilation system hours of operation;
- Annual hours of humidification system use;
- Annual hours of interior lighting use;
- Annual hours of exterior lighting use;
- Quantity of outside air used for ventilation purposes;
- Temperature and humidity set point maintained for comfort;

8.3 REPORTING PERIOD

The reporting period corresponds to a 48-month period from the implementation of the measure. For demand savings, the measurement is limited to the various maximum day temperatures and hours of the days over the whole reporting period.

8.4 BASIS FOR ADJUSTMENTS

8.4.1 Electricity Consumption Savings

Approach Taken	Equation
Measurement of whole building sample	Program energy savings = Total participants (×) **(**Baseline energy consumption adjusted to the independent variables of the reporting period (±) Non-routine adjustments to reporting period conditions (-) Reporting period energy consumption**)** (÷) Sample size

8.4.2 Electricity Demand Savings

Approach Taken	Equation
Measurement of whole building sample	Program energy savings = Total participants (×) **(**Baseline demand adjusted to the independent variables of the reporting period (±) Non-routine adjustments to reporting period conditions (-) Reporting period demand**)** (÷) Sample size

8.5 DESCRIPTION OF THE METHODOLOGY OF THE BASELINE ADJUSTMENT

8.5.1 Routine Adjustments

Mathematical modeling is used in M&V to prepare the baseline energy consumption and demand adjusted to the independent variables of the reporting period. Modeling involves finding a mathematical relationship between dependent and independent variables. The dependent variable, usually energy, is modeled as being governed by one or more independent variables X_i. This type of modeling is called regression analysis. The most common models are linear regressions of the form:

$$y = b_0 + b_2 x_2 + \cdots + b_p x_p + e$$

Where:

- *Y* is the dependent variable, usually in the form of energy use during a specific time period (e.g., 30 days, 1 week, 1 day, 1 hour, etc.)
- X_i (i = 1, 2, 3, … p) represents the 'p' independent variables.
- b_i (i = 0, 1, 2, … p) represents the coefficients derived for each independent variable, and one fixed coefficient (b_0) unrelated to the independent variables.
- *e* represents the residual errors that remain unexplained after accounting for the impact of the various independent variables.

To assess the accuracy of a model, the following factors must be examined:

- The coefficient of determination, R2 should be greater than 0.75.
- Positive mean bias error indicates that regression estimates tend to overstate the actual values. Overall positive bias does tend to cancel out negative bias.
- T-statistic of 2 or more implies that the estimated coefficient is significant relative to its *standard error*, and therefore that a relationship does exist between *Y* and the particular *X* related to the coefficient.

8.5.2 Non-Routine Adjustments

In the event of the addition/withdrawal/stop of equipment in the building, data will be collected through the modification plans or estimates, equipment specifications or information from the manufacturer or a short-term measurement campaign. The choice will be determined based on the nature of the changes to the static factors. The hours of operation of the new equipment can be estimated by the type of use, as agreed with the client.

8.6 SPECIFICATIONS OF METERS USED

The main meters that measure the buildings' total electrical energy consumption and peak load are THESL meters. These meters are compliant with IPMVP requirements without additional validation.

8.7 BUDGET

Table 7: EM&V Budget

Description	EM&V Costs
Draft EM&V Plan	Excluded
Baseline Report	$65,000
Final EM&V Plan	$30,000
Annual Tracking Report	
2011	$15,000
2012	$15,000
2013	$15,000
2014	$15,000
Final EM&V Report	$85,000
Total	**$240,000**

8.8 OTHER KEY ELEMENTS MEASURED

Free ridership: Determined through a survey performed on a sample of participants;

Marketing effectiveness: Determined through program applications;

Total Resource Cost and the Program Administrator Cost: Determined through program applications, energy and demand savings results as well as a costs survey including the cost of utility equipment, operation and maintenance, installation, program administration, and customer dropout and removal of equipment.

8.9 QUALITY ASSURANCE

Only professionals having the Certified Measurement and Verification Professional (CMVP) certification can calculate the savings and adjustments. Moreover, all savings calculations will be based on fundamental engineering principles and performed to the best of the knowledge of the professionals involved. Each calculation will be verified by another person who knows the project and who has the required skills.

All savings calculations will be based on the electricity data from the copies of the bills of energy suppliers.

Energy data entries will be double checked to minimize the chance of errors. This second verification will be completed by another stakeholder.

Independent variable:

- Degree days: All meteorological data will come from Environment Canada – specifically the weather station closest to the project.

Static factor:

- Information regarding changes made to the static factors of the project will be sent by the program manager to be analyzed by the certified CMVP to determine the direct and indirect impacts on the projected savings. This professional will then be able to make the necessary adjustments for the reference year to determine the real savings of the measures implemented.

ECONOLER

160, rue Saint-Paul, Bureau 200, Québec (Québec), Canada G1K 3W1 Tel.: + 1 (418) 692-2592 Fax: +1 (418) 692-4899
www.econoler.com

Toronto Hydro-Electric System Limited

Draft Evaluation, Measurement and Verification Plan:

Commercial, Institutional and Small Industrial Monitoring & Targeting ("M&T")

Submitted to:

Ontario Energy Board

Submitted on April 14, 2011

TABLE OF CONTENTS

1. OPA EM&V Program Design Evaluation Input Template

PROGRAM NAME:	Commercial, Institutional and Small Industrial Monitoring and Targeting (M&T) Program
PROGRAM MANAGER:	Toronto Hydro Electric System Limited

OVERVIEW

PROGRAM TYPE	
Resource Acquisition	☒
Market Transformation	☐
Capability Building	☐

CONSERVATION CATEGORY	
Demand Management/Conservation Behaviour	☒
Energy Efficiency	☐
Fuel Switching	☐
Customer-Based Generation	☐

PROGRAM DESCRIPTION

Toronto Hydro Electric System looks forward to providing support to Commercial, Institutional and Small Industrial organizations inside its service territory to implement new Monitoring and Targeting (M&T) projects in their existing buildings.

M&T is an advanced operational practice employed by progressive building operators and managers to track energy consumption in real-time against targets, pursue operational improvements, and intervene proactively. An M&T project generally encompasses the installation of an Energy Management Information System. Continuous optimization, through the use of real-time metering, monitoring, targeting and reporting, offers advantages over conventional commissioning events by immediately spotting energy waste, and uncovering deeper saving opportunities that are often missed with initial or periodic commissioning. The M&T system will deliver new energy efficiency improvements through process changes, behavioural modifications and identification of future upgrade opportunities. The M&T system will assist operators to sustain new savings.

As the savings will originate from the M&T systems, the conservation measures are the M&T systems themselves. The M&T systems achieve these savings by the following mechanisms: (1) participants will change their behaviour, as well as internal processes and procedures to curb down their energy consumption; (2) more low-cost/no-cost Energy Conservation Measures (ECMs) are implemented by participants; and (3) participants will implement *non*-ERII-eligible capital-intensive ECMs. When participants implement ERII-Eligible capital-intensive ECMs, it will not be attributed to the program and will therefore not be counted twice.

The intended participants in the programs are: Toronto Hydro's eligible customers and building

operators, in the commercial, institutional and small industrial sectors. In short, eligibility criteria are: the building must be a minimum of 3 years old, must be in Toronto Hydro service territory, and have an average monthly peak demand exceeding 200 kW. The industrial facilities must not exceed 15 GWh in annual electricity consumption.

Toronto Hydro will provide a monetary incentive to participating organizations for the implementation of new M&T projects, and a performance-based on-going monetary incentive to support the sustained used of the M&T systems and to increase persistence. M&T systems will be developed and operated by participants with the support of an M&T vendor of their choice. Toronto Hydro will conduct a marketing and communication campaign to increase awareness of the benefits of M&T, increase demand for M&T systems, generate participation in the program, and bolster the M&T services and equipment offer in the market in the medium-term.

PROGRAM THEORY / PROGRAM LOGIC MODEL

The visual representation of the program theory, as well as the delivery and implementation chain, are represented in Appendix A – Logic Model.

A short overview of the program theory is provided in the few next paragraphs.

Toronto Hydro will develop and deliver a targeted advertizing campaign to increase the awareness of targeted customers of the benefits of M&T systems. Toronto Hydro will engage Channel Partners such as BOMA, ASHRAE and CaGBC[1] to obtain third-party endorsements, improve the effectiveness of the "take-to-market" campaign, and extend the outreach. Toronto Hydro will engage M&T vendors and build a relationship with them as Trade Allies to extend the outreach of the campaign and support the match-making of participant and M&T vendors. Toronto Hydro sales force will directly solicit their customers to generate participation. Toronto Hydro will offer and pay a significant M&T project implementation incentive to eligible participants. Toronto Hydro will offer and pay a performance-based annual incentive to participants who can demonstrate that they achieved savings.

The short-term outcomes expected from the program are: targeted customers will be more aware of the benefits of M&T, some customers will be convinced to participate in the program and implement an M&T project, and M&T projects will be implemented in the participants' buildings.

The medium-term outcomes expected from the program are: an increased M&T services and equipment offer in the market served by Toronto Hydro, participants will realize savings caused by operation and behaviour changes and participants will persist in operating the M&T system because of the annual performance incentive.

The long-term outcomes expected from the program are: program-induced sustainable savings, increased perception of property market value of participating buildings (incl. tenant capture and retention, or plant productivity), positive word-of-mouth among targeted customers, and –in the very long-term– implementation of M&T systems without the need for any incentive.

In addition, it is expected that the M&T program will increase the market penetration of the Energy Retrofit Incentive Initiative (ERII) because M&T systems will cause participants to discover ERII-eligible capital-intensive energy conservation measures so that M&T participants will implement more of these measures. This will increase the ERII-induced sustainable savings.

[1] BOMA : Building Owners and Managers Association. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers. CaGBC: Canadian Green Building Council.

These savings will not be double-counted because they are going to be subtracted from the M&T program-induced savings.

PROGRAM TIMING AND KEY ELEMENTS

The expected date of completion of each of the identified program elements are:

- The end of the second quarter as well as the third quarter of 2011 will be used to develop a detailed implementation plan for the program, the marketing collateral, the mobilization of human and financial resources, and the establishment of transactional infrastructure.
- The program "take-to-market" campaign will be launched at the beginning of the first quarter of 2012.
- The program will operate and will be open for participation from the launch of the take-to-market campaign until the end of 2013.
- The last performance-based annual incentive will be paid during 2014.
- All transaction should be closed by the end of the first quarter of 2015.
- A baseline evaluation study (Study #1) will be conducted in 2011.
- An annual program tracking report will be produced in 2011, 2012, 2013 and 2014.
- A final evaluation study (Study #2) will be conducted in 2014.

An independent EM&V contractor will be responsible for all "external" market data collection activities. The anticipated data collection methods are represented in Appendix B – Evaluation Study Flow Chart.

Toronto Hydro will be responsible for "internal" tracking of program data. Toronto Hydro will produce an annual program tracking report in 2011, 2012, 2013 and 2014. All tracking reports will be reviewed by a third party evaluator. The review will consist of a high-level desk review of program data, calculation algorithms and performance indicators.

There will be two evaluation studies: Study #1) the baseline study prior to program implementation; and Study #2) the EM&V final study after program implementation.

As part of the implementation of the Baseline Study (Study #1), the following data collection methods should be used: targeted customer phone survey, targeted-customer phone or in-person interviews, building operator surveys, and building operator interviews, in-person interviews with M&T vendors, and in-person interviews with potential channel partners. Baseline levels will be established, and design assumptions tested, including but not limited to: natural M&T system market penetration, level of awareness and level of offer of M&T systems the Main purchase drivers of M&T systems and the willingness of building operators, trade allies and channel partners. Early recommendations and fine-tuning of the program design and so-called take-to-market strategy will be made.

As part of the implementation of the Final EM&V Study (Study #2), the following data collection methods should be used: participant phone surveys, desk review of transaction documentation including project-level M&V plan and reports, project site visits, non-participant phone survey, trade allies interviews and channel partner interviews. Freeridership, spillover and net-to-gross ratio will be established using self-reporting and pre/post market penetration indicators. The realization ratio will be estimated by establishing the level of discrepancies found in project-level M&V and tracking system during the participant phone survey, the desk reviews and the site visits. The evaluators will test the cost-effectiveness of the program including the Participant Test (PT), the Total Resource Cost Test (TRC), and the Program Administrator Cost Test (PAC). Evaluators will respond to research questions including but not limited to: satisfaction of participants, trade allies and channel partners, program visibility and reputation, effectiveness of

take-to-market strategy, and effectiveness of the program administrative processes and procedures.

The evaluation approach described above is the approach that is anticipated on a preliminary basis by the Toronto Hydro Electric System Limited. Evaluation contractor bidders will be requested to offer options and improvements to the approach. Ultimately, the final version of the methodology will be established in the Baseline Study Plan, and in the Final EM&V Plan.

INPUT ASSUMPTIONS / FORECASTED RESULTS

☐ **Prescriptive**

Measure Name	Existing	New	Incentive/ unit	Forecasted participation
NONE	☐	☐		
	☐	☐		
	☐	☐		

☐ **Quasi-prescriptive**

Measure Name	Existing*	New**	Incentive Structure	Forecasted Savings	
				Energy (kWh)	Demand (kW)
NONE	☐	☐			
	☐	☐			
	☐	☐			

☒ **Custom**

Incentive Structure	Forecasted participation	
	Energy (GWh)	Demand (MW)
Commercial and Institutional Participants. (A)	34.7	0.75
Industrial Participants. (B)	6.0	0.11

Note:
(A) Incentive Structure for Commercial and Institutional Participants: (i) Implementation incentive: Up to 50% of M&T project cost, equal or below $75,000. and (ii) Savings incentive: $0.025 per kWh per year for 2012, 2013 and 2014.
(B) Incentive Structure for Industrial Participants: (i) Implementation incentive: Up to 50% of M&T project cost, equal or below $75,000. And (ii) Savings incentive: $0.025 per kWh saved per year for 2012, 2013 and 2014.

PROGRAM COSTS

COST DESCRIPTION	BUDGET
Development/ Start-up Costs	N/A
Administration and Overhead	$854,118
Marketing and Promotion	$660,817
EM&V	$273,000
Budget Total	$1,787,935

FORECASTED PROGRAM RESULTS SUMMARY

ELEMENT	FORECASTED RESULT
Peak Summer MW Savings	0.86 MW
Peak Winter MW Savings	0.86 MW
Annual MW Savings	0.86 MW
Levelized Cost / kW Year ($/ kW-yr)	TBD
Levelized Cost / kW Year ($/ kW)	TBD
TRC Benefit / Cost Ratio	1.6
Program TRC ($)	$2,835,833

2. OPA Draft Evaluation Plan Template

Program Description	**Description** Toronto Hydro Electric System looks forward to providing support to Commercial, Institutional and Small Industrial organizations inside its service territory to implement new Monitoring and Targeting (M&T) projects in their existing buildings. M&T is an advanced operational practice employed by progressive building operators and managers to track energy consumption in real-time against targets, pursue operational improvements, and intervene proactively. An M&T project generally encompasses the installation of an Energy Management Information System. Continuous optimization, through the use of real-time metering, monitoring, targeting and reporting, offers advantages over conventional commissioning events by immediately spotting energy waste, and uncovering deeper saving opportunities that are often missed with initial or periodic commissioning. The M&T system will deliver new energy efficiency improvements through process changes, behavioural modifications and identification of future upgrade opportunities. The M&T system will assist operators to sustain new savings. The intended participants in the programs are: Toronto Hydro's eligible customers and building operators, in the commercial, institutional and small industrial sectors. In short, eligibility criteria are: the building must be a minimum of 3 years old, must be in Toronto Hydro service territory, and have an average monthly peak demand exceeding 200 kW. The industrial facilities must not exceed 1 GWh in annual electricity consumption. **Key Program Elements** Toronto Hydro will provide a monetary incentive to participating organizations for the implementation of new M&T projects, and a performance-based on-going monetary incentive to support the sustained used of the M&T systems and to increase persistence. M&T systems will be developed and operated by participants with the support of an M&T vendor of their choice. Toronto Hydro will conduct a marketing and communication campaign to increase awareness of the benefits of M&T, increase demand for M&T systems, generate participation in the program, and bolster the M&T services and equipment offer in the market in the medium-term. **Goals and Objectives** A high-level overview of the objectives are provided in the next few paragraphs. **Program Logic Model / Program Theory** The visual representation of the program theory, as well as the delivery and implementation chain, are represented in Appendix A – Logic Model. A short overview of the program theory is provided in the few next paragraphs.

	Toronto Hydro will develop and deliver a targeted advertizing campaign to increase the awareness of targeted customers of the benefits of M&T systems. Toronto Hydro will engage Channel Partners such as BOMA, ASHRAE and CaGBC[2] to obtain third-party endorsements, improve the effectiveness of the "take-to-market" campaign, and extend the outreach. Toronto Hydro will engage M&T vendors and build a relationship with them as Trade Allies to extend the outreach of the campaign and support the match-making of participant and M&T vendors. Toronto Hydro sales force will directly solicit their customers to generate participation. Toronto Hydro will offer and pay a significant M&T project implementation incentive to eligible participants. Toronto Hydro will offer and pay a performance-based annual incentive to participants who can demonstrate that they achieved savings. The short-term outcomes expected from the program are: targeted customers will be more aware of the benefits of M&T, some customers will be convinced to participate in the program and implement an M&T project, and M&T projects will be implemented in the participants' buildings. The medium-term outcomes expected from the program are: an increased M&T services and equipment offer in the market served by Toronto Hydro, participants will realize savings caused by operation and behaviour changes and participants will persist in operating the M&T system because of the annual performance incentive. The long-term outcomes expected from the program are: program-induced sustainable savings, increased perception of property market value of participating buildings (incl. tenant capture and retention, or plant productivity), positive word-of-mouth among targeted customers, and –in the very long-term– implementation of M&T systems without the need for any incentive. In addition, it is expected that the M&T program will increase the market penetration of the Energy Retrofit Incentive Initiative (ERII) because M&T systems will cause participants to discover ERII-eligible capital-intensive energy conservation measures so that M&T participants will implement more of these measures. This will increase the ERII-induced sustainable savings. These savings will not be double-counted because they are going to be subtracted from the M&T program-induced savings. **Program Timing** The expected date of completion of each of the identified program elements are: • The end of the second quarter as well as the third quarter of 2011 will be used to develop a detailed implementation plan for the program, the marketing collateral, the mobilization of human and financial resources, and the establishment of transactional

[2] BOMA : Building Owners and Managers Association. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers. CaGBC: Canadian Green Building Council.

infrastructure.

- The program "take-to-market" campaign will be launched at the beginning of the first quarter of 2012.
- The program will operate and will be open for participation from the launch of the take-to-market campaign until the end of 2013.
- The last performance-based annual incentive will be paid during 2014.
- All transaction should be closed by the end of the first quarter of 2015.
- A baseline evaluation study (Study #1) will be conducted in 2011.
- An annual program tracking report will be produced in 2011, 2012 2013, and 2014.
- A final evaluation study (Study #2) will be conducted in 2014.

Estimated Participation and Results

The estimated participation is 96 participants from the commercial & institutional sector, and 11 participants from the industrial sector.

The estimated results are presented in the table here below:

Incentive Structure	Forecasted participation	
	Energy (GWh)	Demand (MW)
Commercial/Institutional M&T Projects	34.7	0.75
Small-Industrial M&T Projects	6.0	0.11
Total	**40.7**	**0.86**

(Including 30% of free-ridership, and assuming 8 years of operating life.)

Budget

The estimated budget is presented in the table here below:

COST DESCRIPTION	BUDGET
Development/ Start-up Costs	N/A
Administration and Overhead	$854,118
Marketing and Promotion	$660,817
EM&V	$273,000
Incentive	$3,713,475
Budget Total	**$5,501,410**

Conservation Measures

The savings will originate from the M&T systems, therefore the conservation measures are:

- Implementation of new Commercial/Institutional M&T systems
- Implementation of new Industrial M&T systems

The implementation of M&T systems is expected to generate the following

	effects that, in turn, will achieve energy savings: 1. The participants will change their behaviours, internal processes and procedures to curb down their energy consumption. 2. The participants will implement more low-cost/no-cost Energy Conservation Measures (ECMs). 3. The participants will implement *non*-ERII-eligible capital-intensive ECMs. 4. The participants will implement ERII-eligible capital-intensive ECMs. Effects (1), (2) and (3) will be a direct result of the M&T systems, therefore, the savings achieved through these will be attributed to the program. It is challenging and not necessary to identify the nature of effects (1), (2) and (3) ex-ante or ex-post. It is possible to quantify the sum of all the effects through the use of Project-Level M&V activities based on an Option C methodological approach of the International Performance Measurement and Verification Protocol (IPMVP) – Whole Facility approach. These procedures are described further in this plan. It is not possible to identify the nature of effect (4) ex-ante but it will be possible to identify the nature of effect (4) ex-post, as ERII transactions will be tracked through the normal operation of ERII. This effect will not be attributed to the M&T program. It will not be double counted as ERII savings will be subtracted from the results of the Option C M&V activities by the evaluators.
Evaluation Goals and Objectives	The evaluators will have to respond to the following Research Questions: • Research Question 1: What is the market baseline? (Market Characterization) • Research Question 2: Was Toronto Hydro's Marketing and Communication Strategy effective? (Process Evaluation) • Research Question 3: Is Program design and organisation adequate? (Process Evaluation) • Research Question 4: What are positive outcomes attributable to the program? (Impact Evaluation) • Research Question 5: Have targeted markets been transformed? (Market Effects Evaluation) • Research Question 6: How do program costs and benefits compare? (Cost-Effectiveness Evaluation)

Evaluation Deliverables	There will be two evaluation studies: Study #1) the baseline study prior to program implementation; and Study #2) the EM&V final study after program implementation. The anticipated outputs are represented in Appendix B – Evaluation Study Flow Chart. The anticipated outputs are: • Draft EM&V Plan • Study #1- Baseline Study Plan • Study #1- Baseline Data Report • Study #1- Draft Baseline Study Report • Study #1- Final Baseline Study Report & Updated Draft EM&V Plan • Annual Program Tracking Report 2011 • Annual Program Tracking Report 2012 • Annual Program Tracking Report 2013 • Annual Program Tracking Report 2014 • Study #2- Final EM&V Plan • Study #2- Primary Data Report • Study #2- Draft EM&V Report • Study #2- Final EM&V Report Toronto Hydro internal staff will produce annual reports as part of the program tracking activities. The tracking reports will be reviewed by a third party evaluator.
Evaluation Description	Evaluation elements are represented in Appendix B – Evaluation Study Flow Chart. The evaluation approach described below is the approach that is anticipated on a preliminary basis by the Toronto Hydro Electric System Limited. Evaluation contractor bidders will be requested to offer options and improvements to the approach. Ultimately, the final version of the methodology will be established in the Baseline Study Plan, and in the Final EM&V Plan. There will be two evaluation studies: Study #1) the baseline study prior to program implementation; and Study #2) the EM&V final study after program implementation. As part of the implementation of the Baseline Study (Study #1), the following data collection methods should be used: targeted customer phone survey, targeted-customer phone or in-person interviews, building operator surveys, and building operator interviews, in-person interviews with M&T vendors, and in-person interviews with potential channel partners. Baseline levels will be established, and design assumptions tested, including but not limited to: natural M&T system market penetration, level of awareness and level of offer of M&T systems the Main purchase drivers of M&T systems and the willingness of building operators, trade allies and channel partners. Early recommendations and fine-tuning of the program design and so-called take-to-market strategy will be made.

	As part of the implementation of the Final EM&V Study (Study #2), the following data collection methods should be used: participant phone surveys, desk review of transaction documentation including project-level M&V plan and reports, project site visits, non-participant phone survey, trade allies interviews and channel partner interviews. Freeridership, spillover and net-to-gross ratio will be established using self-reporting and pre/post market penetration indicators. The realization ratio will be estimated by establishing the level of discrepancies found in project-level M&V and tracking system during the participant phone survey, the desk reviews and the site visits. The evaluators will test the cost-effectiveness of the program including the Participant Test (PT), the Total Resource Cost Test (TRC), and the Program Administrator Cost Test (PAC). Evaluators will respond to research questions including but not limited to: satisfaction of participants, trade allies and channel partners, program visibility and reputation, effectiveness of take-to-market strategy, and effectiveness of the program administrative processes and procedures. Toronto Hydro internal staff will produce annual reports as part of the program tracking activities. The tracking reports will be reviewed by a third party. The review will consist of a high-level desk review of program data, calculation algorithms and performance indicators; market data collection activities would require additional resources.	
Evaluation Elements	☐ PIA/QPIA Review ☐ New PIA/QPIA ☒ Custom EM&V ☒ Audit and Verification ☒ Energy savings and demand	☒ Market/Participant Research ☒ Program Design & Delivery Review ☒ Market Effects Assessment ☒ Net-to-Gross ratio (incl free rider rate)
Special Provisions	High-Level M&V activities will be conducted by the participants and their M&V vendors at the project level. These High-Level M&V activities will be over and above the M&T analysis activities conducted by the participants as part of their M&T project. A High-Level M&V plan should be developed and delivered to Toronto Hydro by the participants with the support of their M&V service provider along with their participation application. It is assumed that the participants and the M&T service provider will have the knowledge and skill to develop and apply a state-of-the-art M&V plan. However, to enforce consistency of results among practitioners, increase the quality level of the M&V activities and streamline the gleaning of tracking data, Toronto Hydro: • will request the plans to be compliant with the International Performance Measurement and Verification Protocol (IPMVP); • will specify the methodological approach C – Whole building approach – , based on the IPMVP (Toronto Hydro billing data shall be used); • will provide a standardized M&V Plan Template for the participant and their M&T service providers to fill out; and • will provide a standardized annual M&V report template. The standardized M&V Plan Template and the standardized annual M&V	

<table>
<tr><td></td><td>report can be found in Appendix C – Project-Level M&V Template.

The participants along with their M&T service providers will develop and implement the Project-Level M&V plan over and above their M&T activities and analysis. Toronto Hydro will control the quality of the M&V plans and M&V reports, and input the data in the tracking system on a continuous basis. The data will be stored in a database (centralized, multi-table, and referenced) to ease the analysis. The independent evaluators will retrieve the database from Toronto Hydro, and search inconsistencies through a participant phone survey, a desk review and site visits.</td></tr>
<tr><td>Data Collection Responsibilities to Support Program Evaluation</td><td>An independent EM&V contractor will be responsible for all “external” market data collection activities. The anticipated data collection methods are represented in Appendix B – Evaluation Study Flow Chart.

Toronto Hydro Electric System Ltd. will be responsible for “internal” tracking of program data. Toronto Hydro will produce an annual program tracking report in 2011, 2012, 2013 and 2014. All tracking reports will be reviewed by a third party evaluator.</td></tr>
<tr><td>Evaluation Schedule and Budget</td><td>
<table>
<tr><th>Evaluation Deliverable</th><th>Budget</th><th>Date</th></tr>
<tr><td>Draft EM&V Plan</td><td>Excluded</td><td>Done</td></tr>
<tr><td>Sdy#1- Baseline Study Plan</td><td>$9,200</td><td>2011-07</td></tr>
<tr><td>Sdy#1- Baseline Data Report</td><td>$70,900</td><td>2011-10</td></tr>
<tr><td>Sdy#1- Draft Baseline Study Report</td><td>$17,400</td><td>2011-12</td></tr>
<tr><td>Sdy#1- Final Baseline Study Report & Updated Draft EM&V Plan</td><td>$2,800</td><td>2011-12</td></tr>
<tr><td>Annual Program Tracking Report 2011</td><td>$3,000</td><td>2011-12</td></tr>
<tr><td>Annual Program Tracking Report 2012</td><td>$3,000</td><td>2012-12</td></tr>
<tr><td>Annual Program Tracking Report 2013</td><td>$3,000</td><td>2013-12</td></tr>
<tr><td>Sdy#2- Final EM&V Plan</td><td>$9,179</td><td>2014-04</td></tr>
<tr><td>Sdy#2- Primary Data Report</td><td>$99,567</td><td>2014-09</td></tr>
<tr><td>Sdy#2- Draft EM&V Report</td><td>$45,895</td><td>2014-12</td></tr>
<tr><td>Sdy#2- Final EM&V Report</td><td>$6,119</td><td>2014-12</td></tr>
<tr><td>Annual Program Tracking Report 2014</td><td>$3,000</td><td>2014-12</td></tr>
<tr><td>Total Budget</td><td>$273,060</td><td></td></tr>
</table>

EM&V budget assumptions:

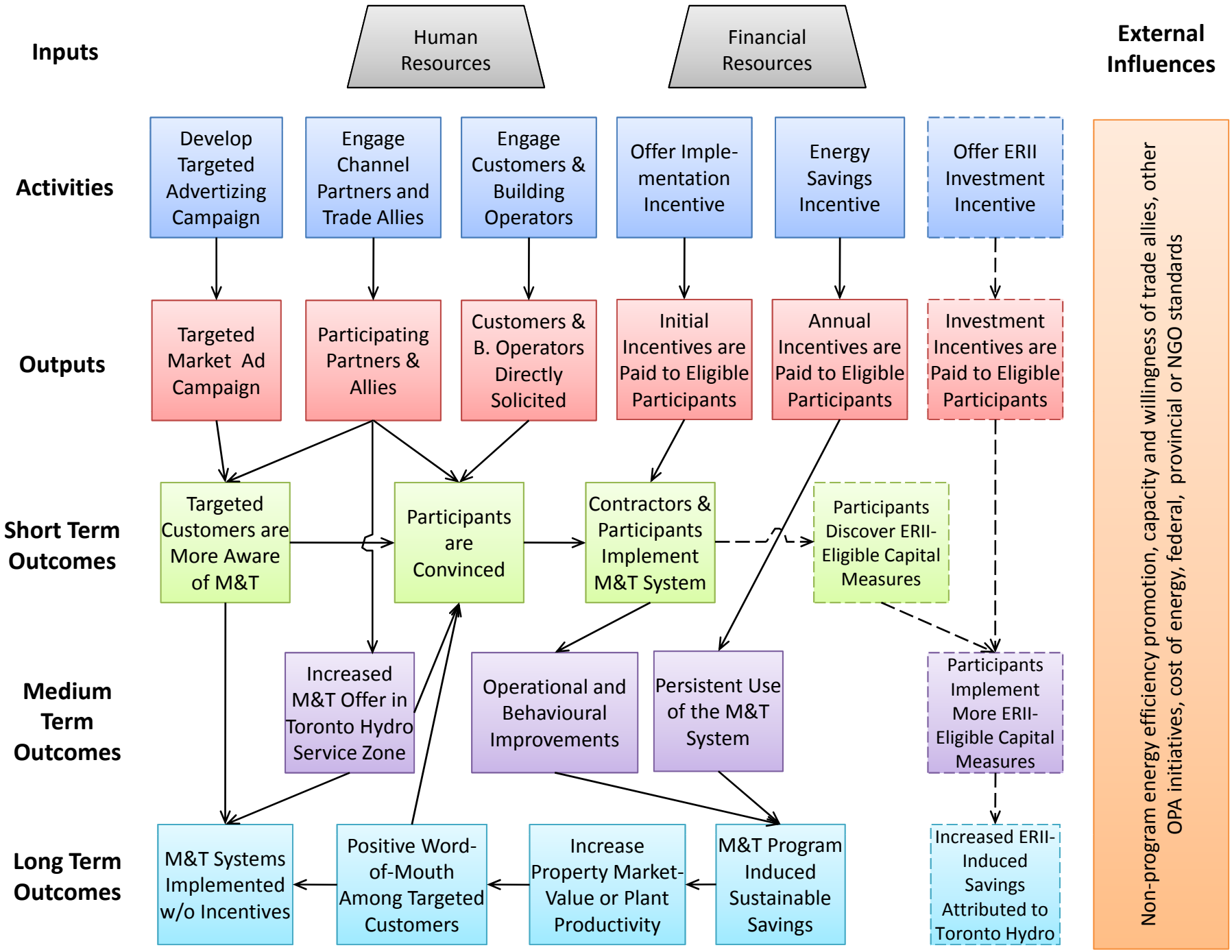
• Only independent EM&V contractor costs were included in the budget. Toronto Hydro internal human resource cost related to the tendering process and the coordination of the EM&V contractor were not included.
• Only EM&V cost were included. Initial project-level M&V and internal program tracking cost were not included.
• An annual inflation rate of 3% was applied to 2011 prices to establish prices in 2012, 2013 and 2014.</td></tr>
</table>

Evaluation Team

The independent EM&V contractors will be selected through two competitive tendering processes for Study #1) Baseline Study and Study #2) Final EM&V Study respectively. The bidder selection approach will be based on quality and cost.

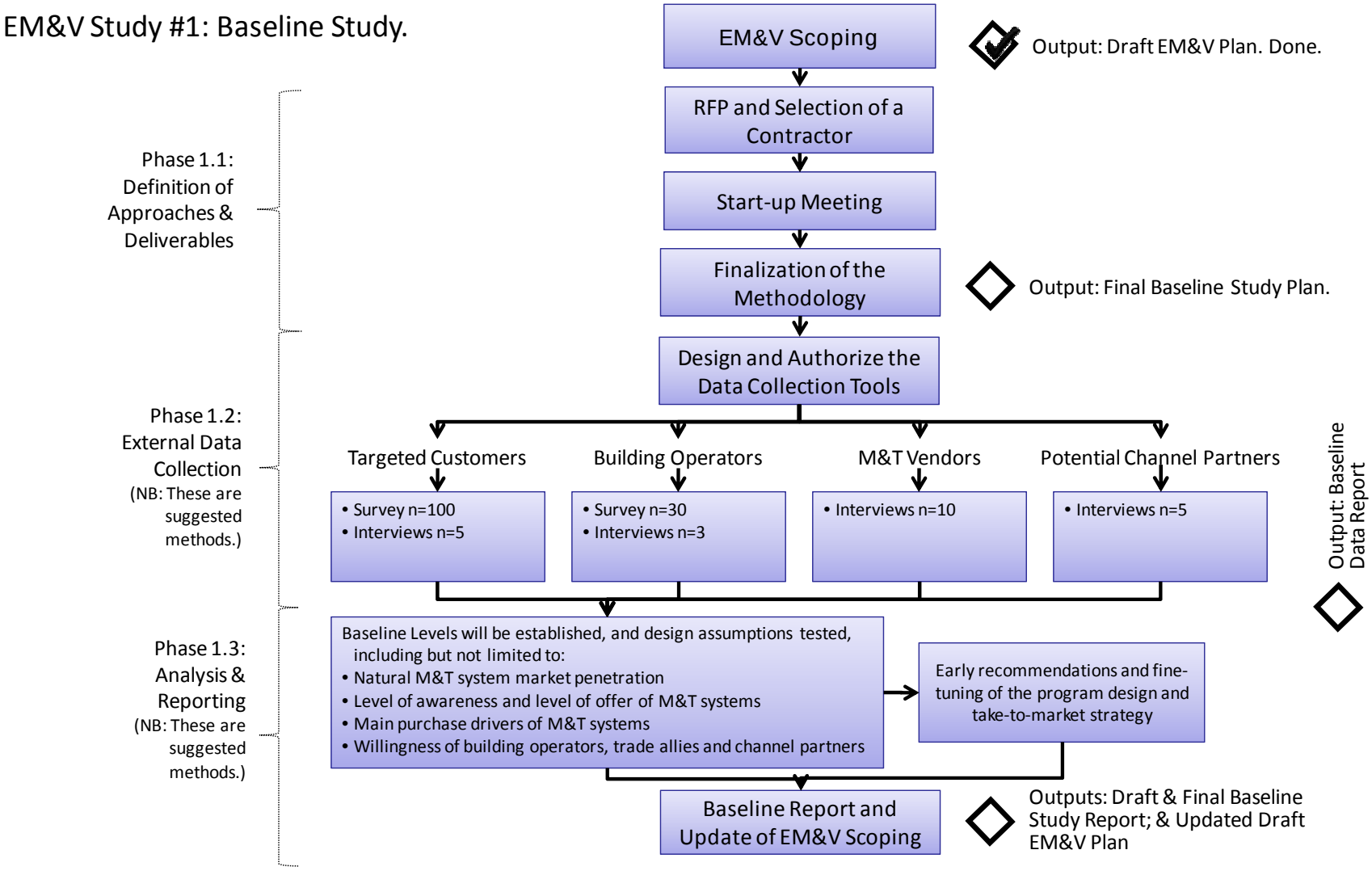
Organization	Name	Title/Accountability
Toronto Hydro Electric System Ltd.	Project Manager	Program Tracking – Collection of "Internal Data". Annual Program Tracking Reports.
Toronto Hydro Electric System Ltd.	Project Manager	Selection of the independent EM&V contractors
Toronto Hydro Electric System Ltd.	Project Manager	Coordination with the independent EM&V contractors
Independent EM&V Contractor selected to conduct Study #1	To Be Determined	Finalize the Baseline Study Plan Collect "External Data" Perform Analysis Deliver Study #1 Outputs
Independent EM&V Contractor selected to conduct Tracking Review	To Be Determined	Review Annual Tracking Reports for 2011, 2012, and 2013.
Independent EM&V Contractor selected to conduct Study #2	To Be Determined	Finalize the EM&V Plan Collect "External Data" Perform Analysis Deliver Study #2 Outputs Review of Tracking Report 2014.

Appendix A. Logic Model Drawing

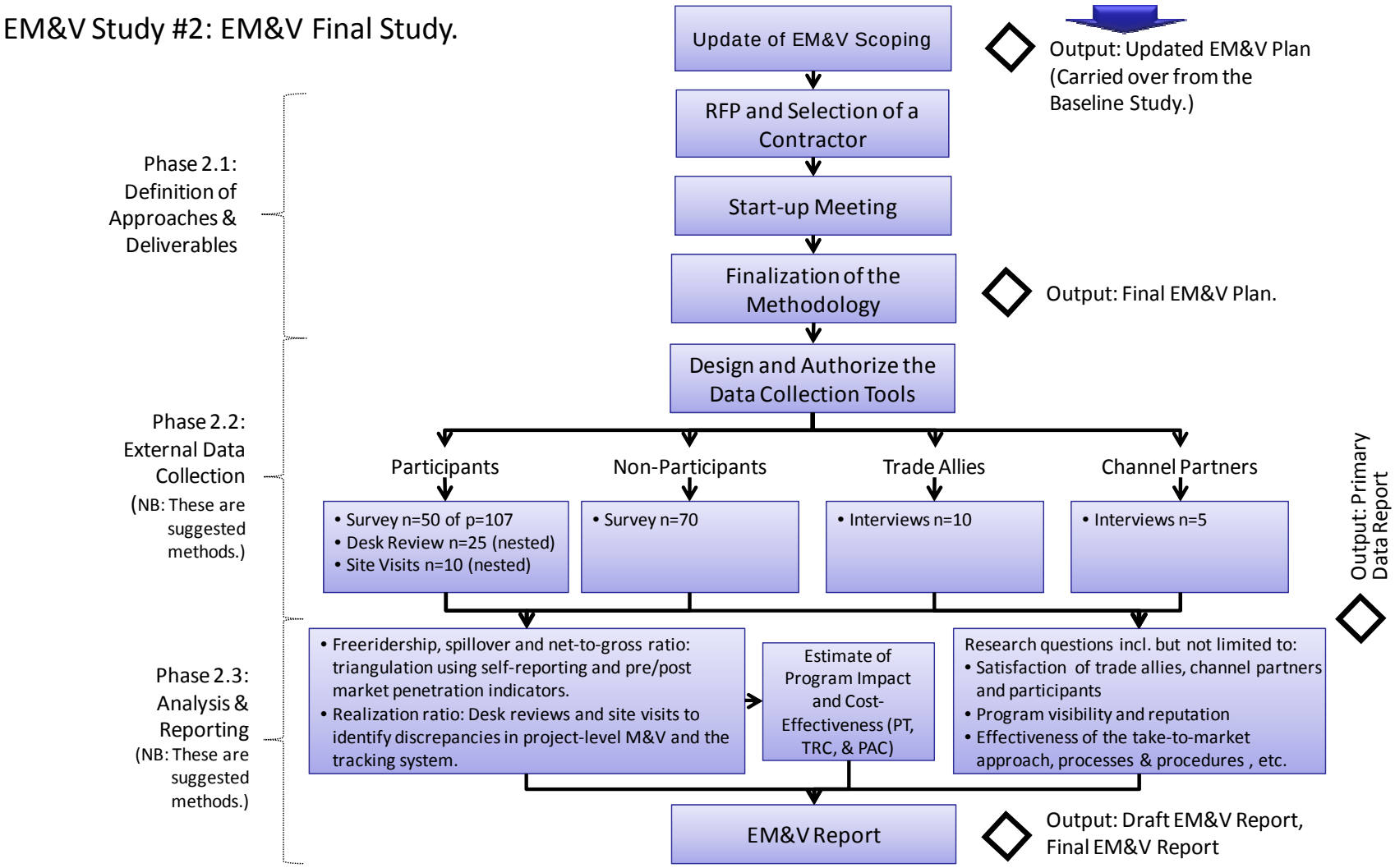

Inputs
Human Resources
Financial Resources
External Influences
Activities
Develop Targeted Advertizing Campaign
Engage Channel Partners and Trade Allies
Engage Customers & Building Operators
Offer Imple-mentation Incentive
Energy Savings Incentive
Offer ERII Investment Incentive
Outputs
Targeted Market Ad Campaign
Participating Partners & Allies
Customers & B. Operators Directly Solicited
Initial Incentives are Paid to Eligible Participants
Annual Incentives are Paid to Eligible Participants
Investment Incentives are Paid to Eligible Participants
Short Term Outcomes
Targeted Customers are More Aware of M&T
Participants are Convinced
Contractors & Participants Implement M&T System
Participants Discover ERII-Eligible Capital Measures
Medium Term Outcomes
Increased M&T Offer in Toronto Hydro Service Zone
Operational and Behavioural Improvements
Persistent Use of the M&T System
Participants Implement More ERII-Eligible Capital Measures
Long Term Outcomes
M&T Systems Implemented w/o Incentives
Positive Word-of-Mouth Among Targeted Customers
Increase Property Market-Value or Plant Productivity
M&T Program Induced Sustainable Savings
Increased ERII-Induced Savings Attributed to Toronto Hydro
Non-program energy efficiency promotion, capacity and willingness of trade allies, other OPA initiatives, cost of energy, federal, provincial or NGO standards

Appendix B. Evaluation Study Flow Chart

EM&V Study #1: Baseline Study.



EM&V Study #2: EM&V Final Study.



Appendix C. Project-Level M&V Template

Measurement and Verification Plan

Subject: High-Level Whole-Building Measurement and Verification Plan of a Monitoring and Targeting Project Implemented with the Financial Support of Toronto Hydro Electric System Limited.

IPMVP Option :	**C**
Date of the Template :	**April 6, 2011**
Version of the Template :	**v.1**

Baseline Period	**1 year (12 month)** **PLEASE SPECIFY THE START DATE AND THE END DATE. (yyyy-mm-dd)**
Reporting Period	**One report per 12-month period. One, two or three 12-month periods.** **PLEASE SPECIFY THE START DATE AND THE END DATE. (yyyy-mm-dd)**

CDM Program: Commercial, Institutional and Small Industrial Monitoring & Targeting 2011-2014

CDM Program Participant: **PLEASE SPECIFY THE NAME OF THE ORGANISATION, THE PROGRAM PARTICIPATION TRACKING NUMBER, THE NAME OF THE CONTACT PERSON, HIS/HER TITLE, EMAIL AND PHONE NUMBER**

M&T Professional Services Provider: **PLEASE SPECIFY THE NAME OF THE ORGANISATION**

Plan Development Professional: **PLEASE SPECIFY HIS/HER NAME, TITLE, COMPANY, EMAIL AND PHONE NUMBER**

Building: **PLEASE SPECIFY THE NAME (IF ANY) AND ADDRESS OF THE BUILDING FOR WHICH THIS PLAN WAS DEVELOPED.**

CDM Program Administrator: Toronto Hydro Electric System Limited

Toronto, Ontario, Canada, PLEASE SPECIFY THE DATE THIS REPORT WAS ISSUED

This M&V plan cannot be used for any purposes except in reference to the International Performance Measurement and Verification Protocol (IPMVP).

Introduction

The following model refers explicitly to the **International Performance Measurement and Verification Protocol** (IPMVP) *Volume I 10000-1:2009* published by the **Efficiency Valuation Organization** (EVO), which is available at www.evo-world.org**.**

It includes the necessary components of a Measurement and Verification Plan, according to **Option C as** described in section 4.9 in the IPMVP document.

Option C: Whole Facility Measurement. A whole-facility meter is required to assess the energy performance of all the systems of certain facilities and the associated interactive effects. The measurement boundary encompasses either the whole facility or a major section.

This high-level Measurement and Verification (M&V) Plan was drafted based on a template provided by Toronto Hydro Electric System Limited. Toronto Hydro Electric System Limited designed an M&V plan template for all participating Monitoring and Targeting (M&T) professionals to ensure consistency between the results of M&V activities of all program participants.

One M&V plan based on this template should be produced for each of the participating buildings in the program.

Goal of the Energy Conservation Measure: Monitoring and Targeting System

Objective : Conservation and Demand Management (CDM) through the Installation and Operation of a Monitoring and Targeting (M&T) System
General Description :
Monitoring and targeting is an advanced operational practice employed by progressive building operators and managers to track energy consumption in real-time against targets, pursue operational improvements, and intervene proactively. Implementation of an M&T System requires the installation of an Energy Management Information System. Continuous optimization, through the use of real-time metering, monitoring, targeting and reporting, offers advantages over conventional commissioning events by immediately spotting energy waste, and uncovering deeper saving opportunities that are often missed with initial or periodic commissioning. The M&T system delivers new energy efficiency improvements through process changes, behavioural modifications and future upgrades. The M&T system will assist operators in finding new savings.
Specific Description for Building : PLEASE SPECIFY THE BUILDING NAME
PLEASE SPECIFY ANYTHING ELSE YOU WANT TO ADD TO THE DESCRIPTION PROVIDED HERE ABOVE.

Planned Electricity Consumption Savings [kWh/year]	***Planned Electricity Demand Savings [kW]***
PLEASE SPECIFY	***PLEASE SPECIFY***

Planned changes *during the reporting period with respect to the baseline period conditions*

- ***IF ANY, PLEASE SPECIFY ALL PLANNED CHANGES THAT WILL HAVE AN EFFECT ON THE ENERGY CONSUMPTION AND/OR DEMAND AND JUSTIFY ANY NON-ROUTINE ADJUSTMENTS.***

1. IPMVP Option Selection and Measurement Boundary

a. Justification for chosen methodological option

Option C was selected because savings for the M&T projects supported by Toronto Hydro Electric System Limited are expected to exceed 8% of the adjusted baseline energy. Participants in the M&T program are expected to implement a wide array of low-cost/no-cost and capital-intensive energy conservation measures. The reporting period was required to be one, two or three years. To minimize the random or unexplained energy variations, especially if the reporting period is only one year, a state-of-the-art statistical baseline modeling is required, as described in Annex B of the IPMVP.

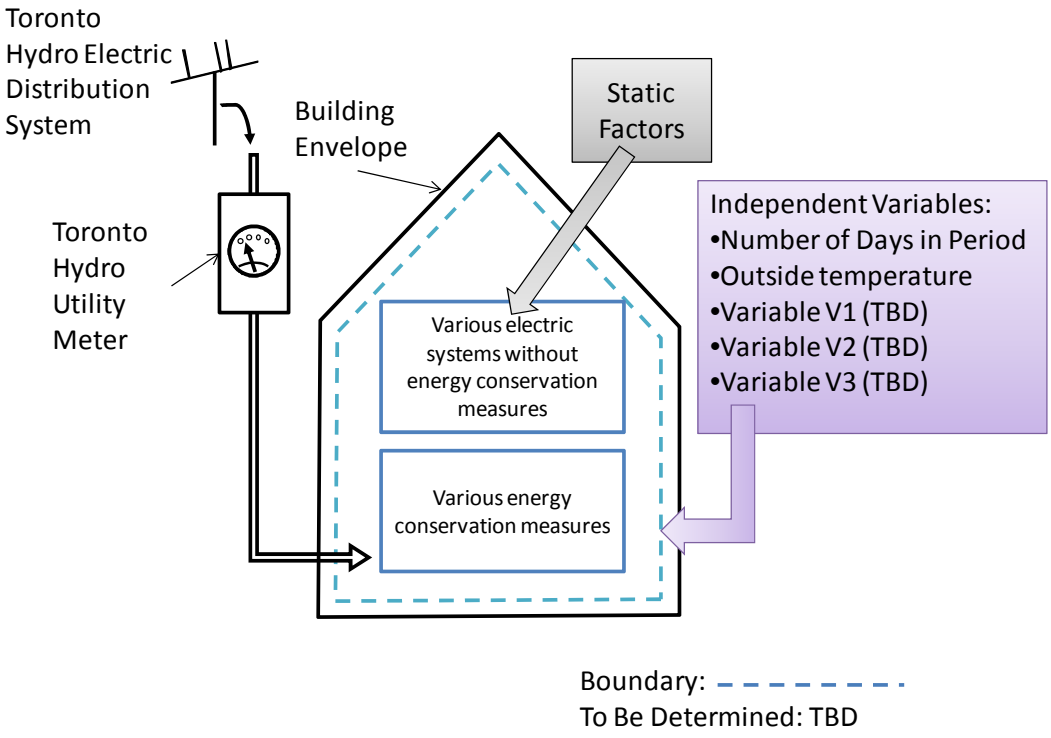
b. Measurement Boundary

The measurement boundary is the total energy consumption of the building. The boundary is illustrated in the figure below.

All interactive effects between electrical systems will occur inside the notional measurement boundary.

It is acknowledged that there might be interactive effects with systems using other fuels such as natural gas. These effects might be significant. These effects should be taken into account by the M&T professional as part of their M&T activities, and their implications discussed with building owners/managers. However, in the context of this particular high-level M&V plan, these effects will be ignored.

Please refer to IPMVP, Section 4.4 to learn about the details and definitions on the concept of interactive effects.



2. Baseline: Period, Energy and Conditions

Document the facility's energy consumption data and conditions of the baseline within the measurement boundary.

a. Identification of the Baseline Period *(BASELINE IPMVP, Section 4.5.1)*

At least 1 year (12 months) :

- ***PLEASE SPECIFY THE START DATE (yyyy-mm-dd)***

- ***PLEASE SPECIFY THE END DATE. (yyyy-mm-dd)***

b. Baseline Electricity Consumption and Demand Data

The baseline energy and demand data is determined by adding all the monthly billing data during the baseline period.

Examples of Data:

Baseline Data :
- Energy Consumption (electricity only): PLEASE SPECIFY kWh / year

- Maximum Demand: PLEASE SPECIFY kW

c. Independent Variable Data

An independent variable is a parameter that can change regularly and that can have a measureable impact on energy consumption of a system or of a site. For example, one independent variable of energy consumption is production, or building occupancy. (see IPMVP Section 4.9.3).

Multi-variable linear regression must be used to test for statistically-significant correlations. The resulting model must have an adjusted R-squared above 0.75 and all the independent variables included in the model must have a t-Stat above 2.0. The mandatory independent variable must be tested. They can be rejected if it can be demonstrated that the t-Stat was below 2.0, which indicate a weak correlation. (see IPMVP Annex B)

There are two mandatory independent parameters that must be tested to establish the correlation between them and the energy baseline.

For **electricity consumption**, the two mandatory independent variables are:

- Cooling Degree-Days (CDDs).
- Heating Degree-Days (HDDs).

In addition, for electricity consumption, it is recommended to test the correlation with the number of days in each period.

For **electricity maximum demand**, the two mandatory independent variables are:

- Coldest daily average temperature
- Warmest daily average temperature

Weather data is available for the Toronto Hydro Service Territory on Environment Canada website.

The weather station that is used is: **PLEASE SPECIFY THE STATION**

In addition, as part of this plan, it is possible to specify one and up to three additional independent variables if a correlation can be demonstrated (i.e. if the resulting t-Stat is above 2.0). Adding independent variables can improve the routine adjustment model (which means it will increase the adjusted R-squared) and therefore increase the precision and accuracy of the savings estimate.

For electricity consumption, the optional independent variables are:

- Electricity Consumption Variable V1: **PLEASE SPECIFY THE VARIABLE**
- Electricity Consumption Variable V2: **PLEASE SPECIFY THE VARIABLE**
- Electricity Consumption Variable V3: **PLEASE SPECIFY THE VARIABLE**

For electricity maximum demand, the optional independent variables are:

- Electricity Max. Demand Variable V1: **PLEASE SPECIFY THE VARIABLE**
- Electricity Max. Demand Variable V2: **PLEASE SPECIFY THE VARIABLE**
- Electricity Max. Demand Variable V3: **PLEASE SPECIFY THE VARIABLE**

d. Static Factors Corresponding to Energy Consumption Data

Static factors are energy-governing factors which are not usually expected to change, and must therefore be monitored throughout the reporting period for any unexpected changes. Examples of static factors include the occupancy type, density and periods; operating conditions other than the independent variables; any baseline conditions that fall short of required conditions during the baseline period (See the IPMVP 4.6).

Please note that the pre-project static factors are not reported in this M&V plan to reduce the paperwork burden for the CDM program participants. However, if there are changes to the static factors that justify a non-routine adjustment of the baseline, then it will be the responsibility of the participant to collect and keep back-up documentation so that these changes can be verified later on. The documentation for these changes can be: contractor or equipment provider invoices, messages sent by building occupants asking to change the operating conditions, photos taken before and after, etc. This back-up documentation should be mentioned in the non-routine adjustment factsheets such as the one presented in Section 5 of this document. Non-routine adjustments cannot be justified by a mistake or oversight made by building occupants, operators or maintenance staff (e.g. a fan was left running). In the same fashion, discretionary building operation setting change (e.g. overriding a variable frequency drive schedule), will not be accepted as a change of static factors if they are not justified by a change in the building usage. If changes to the physical building conditions or operation parameters are made, and those changes have no influence on the energy consumption, then those changes need not to be documented. If no non-routine adjustment is to be claimed, then changes to the static factors need not be documented.

3. Reporting Period

The reporting period should include at least one 12-month period. The reporting period can include up to three 12-month reporting periods. A report should be prepared by the participant and sent to Toronto Hydro Electric System Limited 60 days after the last day of each period.

Reporting Period:	One report per 12-month period. One, two or three 12-month period. **PLEASE SPECIFY THE START DATE AND THE END DATE. (yyyy-mm-dd)**

4. Basis for Adjustments

The conditions will be adjusted to reporting period conditions as described in the IPMVP in Section 4.6 as the "Avoided Energy Use" (Section 4.6.1).

Avoided Energy Use: *The Avoided Energy Use is the measurement of reporting period savings, relative to the energy consumption that would have occurred without the implementation of the M&T project. The baseline is adjusted according to the reporting period conditions. The savings depend on the reporting period conditions.*

The savings will be influenced by the actual weather conditions in the reporting period.

In this M&V plan, the following formula is going to be used is:

Avoided Energy Use = (baseline period energy with routine adjustments to the reporting period conditions ± non-routine adjustments to the reporting period conditions) – reporting period energy

This is different from the actual formula in the IPMVP. Nevertheless, it is coherent with the IPMVP because the baseline period energy with routine adjustments is defined as:

Baseline period energy with routine adjustments = baseline period energy ± routine adjustments to the reporting period conditions

e. Routine and Non-Routine Adjustments

Adjustments are a variation of the baseline caused by physical conditions that have an impact on the energy consumption. Types of adjustments include routine adjustments and non-routine adjustments.

- **Routine Adjustments**

Routine adjustments are necessary for any energy-governing factors which are expected to change routinely throughout the reporting period, ie. the independent variable data discussed in section 2c, such as weather, production volume, etc. See Annex B of the IPMVP for advice on evaluating the validity of mathematical methods.

- **Non-Routine Adjustments**

Non-routine adjustments for any energy-governing factors which are not usually expected to change, ie. static factors discussed in section 2d, such as facility size, the design and operation of installed equipment, etc. The changes of these immutable factors must be controlled throughout the reporting period. See Section 8.2 for an explanation of non-routine adjustments.

5. Analysis Procedure

Specify all baseline mathematical model used, and state all the terms and independent variables which make the analysis valid.

Produce and keep, as backup documentation, the data analysis procedure which established the baseline routine-adjustment modeling formulas, as well as the non-routine adjustment.

It is mandatory to test the correlation between energy use and the weather independent variable (i.e., Heating Degree-Days, Cooling Degree-Days, Max Temperature and Minimum Temperature). Only those variables where a correlation can be demonstrated will be retained to create the baseline mathematical model (i.e., t-Stat > 2.0). If one or many of the weather variables are rejected, the participant should justify why they were rejected (e.g. based on results of the linear regression analysis).

Baseline Period Data Analysis Framework

A sample data analysis table is shown below. This table should be completed with:

- *baseline period data, including period start and end dates, energy consumption, demand, as well as independent variables such as the number of days;*
- *independent variable data, including heating and cooling degree days (HDDs and CDDs), showing which balance point temperature (BPT) is used to calculate each, as well as any other independent variables such as production levels, seasonal occupancy changes, etc.;*
- *please do not include any static factors in the table, changes to any static factors should be reported during the reporting period in the annual report;*
- *utility invoices and calculations backing the data provided must be kept and provided upon demand.*

Baseline Data Table for Electricity Consumption

Period Tag	Utility Electric Consumption Data				Electric Consumption Independent Variables				
	Period Start Date *,***, ****	Period End Date *,***, ****	Energy Consumption during Period	Days in Billing Period	Heating and Cooling Degree Days		Others Independent Variables**		
					HDDs	CDDs	V1	V2	V3
	[yyyy-mm-dd]	[yyyy-mm-dd]	[kWh]		(BPT=___)	(BPT=___)	[____]	[____]	[____]
	Included: Y/N	Included: Y/N							
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
***									
	Totals								

Notes:
*Invoices must be provided and must cover at least 360 consecutive days, and must correspond to the start & end date on the left-hand side.
**Please specify what additional independent variables you have included under v1, v2, and v3, and their units []. Examples include: Production levels, seasonal occupancy changes, etc.
*** In some cases, one additional period might be necessary to cover up to 360 days.
****Please indicate if the Period start Date is considered to be included in the period or not. Please indicate if the period end date is included or not.
Electricity Consumption V1 = _____ unit [____].
Electricity Consumption V2 = _____ unit [____].
Electricity Consumption V3 = _____ unit [____].

Baseline Data Table for Electricity Maximum Demand

Period Tag	Utility Electric Maximum Real Demand Data				Electric Maximum Real Demand Independent Variables				
					Temperatur Extremes		Others Independent Variables**		
	Period Start Date*,***	Period End Date*,***	Maximum Electric Demand during Period	Days in Billing Period	Coldest Daily Temperature	Warmest Daily Temperature	V1	V2	V3
	[yyyy-mm-dd]	[yyyy-mm-dd]	[kW]		Celcius	Celcius	[____]	[____]	[____]
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
***									
	Totals								

Notes:

*Invoices must be provided and must cover at least 360 consecutive days, and must correspond to the start & end date on the left-hand side.

**Please specify what additional independent variables you have included under v1, v2, and v3, and their units []. Examples include: Max Production level, Max occupancy, etc.

*** In some cases, one additional period might be necessary to cover up to 360 days.

Electricity Consumption V1 = _____ unit [____].

Electricity Consumption V2 = _____ unit [____].

Electricity Consumption V3 = _____ unit [____].

Electricity Consumption Baseline Routine Adjustment Mathematical Model

PLEASE SPECIFY THE FORMULA USED TO MODEL THE BASELINE

HERE IS A RECOMMENDED FORMULA:

Baseline period energy with routine adjustments for a month =

B + C1 x X1 + C2 x X2 + C3 x X3 + C4 x X4 +C5 x X5 + C6 x X6

Where:

- B is the intercept coefficient obtained by the linear regression analysis.
- C1 to C6 are the coefficient resulting from the linear regression analysis and corresponding to independent variable X1 to X6.
- X1 to X6 are the independent variables with statistical significance. They should be selected among: number of days in the month, HDD, CDD, V1, V2 and V2.

Names of independent Variables	Coefficient Value resulting from the linear regression analysis	t-Stat resulting from the linear regression analysis
Intercept	B = **PLEASE SPECIFY VALUE**	**PLEASE SPECIFY VALUE**
X1: **PLEASE SPECIFY**	C1 = **PLEASE SPECIFY VALUE**	**PLEASE SPECIFY VALUE**
X2: **PLEASE SPECIFY**	C2 = **PLEASE SPECIFY VALUE**	**PLEASE SPECIFY VALUE**
X3: **PLEASE SPECIFY**	C3 = **PLEASE SPECIFY VALUE**	**PLEASE SPECIFY VALUE**
X4: **PLEASE SPECIFY**	C4 = **PLEASE SPECIFY VALUE**	**PLEASE SPECIFY VALUE**
X5: **PLEASE SPECIFY**	C5 = **PLEASE SPECIFY VALUE**	**PLEASE SPECIFY VALUE**
X6: **PLEASE SPECIFY**	C6 = **PLEASE SPECIFY VALUE**	**PLEASE SPECIFY VALUE**

Adjusted R-squared resulting from the linear regression analysis: **PLEASE SPECIFY**

IF YOU HAD TO USE MORE THAN 13 PERIODS TO GENERATE A VALID BASELINE MATHEMATICAL MODEL, PLEASE MENTION IT HERE. INCLUDE THIS DATA IN AN APPENDIX.

Independent variables that were tested for correlation but rejected:

IF INDEPENDENT VARIABLES WERE TESTED FOR CORRELATION BUT REJECTED (FOR INSTANCE WEATHER VARIABLES), THEN IT SHOULD BE MENTIONNED AND JUSTIFIED HERE.

Calculation notes to back-up the model presented here should be kept and be presented to Toronto Hydro upon request.

Data excluded from the electrical consumption linear regression analysis:

Please note that data cannot be rejected because they bring down the R-squared value. Data can only be rejected if it can be justified through real-world exceptional events during those metering periods. Any rejected data should be identified throughout the period in the table below.

Rejected Data	Justification
PLEASE SPECIFY (start data and end date).	PLEASE PROVIDE JUSTIFICATION BASED ON REAL EVENTS.
PLEASE ADD ROWS.	PLEASE ADD ROWS AS REQUIRED.

Maximum Electricity Demand Baseline Routine Adjustment Mathematical Model

PLEASE SPECIFY THE FORMULA USED TO MODEL THE BASELINE

HERE IS A RECOMMENDED FORMULA:

Baseline period energy with routine adjustments for a month =

B + C1 x X1 + C2 x X2 + C3 x X3 + C4 x X4 +C5 x X5 + C6 x X6

Where:

- B is the intercept coefficient obtained by the linear regression analysis.
- C1 to C6 are the coefficient resulting from the linear regression analysis and corresponding to independent variable X1 to X6.
- X1 to X6 are the independent variables with statistical significance. They should be selected among: max temperature, min temperature, V1, V2 and V2.

Names of independent Variables	Coefficient Value resulting from the linear regression analysis	t-Stat resulting from the linear regression analysis
Intercept	B = PLEASE SPECIFY VALUE	PLEASE SPECIFY VALUE
X1: PLEASE SPECIFY	C1 = PLEASE SPECIFY VALUE	PLEASE SPECIFY VALUE
X2: PLEASE SPECIFY	C2 = PLEASE SPECIFY VALUE	PLEASE SPECIFY VALUE
X3: PLEASE SPECIFY	C3 = PLEASE SPECIFY VALUE	PLEASE SPECIFY VALUE
X4: PLEASE SPECIFY	C4 = PLEASE SPECIFY VALUE	PLEASE SPECIFY VALUE
X5: PLEASE SPECIFY	C5 = PLEASE SPECIFY VALUE	PLEASE SPECIFY VALUE
X6: PLEASE SPECIFY	C6 = PLEASE SPECIFY VALUE	PLEASE SPECIFY VALUE

Adjusted R-squared resulting from the linear regression analysis: **PLEASE SPECIFY**

IF YOU HAD TO USE MORE THAN 13 PERIODS TO GENERATE A VALID BASELINE MATHEMATICAL MODEL, PLEASE MENTION IT HERE. INCLUDE THIS DATA IN AN APPENDIX.

Independent variables that were tested for correlation but rejected:

IF INDEPENDENT VARIABLES WERE TESTED FOR CORRELATION BUT REJECTED (FOR INSTANCE WEATHER VARIABLES), THEN IT SHOULD BE MENTIONNED AND JUSTIFIED HERE.

Calculation notes to back-up the model presented here should be kept and be presented to Toronto Hydro upon request.

Data excluded from the peak demand linear regression analysis:

Please note that data cannot be rejected because they bring down the R-squared value. Data can only be rejected if it can be justified through real-world exceptional events during those metering period. Any rejected data should be identified throughout the period in the table below.

Rejected Data	Justification
PLEASE SPECIFY.	**PLEASE PROVIDE JUSTIFICATION BASED ON REAL EVENTS.**
PLEASE ADD ROWS.	**PLEASE ADD ROWS AS REQUIRED.**

6. Metering Specifications

The meter that will be used is that of Toronto Hydro Electric System.

7. Sample Monitoring Responsibilities

Ultimately, all the reporting data must be provided by the participant. The participant must ensure that the M&T service provider delivers all the data that is required from him/her.

From the perspective participant, it is recommended to assign responsibilities to the various parties involved in the project. The participant should assign reporting and energy data entry responsibilities and energy data entry for independent variables and changes to static factors within the measurement boundaries, during the reporting period.

However, this is an arrangement between the participant, the M&T vendor(s) and other parties. Therefore providing this table to Toronto Hydro Electric System Limited is not mandatory.

Monitoring Responsibilities Table:

Responsible Party	Energy Data Entry	Independent Variables (2c)	Static Factors (2d)
Participant **PLEASE SPECIFY NAME**	***PLEASE SPECIFY***	***PLEASE SPECIFY***	***PLEASE SPECIFY***

M&T Vendor **PLEASE SPECIFY NAME**	***PLEASE SPECIFY***	***PLEASE SPECIFY***	***PLEASE SPECIFY***
OTHER?	***PLEASE ADD IF NECESARRY***	***PLEASE ADD IF NECESARRY***	***PLEASE ADD IF NECESARRY***

9. Report Format

The results should be reported and documented (See the IPMVP, Section 6).

A template for each 12-month report is included in Annex A.

A report should be produced for each 12-month of the reporting period authorized by Toronto Hydro.

The participant should produce a Non-routine Adjustment Substantiation Report for each non-routine adjustment that will be claimed. A template for such a report is presented in Annex B. This document presents the name, description, qualitative and quantitative substantiation of each adjustment. There may be more than one Non-routine Adjustment Substantiation Report attached to each annual M&V report. It is generally not recommended to bundle several non-routine adjustments into one non-routine adjustment factsheet. Keeping these adjustments separated into many report generally makes the presentation of these adjustment clearer and easier to understand for all the parties involved.

10. Quality Assurance

The participant is responsible for quality assurance of all documents produced by third parties including all M&T vendors and presented as part of the M&T plan or M&T report.

This M&V plan, as well as all M&V reports for this M&T project, are going to be reviewed by Toronto Hydro Electric System Limited staff.

This M&V plan, as well as all M&V reports for this M&T project, might be reviewed by a third party evaluation contractor.

Participant and/or their service providers should be ready to 1- respond to questions from the Toronto Hydro Electric System Limited and/or the independent evaluation contractor designated by Toronto Hydro, and 2- present the back-up documentation as specified in this M&V plan including: all original utility bills, baseline modeling, analysis and calculation notes, static factor change and non-routine adjustments

Annex A: Annual Consumption Report Template

Subject: High-Level Whole-Building Measurement and Verification Report of a Monitoring and Targeting Project Implemented with the Financial Support of Toronto Hydro Electric System Limited.

IPMVP Option :	**C**
Date of the Template :	**April 6, 2011**
Version of the Template :	**v.1**

Baseline Period	**1 year (12 month)** **PLEASE SPECIFY THE START DATE AND THE END DATE. (yyyy-mm-dd)**
Overall Reporting Period	**One report per 12-month period. One, two or three 12-month period.** **PLEASE SPECIFY THE START DATE AND THE END DATE. (yyyy-mm-dd)**
Specific 12-Month Report	**PLEASE SPECIFY THE START DATE AND THE END DATE. (yyyy-mm-dd)**

CDM Program Participant: **PLEASE SPECIFY THE NAME OF THE ORGANISATION, THE PROGRAM PARTICIPATION TRACKING NUMBER, THE NAME OF THE CONTACT PERSON, HIS/HER TITLE, EMAIL AND PHONE NUMBER**

Plan Development Professional: **PLEASE SPECIFY HIS/HER NAME, TITLE, COMPANY, EMAIL AND PHONE NUMBER**

Building: **PLEASE SPECIFY THE NAME (IF ANY) AND ADDRESS OF THE BUILDING FOR WHICH THIS PLAN WAS DEVELOPED.**

Toronto, Ontario, Canada, PLEASE SPECIFY THE DATES THIS REPORT WAS ISSUED

1. Introduction

This is a 12-month Measurement and Verification (M&V) Report. This report was made based on a M&V Plan established before the implementation for the Monitoring and Targeting (M&T) project. Please note that a 12-month M&V report should be submitted for each 12-month of the reporting period established in the M&V Plan. This report is made using the template provided in Annex A of the M&V Plan.

Please note that all non-routine adjustments claimed must be documented using a Non-Routine Adjustment Factsheet, and static factor change back-up documentation. Non-Routine Adjustment Factsheets should be attached to this report. There may be more than one Non-Routine Adjustment Factsheets attached to each 12-month M&V report. Non-Routine Adjustment Factsheets are made using the template in Annex B of the M&V Plan.

2. Current Reporting Period Data

One year of reporting period data is required in the annual report. Invoices must be provided and must cover at least 360 consecutive days, and must correspond to the start & end date on the left-hand side.

Current Reporting Period Data

Billing Period Tag	Post-M&T Installation Period Start Date	Post- M&T Installation Period End Date	Post- M&T Installation Energy Consumption during Period	Current Post-M&T Installation Peak Demand during Period
	[yyyy-mm-dd]	[yyyy-mm-dd]	[kWh]	[kW]
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
Total				

3. Independent Variables

The independent variable data should be listed here. This data should be used to make routine adjustments to the baseline using a regression analysis in order to determine their impact on consumption and demand. The resulting baseline adjustments should be listed in the next section.

Independent Variables Used in the Routine Adjustment of Electric Consumption Baseline

Billing Period Tag	Post-M&T Installation Period Start Date	Post-M&T Installation Period End Date	Days in Billing Period	Post-M&T Installation Heating and Cooling Degree Days		Post-M&T Installation Others Independent Variables*		
				HDDs	CDDs	_____	_____	_____
	[yyyy-mm-dd]	[yyyy-mm-dd]		(BPT=___)	(BPT=___)	[____]	[____]	[____]
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
Total								

*Please specify what independent variables you have included under v1, v2, and v3, and their units []. These should match the baseline analysis table in the M&V Plan.

Independent Variables Used in the Routine Adjustment of Electric Peak Demand Baseline

Billing Period Tag	Post-M&T Installation Period Start Date [yyyy-mm-dd]	Post-M&T Installation Period End Date [yyyy-mm-dd]	Days in Billing Period	Post-M&T Installation Extreme Temperature		Post-M&T Installation Others Independent Variables*		
				Coldest Temperature	Warmest Temperature	_____	_____	_____
				Celcius	Celcius	[____]	[____]	[____]
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
Total								

*Please specify what independent variables you have included under v1, v2, and v3, and their units []. These should match the baseline analysis table in the M&V Plan.

4. Changes to Static Factors

Each change to the static factors may cause the electric demand and consumption to change and that should be reflected in the accounted as a Non-Routine adjustment. Please identify all non-routine adjustments that have to be made. These will need to be substantiated through the use of one or many Non-Routine Adjustment Factsheets. All Non-Routine Adjustment Factsheets should be attached to this 12-month M&V report.

List of Non-Routine Adjustments for the Current 12-Month Report

- MAKE A LIST OF THE NON-ROUTINE ADJUSTMENT FACTSHEETS ATTACHED TO THIS REPORT. REFER TO THE SAME TITLE THAN THAT OF THE NON-ROUTINE ADJUSTEMENT FACTSHEET SO THAT IT IS EASY TO REFER TO. ONE ADJUSTMENT = ONE FACTSHEET.
- OTHER NON-ROUTINE ADJUSTMENT...
- ETC...

Please list Non-Routine Adjustments accumulated from previous annual reports. The Non-Routine Adjustments Factsheets to justify these non-routine adjustments should have been attached to the associated report; if they were not, please attach them to the current report.

List of Non-Routine Adjustments for the Previous 12-Month M&V Reports

- **MAKE A LIST OF THE NON-ROUTINE ADJUSTMENTS THAT WERE ATTACHED TO PRIOR M&V REPORTS. ONE NON-ROUTINE ADJUSTMENT = ONE FACTSHEET.**
- **Other**

Non-routine adjustments starting during 12-month periods, but that were not attached to the corresponding 12-month M&V reports:

- **MAKE A LIST OF THE NON-ROUTINE ADJUSTMENTS THAT SHOULD HAVE BEEN ATTACHED TO THE ASSOCIATED M&V REPORT, BUT WERE NOT. ETC. ONE NON-ROUTINE ADJUSTMENT = ONE FACTSHEET.**

5. Resulting Baseline Adjustments

The independent variables and static factors should provide a basis for the routine and non-routine adjustments. Please show baseline adjustments below.

Electric Consumption Baseline Adjustments

Period Tag	Post-M&T Installation Period Start Date	Post-M&T Installation Period End Date	Baseline with Routine Adjustment	Total of all Non-Routine Adjustments	Fully Adjusted Baseline
	[yyyy-mm-dd]	[yyyy-mm-dd]	[kWh]	[kWh]	[kWh]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total					

Electric Peak Demand Baseline Adjustments

Period Tag	Post-M&T Installation Period Start Date	Post-M&T Installation Period End Date	Baseline with Routine Adjustment	Total of all Non-Routine Adjustments	Fully Adjusted Baseline
	[yyyy-mm-dd]	[yyyy-mm-dd]	[kW]	[kW]	[kW]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total					

6. Annual Savings

Using the calculated collected reporting period data and fully adjusted baseline, please summarize final annual savings in the following table.

Final Annual Savings of Electric Consumption

Period Tag	Post-M&T Installation Period Start Date	Post-M&T Installation Period End Date	Post- M&T Installation Energy Consumption during Period	Fully Adjusted Baseline	Savings - Avoided Energy Consumption
	[yyyy-mm-dd]	[yyyy-mm-dd]	[kWh]	[kWh]	[kWh]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total					
				A↑	B↑

The annual savings of **PLEASE SPECIFY B** kWh represents **PLEASE COMPUTE PERCENTAGE B/A** percent of the fully adjusted baseline (**PLEASE SPECIFY A** kWh).

Final Annual Savings of Electric Peak Demand

Period Tag	Post-M&T Installation Period Start Date	Post-M&T Installation Period End Date	Post- M&T Installation Peak Demand during Period	Fully Adjusted Baseline	Savings - Avoided Peak Demand
	[yyyy-mm-dd]	[yyyy-mm-dd]	[kW]	[kW]	[kW]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Total					

Annex B: Non-Routine Adjustment Factsheet

Title of the Non-Routine Adjustment: **PLEASE SPECIFY THE TITLE OF THIS NON-ROUTINE ADJUSTMENT**

CDM Program Participant: **PLEASE SPECIFY THE NAME OF THE ORGANISATION, THE PROGRAM PARTICIPATION TRACKING NUMBER, THE NAME OF THE CONTACT PERSON, HIS/HER TITLE, EMAIL AND PHONE NUMBER**

Plan Development Professional: **PLEASE SPECIFY HIS/HER NAME, TITLE, COMPANY, EMAIL AND PHONE NUMBER**

Building: **PLEASE SPECIFY THE NAME (IF ANY) AND ADDRESS OF THE BUILDING FOR WHICH THIS PLAN WAS DEVELOPED.**

Toronto, Ontario, Canada, **PLEASE SPECIFY THE DATES THIS REPORT WAS ISSUED**

1. Introduction

This is a Non-Routine Adjustment Factsheet. All non-routine adjustments claimed must be documented using a Non-Routine Adjustment Factsheet such as this one, as well as back-up documentation for any static factor changes. This factsheet and all other Non-Routine Adjustment Factsheets should be attached to the 12-month M&V report.

There may be more than one Non-Routine Adjustment Factsheets attached to each 12-month M&V report. Participants can copy the template to produce as many factsheets as they want.

This Non-Routine Adjustment Factsheet was made using the template in Annex B of the M&V Plan.

2. Energy Value of This Baseline Non-Routine Adjustment

Start Month of the Adjustment: **PLEASE SPECIFY**

End Month of the Adjustment (If any): **PLEASE SPECIFY**

The following table presents the energy values of the non-routine adjustment claimed.

Baseline Non-Routine Adjustments

Post-M&T Installation Billing Period Start Date	First 12-Month Period		Second 12-Month Period (if relevant)		Third 12-Month Period (if relevant)	
	Baseline Electric Consumption Adjustment	Baseline Electric Peak Demand Adjustment	Baseline Electric Consumption Adjustment	Baseline Electric Peak Demand Adjustment	Baseline Electric Consumption Adjustment	Baseline Electric Peak Demand Adjustment
	[kWh]	[kW]	[kWh]	[kW]	[kWh]	[kW]
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						
Total						

3. Qualitative Substantiation

Short description and explanation of why a non-routine adjustment is claimed:

PLEASE PROVIDE A DESCRIPTION AND AN EXPLANATION HERE. BE SPECIFIC ABOUT WHAT THE STATIC FACTORS ARE, AND WHAT THE CONDITION WAS BEFORE AND AFTER THE STATIC FACTOR WAS CHANGED.

Note: Non-routine adjustments cannot be justified by a mistake made by building occupants, operators or maintenance staff. In the same fashion, discretionary building operation setting change (e.g. overriding a variable frequency drive schedule), will not be accepted as a change of static factors if they are not justified by a change in the building usage.

4. Quantitative Substantiation

Short description and explanation of the calculation made to establish the energy value of this non-routine adjustment:

PLEASE PROVIDE AN EXPLANATION HERE. BE SPECIFIC ABOUT THE METHODS, ALGORYTHMS, WEATHER DATA USED, SOFTWARE, MEASUREMENTS CONDUCTED, ETC. REFER TO EXTERNAL DOCUMENTS TO PROVIDE DETAILS SUCH AS EXCEL SPREADSHEETS.

5. Static Factor Change Back-Up Documentation

List and give a short description of the documents used as back-up documentation.

- **PLEASE MAKE A LIST OF THE BACK-UP DOCUMENTATION AVAILABLE.**

Static Factor Change Back-Up Documentation could include: contractor or equipment provider invoices, messages sent by building occupants asking to change the operating conditions, photos taken before and after, etc.

These documents should be available and should be provided to Toronto Hydro or the mandated program evaluator upon request.

Toronto Hydro-Electric System Limited

Draft Evaluation, Measurement and Verification Plan:

Community Outreach Program

Submitted to:

Ontario Energy Board

Submitted on April 14, 2011

TABLE OF CONTENTS

1 OPA EM&V Program Design Evaluation Input Template

PROGRAM NAME:	Community Outreach and Education Initiative
PROGRAM MANAGER:	Toronto Hydro Electric System Limited

OVERVIEW

PROGRAM TYPE	
Resource Acquisition	☐
Market Transformation	☐
Capability Building	☒

CONSERVATION CATEGORY	
Demand Management/Conservation Behaviour	☒
Energy Efficiency	☐
Fuel Switching	☐
Customer-Based Generation	☐

PROGRAM DESCRIPTION

Toronto Hydro-Electric System Limited will provide information and education about electricity Conservation and Demand Management (CDM) to the residents of targeted diverse Toronto neighborhoods encompassing a minimum of 1 million Torontonians annually.

The program will promote the understanding of energy issues and lead to behavioral changes that result in the overall reduction of electricity demand and consumption. Toronto Hydro will provide electricity education on shifting use to off-peak times, using less electricity, and using electricity more efficiently via efficient technologies. Toronto Hydro will also generate positive media coverage for Toronto Hydro and stakeholders including the Ministry of Energy, the Ontario Power Authority (OPA) and the Ontario Energy Board (OEB).

The program is an Educational CDM Program in conformance with the requirements of section 4.3 of the Ontario Energy Board's CDM Code for Electricity Distributor 2010. The OPA's Evaluation Measurement and Verification (EM&V) Protocols and Requirements document was used to develop the Draft EM&V plan. However, since it provided limited guidance on how to evaluate educational CDM programs, Chapter 9 of the California Evaluation Framework[1] was also used as a supplement. Toronto Hydro's Community Outreach Initiative fits the description of educational programs as described in the California Evaluation Framework; with no pretention to any form of market effect or direct impact.

[1] California Public Utilities Commission, The California Evaluation Framework, USA, June 2004, Project Number: K2033910 [ONLINE] As seen on April 7, 2011

The program will consist of annual outreach in the period from 2011 to 2014 through:

- In-store Retail information and education events;
- Festive Light Exchange information and education events;
- Energy efficiency products giveaways at educational event venues;
- Direct marketing, advertisement and public relations campaign to generate participation in the events;
- Direct information and education through Toronto Police forces, and provision of school educations materials and set up of on-campus school events.

Toronto Hydro will work with the following organizations as channel partners: selected retail outlets, the Toronto Association of Business Improvement Areas (TABIA), the Toronto Police Service (TPS), the Toronto Anti-Violence Intervention Strategy (TAVIS) and many Toronto School Boards (TSBs).

Toronto Hydro has recruited, hired and trained energy ambassadors to engage diverse residents in face-to-face education and outreach. Toronto Hydro has ambassadors that can communicate in the five most commonly spoken languages.

PROGRAM THEORY / PROGRAM LOGIC MODEL

The visual representation of the program theory, as well as the delivery and implementation chain, are represented in Appendix A – Logic Model.

A short overview of the program theory is provided in the few next paragraphs.

Toronto Hydro's energy ambassadors will deliver face-to-face information, education and engagement to elicit understanding and behaviour change as it relates to CDM to residents of Toronto's targeted diverse neighbourhoods. They will be provided with outreach and education materials: information and education booth, watt-meters, educational posters, signs and brochures. The venues where these events will take place are: local retail outlets (i.e. "In-Store Retail events"), and small local community events (i.e. "Festive Light Exchange events").

Toronto Hydro will conduct a local advertisement and public relations campaign to generate participation in the events. Also, Toronto Hydro will giveaway energy efficiency products to act as a "hook" for residents that will drive them to the event venues and booths and enable the direct information and education to happen. In addition, Toronto Hydro will work with the TPS and the TAVIS so that TPS forces and TAVIS staff deliver direct information and education to hard-to-reach residents.

Moreover, Toronto Hydro will develop and conduct a School Education and Outreach campaign in schools in the targeted diverse neighbourhoods. Toronto Hydro will work with TSBs to select the schools and coordinate with the school staff. Toronto Hydro will deliver education programs and materials to the selected schools and deliver on-campus events.

Main outcome of the program: All the direct information and education activities including the In-Store Retail events, the "Festive Light Exchange events, the Toronto Police direct information, and education. The school education and outreach activities will inform the participants about proper CDM behaviours and CDM Topic areas.

Finally, this information and education will indirectly increase the understanding of energy issues and lead to behavioural changes that result in the overall reduction of electricity demand and consumption in the targeted neighbourhoods.

PROGRAM TIMING AND KEY ELEMENTS

The Outreach and Education Initiative is not a new program. It has attracted a fair amount of participants over the course of the past six years (2005 to 2010). The program staff will carry on delivering an annual quota of events, energy efficiency product giveaways, collateral materials and educational materials for schools and TPS forces and TAVIS staff. Toronto Hydro will keep on updating and creating a certain amount of collateral and education materials.

An independent EM&V contractor will be responsible for all external market data collection activities. The anticipated data collection methods are represented in Appendix B – Evaluation Study Flow Chart.

To collect market data, the evaluators will conduct a phone survey of the residents of the targeted diverse neighbourhoods. The call center staff will make phone calls to find those residents with recall of the local advertisement and public relations campaign. They will use random-digit dialling and a sample-quota system for those with recall. They will build statistics of the number of residents with recall. For those with recall, they will ask if they participated in the events (In-store Retails and Festive Light Exchange events). Those who did not participate in the events will be deemed to be “non-participants” (a.k.a. real non-participants). They will follow the “non-participant” survey path and be asked questions on the reasons for not participating, on their general knowledge on CDM, etc. Those who did participate, will follow the “participant” survey path and be asked questions on their satisfaction of the events, their recall of the topics and knowledge, etc.

In addition, the evaluators will conduct in-person interviews with: the retail outlets who partnered with Toronto Hydro, school teachers where the school events took place, TPS officers who were involved in the delivery of the direct information and education, a representative of the TPS, a representative of TABIA, a representative of TAVIS and representatives of TSBs.

Toronto Hydro will be responsible for internal tracking of program data.

As part of the tracking of the program, Toronto Hydro will conduct certain tracking activities, keep an appropriate paper trail, input and store the data in a database format, and deliver a soft and a hard copy of the data to the evaluators. The specific activities that need to be conducted by Toronto Hydro are:

- Event participant general headcount (broken down per event, neighbourhood, and targeted resident profile).
- Energy efficiency product giveaways count (broken down per event, neighbourhood, targeted resident profile including start and end time stamp, address and contact information of the owner of the venue and/or local event organizer).
- Energy ambassadors self-reporting evaluation questionnaires.
- On-the-spot event participant evaluation questionnaires (for In-Store Retail events, and Festive Light events).
- Teacher-administered survey for targeted school students.
- Police officers self-reporting evaluation questionnaires.

Toronto Hydro will condense and analyse the tracking data in annual program tracking report issued at the end of year 2011, 2012, 2013 and 2014. All reports will be reviewed by a third-party evaluator. The review will consist of a high-level desk review of program data, continuous tracking methods (questionnaires, headcount methods, etc.) and performance indicators. This

estimate also will include a few "energy ambassador ride-alongs"; but other market data collection activities would require additional resources.

INPUT ASSUMPTIONS / FORECASTED RESULTS

☐ Prescriptive

Measure Name	Existing	New	Incentive/ unit	Forecasted participation
NONE	☐	☐		
	☐	☐		
	☐	☐		

☐ Quasi-prescriptive

Measure Name	Existing*	New**	Incentive Structure	Forecasted Savings	
				Energy (kWh)	Demand (kW)
NONE	☐	☐			
	☐	☐			
	☐	☐			

☐ Custom

Incentive Structure	Forecasted participation	
	Energy (kWh)	Demand (kW)
NONE		

PROGRAM COSTS

COST DESCRIPTION	BUDGET
Development/ Start-up Costs	N/A
Administration and Overhead	$1,634,665
Marketing and Promotion	$2,020,000
EM&V	$45,000
Budget Total	$3,699,665

FORECASTED PROGRAM RESULTS SUMMARY

ELEMENT	FORECASTED RESULT
Peak Summer kW Savings	Not Applicable
Peak Winter kW Savings	Not Applicable
Annual kW Savings	Not Applicable
Levelized Cost / kW Year ($/ kW-yr)	Not Applicable
Levelized Cost / kW Year ($/ kW)	Not Applicable
TRC Benefit / Cost Ratio	Not Applicable
Program TRC ($)	Not Applicable

2 OPA Draft Evaluation Plan Template

Program Description	**Description** Toronto Hydro-Electric System Limited will provide information and education about electricity Conservation and Demand Management (CDM) to the residents of targeted diverse Toronto neighborhoods encompassing a minimum of 1 million Torontonians annually. The program will promote the understanding of energy issues and lead to behavioral changes that result in the overall reduction of electricity demand and consumption. Toronto Hydro will provide electricity education on shifting use to off-peak times, using less electricity, and using electricity more efficiently via efficient technologies. Toronto Hydro will also generate positive media coverage for Toronto Hydro and stakeholders including the Ministry of Energy, the Ontario Power Authority (OPA) and the Ontario Energy Board (OEB). The program is an Educational CDM Program in conformance with the requirements of section 4.3 of the Ontario Energy Board's CDM Code for Electricity Distributor 2010. The OPA's Evaluation Measurement and Verification (EM&V) Protocols and Requirements document was used to develop the Draft EM&V plan. However, since it provided limited guidance on how to evaluate educational CDM programs, Chapter 9 of the California Evaluation Framework[2] was also used as a supplement. Toronto Hydro's Community Outreach Initiative fits the description of educational programs as described in the California Evaluation Framework; with no pretention to any form of market effect or direct impact. **Key Program Elements** The program will consist of annual outreach in the period from 2011 to 2014 through: • In-store Retail information and education events; • Festive Light Exchange information and education events; • Energy efficiency products giveaways at educational event venues; • Direct marketing, advertisement and public relations campaign to generate participation in the events; • Direct information and education through Toronto Police forces, and provision of school educations materials and set up of on-campus school events. Toronto Hydro will work with the following organizations as channel partners: selected retail outlets, the Toronto Association of Business Improvement Areas (TABIA), the Toronto Police Service (TPS), the Toronto Anti-Violence Intervention Strategy (TAVIS) and many Toronto School Boards (TSBs).

[2] California Public Utilities Commission, The California Evaluation Framework, USA, June 2004, Project Number: K2033910 [ONLINE] As seen on April 7, 2011

	Toronto Hydro has recruited, hired and trained energy ambassadors to engage diverse residents in face-to-face education and outreach. Toronto Hydro has ambassadors that can communicate in the five most commonly spoken languages. **Goals and Objectives** A high-level overview of the objectives are provided in the next few paragraphs. **Program Logic Model / Program Theory** The visual representation of the program theory, as well as the delivery and implementation chain are represented in Appendix A – Logic Model. A short overview of the program theory is provided in the few next paragraphs. Toronto Hydro's energy ambassadors will deliver face-to-face information, education and engagement to elicit understanding and behaviour change as it relates to CDM to residents of Toronto's targeted diverse neighbourhoods. They will be provided with outreach and education materials: information and education booth, watt-meters, educational posters, signs and brochures. The venues where these events will take place are: local retail outlets (i.e. "In-Store Retail events"), and small local community events (i.e. "Festive Light Exchange events"). Toronto Hydro will conduct a local advertisement and public relations campaign to generate participation in the events. Also, Toronto Hydro will giveaway energy efficiency products to act as a "hook" for residents that will drive them to the event venues and booths and enable the direct information and education to happen. In addition, Toronto Hydro will work with the TPS and the TAVIS so that TPS forces and TAVIS staff deliver direct information and education to hard-to-reach residents. Moreover, Toronto Hydro will develop and conduct a School Education and Outreach campaign in schools in the targeted diverse neighbourhoods. Toronto Hydro will work with TSBs to select the schools and coordinate with the school staff. Toronto Hydro will deliver education programs and materials to the selected schools and deliver on-campus events. Main outcome of the program: All the direct information and education activities including the In-Store Retail events, the "Festive Light Exchange events, the Toronto Police direct information, and education. The school education and outreach activities will inform the participants about proper CDM behaviours and CDM Topic areas. Finally, this information and education will indirectly increase the understanding of energy issues and lead to behavioural changes that result in the overall reduction of electricity demand and consumption in the targeted neighbourhoods.

<table>
<tr>
<td></td>
<td>
Program Timing

The Outreach and Education Initiative is not a new program. It has attracted a fair amount of participants over the course of the past six years (2005 to 2010). The program staff will carry on delivering an annual quota of events, energy efficiency product giveaways, collateral materials and educational materials for schools and TPS forces and TAVIS staff. Toronto Hydro will keep on updating and creating a certain amount of collateral and education materials.

Estimated Participation and Results

Subject to approval, the estimated participation is 90,000 participants per year from the targeted neighbourhoods (as that for 2010). The local advertisement and public relations campaign will target a minimum of 1 million Torontonians annually.

Budget

The estimated budget is presented in the table here below:

<table>
<tr><th>COST DESCRIPTION</th><th>BUDGET</th></tr>
<tr><td>Development/ Start-up Costs</td><td>N/A</td></tr>
<tr><td>Administration and Overhead</td><td>$1,634,665</td></tr>
<tr><td>Marketing and Promotion</td><td>$2,020,000</td></tr>
<tr><td>EM&V</td><td>$45,000</td></tr>
<tr><td>Incentive</td><td>$1,960,000</td></tr>
<tr><td>Budget Total</td><td>$5,659,665</td></tr>
</table>
</td>
</tr>
<tr>
<td>Conservation Measures</td>
<td>
At the moment, the program does not target any measures in particular. The program will promote the understanding of energy issues and lead to behavioural changes that result in the overall reduction of electricity demand and consumption. Toronto Hydro will provide electricity education on shifting use to off-peak times, using less electricity, and using electricity more efficiently via efficient technologies.

To increase program evaluability, soon after the Board’s approval of the program application, Toronto Hydro will establish the CDM Topic Areas, and CDM Behaviours to be adopted by participants. These elements have not been listed yet. Even after they will be listed, the description of these topic areas and behaviours will not be extensive and specific enough to encapsulate them into the concept of “measures” such as those presented in the OPA’s Measures and Assumption Lists. Hence converting the benefits of the program into impact will not be possible.
</td>
</tr>
</table>

Evaluation Goals and Objectives	The evaluators will have to respond to the following Research Questions: • Research Question 1: Did development of local communication campaign and product giveaways convince targeted people to participate in events? (Process Evaluation) • Research Question 2: Was in-store retail campaign and festive light exchange effectively organised? (Process Evaluation) • Research Question 3: Have the Toronto Police Outreach and Toronto School Boards been effective channel at reaching participants? (Process Evaluation) • Research Question 4: Community Outreach and Education Initiative effective at delivering information about appropriate CDM Behaviours and Topic Areas? (Process Evaluation) • Research Question 5: What are the satisfaction levels of Program Stakeholders? (Process Evaluation) • Research Question 6: Should program carry on with same targets (i.e. neighbourhoods, profiles, CDM Topics, and behaviours) or else what should be the new targets of the program? (Market Characterization) Ultimately, the evaluators will come up with recommendations to improve the effectiveness of the delivery of information to the neighbourhoods, the marketing/sales activities to drive new participants to the events, and improve the effectiveness of the program administration.
Evaluation Deliverables	There will be one evaluation study in 2014 to retrieve the program tracking data from 2011, 2012, 2013 and 2014, to collect additional market data through independent surveys and interviews analyse the data and to respond to the evaluation research questions. The anticipated outputs are represented in Appendix B – Evaluation Study Flow Chart. The anticipated outputs are: • Draft EM&V Plan (Done) • Annual Program Tracking Report 2011 • Annual Program Tracking Report 2012 • Annual Program Tracking Report 2013 • Final EM&V Plan • Draft EM&V Report • Final EM&V Report • Annual Program Tracking Report 2014 Toronto Hydro internal staff will produce annual reports as part of the program tracking activities. The tracking reports will be reviewed by a third party evaluator.
Evaluation Description	At first, during 2011, 2012, 2013 and 2014, as part of the tracking of the program, Toronto Hydro will conduct certain tracking activities, keep an appropriate paper trail, input and store the data in a database format, and

	deliver a soft and a hard copy of the data to the evaluators. The specific activities that need to be conducted by Toronto Hydro are: • Event participant general headcount (broken down per event, neighbourhood, and targeted resident profile). • Energy efficiency product giveaways count (broken down per event, neighbourhood, targeted resident profile including start and end time stamp, address and contact information of the owner of the venue and/or local event organizer). • Energy ambassadors self-reporting evaluation questionnaires. • On-the-spot event participant evaluation questionnaires (for In-Store Retail events, and Festive Light events). • Teacher-administered survey for targeted school students. • Police officers self-reporting evaluation questionnaires. Toronto Hydro will condense and analyse the tracking data in annual program tracking report issued at the end of year 2011, 2012, 2013 and 2014. All reports will be reviewed by a third-party evaluator. The review will consist of a high-level desk review of program data, continuous tracking methods (questionnaires, headcount methods, etc.) and performance indicators. This estimate also will include a few "energy ambassador ride-alongs"; but other market data collection activities would require additional resources. During the evaluation study in 2014, to collect market data, the evaluators will conduct a phone survey of the residents of the targeted diverse neighbourhoods. The call center staff will make phone calls to find those residents with recall of the local advertisement and public relations campaign. They will use random-digit dialling and a sample-quota system for those with recall. They will build statistics of the number of residents with recall. For those with recall, they will ask if they participated in the events (In-store Retails and Festive Light Exchange events). Those who did not participate in the events will be deemed to be “non-participants” (a.k.a. real non-participants). They will follow the “non-participant” survey path and be asked questions on the reasons for not participating, on their general knowledge on CDM, etc. Those who did participate will follow the “participant” survey path and be asked questions on their satisfaction of the events, their recall of the topics and knowledge, etc. In addition, the evaluators will conduct in-person interviews with: the retail outlets who partnered with Toronto Hydro, school teachers where the school events took place, TPS officers who were involved in the delivery of the direct information and education, a representative of the TPS, a representative of TABIA, a representative of TAVIS and representatives of TSBs.	
Evaluation Elements	☐ PIA/QPIA Review ☐ New PIA/QPIA ☐ Custom EM&V ☐ Audit and Verification ☐ Energy savings and demand	☒ Market/Participant Research ☒ Program Design & Delivery Review ☐ Market Effects Assessment ☐ Net-to-Gross ratio (incl free rider rate)

Special Provisions	To increase program evaluability, soon after the Board's approval of the program application, Toronto Hydro will establish short lists of the following items and keep these lists as important records of the program. Evaluators will ask for these lists. • Targeted neighbourhoods (i.e., a mean to ease stratification, and reduce the message dissolution). • Targeted resident profiles (i.e., a mean to ease stratification, and narrow the research effort). • CDM Topic Areas (i.e., a mean to monitor change of awareness and knowledge). • CDM Behaviours (i.e., what the recipient of the education are expected to do as a result of the education efforts). Toronto Hydro will be evaluated based on their ability to reaching out to the targeted neighbourhoods and targeted profiles in the short lists. Toronto Hydro will be evaluated based their success in convoying information on the CDM topic areas and behaviours in the short lists. In order to cut down the EM&V cost, Toronto Hydro will include many evaluation questionnaires administered at the time of the exposure of the program for all or a sample of the market receiving the program service. These activities will be part of the tracking of the program.
Data Collection Responsibilities to Support Program Evaluation	An independent EM&V contractor will be responsible for all external market data collection activities. The anticipated data collection methods are represented in Appendix B – Evaluation Study Flow Chart. Toronto Hydro will be responsible for internal tracking of program data. All tracking reports will be reviewed by a third party evaluator. Toronto Hydro will condense and analyse the tracking data in annual program tracking report issued at the end of year 2011, 2012, 2013 and 2014.

Evaluation Schedule and Budget

Evaluation Deliverable	Budget	Date
Draft Evaluation Plan	Excluded.	DONE
Annual Program Tracking Report 2011	$2,000	2011-12
Annual Program Tracking Report 2012	$2,000	2012-12
Annual Program Tracking Report 2013	$2,000	2013-12
Final Evaluation Plan	$2,841	2014-07
Draft Final Evaluation Report	$32,322	2014-09
Final Evaluation Report	$2,185	2014-12
Annual Program Tracking Report 2014	$2,000	2014-12
Total Budget	**$45,348**	

EM&V budget assumptions:

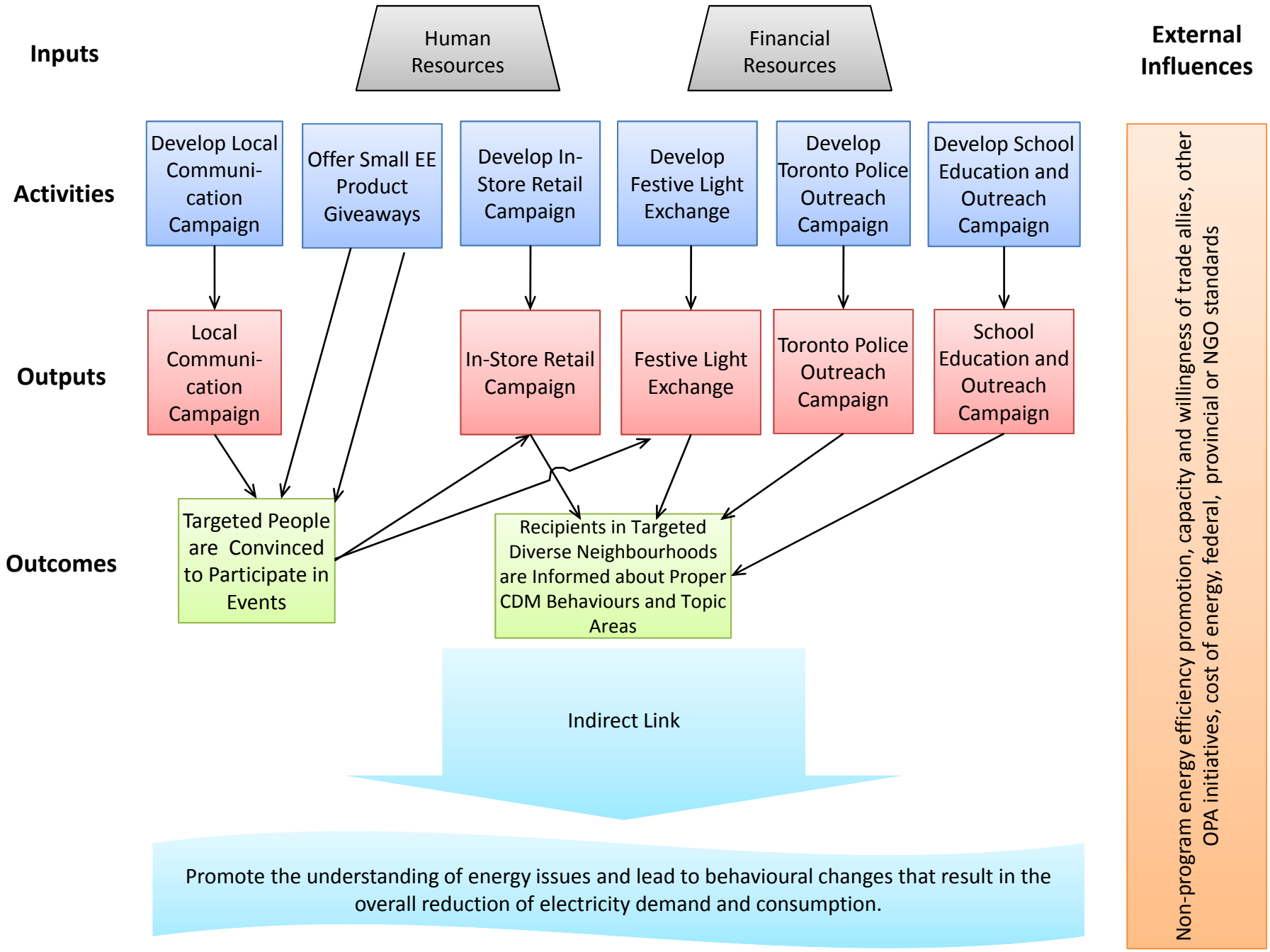
- Only independent EM&V contractor costs were included in the budget. Toronto Hydro internal human resource cost related to the tendering process and the coordination of the EM&V contractor were not included.
- Only EM&V cost were included. Internal program tracking cost were not included.
- An annual inflation rate of 3% was applied to 2011 prices to establish prices in 2012, 2013 and 2014.
- EM&V contractors expenses (e.g., transportation, perdiem allowance for food and accommodation) were not included in the budget.

Evaluation Team

The independent EM&V contractors will be selected through a competitive tendering process. The bidder selection approach will be based on quality and cost.

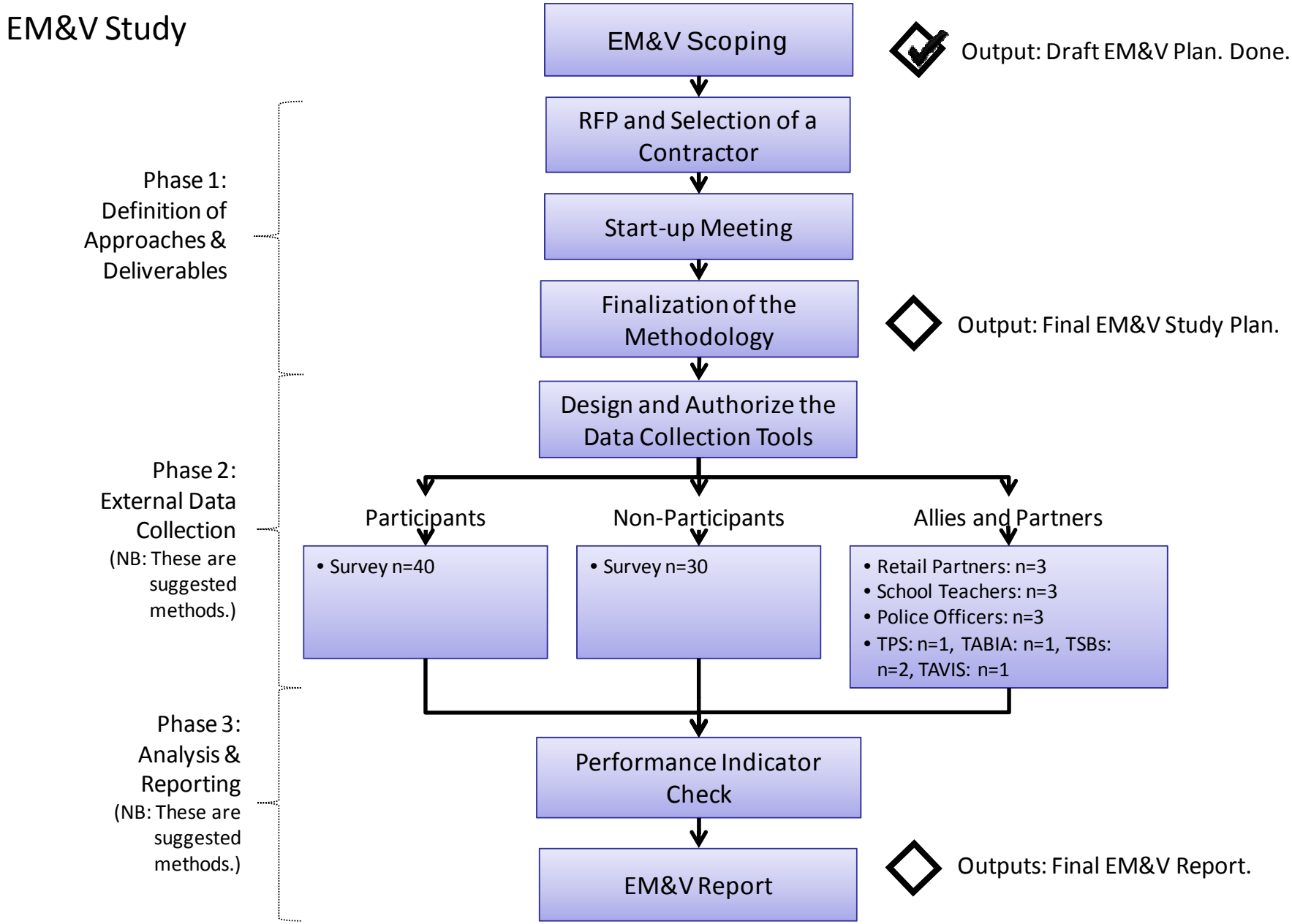
Organization	Name	Title/Accountability
Toronto Hydro Electric System Ltd.	Program Manager	Program Tracking and Annual Tracking Reports – Collection of “Internal Data”.
Toronto Hydro Electric System Ltd.	Program Manager	Selection of the independent EM&V contractors
Toronto Hydro Electric System Ltd.	Program Manager	Coordination with the independent EM&V contractors
Independent EM&V Contractor selected to conduct review of the tracking reports	To Be Determined	Review the tracking report 2011, 2012, and 2013
Independent EM&V Contractor selected to conduct the EM&V Study	To Be Determined	Finalize the EM&V Plan Collect “External Data” Perform Analysis Deliver the EM&V Study Review of tracking report 2014

Appendix A. Logic Model Drawing


Inputs
Human Resources
Financial Resources
External Influences
Activities
Develop Local Communi-cation Campaign
Offer Small EE Product Giveaways
Develop In-Store Retail Campaign
Develop Festive Light Exchange
Develop Toronto Police Outreach Campaign
Develop School Education and Outreach Campaign
Outputs
Local Communi-cation Campaign
In-Store Retail Campaign
Festive Light Exchange
Toronto Police Outreach Campaign
School Education and Outreach Campaign
Outcomes
Targeted People are Convinced to Participate in Events
Recipients in Targeted Diverse Neighbourhoods are Informed about Proper CDM Behaviours and Topic Areas
Indirect Link
Promote the understanding of energy issues and lead to behavioural changes that result in the overall reduction of electricity demand and consumption.
Non-program energy efficiency promotion, capacity and willingness of trade allies, other OPA initiatives, cost of energy, federal, provincial or NGO standards

Appendix B. Evaluation Study Flow Chart

EM&V Study



Where: TABIA is the Toronto Association of Business Improvements Areas, TPS is the Toronto Police Services, TAVIS is the Toronto Anti-Violence Intervention Strategy, and TSBs are the Toronto School Boards.

Toronto Hydro-Electric System Limited
EB-2011-0011
Exhibit K
Tab 2
Schedule 5
Filed: 2011 Apr 21
(20 pages)

TORONTO HYDRO-ELECTRIC SYSTEM LIMITED

FLAT RATE WATER HEATER CONVERSION & DEMAND RESPONSE

DRAFT EVALUATION PLAN DEVELOPMENT
- April 2011 -

ECONOLER

ABBREVIATIONS AND ACRONYMS

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CDM	Conservation Demand Management
CMVP	Certified Measurement and Verification Professional
EM&V	Evaluation Measurement and Verification
FRWH	Flat Rate Water Heater
FRWHCDR	Flat Rate Water Heater Conversion & Demand Response
IPMVP	International Performance Measurement and Verification Protocol
MURB	Multi-Unit Residential Building
M&V	Measurement and Verification
OEB	Ontario Energy Board
OPA	Ontario Power Authority
THESL	Toronto Hydro-Electric System Limited

TABLE OF CONTENTS

LIST OF TABLES

1 PROGRAM DESCRIPTION AND OBJECTIVES

In Toronto Hydro-Electric System Limited's (THESL) service territory, there are approximately 11,000 electric Flat Rate Water Heater (FRWH) customers, which includes a mix of residential, small commercial and low-rise multi-unit residential buildings. Originally this water heater load was installed on an unmetered circuit and was controlled by THESL to manage peak load. These electric water heaters represent a controllable load that can still be used to reduce demand during periods when the electricity grid is at high capacity.

As this load is unmetered, customers typically do not manage their energy use as efficiently or as effectively as those whose water heaters are metered. This has been confirmed with studies conducted by THESL on over 50 FRWH single-family residences that converted to metered water heaters and where the metering showed average electricity savings of 20.5%. However, it is not expected that this level of savings would be seen in Multi-Unit Residential Buildings (MURBs) or in other rental situations where the occupant does not directly pay for electricity.

A summary of the total and remaining eligible customers can be found below:

Table 1: Summary of the Total and Remaining Eligible Customers

Customer Description	Remaining Water Heater Conversions
Customer Owned	951
Rentals (not eligible)	2,092
Residential	3,574
Multi-Units (not eligible)	3,356
Move-Ins *	991
TOTAL	**10,964**
TOTAL (Eligible Units)	**5,516**

* Move-Ins are single-family residences that have changed ownership and which are categorized for marketing purposes as such.

The objectives of the flat rate water heater and demand response conversion program are as follows:

- Encourage 80% of the remaining 5,500 single-family residences with flat rate water heaters to convert to metered service. The conversions are anticipated to be completed by the end of December 31, 2012 provided approval is received by the end of March 2011. If approval is delayed beyond that, the program will extend into 2013.

- Contribute 10.2 GWh in cumulative net electricity savings, 0.3 MW in summer demand reduction plus 1.49 MW in demand response capacity over the four-year Conservation Demand Management (CDM) program timeline to THESL's mandated conservation targets.

2 PROGRAM THEORY

The Flat Rate Water Heater Conversion & Demand Response (FRWHCDR) program is proposed to assist single-family residential owners in converting flat rate water heaters to a metered service.

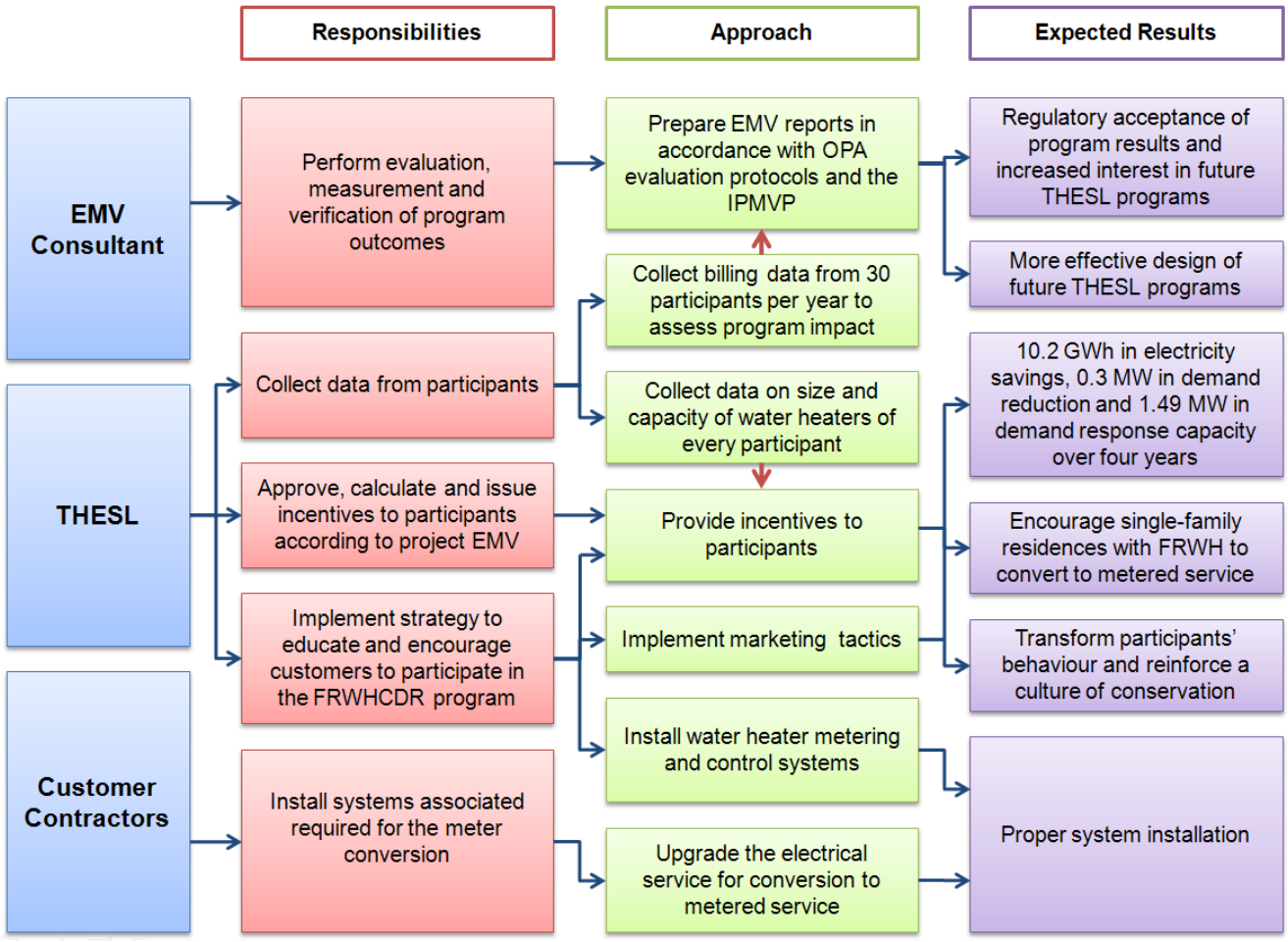
The FRWHCDR program will provide an incentive of CAD 0.20 per kWh of the estimated electricity savings to single-family residential FRWH customers to convert to a metered service. As noted, rental, commercial and multi-unit residential buildings are not eligible for this program. This incentive will reduce approximately 50% of the estimated cost attributed to the total average cost for the conversion. The rationale for providing an incentive higher than the Ontario Power Authority's (OPA) province-wide programs is to make the conversion an attractive proposition and encourage the desired behavioural changes.

Table 2: Incentives for the Typical Tank Conversions

Gallons	Bottom Element Size (Watts)	Top Element Size (Watts)	Incentive (CAD)
40	800	800	138.70
40	1,000	1,000	165.95
40	1,000	3,000	176.66
40	3,000	1,000	220.95
40	3,000	3,000	264.75
60	1,000	3,000	198.07

This program will run for two years from the program approval date.

3 PROGRAM LOGIC MODEL



4 TARGETED ENERGY AND PEAK SAVINGS ESTIMATES

4.1 ELECTRICITY CONSUMPTION SAVINGS

The savings calculations are based on establishing the annual electricity consumption savings for each tank/element combination, which are then used to derive an average saving per tank based on common customer use patterns.

The annual electricity consumption per tank size and element size is shown below. These values were approved by the Ontario Energy Board (OEB) during rate submissions in 2000 by THESL.

These calculations were used to estimate an average tank consumption of 4,640 kWh for residential consumers.

Table 3: Electricity Consumption Savings

Gallons	Bottom Element Size (Watts)	Top Element Size (Watts)	Annual Consumption (kWh)	Annual Savings (kWh)	Number of Tanks	Total Annual Consumption (MWh)
40	800	800	3,468	694	1,009	3,499
40	1,000	1,000	4,149	830	110	456
40	1,000	3,000	4,417	883	2,478	10,944
40	3,000	1,000	5,524	1,105	751	4,148
40	3,000	3,000	6,619	1,324	458	3,031
60	1,000	3,000	4,952	990	710	3,516
				Total	**5,516**	**25,595**
				Avg. Cons.	**4,640**	

As noted previously, savings of 20.5% were applied to the average electricity usage to achieve an average electricity saving per tank of 951 kWh. These savings were then applied to the projected number of conversions to determine total electricity savings. In addition, there are small electricity savings as a result of load control events. The savings are estimated at 21 kWh annually per tank based on 20 four-hour activations.

4.2 ELECTRICITY DEMAND SAVINGS

Demand savings are estimated using American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE) standard profiles and result in a factor of 33.5% of element size being achieved during the summer peak demand period. This result was applied to the tank/element sizes to obtain the savings noted below.

Table 4: Electricity Demand Savings

Gallons	Bottom Element Size (Watts)	Top Element Size (Watts)	Annual Consumption (kWh)	Number of Tanks	Peak Load in Class (kW)
40	800	800	3,468	1,009	807
40	1,000	1,000	4,149	110	110
40	1,000	3,000	4,417	2,478	2,478
40	3,000	1,000	5,524	751	2,253
40	3,000	3,000	6,619	458	1,374
60	1,000	3,000	4,952	710	710
				Total	**7,732**
				Average kW/tank	**1.39**

Table 5: Calculated Electrical Demand per Tank Size

Description	Value
Peak Demand (kW)	7,732
Peak Coincidence Factor	33.54%
On Peak Demand (kW)	2,594
Savings (%)	21
Demand Reduction (kW)	532
On Peak Demand Savings (kW/tank)	0.096
Demand Response Savings (kW/tank)[1]	0.375

[1] Demand Response Savings per Tank = 2,594 kW (Estimated On Peak Load)/5,516 tanks – 0.096 kW/tank
= 0.375 kW/tank

Savings per tank amount to 0.096 kW if the system is changed to a metered service. For demand response savings, the peak coincidence factor value is used to calculate the demand response reduction that will be achieved. This value is conservative based on the ASHRAE demand response profiles.

4.3 SAVINGS SUMMARY

The tables below summarize the net total estimated savings with a free ridership factor of 30% for the FRWH conversions and 10% for the peaksaver® measure. These values are assumed in calculating net savings.

Table 6: Total Estimated Savings

Net MW Reduction					
	2011	**2012**	**2013**	**2014**	**Total**
Metered Service Conversion	0.10	0.20	0.00	0.00	**0.30**
Demand Response Capacity	0.50	0.99	0.00	0.00	**1.49**
Net MWh Reduction					
	2011	**2012**	**2013**	**2014**	**Total**
Metered Service	979	1,959	0	0	**2,938**
Demand Response	40	79	0	0	**119**
Cumulative Savings	**1,019**	**4,076**	**8,153**	**10,190**	**10,190**

5 PROGRAM'S KEY RESEARCH OBJECTIVES AND IDENTIFICATION OF RESPONSIBLE PARTIES

5.1 PROGRAM'S KEY RESEARCH OBJECTIVES

The program's key objectives are to verify:

- Gross energy and demand savings: 0.3 MW summer demand reduction and 8.6 GWh electricity savings over the two years of the program;
- Net energy and demand savings: 0.2 MW summer demand reduction and 4.1 GWh electricity savings over the two years of the program;
- Free ridership: 30% for water heater conversions and 10% for peaksaver® program;
- Total Resource Cost and Program Administrator Cost:

Table 7: Total Resource Cost and Program Administrator Cost

Name of Test	Benefits	Cost	Net Benefit	Ratio
Total Resource Cost	$4,187,405	$2,242,177	$1,945,228	1.9
Program Administrator Cost	$4,229,134	$2,431,191	$1,797,943	1.7

- Marketing effectiveness: It is expected that the incentives will encourage 80% of the remaining 5,561 tanks to convert.

Table 8: Market Penetration

Type	2011	2012	Total
Total	1,471	2,942	4,413
Monthly Conversion Rate	123	245	184

Note that the impact of the demand response capacity will be evaluated by the OPA.

5.2 RESPONSIBLE PARTIES

Table 9: Responsible Parties

Parties	Identification
Program Manager	THESL
Evaluation Measurement and Verification (EM&V) Consultant	Third party

6 SCHEDULE FOR EVALUATION DELIVERABLES

Table 10: Deliverables Schedule

Deliverables	Frequency
Draft Evaluation Plan	Included in application.
Final Evaluation Plan Development	Prior to program start.
Annual Reports	In accordance with OEB code requirements.
Final Reports	At program conclusion. Summary of Annual Reports.

7 SUMMARY OF DATA COLLECTION EXPECTED FROM PROGRAM ADMINISTRATORS

THESL will require supporting data from program participants to substantiate the claimed savings. Documentation archives will be maintained and will be used for governance, reference and audit purposes.

THESL employs a comprehensive financial and work order system to keep track of CDM-related expenditures. After validation and verification of participant and third party invoices, payments will be made and recorded in the system. Each invoice will be substantiated by supporting documents.

Internal operational reports will be prepared and reviewed monthly subject to THESL's corporate governance rules and policies, including those established to govern OPA programs. Annual reports consisting of financial and operational results as well as energy and demand savings (based on project M&V and program EM&V results from independent third party reports) will be submitted to the OEB.

THESL is committed to delivering CDM programs that have a cost/benefit ratio greater than one. Total resource cost and program administrator cost calculations will be performed annually and at the end of the program. They will be included in the OEB reports.

All data collection efforts will be in conformance with the OEB CDM Code as well as with any other instruction received. The program administrator is expected to collect and provide to the EM&V Consultant the following data:

- Confirmation of conversion;
- Number of sites;
- Cost of installation;
- Applications;
- Water heater size and capacity.

8 PROPOSED METRICS TO TRACK PROGRAM PROGRESS

Evaluation of program progress is performed in accordance with IPMVP standards and OPA M&V protocols. Therefore, the following aspects must be addressed in the evaluation plan:

- Measurement option and boundaries selected;
- Baseline: period, energy and conditions;
- Reporting period;
- Basis for adjustments;
- Budget;
- Specifications of meters used;
- Other key elements measured;
- Quality assurance.

It is important to note that the demand response impacts are to be evaluated by the OPA as part of their EM&V.

8.1 MEASUREMENT OPTION AND BOUNDARIES SELECTED

The option selected to determine savings
Option B: water heater electrical demand and consumption measurement Based on Volume 1 of the IPMVP, EVO 10000-1: 2007 (En)

Justification for the option selection, gain/reporting period ratio
Water heater electrical demand and consumption measurement was selected because only the performance of the systems affected by the program is of concern.

Measurement boundaries
The measurement boundaries are the water heaters for a sample of 30 participants each program year.

8.2 BASELINE: PERIOD, ENERGY AND CONDITIONS

The baseline period must be established to represent a full operating cycle from maximum to minimum energy use in order to fairly represent all operating conditions of a normal operating cycle. The baseline should also include only time periods for which all fixed and variable energy-governing facts are known about program participants. Moreover, the baseline should coincide with the period immediately before commitment to undertake the retrofit. Periods further back in time would not reflect the conditions existing before the retrofit and may therefore not provide a proper baseline for measuring the effect of the program.

8.2.1 Identification of the Baseline Period

The baseline period should cover a full month prior to program implementation.

8.2.2 Independent Variable Data

Independent variables include factors that can affect water heater use and which will be systematically taken into consideration to establish the reference year calculation during the reporting period. No independent variables were identified in this case.

8.2.3 Static Factors Corresponding to Energy Usage Data

Static factors include equipment and operations that are considered fixed during the preparation of the measurement plan. No current adjustment calculation is considered for these factors in the M&V plan. However, in the event of a change in data and parameters, a non-routine adjustment could be added to the baseline calculation. The following list presents some events that could result in changes in static factors. This list is not exhaustive and any other modification that changes energy needs could be added.

- Number of occupants
- Temperature of hot and cold water.

8.3 REPORTING PERIOD

The reporting period corresponds to a 24-month period from the implementation of the measure.

8.4 BASIS FOR ADJUSTMENTS

8.4.1 Electricity Consumption Savings

Approach Taken	Equation
Water heater electrical consumption measurement	Program energy savings = Total participants × (Sample energy consumption of the baseline - Sample energy consumption of the reporting period) ÷ Sample size +/- Adjustments

8.4.2 Electricity Demand Savings

Approach Taken	Equation
Water heater electrical demand measurement	Program energy savings = Total participants × (Sample demand of the baseline - Sample demand of the reporting period) ÷ Sample size +/- Adjustments

8.5 BUDGET

Table 11 shows the approximate EM&V costs associated to the program:

Table 11: EM&V Budget

Description	EM&V Costs
Draft EM&V Plan	$2,500
Final EM&V Plan	$2,500
Annual Tracking Report	
2011	$5,000
2012	$5,000
Final EM&V Report	$15,000
Total	**$30,000**

8.6 SPECIFICATIONS OF METERS USED

Baseline Period:

- A power meter will be set to measure the electrical power of the water heaters;
- A time-of-use data logger will be set to measure the hours of operation of the water heaters.

Reporting Period:

- New THESL water heater meters will be used to evaluate the electrical demand and consumption post implementation.

8.7 OTHER KEY ELEMENTS MEASURED

Free ridership: Determined through a survey performed on a sample of participants;

Marketing effectiveness: Determined through program applications;

Total Resource Cost and the Program Administrator Cost: Determined through program applications, energy and demand savings results as well as a costs survey including the cost of utility equipment, operation and maintenance, installation, program administration, and customer dropout and removal of equipment.

8.8 QUALITY ASSURANCE

- Only professionals having the CMVP (Certified Measurement and Verification Professional) certification can calculate savings and adjustments. Moreover, all savings calculations will be based on fundamental engineering principles and performed to the best of the knowledge of the professionals involved. Each calculation will be verified by another person who knows the project and who has the required skills.
- All savings calculations will be based on the electricity data from the copies of the bills of energy suppliers.
- Energy data entries will be double checked to minimize the chance of errors. This second verification will be completed by another stakeholder.
- Independent variable
  - Degree days: All meteorological data will come from Environment Canada – specifically the weather station closest to the project.
- Static factor
  - Information regarding changes made to the static factors of the project will be sent by the program manager to be analyzed by the certified CMVP to determine the direct and indirect impacts on projected savings. This professional will then be able to make the necessary adjustments for the reference year to determine the real savings of the measures implemented.

ECONOLER

160, rue Saint-Paul, Bureau 200, Québec (Québec), Canada G1K 3W1 Tel.: + 1 (418) 692-2592 Fax: +1 (418) 692-4899
www.econoler.com

ENERGY PROFILES LIMITED

Draft Evaluation Plan:

Greening Greater Toronto Commercial Building Energy Initiative ("CBEI")

Prepared for Toronto Hydro-Electric System Limited

April 2011

Contents

1.0 INTRODUCTION

Energy Profiles Limited has prepared this document for Toronto Hydro-Electric System Limited (THESL). The intent of the report is to provide a clear basis on which to evaluate the success of the proposed Greening Greater Toronto Commercial Building Energy Initiative (CBEI), and to fulfill the OPA EM&V Protocol requirements for a "Draft Evaluation Plan".

2.0 PROGRAM DESCRIPTION

2.1 Description

The CBEI educational initiative targets large commercial building tenants, building managers and landlords. The intent is to increase stakeholder knowledge and awareness of energy efficiency opportunities and foster a productive dialogue leading to the pursuit of energy projects. Otherwise, this level of cooperation does not normally exist, especially in areas where both tenant and building management spheres of control overlap.

This educational initiative will support the existing Greening Greater Toronto (GGT) organization assuring the continuation of its CBEI program. This program submission to the OEB covers a 12-month period commencing in 2011. Through the Toronto City Summit Alliance, the GGT membership is comprised of senior executives from leading real estate organizations for the express purpose of educating and advancing the cause of energy efficiency.

This educational initiative is not targeted at specific measures as it will broadly support all "Commercial-Institutional" programs and will apply across a wide spectrum of energy saving applications addressed within those programs.

Challenge Teams within each building will be comprised of building management and leading building tenants. Each team will be provided with a broad list of potential efficiency initiatives for consideration along with supporting educational information. This documentation is intended only as a guide as the expectation is that teams will develop solutions specific to their own circumstances. Information provided will also highlight available CDM programs. Teams will also be encouraged to include innovative initiatives that are not included in the list. From this list the Challenge Teams will develop their plans for improving energy efficiency.

The organization is led by a volunteer Leadership Council which is comprised of a peer group of 48 senior executives representing leading real estate organizations.

2.2 Program Theory

As an initiative of the Toronto City Summit Alliance and supported by THESL, GGT launched the Commercial Building Energy Initiative (CBEI) in 2010 to improve the energy efficiency of the building stock in the GTA through education and outreach by addressing the following barriers to improved energy efficiency:

- The lack of a measurement standard for building energy performance
- Difficulty in acquiring data to build business cases for the justification of energy efficiency projects
- Ineffective communication between tenants and building owners leading to slow adoption of energy efficiency initiatives

- Lack of broader education about energy efficiency especially amongst building occupants

The relationship between tenants and landlords is governed through formal lease agreements, which clearly articulate and separate the duties and responsibilities of each party. Within this segregated environment, cooperative undertakings like jointly sponsored and mutually beneficial energy efficiency initiatives require an outside catalyst.

2.3 Key Program Elements

This initiative supports four main efforts to increase the knowledge level and awareness amongst the stakeholders:

- Facilitating the start of Owner/Tenant Working Groups within commercial buildings with the intent of undertaking new energy efficiency initiatives by instigating a level of conversation that typically does not happen without help.
- Hosting building-specific "Greening Our Workplaces Tenant Series" of events to showcase recent commercial tenant-led energy efficiency initiatives with some tenants for the benefit of neighbouring tenants within the same building.
- Conducting a Corporate Challenge whereby individual office buildings will compete to improve energy efficiency within the building. The Challenge Team within each building will be comprised of building management and building tenants. The Challenge will track progress and reward success for participation, collaboration, innovation and actual energy efficiency improvements.
- Create case studies promoting energy efficiency best-practices as an experience base.

2.4 Goals and Objectives

An initiative of the Toronto City Summit Alliance and supported by THESL, Greening Greater Toronto has launched the CBEI to improve the energy efficiency of the commercial-institutional building stock in the GTA by addressing the following barriers:

- Sponsoring a measurement standard for building energy efficiency to facilitate energy performance efforts.
- Gathering information and disseminate business cases to educate and encourage other participants to follow.
- Improving the level of communication and cooperation between tenants and building owners to enable launching efficiency initiatives especially in areas with overlapping interests.
- Improving the overall awareness and knowledge of stakeholders about building energy efficiency opportunities.

GGT aims to achieve these objectives through education and by fostering greater dialogue through the unique interactions at events involving groups within a common commercial building environment that do not ordinarily communicate about energy efficiency.

2.5 Program Logic Model

See Appendix A for the program logic model.

2.6 Program Timing

The program will operate for the 12 month period directly following program approval.

2.7 Estimated Participation and Results

This educational initiative will target all major office landlords, building owners and property managers both in the private and public sectors within the "Commercial-Institutional" sector for Large Businesses.

2.7.1 Projected Number of Participants

The commercial sector represents 31% of THESL's annual electricity consumption. Within that sector, large commercial office space (defined as greater than 1,000 kW) represents 27% of the electricity consumption spread across 108 accounts. By way of comparison, the intermediate group (defined as accounts between 50kW and 1,000 kW) represents only 23% of that sector's electrical consumption across a more substantial customer base of 1,441 accounts.

Participation is driven through membership in GGT. The current membership of the Leadership Council of GGT includes landlords that own and or manage approximately 40% of the commercial office space and tenants that occupy approximately 40% of the commercial office space in the GTA.

With the Corporate Challenge moving to involve all the tenants of our landlord member buildings, the tenant participation will continue to expand far beyond the current GGT membership.

GGT will also continue to actively reach out to other landlords in the GTA to take up the Challenge using the profile and influence of the existing membership as leverage.

2.7.2 Projected MW and MWh Savings

As an education program, savings will manifest indirectly as energy reduction projects are undertaken by tenants and building owners as separate initiatives downstream of the engagement sponsored under this program.

The Leadership Council for the GGT, representing its constituent organizations, has agreed to an initial target of 10% energy reduction from 2009 levels by end of 2014 across its membership base as part of its mandate. GGT will track results as reported by its members.

2.8 Budget

The 2011-2014 budgeting plan for the Program is summarized in the following table:

Description	2011
Marginal Costs	
Fixed Costs	
Legal Cost	$10,000
Marketing	$4,129
Administrative Costs	$20,000
Operation Cost	$2,078
EM&V	$1,445
Total Fixed Costs	**$37,653**
Variable Costs	
Operation Cost	$250,000
Total Variable Costs	**$250,000**
Total Marginal Cost	$287,653
Total Allocable Cost	$8,054
Total Program Costs	**$295,707**
Total Incentives	$0
Total Budget	**$295,707**

3.0 CONSERVATION MEASURES

This educational initiative targets a wide spectrum of conservation measures requiring the co-operation of tenants and building managers. These measures are not *funded* under the Program, but it is expected that the Program will encourage energy efficiency retrofits under the province wide and THESL specific programs.

Measures may include, but are not limited to the following:

1. Lighting control via occupancy sensors
2. Lighting retrofits
3. Efficient HVAC scheduling
4. Recycling programs
5. Computer workstation power optimization
6. Appliance upgrade programs

4.0 EVALUATION GOALS AND OBJECTIVES

The objectives of this program evaluation are to determine the following:

1. The effectiveness of the program in motivating participants to undertake energy efficiency projects and initiatives
2. The effectiveness of the program in maintaining the existing CBEI membership base and increasing future membership
3. The effectiveness of the program delivery in terms of marketing/sales activities in signing up future participants for,
    a. Greening Our Workplaces tenant series
    b. Owner/tenant working groups
    c. Corporate Challenge
4. The perceived value of the program based on participant feedback.
    a. Quality of materials
    b. Value of information provided
5. The perceived value of time/funding invested
6. The perceived effectiveness of the training delivery and program administration organization

5.0 EVALUATION DELIVERABLES

The following documents shall be delivered over the course of program implementation

1. Draft EM&V Plan
2. Final EM&V Plan
3. Final Report

6.0 EVALUATION DESCRIPTION

The CBEI program is an ongoing educational initiative, operated by a third-party program administrator. As such, the program evaluation focuses on maintaining / increasing program membership and participation, the quality and impact of the training provided, and the effectiveness of the third-party program administrator.

The evaluation elements are anticipated to include (but are not limited to) those listed in the corresponding sections below. It is expected that these elements will be reviewed, discussed, evaluated or analyzed as appropriate and according to the OPA's EM&V Protocols to ensure that they meet the Program Evaluation Goals and Objectives during the Draft Evaluation Plan development phase. Review of these elements will assist THESL in determining and/or validating the appropriateness of the program design, administration and measures assumption elements and whether adjustments are necessary in order to successfully deliver the Initiative and to achieve the anticipated goals and objectives and estimated participation and results.

Program evaluation will be carried out by a certified independent third-party EM&V Professional based on the OPA EM&V Protocol. It will focus on the following areas to assess the cost-effective delivery of the Program:

The objectives of this program evaluation are to determine the following:

1. The effectiveness of the program in motivating participants to undertake energy efficiency projects and initiatives
2. The effectiveness of the program in maintaining the existing CBEI membership base and increasing future membership
3. The effectiveness of the program delivery in terms of marketing/sales activities in signing up future participants
4. The perceived value of the program based on participant feedback.
5. The perceived value of time/funding invested
6. The perceived effectiveness of the training delivery and program administration organization

Program evaluation will be end-to-end, from program design, through delivery, to the final financial settlement of each project completed.

7.0 EVALUATION ELEMENTS

7.1 Program Delivery (Marketing/Sales) Effectiveness

Marketing and sales effectiveness shall be evaluated based on penetration of the following target markets:

Primary Target Market

- Building Owners and Landlords
- Major commercial building tenants
- Building Operators includes Property Managers and Facility Management Organizations

Secondary Market

- Minor Tenants
- Commercial and institutional trade associations

7.2 CBEI Membership Rate

Membership in the CBEI program shall be evaluated based on maintaining current membership, as well as increasing membership over the funding period.

Membership shall be measured in terms of the following:

1. Number of member property owners / managers
2. Owned / managed square footage by member owners / managers (as a percentage of qualified prospective owned / managed space)
3. Number of major tenant members

7.3 Program Participation Rates

Participation shall be measured for each of the various programs included in the CBEI initiative:

Greening Our Workplaces Tenant Series

1. Number of organizations attending
2. Number of participants attending

Owner/Tenant working groups

1. Number of organizations attending
2. Number of participants attending

Corporate Challenge

1. Number of organizations attending
2. Number of participants attending

7.4 Participant Feedback

Participant feedback shall be solicited and compiled for each of the initiatives listed in Section 7.3 to determine:

1. Perceived value of information provided
2. Perceived impact of initiatives on driving energy management and a culture of conservation
3. Quality of materials provided, including:
    a. Business cases
    b. Case studies (Living Library)
    c. Presentation materials

7.5 Project Implementation Rate

The lasting and long term impacts of the Commercial Building Energy Initiative's training and facilitation efforts shall be established based on the following key metrics:

1. Number of qualified customers that have implemented or are in the process of implementing demand or consumption saving measures after participating in the "CBEI"
2. Number of qualified customers that have taken preliminary steps to implement energy savings measures

Results shall be adjusted for qualified customers who would have taken energy saving measures despite the outcome from the Commercial Building Energy Initiative.

7.6 Effectiveness of Program Administration Organization

The third-party program administration organization shall be evaluated based on all aspects of the program, as discussed in this Section 7, with a focus on the following criteria as per OPA Evaluation Protocol 5-A:

- ***Program Design -*** *an assessment of program design and theory;*
- ***Program Administration*** *- an assessment of program administration including identification of staffing requirements and training needs, and review of program tracking systems;*
- ***Program Implementation and Delivery*** *– an assessment of program implementation*

and delivery including identifying process issues, assessing program targeting and marketing efforts, and quality control methods;

- ***Market Feedback*** *– an assessment of market satisfaction with program elements and identification of market effects (intended and unintended)*[1]

[4] OPA CDM Evaluation Protocols 5-A

8.0 DATA COLLECTION RESPONSIBILITIES TO SUPPORT PROGRAM EVALUATION

Data collection will be completed with the assistance of a third-party certified EM&V consultant to ensure complete and appropriate collection of data to support Program evaluation. Data collection required shall include but not be limited to the following:

Membership statistics: by organization and square footage

Participation rate statistics for the following:

- Greening Our Workplaces tenant series
- Owner/tenant working groups
- Corporate Challenge

Participant satisfaction information:

- Participant satisfaction survey results
- Post-participation project implementation survey results

9.0 EVALUATION SCHEDULE AND BUDGET

The schedule will be established by the Third-Party certified EM&V consultant in conjunction with THESL.

Deliverable	Delivery Timeline
Draft Evaluation Plan	Included in program application
Final Program Evaluation Plan	Prior to program start
Final Report	Following conclusion of funding period

The budget for EM&V activities is estimated at $1,445 over the funding period.

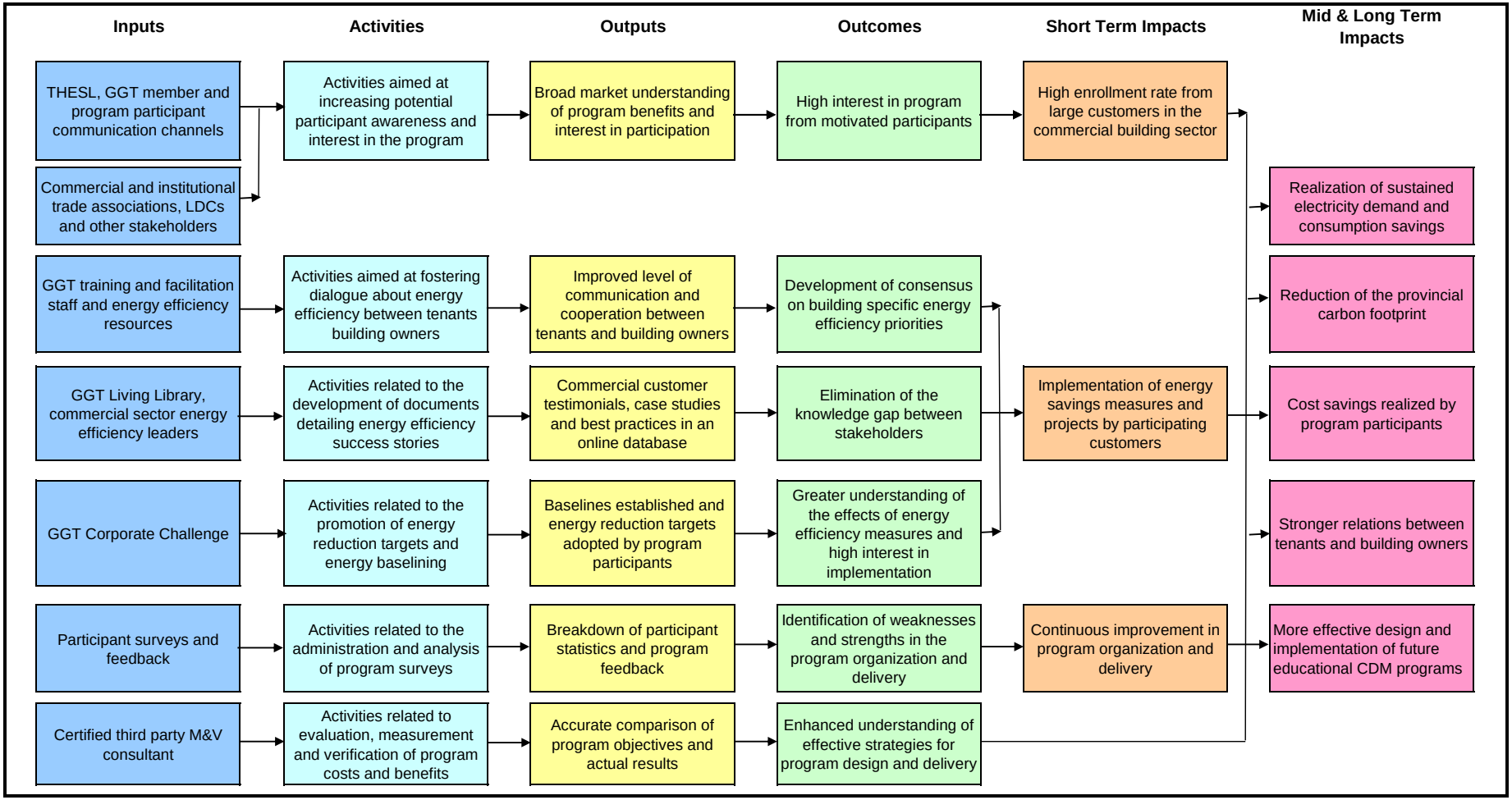
10.0 EVALUATION TEAM

A third-party certified EM&V consultant team, with support from THESL CDM personnel, shall be responsible for Evaluation of the Program.

APPENDIX A PROGRAM LOGIC MODEL

ENERGY PROFILES LIMITED

CBEI Program Logic Model



ENERGY PROFILES LIMITED

Draft Evaluation Plan:

Hydronic System Balancing Program ("HSBP")

Prepared for Toronto Hydro-Electric System Limited

April 2011

Contents

1.0 INTRODUCTION

Energy Profiles Limited has prepared this report for Toronto Hydro-Electric System Limited (THESL). The intent of the report is to provide a clear basis on which to evaluate the success of the proposed Hydronic System Balancing Program (HSBP), and to fulfill the OPA EM&V Protocol requirements for a "Draft Evaluation Plan".

2.0 PROGRAM DESCRIPTION

2.1 Description

This program is aimed at reducing the hydronic system pump load and consumption in the office, institutional, multi-residential and hospitality sectors within the City of Toronto. The estimated summer pump peak load, in the identified market segments, is approximately 164.8 MW. The corresponding electricity consumption is estimated to be 1,014 GWh. This is a significant load that is not effectively targeted under the Province-Wide Commercial and Industrial (C&I) sector programs.

2.2 Program Theory

The basis of the Hydronic System Balancing Program ("the Program") is the assertion that most hydronic systems and Domestic Cold Water (DCW) booster pumps are oversized and operating against balancing valves that throttle flow and unnecessarily increase energy consumption. It is not uncommon to find pumps with balancing valves installed on their discharge side needlessly consuming 30% more electricity when compared with actual requirements.

The rationale for this program is that it provides a simple, low risk measure across a significant load that will provide initial stimulus and success for customers wishing to promote energy efficiency within their organizations. It is expected that the Program will also be an enabler for the Province-wide C&I programs as the initial balancing assessment will identify additional measures for implementation through the OPA's Tier 1 Energy Replacement Incentive Program (ERIP).

The opportunity to reduce pump energy through impeller changes or the application of variable frequency drives (VFD) is a well-recognized, but rarely implemented means of reducing pumping energy consumption. At the building design stage, pump capacity is typically oversized often as a result of compounding design safety factors. Evidence of the energy saving opportunity is identified in many references including the US Department of Energy's (DOE) "Improving Pump System Performance" and is a standard measure in guidelines for many industries, for example, data centres.

A sample of some of the results achieved in the United States and the United Kingdom are shown below:

Type of Facility	Location	Measure Completed	Simple Payback	Reduction Demand/Consumption
Hospital	California	Condenser Pumps	1	11kW/44,700kWh
Hotel	California	HVAC Pumps	<1.0	400,000kWh
Office	Oregon	Condenser Pumps	0.8	25.8kW/103,053kWh
Hotel	UK	HVAC Pumps	2.2	57,000kWh

2.3 Key Program Elements

2.3.1 Program Incentives

The Program includes two incentive elements – one for assessing the site for opportunities, and the second for implementing the identified measures within a specified time period.

The site assessment incentive is to cover an on-site assessment by a program approved National Environmental Balancing Bureau (NEBB) Certified Testing and Balancing Professional. The objective of the assessment is to identify the potential for:

- Applying variable frequency drives or trimming impellers on the chilled/hot water main circulation pumps.
- Retrofitting the booster pumps with multistage pumps and/or variable frequency drives.
- Identifying mechanical deficiencies associated with the distribution systems.

The balancing assessment incentive is limited to the cost of the audit up to a maximum of $1,500/facility.

The second element of proposed incentives is to support customer investment in the identified measures. Customers that act on the assessment recommendations, and implement the proposed measures, will be eligible for an incentive of $0.10 per kilowatt hour of annual savings. The typical expected pay-back on this investment is approximately 2 years.

2.3.2 Program Scope

The Program scope will include:

1) Assessment Contractor Training

   a) THESL will provide training sessions for already NEBB Certified contractors to focus on the scope and reporting required under the Program. These training sessions will be a pre-requisite for contractors to participate in the Program and become a program approved hydronic system balancing contractor (assessment contractor).

   b) Annual refresher courses will be conducted for participating assessment contractors during the life of the Program.

2) Pre-Application (Assessment) Stage

   a) Participants will select a program approved NEBB assessment contractor to conduct a hydronic system assessment. The assessment will include:

      i) Identification of applicable pumping systems and equipment

      ii) Confirmation of existing flow control devices and flow configuration to determine

project viability

iii) Identification of suitable energy saving measure(s)

b) Calculation of potential costs and savings

c) An assessment performed by a program approved assessment contractor by will be eligible for an incentive up to the maximum allowable amount.

3) Application Stage

a) Program participants will fill out the appropriate application forms through the Program website with the help of the Program approved assessment contractor.

b) Applications will be reviewed and approved by THESL' technical engineering staff for conformance and technical due diligence.

4) Initial Balancing Stage

a) The participant's chosen assessment contractor will undertake an audit of the main hydronic systems and DCW booster pumps.

b) The approved contractor will prepare an opportunity report indicating the proposed savings and potential costs.

c) This report will be forwarded to the participant and THESL for review.

d) THESL will approve the incentive, provided the report criteria have been met.

5) Pre-Implementation Stage

a) Participant will fill out a project implementation form outlining the measures that are to be completed for THESL's approval.

b) THESL will review proposed measures to approve incentives providing all program rules/eligibility have been satisfied.

6) Implementation Stage

a) Physical modifications to pumping systems or controls are undertaken. Customer manages vendor/service providers completing the work.

b) Service providers will offer installations and training.

c) Assessment contractor will perform post-installation measurements and prepare an actual savings report which shall include the detailed calculations for actual and projected savings, as per the M&V requirements described in Section 7.1.

7) Post-Implementation Stage

a) Participant will submit a post implementation report including the assessment contractor's savings report to THESL.

b) THESL will review post-implementation reports and provide incentives. A third party certified M&V consultant shall review a representative sample of post-implementation reports and perform inspections at a representative sampling of sites to ensure program veracity, as described in Section 7.1.

2.4 Goals and Objectives

The objective of the Program is to permanently reduce electrical load and consumption for both the heating and cooling hydronic systems and also for booster pumps in the C&I market. The Program is expected to achieve 62 GWh in savings and 3.4 MW in summer demand reduction, which will make a significant contribution towards THESL's savings target.

The following considerations are key program drivers:

- Popularizing hydronic balancing measures and promoting improved hydronic system operation and ultimately re-define design practices.
- Developing a business opportunity for balancing contractors to focus on energy efficiency

Additional objectives of the Program are to:

- Provide participating organizations with a low risk and effective energy efficiency measure that identifies future potential projects.
- Train and enable the hydronic and air balancing community to effectively and sustainably assess the opportunities.
- Promote better technology applications and promote variable flow systems.
- Raise the level of awareness of this energy saving opportunity and encourage pumping system assessments as a common measure to examine and implement.

2.5 Program Logic Model

See Appendix A for the program logic model.

2.6 Program Timing

The Program will operate between program approval and December 31, 2014.

2.7 Estimated Participation and Results

As there are two distinct phases to the Program, estimates for the audit and then implementation are discussed separately.

2.7.1 Site Assessments

THESL's expectation is that 25% of the target market will participate in the initial audit program or site assessment. The estimate is based on THESL's Power Saver Blitz (PSB) program that offered free lighting audits to over 44,000 customers with a resulting uptake of 74%. Although this marketing approach for this program also involves a vendor-driven "blitz" approach similar to PSB, the higher technical requirement and limited industry capacity suggest that a downgraded expected penetration of 25% is more appropriate.

2.7.2 Implementation

When establishing the projections we have relied upon the experience from other jurisdictions with programs similar in scope. We have also placed some importance in evaluating the different investment criteria used by the market segments for general energy efficiency projects. A key criterion for evaluating investment is simple payback. When evaluating the Program penetration we employed costing estimates from several suppliers and our own multiple installation experience as an energy service company in Toronto. The typical average project retrofit cost used for the analysis is:

Type	Estimated System Cost	Estimated System Savings	Simple Payback (years)
Heating/Cooling	$18,107	$9,623	1.9
Booster Pumps	$39,616	$7,861	5.0

The anticipated commercial/institutional market penetration rates are based on the following observations:

- The retro-commissioning market, which has similar paybacks and goals as this program, has been evaluated in California and shows an annual 5.1% penetration rate within a much more established conservation market.
- At the same time, 80% of organizations will consider proceeding with projects having a payback of less than 1.9 years in the commercial sector.
- Studies have found that higher energy costs lead to a greater adoption of energy savings measures[9], which is important as electricity prices are expected to rise 46% over the next five years.
- Evaluation of energy efficiency measures completed under the IAC program in the United States yielded a predictive model that indicates, for the paybacks noted below, an adoption rate of 50% for the heating/cooling retrofits and 40% for the booster pump upgrades.

Based on the information noted above and the program design elements, the expected implementation rate for those that will have participated in the audit portion of the Program is noted in the table below.

Segment	Number of Facilities	Audit Penetration Rate	Number of Audits	Htg./Clg. Pump Implement. Rate	Number of Htg./Clg. Pump Projects	Booster Pump Penetration Rate	Number of Booster Pump Projects
Offices	227	25%	57	50%	28	30%	17
Hospitality	61	25%	15	50%	8	30%	5
Multi-residential	1,460	25%	365	50%	183	30%	110
Institutional	236	25%	59	50%	30	30%	18
Total	1,984	25%	496	50%	248	30%	149

2.7.3 Projected MW and MWh Savings

The expected savings for heating / cooling and DCW booster pump modifications are projected to be 30%. The expected savings for heating / cooling pumps are consistent with a study conducted on 14 commercial buildings in Wisconsin where the demand/consumption savings were on average around 35%. The expected savings for DCW booster pumps are consistent with a Canadian Housing and Mortgage Corporation pilot program conducted at 7 residential high-rise buildings in Toronto where demand and consumption savings were 51% and 30% respectively.

The tables below summarize the net total estimated savings with a free-ridership factor of 30% assumed in calculating net savings. Evaluation, Measurement and Verification (EM&V) will determine actual results.

Net MW Reduction					
	2011	2012	2013	2014	Total
Heating/Cooling	0.2	1	1.7	0.5	3.4
Booster Pumps	0.1	0.5	0.8	0.2	1.5
Total	**0.2**	**1**	**1.7**	**0.5**	**3.4**
Cummulative Net MWh Reduction					
Heating/Cooling	925	7,397	23,116	41,610	41,610
Booster Pumps	453	3,626	11,330	20,394	20,394
Total	**1,378**	**11,023**	**34,447**	**62,004**	**62,004**

2.8 Budget

The 2011-2014 budgeting plan for the Program is summarized in the following table:

Description	2011	2012	2013	2014	Total
Marginal Costs					
Fixed Costs					
Legal Cost	26,250	5,775	5,775	5,775	43,575
Marketing	47,250	21,450	21,450	21,450	111,600
Sales	6,710	6,844	6,981	6,710	27,245
Program EMV	25,000	25,000	25,000	25,000	100,000
Administrative Costs	1,192	3,542	3,404	3,404	11,542
Operation Cost	37,786	42,551	46,278	20,962	147,577
Contractor Training	22,500	7,500	7,500	7,500	45,000
Toral Fixed Costs	**166,688**	**112,663**	**116,388**	**90,801**	**486,539**
Variable Costs					
Administrative Costs	4,767	14,168	17,020	7,151	43,106
Operation Cost	151,144	170,206	231,388	104,809	657,547
Total Variable Costs	**155,912**	**184,374**	**248,408**	**111,960**	**700,653**
Total Marginal Cost	**322,600**	**297,036**	**364,796**	**202,761**	**1,187,193**
Total Allocable Cost	**9,033**	**8,317**	**10,214**	**5,677**	**33,241**
Total Program Costs	**331,632**	**305,353**	**375,010**	**208,438**	**1,220,434**
Total Incentives	249,387	1,124,320	1,601,067	524,960	3,499,734
Total Budget	**581,019**	**1,429,673**	**1,976,077**	**733,398**	**4,720,167**

3.0 CONSERVATION MEASURES

The following conservation measures are promoted by the Program:

1. Multistage booster pump installation or VSD installation for DCW booster pumps
2. VSD installation or impeller trimming for central heating and cooling pumps

4.0 EVALUATION GOALS AND OBJECTIVES

The objectives of this program evaluation are to determine the following:

1. The achieved program gross peak demand (MW) and energy savings (MWh) reductions
2. The net program peak demand reductions and energy savings in consideration of the freeridership and other contributing elements
3. The net cost per MW and MWh of savings
4. The actual TRC and PAC results based on the achieved savings
5. The effectiveness of the program delivery in terms of marketing/sales activities in signing up participants
6. Program administration and governance effectiveness
7. The effectiveness of the Program in developing a self-sustaining opportunity for the testing and balancing industry to identify and capture hydronic system savings.

5.0 EVALUATION DELIVERABLES

The following documents shall be delivered over the course of program implementation

1. Draft Evaluation Plan
2. Final Evaluation Plan
3. Annual Report
4. Final Report

6.0 EVALUATION DESCRIPTION

The evaluation elements are anticipated to include (but are not limited to) those listed in the corresponding sections below. It is expected that these elements will be reviewed, discussed, evaluated or analyzed as appropriate and according to the OPA's EM&V Protocols to ensure that they meet the Program Evaluation Goals and Objectives during the Draft Evaluation Plan development phase. Review of these elements will assist THESL in determining and/or validating the appropriateness of the program design, administration and measures assumption elements and whether adjustments are necessary in order to successfully deliver the Initiative and to achieve the anticipated goals and objectives and estimated participation and results.

Program evaluation will be carried out by a certified independent third-party EM&V Professional based on the OPA EM&V Protocol. It will focus on the following areas to assess the cost-effective delivery of the Program:

- The achieved program gross peak demand (MW) and energy savings (MWh) reductions
- The net program peak demand reductions and energy savings in consideration of the freeridership and other contributing elements
- The net cost per MW and MWh of savings
- The actual TRC and PAC results based on the achieved savings
- The effectiveness of the program delivery in terms of marketing/sales activities in signing up participants
- Program administration and governance effectiveness
- The effectiveness of the Program in developing a self-sustaining opportunity for the testing and balancing industry to identify and capture hydronic system savings

Program evaluation will be end-to-end, from program design, through delivery, to the final financial settlement of each project completed.

7.0 EVALUATION ELEMENTS

7.1 Gross Energy and Demand Savings

Gross savings estimates shall be determined by the balancing consultant for each project. It is anticipated that most projects will involve constant volume systems.

For constant volume systems, savings shall be calculated as per the IPMVP Option A as described below.

Savings for variable volume systems shall be calculated using the same approach (IPMVP Option A) while ensuring that flow rates are taken into account pre and post-retrofit. The calculated demand savings should be properly representative of actual reductions achieved; it is recognized that consumption savings will tend to be understated, lending a conservative bias to reported savings.

7.1.1 Selection of Baseline Period and Reporting Period

As specified in the IPMVP, the baseline period and reporting period should span at least one normal operating cycle of the equipment. This period would typically be at least one year in order to capture the effects of heating and cooling seasons on pump load.

In the case of constant volume systems, short term power measurements combined with estimated annual operating hours will typically be sufficient to approximate Baseline Period and Reporting Period usage.

7.1.2 Savings Calculations: Constant Volume Systems

Baseline Period and Reporting Period (post-retrofit) demand and energy use shall be calculated as follows for constant volume systems, as per IPMVP Option A:

<u>Demand Measurement</u>

Demand shall be measured using a power meter during normal pump operation at the source side of the pump. Care should be taken to ensure that the readings are properly representative of steady-state operation.

<u>Energy Use Calculation</u>

Baseline and Reporting Period energy use shall be calculated for each eligible measure as follows:

*Energy Use = Demand (kW) * Annual operating Hours*

Operating hours shall be estimated based on heating/cooling schedules, seasonality and building usage characteristics.

Savings Calculation

Gross energy and demand savings shall be calculated as follows:

Savings = (Baseline Period Use or Demand - Reporting Period Use or Demand)

7.1.3 Savings Calculations: Variable Volume Systems

The energy consumption savings calculations associated with variable volume systems is considerably of more involved than those of constant volume systems. Because of the range of possible water flow profiles, significant temporary metering resources would be required. Nominally, IPMVP Option B would be used.

It is anticipated that this would add considerable cost to the program, even though variable volume systems are anticipated to represent a small fraction of the projects implemented as part of this Program.

On that basis, savings for variable volume systems shall be calculated as per Section 7.1.2, with the additional requirement that measurements for Baseline Period and Reporting Period energy and demand be taken during similar operating conditions, i.e. the same flow.

The calculated demand savings will be properly representative of actual reductions achieved. Consumption savings will tend to be understated, lending a conservative bias to reported savings.

7.1.4 Gross Savings Verification

Gross energy and demand savings shall be verified by an independent third party M&V consultant for a representative sample of projects through the following activities:

1. Site inspections to confirm installation and correct operation of equipment.
2. Power measurements taken pre- and post-project implementation to verify calculated savings.
3. Review of savings reports, as submitted to THESL by participant, for accuracy and completeness.

Uncertainty and Confidence Interval

It is intended that gross savings be verified to be within +/- 10% at a 90% confidence level[1].

Sampling Methodology

The third party M&V consultant will randomly select sample projects for verification. For each project selected, the M&V consultant will perform Baseline Period and Reporting Period power

[1] Recommended confidence level from OPA CDM Evaluation Protocols 7-A

measurements as described in Sections 7.1.2 and 7.1.3.

For each measurement, the difference between the Stated Value (as measured by the balancing consultant) and the Verified Value (as measured by the M&V consultant) will be divided by the Stated Value, giving a normalized percent difference for each measurement, as shown in Equation (1).

Normalized Difference (ND) = (Verified Value – Stated Value) / Stated Value (1)

Calculation of Uncertainty

The uncertainty will be calculated for the average ND of the measurements, μ, per Equation (2):

$$\mu = \hat{\mu} \pm \frac{c}{\sqrt{n}} \hat{\sigma} \qquad (2)$$

Where

$\hat{\mu}$ is the average ND of the sample data collected,

c is a parameter related to the level of confidence (90% in this case),

n is the sample size, and

$\hat{\sigma}$ is the standard deviation of the sample data collected.

The value of c is derived the probability density function of the t distribution and can be calculated with the TINV function in Microsoft Excel.

c = TINV (α, df)

Where

α = 1-0.90 (the confidence level)

df = n -1 (one less than the sample size)

The combined precision of the Baseline Period and Reporting Period measurements will determine the uncertainty in the savings for each project. The uncertainty in the savings (S) is calculated as the "root-sum-of-squares" of the uncertainty in the reporting period measurement (RPM) and the baseline period measurement (BPM) of each measurement, as shown in Equation (3).

$$\delta S = \sqrt{(\delta RPM)^2 + (\delta BPM)^2} \qquad (3)$$

Procedure

The M&V consultant will start by taking measurements at 3 randomly selected projects out of

the first 25 approved to proceed. Based on this data, the uncertainty will be calculated. The results of this calculation will determine if additional samples are required to achieve the required uncertainty of plus or minus 10% at a 90% confidence level.

The uncertainty will be recalculated following each further sample until the desired uncertainty is reached. If the desired uncertainty cannot be reached, the actual uncertainty obtained should be stated along with the gross savings results.

7.2 Net Energy and Demand Savings

Net energy and demand savings shall be determined by applying the calculated net-to-gross ratio to the gross energy and demand savings as described below.

Furthermore, net demand savings shall be adjusted to estimate the demand savings coincident with the System peak.

7.2.1 Net-to-Gross Ratio

As described in the OPA CDM Cost Effectiveness Guide,

> *The net-to-gross ratio is an adjustment factor that determines the resource savings, benefits and costs that are attributable to a CDM Program.*
>
> *The net-to-gross ratio may reflect one or more of the following elements (where applicable):*
>
> - ***Free ridership rate:*** *Percentage of participants that would have implemented a CDM measure even without the CDM Program;*
> - ***Installation rate:*** *Percentage of participants who install a CDM measure and keep it installed for its effective useful life (without removing the CDM measure prematurely);*
> - ***Rebound effect:*** *Increased energy use before or after a period in which resource savings occur as a result of implementing a CDM measure; and,*
> - ***Spillover:*** *Actions taken by consumers to implement CDM measures because they are influenced by a CDM Program, but do not actually participate in that CDM Program (i.e., the opposite of free ridership).*
>
> *Transmission and distribution losses should not be included as a component of the net-to-gross ratio. Line losses are discussed further in Section 4.7.*
>
> *The net-to-gross ratio can be applied at the measure-level or at the program-level. It is not necessary to apply each element of the net-to-gross ratio to measures or programs since they are not always relevant depending on the particular measure or program. In addition, the net-to-gross ratio is dependent on program design, so it may not be*

appropriate to assign the same net-to-gross ratio to each CDM measure or program.[2]

For the purposes of the Program, free ridership is the only element that need be considered in calculating the net-to-gross ratio. Installation rate, rebound effect, and spillover are assumed to be negligible.

A default free ridership rate of 30%[3] shall be applied at the program level, unless compelling evidence is found to suggest that a different factor should be used.

7.3 Program Cost Effectiveness

Program cost effectiveness shall be evaluated based on Total Resource Cost (TRC) and Program Administrator Cost (PAC) metrics per the OPA CDM Cost Effectiveness Guide.

7.3.1 Components of Cost Effectiveness Metrics

The following items are the applicable components of the cost effectiveness metrics, as described in the OPA CDM Cost Effectiveness Guide, Section 2:

- ***Avoided Supply Costs:*** *the avoided energy costs, avoided generation capacity costs, avoided transmission capacity costs and avoided distribution capacity costs associated with the implementation of CDM Programs. For the TRC Test only, avoided energy costs include avoided costs associated with natural gas, water, fuel oil and propane savings, where applicable. Avoided supply costs accrue for as long as resource savings achieved by CDM Programs persist.*
- ***Incentive Costs:*** *costs that may include cash incentives, in-kind contributions and/or tax benefits that the program-sponsoring institution provides to participating customers to encourage the implementation of a CDM measure.*
- ***Incremental Equipment Costs:*** *the capital, operating and maintenance ("O&M"), and/or fuel costs incurred by a participating customer to implement a CDM measure. Depending on the nature of the CDM measure, this type of cost can be either the cost difference between a CDM measure and a base measure, or the full cost of a CDM measure. For example, in the case of an energy efficient appliance being purchased instead of a standard model, the cost differential between the two options would be the incremental equipment cost. However, in the case of residential attic insulation, the full cost of the insulation would be accounted for as the incremental equipment cost since the base measure is not insulating the attic (which is not associated with a cost). Incremental equipment costs may be incurred throughout the lifetime of a CDM measure. For example, O&M costs may be incurred on a regular basis during a CDM measure's lifetime.*
- ***Program Costs:*** *the costs related to program design, implementation, marketing, EM&V*

[2] Ontario Power Authority. (2010) *OPA Conservation and Demand Management Cost Effectiveness Guide*.
[3] Default free-rider factor for custom projects as noted in OEB Decision and Order, EB-2007-0096 (Page 9).

and administration, including fixed overhead costs. Program costs may be incurred at the program-level or at the portfolio-level. Incentive costs are not a component of program costs.[2]

For the purposes of the Program, incentive costs shall include payments to participants for both the assessment and implementation phases of a project.

Incremental equipment costs shall include all costs incurred by the customer for impeller trimming or the purchase and installation of VSDs on affected pumps, but shall exclude the costs of other upgrades to existing pumps or the cost of new pumps, outside of the scope of the Program.

Note that all costs and savings should be calculated in net present value, taking into account estimated inflation rates.

7.3.2 Total Resource Cost (TRC) Test

A TRC test shall be performed as part of the cost effectiveness analysis of the Program, as described in the OPA CDM Cost Effectiveness Guide, Section 2.2.1.

The TRC Test measures benefits and costs from a societal perspective. This test is described by the following equation:

TRC Test Net Benefit = Avoided Supply Cost – (Incremental Equipment Cost + Program Cost)

For the TRC Test only, avoided supply costs include avoided energy costs associated with natural gas, water, fuel oil and propane savings, where applicable.

Incentive costs are a transfer from a program-sponsoring organization to participating customers, and consequently do not impact the net benefit from a societal perspective.[2]

7.3.3 Program Administrator Cost (PAC) Test

A PAC test shall be performed as part of the cost effectiveness analysis of the HSBP, as described in the OPA CDM Cost Effectiveness Guide, Section 2.2.2.

The PAC Test measures benefits and costs from the perspective of a program administrator. This test is described by the following equation:

PAC Test Net Benefit = Avoided Supply Cost – (Incentive Cost + Program Cost)

For the PAC Test, avoided energy costs only include avoided costs associated with the electricity system.[2]

7.4 Program Delivery (Marketing/Sales) Effectiveness

The effectiveness of marketing and sales activities shall be established based on the following key metrics:

1. Number of qualified customers engaged through direct or indirect marketing (as a percentage of total market size)
2. Number of qualified customers enrolled in the Program as a result of direct or indirect marketing (as a percentage of total market size)

Results shall be disaggregated based on the Program's primary and secondary target markets for both the site assessment and implementation phases as follows:

Primary Target Market

- Facilities and Building Managers
- Chief Building Operators
- Hydronic Systems Balancing Companies
- Mechanical Engineering Consultants and Designers

Secondary Market

- Commercial, institutional and hospitality trade associations, pump manufacturers, distributors, and maintenance vendors

7.5 Program Administration and Governance Effectiveness

Program Administration and Governance shall be evaluated based on the following criteria as per OPA Evaluation Protocol 5-A:

- ***Program Design -*** *an assessment of program design and theory;*
- ***Program Administration*** *- an assessment of program administration including identification of staffing requirements and training needs, and review of program tracking systems;*
- ***Program Implementation and Delivery*** *– an assessment of program implementation and delivery including identifying process issues, assessing program targeting and marketing efforts, and quality control methods;*
- ***Market Feedback*** *– an assessment of market satisfaction with program elements and identification of market effects (intended and unintended)*[4]

[4] OPA CDM Evaluation Protocols 5-A

8.0 DATA COLLECTION RESPONSIBILITIES TO SUPPORT PROGRAM EVALUATION

Data collection will be completed with the assistance of a third-party certified EM&V consultant to ensure complete and appropriate collection of data to support Program evaluation. Data collection required shall include but not be limited to the following:

As applicable for each participant / perspective participant:

1. Opportunity assessment prepared by assessment contractor during Assessment Stage
2. Opportunity report prepared by assessment contractor during Initial Balancing Stage
3. Post implementation report prepared by assessment contractor during Post-implementation Stage

Enrollment rates resulting from marketing activities such as:

1. Customers contacted via phone, email, direct mail
2. Customers engaged by key account managers
3. Customers engaged through channel partners
4. Incoming enquiries
5. Website and other marketing materials

Costs required for program cost effectiveness tests, to be performed per the OPA CDM Cost Effectiveness Guide, as described in Section 7.3:

1. Avoided supply costs
2. Incentive costs
3. Incremental equipment costs
4. Program costs

Participant satisfaction information: Participant satisfaction survey results

9.0 EVALUATION SCHEDULE AND BUDGET

The schedule will be established by the Third-Party certified EM&V consultant in conjunction with THESL.

Deliverable	Delivery Timeline
Draft Evaluation Plan	Included in program application
Final Program Evaluation Plan	Prior to program start
Annual Reports	Following each year of program operation
Final Report	Following conclusion of program in 2014

The budget for EM&V activities is estimated at $25,000 / year for four years.

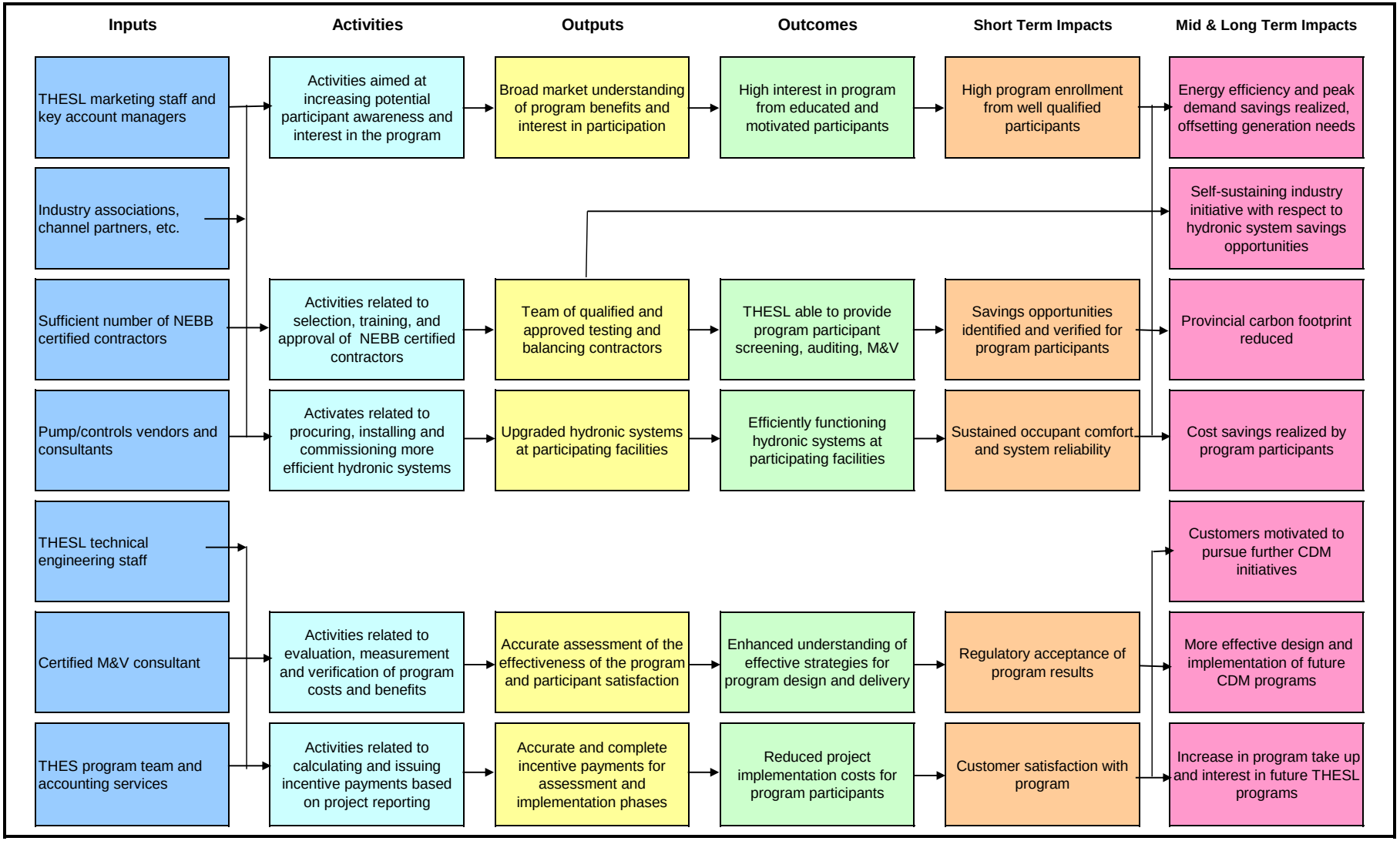
10.0 EVALUATION TEAM

A third-party certified EM&V consultant team, with support from THESL CDM personnel, shall be responsible for Evaluation of the Program.

APPENDIX A PROGRAM LOGIC MODEL

ENERGY PROFILES LIMITED

HSBP Program Logic Model



ENERGY PROFILES LIMITED

Draft Evaluation Plan:

Multi-Unit Residential Building Demand Response ("MURB DR")

Prepared for Toronto Hydro-Electric System Limited

April 2011

Table of Contents

1.0 INTRODUCTION

Energy Profiles Limited has prepared this report at the request of Toronto Hydro-Electric System Limited (THESL). The intent of the report is to provide a clear basis on which to evaluate the success of the proposed Multi-Unit Residential Building Demand Response Program (MURB DR), and to fulfill the OPA EM&V Protocol requirements for a "Draft Evaluation Plan".

2.0 PROGRAM DESCRIPTION

2.1 Description

The MURB DR program is modeled after the OPAs' peaksaver® program. The program is targeted at the multi-residential sector (both individually and bulk-metered buildings) and is designed to allow cooling units in the common areas and owner / tenant suites to have their temperature set points increased to reduce the total centralized cooling load in the facility. Non-essential loads in the common areas will also be turned off during system peak load events. The reduction in these loads will also reduce the facilities electricity demand. This will include an intensive sales/marketing effort coupled with vendor selection and program roll-out.

2.2 Program Theory

The program is designed to reduce the summer peak demand load attributable to the MURB sector. The MURB sector is a significant contributor to the peak summer demand and is one of the sectors that are experiencing electrical load growth in the THESL service territory. The table below shows the significance of this sector.

Sector	Total Sector Demand (MW)	Total Sector Consumption (GWh)	Estimated Cooling Demand	Estimated Cooling Consumption
Rental	188	1,035	63.7	200.9
Condos - Sub-metered	41	238	14.1	48
Condos - Non Sub-metered	371	2,128	125.7	412.9
MURB Total	**600**	**3,401**	**203.5**	**661.8**
THESL Total	4,592	24,049	944.9	2,540.30
Percent of Total	**13%**	**14%**	**22%**	**26%**

This load will not be adequately addressed under the OPA-Contracted Province-Wide programs for the following reasons:

- Condominiums are predominantly cooled via a central chiller plant. Reducing the peak summer demand of the facilities would require upgrading the efficiency of the chiller and ancillary equipment. However, these changes have already occurred over the last five years to comply with the requirement to phase out CFC chillers. This leaves little scope to impact the cooling demand via the traditional retrofit approach.
- The *peaksaver*® program is geared towards single family residences and is not designed to impact the MURB sector with central equipment plants.

This program is a means of dealing with a large portion of the summer peak cooling load that will not otherwise be addressed by the OPA-Contracted Province-Wide programs.

2.3 Key Program Elements

2.3.1 Program Details

The MURB DR program will permit the cooling and non-essential loads in the facility to be reduced during periods when electricity demand needs to be decreased to alleviate the electricity grid load. To achieve this, participating condominiums will have a wireless network setup within their building to communicate and activate load control devices and Programmable Communicating Thermostats (PCT) installed within the condominium units. Activation will occur automatically based on signals provided by THESL during a Load Control Event (LCE) and in response the system will control the cooling loads in the common areas and the suites. Non-essential loads in common areas will also be turned off.

The typical common area elements that will be controlled include: corridor pressurization fans, recreational area cooling units and other discretionary loads. In-suite loads will be controlled using a PCT that will control air-conditioning output from a fan coil or heat pump. The PCT will come preprogrammed with a specific profile, as identified from the signup package, for typical occupancy patterns (i.e. unoccupied during weekdays). The owner/occupant will also be able to manually modify or override these initial settings on a limited basis. The PCT will then respond to load reduction signals and increase the set points in the controlled space to reduce or eliminate the cooling load. This will occur based on IESO/ peaksaver® activation protocols as per Section 5.4.1 for the duration of the event after which the set points will transition to the original settings.

The occupant may also override the activation; however, this will be recorded and the activation fees will be reduced accordingly. A web-based service will track the activations and record all of the overrides that have occurred during the activation season. This information will be used to calculate incentives that will flow back to the condominium corporation and individual suite owners.

The system will be installed on a turn-key basis by a vendor that will be selected via an RFP process, on behalf of THESL or in conjunction with other utilities. The vendor will maintain the customer interface, provide maintenance/support services and training.

2.3.2 Program Incentives

Incentives for participation in the program will be applicable for both suite owners as well as the Condominium Corporation.

1) <u>Ownership: Suite Level</u>

The suite owner will receive $50 on sign-up and $25 per year afterwards for participating in the program. The $25 fee will be prorated based on the percentage of events participated in during the course of the year. In the case of the THESL suite metered sites this will be applied as a

billing credit. In the case of non-THESL suite metered sites, THESL will work with the existing service provider to a reasonable settlement methodology and provide settlement for the suite owner. For bulk-metered condominiums the incentive will be paid to the Condominium Corporation or owner for distribution.

2) Ownership: Condominium Corporation or Other Entity

The condominium corporation or owner will receive $50 on sign-up for each participating suite and $25 per year afterwards for each suite that participates in the program. The $25 fee will be prorated based on the percentage of LCEs participated in during the course of the year.

For common area loads the incentive will be $50 for every 5kW controlled with annual $25 fees for every 5 kW of load controlled in subsequent years. Controlled load will be based on nameplate ratings.

2.3.3 Program Scope

1. Calibration Stage

    a) THESL will install the Demand Response system at two (2) selected sites to calibrate and refine the delivery model using early customer response to the technology.

2. RFP Stage

    a) THESL will issue an RFP for the turn-key provision of demand response software, load control devices and PCT supply and installation. The selected vendor will also provide a web interface, training and maintenance/support services.

    b) The selected vendor will evaluate and apply required modifications to system controls and operation.

3. Pre-Application Stage

    a) In a joint venture with the selected vendor, THESL will communicate and market the program to the target customer group.

4. Application Stage

    a) THESL will continue in its efforts to communicate and market the program to the target customer group.

    b) Customer applications will be accepted and reviewed to ensure that the sites meet the eligibility criteria for the program.

5. Full Scale Implementation Stage

    a) THESL will manage third party program vendor/service providers.

    b) Service providers will offer installations, PCT education, service calls and technical support to the program participants.

    c) THESL will provide vendor with customer enrolment data.

6. Operational Stage (Load Control Events)

    a) Demand reduction events will be induced within enrolled participant base though vendor-managed web-based control interface.

    b) Records of program participants' compliance with demand reduction efforts during load control events will be maintained based on the participants' override of the demand response activation.

7. Post-Implementation Stage

    a) THESL will verify demand reduction results based on aggregate interval data from participating customers.

    b) Incentives will be processed according to each participating customer's history of compliance with demand response during load control events.

    c) THESL will manage the third party program evaluation process.

2.4 Goals and Objectives

The objective of this program is to:

- Achieve sufficient market penetration in the MURB sector to reduce the net peak summer electricity demand by 11.7 MW and save 467 MWh in cumulative energy savings.
- Provide condominium owners and corporations with a tool to reduce the electricity and natural gas consumption thereby reducing their monthly maintenance fees.
- Promote a culture of conservation in a market that has little opportunity for conventional energy efficiency measures at the suite level.
- Help to reduce the need to build expensive "peaking" electricity generating plants that operate only a few hours during peak demand days.

2.5 Program Logic Model

See Appendix A for Program Logic Model.

2.6 Program Timing

The program will run from when approval is granted until December 31, 2014.

2.7 Estimated Participation and Results

In THESL'S service area the Peaksaver® program managed to sign-up 60,000 customers out of an eligible customer base of 200,000 for a penetration rate of almost 30% in the residential single family segment of the program.

Based on the similarity of the program design elements and the penetration rates achieved with peaksaver®, and the provision of a higher incentive rate than that paid to customers participating in the peaksaver® program, a 40% participation rate is expected for the individual suites in each participating condominium.

Facilities can participate with or without individual suite participation provided they can meet the conditions outlined in Section 5. Based on THESL's experience in the existing sub metering marketplace, the expected penetration rate in bulk-metered condominiums is only expected to be half of that occurring in sub-metered condominiums.

Sector	Buildings	Units	Building Penetration Rate (%)	Participating Buildings	Suite Penetration Rate (%)	Participating Suites
Rental	727	145,400	0%	0	0%	0
Condos - Sub-metered	200	30,800	30%	60	40%	3,696
Condos - Bulk-metered	1,056	162,624	15%	158	40%	9,757
Total	1,983	338,824	11%	218	3%	13,453

2.7.1 Projected MW and MWh Savings

1) Methodology

The demand and consumption savings are calculated using analysis of the sector cooling loads and using the penetration rates extrapolated for the projected market share. The energy savings are a function of assuming savings from 20 activation hours per year.

2) Savings Summary

The projected net electricity demand and consumption savings expected over the four year duration of the program are summarized in the table below. Evaluation, Measurement and Verification (EM&V) will determine actual results.

Year	# Participants	Projected MW Reduction	Projected MWH Savings	Cumulative MWH Savings
2011	2	0.1	2	2
2012	55	2.9	62	67
2013	76	4.1	87	218
2014	85	4.6	97	467
Total	218	11.7	248	467

Average kW redution/site	53.6
Average kWh reduction/site	1136

2.8 Budget

The 2011-2014 budgeting plan for the program is summarized in the following table:

Description	2011	2012	2013	2014	Total
Marginal Costs					
Fixed Costs					
Legal Cost	$52,500	$15,750	$15,750	$15,750	**$99,750**
Marketing	$147,525	$147,525	$110,644	$73,763	**$479,456**
Sales	$67,100	$134,200	$134,200	$67,100	**$402,599**
Program EMV	$0	$60,000	$60,000	$60,000	**$180,000**
Administrative Costs	$291	$7,284	$10,197	$11,363	**$29,135**
Operation Cost	$49,388	$59,182	$59,478	$38,460	**$206,507**
Total Fixed Costs	**$316,804**	**$423,940**	**$390,268**	**$266,435**	**$1,397,447**
Variable Costs					
Administrative Costs	$1,165	$29,135	$40,789	$45,450	**$116,539**
Operation Cost	$197,553	$236,727	$237,911	$153,839	**$826,030**
Vendor Cost	$150,670	$3,766,745	$5,307,076	$5,956,843	**$15,181,333**
Total Variable Costs	$349,389	$4,032,607	$5,585,776	$6,156,131	**$16,123,903**
Total Marginal Cost	$666,193	$4,456,547	$5,976,044	$6,422,566	**$17,521,350**
Total Allocable Cost	$17,448	$94,648	$125,139	$132,820	**$370,055**
Total Program Costs	$683,641	$4,551,195	$6,101,183	$6,555,386	**$17,891,405**
Total Incentives	$20,180	$353,905	$672,420	$976,779	**$2,023,285**
Total Budget	$703,821	$4,905,100	$6,773,604	$7,532,165	**$19,914,690**

3.0 CONSERVATION MEASURES

The MURB DR program promotes demand reduction and energy efficiency during peak demand days in the cooling season.

4.0 EVALUATION GOALS AND OBJECTIVES

The objectives of this program evaluation are to determine the following:

1. The achieved program gross peak demand (MW) and energy savings (MWh) reductions
2. The net program peak demand reductions and energy savings in consideration of the freeridership and other contributing elements
3. The net cost per MW and MWh of savings
4. The actual TRC and PAC results based on the achieved savings
5. The effectiveness of the program delivery in terms of marketing/sales activities in signing up participants
6. The effectiveness of the program administration and governance

5.0 EVALUATION DELIVERABLES

The following documents shall be delivered over the course of program implementation:

1. Draft Evaluation Plan
2. Final Evaluation Plan
3. Annual Report
4. Final Report

6.0 EVALUATION DESCRIPTION

Program evaluation will be carried out by a certified independent third-party EM&V Professional based on the OPA EM&V Protocol.

The key component of the program is determining the effectiveness of the LCE's on system demand in a timely fashion. This will be determined by using the aggregate interval data for the participating customers. The centralized web software will upload this data and provide the comparison between the normalized baseline consumption, using industry best practices, versus the actual consumption throughout the LCE. This will provide a more up to date picture of the actual impact of the program rather than waiting several months for the formal evaluation of results. This feedback will be used to determine if the program has to be modified to meet the savings targets.

To ensure that the analysis being completed is in line with the IESO methodology and the overall program OPA EM&V Protocol, the third party evaluator will be involved in reviewing and approving the protocols used for monitoring demand reductions.

Overall, program evaluation will focus on the following areas to assess the cost-effective delivery of the Program:

- The achieved program gross peak demand (MW) and energy savings (MWh) reductions
- The net program peak demand reductions and energy savings in consideration of the freeridership and other contributing elements
- The net cost per MW and MWh of savings
- The actual TRC and PAC results based on the achieved savings
- The effectiveness of the program delivery in terms of marketing/sales activities in signing up participants
- The effectiveness of the program administration and governance

Program evaluation will be end-to-end, from program design, through delivery, to the final financial settlement of each project completed.

7.0 EVALUATION ELEMENTS

7.1 Gross Energy and Demand Savings

Gross energy and demand savings shall be calculated as the average difference between actual energy and demand usage during an LCE and the calculated baseline energy and demand, as follows:

Energy/demand Savings = Average (baseline energy/demand) – Average (actual energy/demand)

7.1.1 LCE Energy and Demand Measurement

Actual energy and demand measurements shall be obtained from the 15 minute interval data from the building and/or suite level THESL billing meters.

7.1.2 Baseline Usage Determination

It is impossible to directly measure how much energy would have been used during an LCE had the event not occurred. Therefore, an adjusted baseline must be calculated to calculate the savings from a demand response activation.

There is no accepted standard for developing a residential demand response baseline, and baseline methodologies vary widely between programs throughout North America based on program design and objectives.

The baseline for the MURB DR program shall be developed in conjunction with the third-party M&V evaluator, and shall be in keeping with guidance from Lawrence Berkeley National Laboratory:

> *A good demand response estimation method should meet the criteria of simple implementation, accuracy, and usefulness:*
>
> - *Is the method easy to implement? A method is undesirable if it requires extensive training requirement and is time-consuming to apply.*
> - *Are the results accurate? Under- or over-estimating a program's kW savings leads to under- or over-statement of the program's demand response value. Hence, accuracy is an overarching goal of any demand response estimation method.*
> - *Are the results useful? Transparency facilitates third-party review and validation. A black-box approach is undesirable because it invites skepticism, diminishing a demand response program's acceptance by various stakeholders (e.g., ratepayers, utilities and regulators).*[1]

Nominally, a regression-based load comparison approach will be used to develop the baseline, as recommended by Lawrence Berkeley National Laboratory.[1]

[1] Lawrence Berkeley National Laboratory, "Residential Demand Response Evaluation: A Scoping Stuy", June 2006.

Uncertainty resulting from the selection of baseline methodology shall be incorporated into the net savings in the form of a freeridership rate.

7.1.3 Gross Savings Verification

Gross energy and demand savings shall be verified by an independent third party M&V consultant for a representative sample of participating facilities through the following activities:

1. Site inspections to confirm installation and correct operation of demand response technology.
2. Independent application of the gross savings calculation.

Uncertainty

Gross savings shall be verified to achieve overall uncertainty of +/- 10% at a 90% confidence level[2].

Sampling Methodology

The third party M&V consultant will randomly select sample projects for verification. For each project selected, the M&V consultant will perform baseline and actual LCE measurement calculations as described in Sections 7.1.1 and 7.1.2.

For each measurement, the difference between the Stated Value (as calculated by THESL) and the Verified Value (as measured by the M&V consultant) will be divided by the Stated Value, giving a normalized percent difference for each measurement, as shown in Equation (1).

Normalized Difference (ND) = (Verified Value – Stated Value) / Stated Value (1)

Calculation of Precision

The uncertainty will be calculated for the average ND of the measurements, μ, per Equation (2):

$$\mu = \hat{\mu} \pm \frac{c}{\sqrt{n}} \hat{\sigma} \qquad (2)$$

Where

$\hat{\mu}$ is the average ND of the sample data collected,

c is a parameter related to the level of confidence (90% in this case),

n is the sample size, and

[2] Recommended confidence level from OPA CDM Evaluation Protocols 7-A

$\hat{\sigma}$ is the standard deviation of the sample data collected.

The value of c is derived the probability density function of the t distribution and can be calculated with the TINV function in Microsoft Excel.

c = TINV (α, df)

Where

α = 1-0.90 (the confidence level)

df = n -1 (one less than the sample size)

The combined precision of the baseline and actual LCE measurement will determine the uncertainty in the savings for each project. The uncertainty in the savings (S) is calculated as the "root-sum-of-squares" of the uncertainty in the actual LCE measurement (RPM) and the baseline measurement (BPM) of each measurement, as shown in Equation (3).

$$\delta S = \sqrt{(\delta RPM)^2 + (\delta BPM)^2} \qquad (3)$$

Procedure

The M&V consultant will start by taking measurements at 2 randomly selected projects out of the first 10 approved to proceed. Based on this data, the precision will be calculated. The results of this calculation will determine if additional samples are required to achieve the required precision of plus or minus 10% at a 90% confidence level.

The precision will be recalculated following each further sample until the desired precision is reached. If the desired precision cannot be reached, the actual precision obtained should be stated along with the gross savings results.

7.2 Net Energy and Demand Savings

Net energy and demand savings shall be determined by applying the calculated net-to-gross ratio to the gross energy and demand savings as described below.

Furthermore, net demand savings shall be adjusted to estimate the demand savings coincident with the System peak.

7.2.1 Net-to-Gross Ratio

As described in the OPA CDM Cost Effectiveness Guide,

> *The net-to-gross ratio is an adjustment factor that determines the resource savings, benefits and costs that are attributable to a CDM Program.*
>
> *The net-to-gross ratio may reflect one or more of the following elements (where*

applicable):

- ***Free ridership rate:*** *Percentage of participants that would have implemented a CDM measure even without the CDM Program;*
- ***Installation rate:*** *Percentage of participants who install a CDM measure and keep it installed for its effective useful life (without removing the CDM measure prematurely);*
- ***Rebound effect:*** *Increased energy use before or after a period in which resource savings occur as a result of implementing a CDM measure; and,*
- ***Spillover:*** *Actions taken by consumers to implement CDM measures because they are influenced by a CDM Program, but do not actually participate in that CDM Program (i.e., the opposite of free ridership).*

Transmission and distribution losses should not be included as a component of the net-to-gross ratio. Line losses are discussed further in Section 4.7.

The net-to-gross ratio can be applied at the measure-level or at the program-level. It is not necessary to apply each element of the net-to-gross ratio to measures or programs since they are not always relevant depending on the particular measure or program. In addition, the net-to-gross ratio is dependent on program design, so it may not be appropriate to assign the same net-to-gross ratio to each CDM measure or program.[3]

For the purposes of the Program, freeridership, installation rate and rebound effect are the only elements that need be considered in calculating the net-to-gross ratio. Spillover and installation rate are not applicable.

Freeridership Rate

For the MURB DR program, freeridership consists of individuals who would have adjusted their thermostats to reduce cooling energy even if they were not participating in the program. It is anticipated that their will be few individuals who fall into this category, but for the purposes of this document it has been assumed to be on the order of 10%.

Rebound Effect

Directly following an LCE, air conditioning equipment in participating facilities will ramp up to bring temperatures back down to normal operating conditions. This effect can be measured by extending the baseline calculation and actual load measurements to the hour directly following the LCE.

The rebound effect applies to energy savings only, as it is assumed that the hour following the LCE will not be coincident with the system load peak. (It could, however, set the building peak.)

[3] Ontario Power Authority. (2010) *OPA Conservation and Demand Management Cost Effectiveness Guide*.

7.3 Program Cost Effectiveness

Program cost effectiveness shall be evaluated based on Total Resource Cost (TRC) and Program Administrator Cost (PAC) metrics per the OPA CDM Cost Effectiveness Guide.

7.3.1 Components of Cost Effectiveness Metrics

The following items are the applicable components of the cost effectiveness metrics, as described in the OPA CDM Cost Effectiveness Guide, Section 2:

- ***Avoided Supply Costs:*** *the avoided energy costs, avoided generation capacity costs, avoided transmission capacity costs and avoided distribution capacity costs associated with the implementation of CDM Programs. For the TRC Test only, avoided energy costs include avoided costs associated with natural gas, water, fuel oil and propane savings, where applicable. Avoided supply costs accrue for as long as resource savings achieved by CDM Programs persist.*
- ***Incentive Costs:*** *costs that may include cash incentives, in-kind contributions and/or tax benefits that the program-sponsoring institution provides to participating customers to encourage the implementation of a CDM measure.*
- ***Incremental Equipment Costs:*** *the capital, operating and maintenance ("O&M"), and/or fuel costs incurred by a participating customer to implement a CDM measure. Depending on the nature of the CDM measure, this type of cost can be either the cost difference between a CDM measure and a base measure, or the full cost of a CDM measure. For example, in the case of an energy efficient appliance being purchased instead of a standard model, the cost differential between the two options would be the incremental equipment cost. However, in the case of residential attic insulation, the full cost of the insulation would be accounted for as the incremental equipment cost since the base measure is not insulating the attic (which is not associated with a cost). Incremental equipment costs may be incurred throughout the lifetime of a CDM measure. For example, O&M costs may be incurred on a regular basis during a CDM measure's lifetime.*
- ***Program Costs:*** *the costs related to program design, implementation, marketing, EM&V and administration, including fixed overhead costs. Program costs may be incurred at the program-level or at the portfolio-level. Incentive costs are not a component of program costs.*[3]

Note that all costs and savings should be calculated in net present value, taking into account estimated inflation rates.

7.3.2 Total Resource Cost (TRC) Test

A TRC test shall be performed as part of the cost effectiveness analysis of the Program, as described in the OPA CDM Cost Effectiveness Guide, Section 2.2.1.

The TRC Test measures benefits and costs from a societal perspective. This test is described by the following equation:

TRC Test Net Benefit = Avoided Supply Cost – (Incremental Equipment Cost + Program Cost)

For the TRC Test only, avoided supply costs include avoided energy costs associated with natural gas, water, fuel oil and propane savings, where applicable.

Incentive costs are a transfer from a program-sponsoring organization to participating customers, and consequently do not impact the net benefit from a societal perspective.[3]

7.3.3 Program Administrator Cost (PAC) Test

A PAC test shall be performed as part of the cost effectiveness analysis of the HSBP, as described in the OPA CDM Cost Effectiveness Guide, Section 2.2.2.

The PAC Test measures benefits and costs from the perspective of a program administrator. This test is described by the following equation:

PAC Test Net Benefit = Avoided Supply Cost – (Incentive Cost + Program Cost)

For the PAC Test, avoided energy costs only include avoided costs associated with the electricity system.[3]

7.4 Program Delivery (Marketing/Sales) Effectiveness

The effectiveness of marketing and sales activities shall be established based on the following key metrics:

1. Number of qualified customers engaged through direct or indirect marketing (as a percentage of total market size)
2. Number of qualified customers enrolled in the Program as a result of direct or indirect marketing (as a percentage of total market size)

Results shall be disaggregated based on the Program's target markets as follows:

<u>Main Target Sectors</u>

- Multi- Residential Condominium Buildings
- Multi- Residential Rental Buildings

<u>Primary Target Market</u>

- Condominium Corporations

- Condominium Owners
- Property Mangers
- Unit Owners
- Sub metering companies
- Industry Associations

Secondary Market

- Associations (ACMO, CCI, GTAA)
- Stakeholder groups

7.5 Program Administration and Governance Effectiveness

Program Administration and Governance shall be evaluated based on the following criteria as per OPA Evaluation Protocol 5-A:

- ***Program Design -*** *an assessment of program design and theory;*
- ***Program Administration*** *- an assessment of program administration including identification of staffing requirements and training needs, and review of program tracking systems;*
- ***Program Implementation and Delivery*** *– an assessment of program implementation and delivery including identifying process issues, assessing program targeting and marketing efforts, and quality control methods;*
- ***Market Feedback*** *– an assessment of market satisfaction with program elements and identification of market effects (intended and unintended)*[4]

[4] OPA CDM Evaluation Protocols 5-A

8.0 DATA COLLECTION RESPONSIBILITIES TO SUPPORT PROGRAM EVALUATION

Data collection will be completed with the assistance of a third-party certified EM&V consultant to ensure complete and appropriate collection of data to support Program evaluation. Data collection required shall include but not be limited to the following:

As applicable for each participant / perspective participant:

1. 15 minute interval metered data from THESL billing meters for participating buildings / suites for LCE periods as well as baseline calculation periods
2. Listing of individual suites participating at participating buildings
3. Listing of controlled common area load details at participating buildings
4. Hourly weather data for Toronto.

Enrollment rates resulting from marketing activities such as:

1. Customers contacted via phone, email, direct mail
2. Customers engaged by key account managers
3. Customers engaged through channel partners
4. Incoming enquiries
5. Website and other marketing materials

Costs required for program cost effectiveness tests, to be performed per the OPA CDM Cost Effectiveness Guide, as described in Section 7.3:

1. Avoided supply costs
2. Incentive costs
3. Incremental equipment costs
4. Program costs

Participant satisfaction information: Participant satisfaction survey results

9.0 EVALUATION SCHEDULE AND BUDGET

The schedule will be established by the Third-Party certified EM&V consultant in conjunction with THESL.

Deliverable	Delivery Timeline
Draft Evaluation Plan	Included in program application
Final Program Evaluation Plan	Prior to program start
Annual Reports	Following each year of program operation
Final Report	Following conclusion of program in 2014

The budget for EM&V activities is estimated at $60,000/year for the years 2012 – 2014, for a total of $180,000.

10.0 EVALUATION TEAM

A third-party certified EM&V consultant team, with support from THESL CDM personnel, shall be responsible for Evaluation of the Program.

APPENDIX A PROGRAM LOGIC MODEL

ENERGY PROFILES LIMITED

MURB DR Program Logic Model