RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 1:

Reference(s): **Exhibit 1A, Updated Evidence, Appendix A, Table of Revisions, page 1, to letter dated September 23, 2014 from Daliana Coban to OEB**

Please explain why the forecast 2015 Capital Investments have increased from $523.6 million to $539.6 million, an increase of $16.0 million, when the components of the total, mandated obligations, and safety have increased by only $2.8 million and $0.7 million (decrease), respectively.

RESPONSE:

Due to a formatting error, the table entitled "Capital Investments by Trigger Driver ($ Millions)" at page 1 of Appendix A to the Updated Evidence Cover letter, did not capture all the changes that were made to Exhibit 1A, Tab 2, Schedule 1, page 17, Table 2 (Filed: 2014 Jul 31, Corrected 2014 Sep 23). More specifically, it did not reflect that the System Maintenance and Capital Investment Support driver increased by $10.76 million and that the Capacity Constraints driver increased by $3.16 million as a result of the update. For greater clarity, below is the correct table that should have been filed at page 1 of Appendix A to the Updated Evidence Cover Letter:

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

1 **Capital Investments by Trigger Driver ($ Millions)**

Trigger Driver	2015	2016	2017	2018	2019
Failure Risk	~~156.9~~ 156.91	~~130.3~~ 130.31	~~134.9~~ 134.93	~~151.4~~ 151.42	~~156.8~~ 156.76
Functional Obsolescence	~~80.6~~ 80.61	~~105.5~~ 105.54	~~78.3~~ 78.31	~~75.1~~ 75.05	~~74.5~~ 74.54
Customer Service Requests / Third Party Requests	~~55.3~~ 55.31	~~71.7~~ 71.74	~~82.9~~ 82.94	~~76.6~~ 76.58	~~69.8~~ 69.77
System Maintenance & Capital Investment Support	~~69.5~~ 80.26	~~50.8~~ 52.14	~~32.3~~ 28.93	~~32.1~~ 32.13	~~27.9~~ 27.88
Capacity Constraints	~~51.2~~ 54.36	~~31.0~~ 30.95	~~37.1~~ 37.10	~~22.5~~ 22.50	~~44.4~~ 44.35
Failure	~~31.9~~ 31.90	~~32.7~~ 32.71	~~33.1~~ 33.11	~~33.6~~ 33.61	~~34.2~~ 34.18
Other	~~10.3~~ 10.28	~~19.9~~ 19.75	~~28.8~~ 28.65	~~38.3~~ 37.89	~~49.9~~ 49.37
Mandated Service Obligations	~~28~~ 30.82	~~20.6~~ 21.8	~~16.7~~ 17.99	~~12.9~~ 13.83	~~14.6~~ 15.69
Reliability	~~11~~ 10.97	~~9.4~~ 9.38	~~13.8~~ 13.83	~~13.8~~ 13.81	~~17.4~~ 17.36
System Efficiency	~~11.7~~ 11.68	~~16.2~~ 16.20	~~11.6~~ 11.58	~~13.2~~ 13.23	~~12.2~~ 12.24
Safety	~~17.2~~ 16.50	~~13.7~~ 13.73	0.0	0.0	0.0
Total Capital Expenditures	~~523.6~~ 539.61	~~501.7~~ 504.24	~~469.6~~ 467.36	~~469.4~~ 470.05	~~501.6~~ 502.16

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 2:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 4

"Toronto Hydro has been an efficient organization."

a) Please provide data which validates Toronto Hydro's claim that it is efficient, and shows the organizations relative to which Toronto Hydro has been efficient.
b) Please indicate what period of time Toronto Hydro has measured its efficiency relative to what it considers to be an appropriate peer group.
c) Please provide a copy of Toronto Hydro's distribution licence.

RESPONSE:

a) Please see Exhibit 1B, Tab 2, Schedule 5, Appendix B, a report prepared by Power System Engineering Inc. ("PSE") *Econometric Benchmarking of Toronto Hydro's Historical and Projected Total Cost and Reliability Levels*.

b) The PSE study referenced in (a) covers a 2002-2019 timeframe. Toronto Hydro began exploring this approach to benchmarking its cost efficiency in 2012.

c) Toronto Hydro's distribution licence is provided as Appendix A.

Electricity Distribution Licence

ED-2002-0497

Toronto Hydro-Electric System Limited

Valid Until

October 16, 2023

Original signed by

_____
Jennifer Lea
Counsel, Special Projects
Ontario Energy Board
Date of Issuance: October 17, 2003
Date of Amendment: November 12, 2010
Date of Amendment: February, 22, 2012

Ontario Energy Board
P.O. Box 2319
2300 Yonge Street
27th. Floor
Toronto, ON M4P 1E4

Commission de l'énergie de l'Ontario
C.P. 2319
2300, rue Yonge
27e étage
Toronto ON M4P 1E4

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1 Definitions

In this Licence:

"**Accounting Procedures Handbook**" means the handbook, approved by the Board which specifies the accounting records, accounting principles and accounting separation standards to be followed by the Licensee;

"**Act**" means the *Ontario Energy Board Act, 1998*, S.O. 1998, c. 15, Schedule B;

"**Affiliate Relationships Code for Electricity Distributors and Transmitters**" means the code, approved by the Board which, among other things, establishes the standards and conditions for the interaction between electricity distributors or transmitters and their respective affiliated companies;

"**distribution services**" means services related to the distribution of electricity and the services the Board has required distributors to carry out, including the sales of electricity to consumers under section 29 of the Act, for which a charge or rate has been established in the Rate Order;

"**Conservation and Demand Management**" and "**CDM**" means distribution activities and programs to reduce electricity consumption and peak provincial electricity demand;

"**Conservation and Demand Management Code for Electricity Distributors**" means the code approved by the Board which, among other things, establishes the rules and obligations surrounding Board approved programs to help distributors meet their CDM Targets;

"**Distribution System Code**" means the code approved by the Board which, among other things, establishes the obligations of the distributor with respect to the services and terms of service to be offered to customers and retailers and provides minimum, technical operating standards of distribution systems;

"**Electricity Act**" means the *Electricity Act, 1998*, S.O. 1998, c. 15, Schedule A;

"**Licensee**" means Toronto Hydro-Electric System Limited;

"**Market Rules**" means the rules made under section 32 of the Electricity Act;

"**Net Annual Peak Demand Energy Savings Target**" means the reduction in a distributor's peak electricity demand persisting at the end of the four-year period (i.e. December 31, 2014) that coincides with the provincial peak electricity demand that is associated with the implementation of CDM Programs;

"**Net Cumulative Energy Savings Target**" means the total amount of reduction in electricity consumption associated with the implementation of CDM Programs between 2011-2014;

"**OPA**" means the Ontario Power Authority;

"**Performance Standards**" means the performance targets for the distribution and connection activities of the Licensee as established by the Board in accordance with section 83 of the Act;

"**Provincial Brand**" means any mark or logo that the Province has used or is using, created or to be created by or on behalf of the Province, and which will be identified to the Board by the Ministry as a provincial mark or logo for its conservation programs;

"**Rate Order**" means an Order or Orders of the Board establishing rates the Licensee is permitted to charge;

"**regulation"** means a regulation made under the Act or the Electricity Act;

"**Retail Settlement Code**" means the code approved by the Board which, among other things, establishes a distributor's obligations and responsibilities associated with financial settlement among retailers and consumers and provides for tracking and facilitating consumer transfers among competitive retailers;

"**service area**" with respect to a distributor, means the area in which the distributor is authorized by its licence to distribute electricity;

"**Standard Supply Service Code**" means the code approved by the Board which, among other things, establishes the minimum conditions that a distributor must meet in carrying out its obligations to sell electricity under section 29 of the Electricity Act;

"**wholesaler**" means a person that purchases electricity or ancillary services in the IESO administered markets or directly from a generator or, a person who sells electricity or ancillary services through the IESO-administered markets or directly to another person other than a consumer.

2 Interpretation

2.1 In this Licence, words and phrases shall have the meaning ascribed to them in the Act or the Electricity Act. Words or phrases importing the singular shall include the plural and vice versa. Headings are for convenience only and shall not affect the interpretation of the Licence. Any reference to a document or a provision of a document includes an amendment or supplement to, or a replacement of, that document or that provision of that document. In the computation of time under this Licence, where there is a reference to a number of days between two events, they shall be counted by excluding the day on which the first event happens and including the day on which the second event happens and where the time for doing an act expires on a holiday, the act may be done on the next day that is not a holiday.

3 Authorization

3.1 The Licensee is authorized, under Part V of the Act and subject to the terms and conditions set out in this Licence:

a) to own and operate a distribution system in the service area described in Schedule 1 of this Licence;

b) to retail electricity for the purposes of fulfilling its obligation under section 29 of the Electricity Act in the manner specified in Schedule 2 of this Licence; and

c) to act as a wholesaler for the purposes of fulfilling its obligations under the Retail Settlement Code or under section 29 of the Electricity Act.

4 Obligation to Comply with Legislation, Regulations and Market Rules

4.1 The Licensee shall comply with all applicable provisions of the Act and the Electricity Act and regulations under these Acts, except where the Licensee has been exempted from such compliance by regulation.

4.2 The Licensee shall comply with all applicable Market Rules.

5 Obligation to Comply with Codes

5.1 The Licensee shall at all times comply with the following Codes (collectively the "Codes") approved by the Board, except where the Licensee has been specifically exempted from such compliance by the Board. Any exemptions granted to the licensee are set out in Schedule 3 of this Licence. The following Codes apply to this Licence:

a) the Affiliate Relationships Code for Electricity Distributors and Transmitters;

b) the Distribution System Code;

c) the Retail Settlement Code; and

d) the Standard Supply Service Code.

5.2 The Licensee shall:

a) make a copy of the Codes available for inspection by members of the public at its head office and regional offices during normal business hours; and

b) provide a copy of the Codes to any person who requests it. The Licensee may impose a fair and reasonable charge for the cost of providing copies.

6 Obligation to Provide Non-discriminatory Access

6.1 The Licensee shall, upon the request of a consumer, generator or retailer, provide such consumer, generator or retailer with access to the Licensee's distribution system and shall convey electricity on behalf of such consumer, generator or retailer in accordance with the terms of this Licence.

7 Obligation to Connect

7.1 The Licensee shall connect a building to its distribution system if:

a) the building lies along any of the lines of the distributor's distribution system; and

b) the owner, occupant or other person in charge of the building requests the connection in writing.

7.2 The Licensee shall make an offer to connect a building to its distribution system if:

a) the building is within the Licensee's service area as described in Schedule 1; and

b) the owner, occupant or other person in charge of the building requests the connection in writing.

7.3 The terms of such connection or offer to connect shall be fair and reasonable and made in accordance with the Distribution System Code, and the Licensee's Rate Order as approved by the Board.

7.4 The Licensee shall not refuse to connect or refuse to make an offer to connect unless it is permitted to do so by the Act or a regulation or any Codes to which the Licensee is obligated to comply with as a condition of this Licence.

8 Obligation to Sell Electricity

8.1 The Licensee shall fulfill its obligation under section 29 of the Electricity Act to sell electricity in accordance with the requirements established in the Standard Supply Service Code, the Retail Settlement Code and the Licensee's Rate Order as approved by the Board.

9 Obligation to Maintain System Integrity

9.1 The Licensee shall maintain its distribution system in accordance with the standards established in the Distribution System Code and Market Rules, and have regard to any other recognized industry operating or planning standards adopted by the Board.

10 Market Power Mitigation Rebates

10.1 The Licensee shall comply with the pass through of Ontario Power Generation rebate conditions set out in Appendix A of this Licence.

11 Distribution Rates

11.1 The Licensee shall not charge for connection to the distribution system, the distribution of electricity or the retailing of electricity to meet its obligation under section 29 of the Electricity Act except in accordance with a Rate Order of the Board.

12 Separation of Business Activities

12.1 The Licensee shall keep financial records associated with distributing electricity separate from its financial records associated with transmitting electricity or other activities in accordance with the Accounting Procedures Handbook and as otherwise required by the Board.

13 Expansion of Distribution System

13.1 The Licensee shall not construct, expand or reinforce an electricity distribution system or make an interconnection except in accordance with the Act and Regulations, the Distribution System Code and applicable provisions of the Market Rules.

13.2 In order to ensure and maintain system integrity or reliable and adequate capacity and supply of electricity, the Board may order the Licensee to expand or reinforce its distribution system in accordance with Market Rules and the Distribution System Code, or in such a manner as the Board may determine.

14 Provision of Information to the Board

14.1 The Licensee shall maintain records of and provide, in the manner and form determined by the Board, such information as the Board may require from time to time.

14.2 Without limiting the generality of paragraph 14.1, the Licensee shall notify the Board of any material change in circumstances that adversely affects or is likely to adversely affect the business, operations or assets of the Licensee as soon as practicable, but in any event no more than twenty (20) days past the date upon which such change occurs.

15 Restrictions on Provision of Information

15.1 The Licensee shall not use information regarding a consumer, retailer, wholesaler or generator obtained for one purpose for any other purpose without the written consent of the consumer, retailer, wholesaler or generator.

15.2 The Licensee shall not disclose information regarding a consumer, retailer, wholesaler or generator to any other party without the written consent of the consumer, retailer, wholesaler or generator, except where such information is required to be disclosed:

a) to comply with any legislative or regulatory requirements, including the conditions of this Licence;

b) for billing, settlement or market operations purposes;

c) for law enforcement purposes; or

d) to a debt collection agency for the processing of past due accounts of the consumer, retailer, wholesaler or generator.

15.3 The Licensee may disclose information regarding consumers, retailers, wholesalers or generators where the information has been sufficiently aggregated such that their particular information cannot reasonably be identified.

15.4 The Licensee shall inform consumers, retailers, wholesalers and generators of the conditions under which their information may be released to a third party without their consent.

15.5 If the Licensee discloses information under this section, the Licensee shall ensure that the information provided will not be used for any other purpose except the purpose for which it was disclosed.

16 Customer Complaint and Dispute Resolution

16.1 The Licensee shall:

a) have a process for resolving disputes with customers that deals with disputes in a fair, reasonable and timely manner;

b) publish information which will make its customers aware of and help them to use its dispute resolution process;

c) make a copy of the dispute resolution process available for inspection by members of the public at each of the Licensee's premises during normal business hours;

d) give or send free of charge a copy of the process to any person who reasonably requests it; and

e) subscribe to and refer unresolved complaints to an independent third party complaints resolution service provider selected by the Board. This condition will become effective on a date to be determined by the Board. The Board will provide reasonable notice to the Licensee of the date this condition becomes effective.

17 Term of Licence

17.1 This Licence shall take effect on October 17, 2003 and expire on October 16, 2023. The term of this Licence may be extended by the Board.

18 Fees and Assessments

18.1 The Licensee shall pay all fees charged and amounts assessed by the Board.

19 Communication

19.1 The Licensee shall designate a person that will act as a primary contact with the Board on matters related to this Licence. The Licensee shall notify the Board promptly should the contact details change.

19.2 All official communication relating to this Licence shall be in writing.

19.3 All written communication is to be regarded as having been given by the sender and received by the addressee:

a) when delivered in person to the addressee by hand, by registered mail or by courier;

b) ten (10) business days after the date of posting if the communication is sent by regular mail; and

c) when received by facsimile transmission by the addressee, according to the sender's transmission report.

20 Copies of the Licence

20.1 The Licensee shall:

a) make a copy of this Licence available for inspection by members of the public at its head office and regional offices during normal business hours; and

b) provide a copy of this Licence to any person who requests it. The Licensee may impose a fair and reasonable charge for the cost of providing copies.

21 Conservation and Demand Management

21.1 The Licensee shall achieve reductions in electricity consumption and reductions in peak provincial electricity demand through the delivery of CDM programs. The Licensee shall meet its 2014 Net Annual Peak Demand Savings Target of 286.270 MW, and its 2011-2014 Net Cumulative Energy Savings Target of 1,303.990 GWh (collectively the "CDM Targets"), over a four-year period beginning January 1, 2011.

21.2 The Licensee shall meet its CDM Targets through:

a) the delivery of Board approved CDM Programs delivered in the Licensee's service area ("Board-Approved CDM Programs");

b) the delivery of CDM Programs that are made available by the OPA to distributors in the Licensee's service area under contract with the OPA ("OPA-Contracted Province-Wide CDM Programs"); or

c) a combination of a) and b).

21.3 The Licensee shall make its best efforts to deliver a mix of CDM Programs to all consumer types in the Licensee's service area.

21.4 The Licensee shall comply with the rules mandated by the Board's Conservation and Demand Management Code for Electricity Distributors.

21.5 The Licensee shall utilize the common Provincial brand, once available, with all Board-Approved CDM Programs, OPA-Contracted Province-Wide Programs, and in conjunction with or co-branded with the Licensee's own brand or marks.

SCHEDULE 1 DEFINITION OF DISTRIBUTION SERVICE AREA

This Schedule specifies the area in which the Licensee is authorized to distribute and sell electricity in accordance with paragraph 8.1 of this Licence.

1. The City of Toronto as of January 1, 1998.

SCHEDULE 2 PROVISION OF STANDARD SUPPLY SERVICE

This Schedule specifies the manner in which the Licensee is authorized to retail electricity for the purposes of fulfilling its obligation under section 29 of the Electricity Act.

The Licensee is authorized to retail electricity directly to consumers within its service area in accordance with paragraph 8.1 of this Licence, any applicable exemptions to this Licence, and at the rates set out in the Rate Orders.

SCHEDULE 3 LIST OF CODE EXEMPTIONS

This Schedule specifies any specific Code requirements from which the Licensee has been exempted.

1. The Licensee is exempt from the requirements of section 2.5.3 of the Standard Supply Service Code with respect to the price for small volume/residential consumers, subject to the Licensee offering an equal billing plan as described in its application for exemption from Fixed Reference Price, and meeting all other undertakings and material representations contained in the application and the materials filed in connection with it.

2. The Licensee is exempt from the requirements of section 2.4.26A, 2.6.5, and 4.2.2.4 of the Distribution System Code. These exemptions will expire December 17, 2012.

3. The Licensee is exempt from the requirements of section 7.7.1 of the Retail Settlement Code only with respect to the 10 day timeline to notify retailers and customers (whose accounts meet the criteria established in section 7.7.1) of a billing error. This exemption will expire December 17, 2012.

APPENDIX A

MARKET POWER MITIGATION REBATES

4. **Definitions and Interpretations**

In this Licence

"embedded distributor" means a distributor who is not a market participant and to whom a host distributor distributes electricity;

"embedded generator" means a generator who is not a market participant and whose generation facility is connected to a distribution system of a distributor, but does not include a generator who consumes more electricity than it generates;

"host distributor" means a distributor who is a market participant and who distributes electricity to another distributor who is not a market participant.

In this Licence, a reference to the payment of a rebate amount by the IESO includes interim payments made by the IESO.

5. **Information Given to IESO**

a Prior to the payment of a rebate amount by the IESO to a distributor, the distributor shall provide the IESO, in the form specified by the IESO and before the expiry of the period specified by the IESO, with information in respect of the volumes of electricity withdrawn by the distributor from the IESO-controlled grid during the rebate period and distributed by the distributor in the distributor's service area to:

i consumers served by a retailer where a service transaction request as defined in the Retail Settlement Code has been implemented; and

ii consumers other than consumers referred to in clause (i) who are not receiving the fixed price under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998.*

b Prior to the payment of a rebate amount by the IESO to a distributor which relates to electricity consumed in the service area of an embedded distributor, the embedded distributor shall provide the host distributor, in the form specified by the IESO and before the expiry of the period specified in the Retail Settlement Code, with the volumes of electricity distributed during the rebate period by the embedded distributor's host distributor to the embedded distributor net of any electricity distributed to the embedded distributor which is attributable to embedded generation and distributed by the embedded distributor in the embedded distributor's service area to:

i consumers served by a retailer where a service transaction request as defined in the Retail Settlement Code has been implemented; and

ii consumers other than consumers referred to in clause (i) who are not receiving the fixed price under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998*.

c Prior to the payment of a rebate amount by the IESO to a distributor which relates to electricity

consumed in the service area of an embedded distributor, the host distributor shall provide the IESO, in the form specified by the IESO and before the expiry of the period specified by the IESO, with the information provided to the host distributor by the embedded distributor in accordance with section 2.

The IESO may issue instructions or directions providing for any information to be given under this section. The IESO shall rely on the information provided to it by distributors and there shall be no opportunity to correct any such information or provide any additional information and all amounts paid shall be final and binding and not subject to any adjustment.

For the purposes of attributing electricity distributed to an embedded distributor to embedded generation, the volume of electricity distributed by a host distributor to an embedded distributor shall be deemed to consist of electricity withdrawn from the IESO-controlled grid or supplied to the host distributor by an embedded generator in the same proportion as the total volume of electricity withdrawn from the IESO-controlled grid by the distributor in the rebate period bears to the total volume of electricity supplied to the distributor by embedded generators during the rebate period.

3. Pass Through of Rebate

A distributor shall promptly pass through, with the next regular bill or settlement statement after the rebate amount is received, any rebate received from the IESO, together with interest at the Prime Rate, calculated and accrued daily, on such amount from the date of receipt, to:

a retailers who serve one or more consumers in the distributor's service area where a service transaction request as defined in the Retail Settlement Code has been implemented;

b consumers who are not receiving the fixed price under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998* and who are not served by a retailer where a service transaction request as defined in the Retail Settlement Code has been implemented; and

c embedded distributors to whom the distributor distributes electricity.

The amounts paid out to the recipients listed above shall be based on energy consumed and calculated in accordance with the rules set out in the Retail Settlement Code. These payments may be made by way of set off at the option of the distributor.

If requested in writing by OPGI, the distributor shall ensure that all rebates are identified as coming from OPGI in the following form on or with each applicable bill or settlement statement:

"ONTARIO POWER GENERATION INC. rebate"

Any rebate amount which cannot be distributed as provided above or which is returned by a retailer to the distributor in accordance with its licence shall be promptly returned to the host distributor or IESO as applicable, together with interest at the Prime Rate, calculated and accrued daily, on such amount from the date of receipt.

Nothing shall preclude an agreement whereby a consumer assigns the benefit of a rebate payment to a retailer or another party.

Pending pass-through or return to the IESO of any rebate received, the distributor shall hold the funds received in trust for the beneficiaries thereof in a segregated account.

ONTARIO POWER GENERATION INC. REBATES

For the payments that relate to the period from May 1, 2006 to April 30, 2009, the rules set out below shall apply.

1. Definitions and Interpretations

In this Licence

"embedded distributor" means a distributor who is not a market participant and to whom a host distributor distributes electricity;

"embedded generator" means a generator who is not a market participant and whose generation facility is connected to a distribution system of a distributor, but does not include a generator who consumes more electricity than it generates;

"host distributor" means a distributor who is a market participant and who distributes electricity to another distributor who is not a market participant.

In this Licence, a reference to the payment of a rebate amount by the IESO includes interim payments made by the IESO.

2. Information Given to IESO

a Prior to the payment of a rebate amount by the IESO to a distributor, the distributor shall provide the IESO, in the form specified by the IESO and before the expiry of the period specified by the IESO, with information in respect of the volumes of electricity withdrawn by the distributor from the IESO-controlled grid during the rebate period and distributed by the distributor in the distributor's service area to:

i consumers served by a retailer where a service transaction request as defined in the Retail Settlement Code has been implemented and the consumer is not receiving the prices established under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998*; and

ii consumers other than consumers referred to in clause (i) who are not receiving the fixed price under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998***.**

b Prior to the payment of a rebate amount by the IESO to a distributor which relates to electricity consumed in the service area of an embedded distributor, the embedded distributor shall provide the host distributor, in the form specified by the IESO and before the expiry of the period specified in the Retail Settlement Code, with the volumes of electricity distributed during the rebate period by the embedded distributor's host distributor to the embedded distributor net of any electricity distributed to the embedded distributor which is attributable to embedded generation and distributed by the embedded distributor in the embedded distributor's service area to:

i consumers served by a retailer where a service transaction request as defined in the Retail Settlement Code has been implemented; and

ii consumers other than consumers referred to in clause (i) who are not receiving the fixed price under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998*.

c Prior to the payment of a rebate amount by the IESO to a distributor which relates to electricity consumed in the service area of an embedded distributor, the host distributor shall provide the IESO, in the form specified by the IESO and before the expiry of the period specified by the IESO, with the information provided to the host distributor by the embedded distributor in accordance with section 2.

The IESO may issue instructions or directions providing for any information to be given under this section. The IESO shall rely on the information provided to it by distributors and there shall be no opportunity to correct any such information or provide any additional information and all amounts paid shall be final and binding and not subject to any adjustment.

For the purposes of attributing electricity distributed to an embedded distributor to embedded generation, the volume of electricity distributed by a host distributor to an embedded distributor shall be deemed to consist of electricity withdrawn from the IESO-controlled grid or supplied to the host distributor by an embedded generator in the same proportion as the total volume of electricity withdrawn from the IESO-controlled grid by the distributor in the rebate period bears to the total volume of electricity supplied to the distributor by embedded generators during the rebate period.

3. Pass Through of Rebate

A distributor shall promptly pass through, with the next regular bill or settlement statement after the rebate amount is received, any rebate received from the IESO, together with interest at the Prime Rate, calculated and accrued daily, on such amount from the date of receipt, to:

a retailers who serve one or more consumers in the distributor's service area where a service transaction request as defined in the Retail Settlement Code has been implemented and the consumer is not receiving the prices established under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998*;

b consumers who are not receiving the fixed price under sections 79.4, 79.5 and 79.16 of the *Ontario Energy Board Act, 1998* and who are not served by a retailer where a service transaction request as defined in the Retail Settlement Code has been implemented; and

c embedded distributors to whom the distributor distributes electricity.

The amounts paid out to the recipients listed above shall be based on energy consumed and calculated in accordance with the rules set out in the Retail Settlement Code. These payments may be made by way of set off at the option of the distributor.

If requested in writing by OPGI, the distributor shall ensure that all rebates are identified as coming from OPGI in the following form on or with each applicable bill or settlement statement:

"ONTARIO POWER GENERATION INC. rebate"

Any rebate amount which cannot be distributed as provided above or which is returned by a retailer to the distributor in accordance with its licence shall be promptly returned to the host distributor or IESO as applicable, together with interest at the Prime Rate, calculated and accrued daily, on such amount from the date of receipt.

Nothing shall preclude an agreement whereby a consumer assigns the benefit of a rebate payment to a retailer or another party.

Pending pass-through or return to the IESO of any rebate received, the distributor shall hold the funds received in trust for the beneficiaries thereof in a segregated account.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 3:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 7 of 30, line 14

Please discuss, in detail, the pressures from economics (system load) growth and capacity contracts from "the increased proliferation of distributed generation". Please provide both qualitative and quantitative analyses to explain those pressures, and their magnitude.

RESPONSE:

Please refer to Exhibit 2B, Section E5.5 for a Qualitative and Quantitative Analysis of the ongoing challenges from increased distributed generation and how Toronto Hydro intends to address them.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 4:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 7, lines 4-12

Does the percentage of assets described to be at the end of the useful lives by 2015 take into account of the replacement assets that have been installed in 2013, 2014 to date, and will be installed in 2015? Does the phrase by 2015, mean over by January 1, 2016 or December 31, 2014?

RESPONSE:

Toronto Hydro states that by 2015, 26% of assets will be operating beyond their useful lives. This statement takes into consideration assets that have been installed in 2013, as well as those planned to be installed during 2014. The reference to 'by 2015' refers to January 1, 2015.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 5:

Reference(s): **Exhibit 1A, Tab 2, Schedule 1, page 8, 2.3 Toronto Hydro Corporate Strategy**

"The utility's strategic vision is to continuously maximize customers' and stakeholders' satisfaction by operating in a safe, reliable and environmentally responsible manner at optimal costs. To realize this vision, Toronto Hydro employs a framework consisting of four strategic pillars:

1. *Customer Service: deliver value-for-money to Toronto Hydro's customers, including making it easier for them to work with the utility, helping them conserve energy and providing them with tools and technology;*
2. *Operations: improve reliability through optimal and sustainable system management, including keeping the system safe, building a grid that supports a modern city and maintaining productivity;*
3. *People: fully-engages, safe and healthy workforce, that meets the changing business environment; and*
4. *Financial Strength: meet financial objectives including obtaining a fair return.*
5. *These strategic pillars guide the establishment of the utility's goals and business plans, and focus the organization."*

Why does your Corporate Strategy not include Public Policy Responsiveness, which is one of the four Performance Outcomes described in the RRFE?

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

RESPONSE:

As discussed in further detail in Exhibit 1C, Tab 3, Schedule 1, Toronto Hydro's corporate pillars are aligned with the OEB's performance outcomes described in the Renewed Regulatory Framework for Electricity ("RRFE") report, among other things. In Toronto Hydro's view, public policy is a component of the legislative and regulatory environment in which LDCs operate. The utility's corporate pillars represent its strategic drivers, which are necessarily underpinned by the legislative and regulatory environment.

Toronto Hydro's track record demonstrates its commitment to public policy, as articulated in the OEB's RRFE. Examples include:

- Connecting 890 unique Distributed Generation ("DG") projects to the utility's system since 2009, which amounts to 110 MW of generation capacity made up of various technologies (See Exhibit 2B, Section E3).
- Planning for system upgrades and modifications required to integrate future DG resources into the system, such as eliminating short circuit constraints, enhancing generation control and monitoring capabilities etc (See Exhibit 2B, Section E3).
- Connecting 100% of eligible micro-generation projects and performing 100% of DG-related connection impact assessments within the prescribed timelines.
- Achieving 99.8% of the utility's net cumulative energy savings target and 32.7% of net peak demand savings target by the end of 2013 (See Toronto Hydro's Regulatory Scorecard and the response to Interrogatory 2B-EP-14 part (d)).

Toronto Hydro also notes that it developed its corporate pillars prior to the OEB's articulation of the RRFE performance outcomes in 2012.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 6:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 11

"Toronto Hydro assesses that since amalgamation in 1998, its productivity efforts have resulted in significant savings for ratepayers."

Please describe in detail each element of its productivity efforts since 1998 and the savings that result from each effort. To what extent have the savings persisted?

RESPONSE:

For a comprehensive description of Toronto Hydro's productivity initiatives and the associated benefits addressed by the reference, please see Exhibit 1B, Tab 2, Schedule 5, Appendix A, *Toronto Hydro-Electric-System Limited: Historic Performance and Productivity Initiatives from Amalgamation to Present*.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 7:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 13

Please provide copies of any climate change adaptation studies that Toronto Hydro has done.

RESPONSE:

Please refer to Appendix A to this response for a copy of the Toronto Hydro-Electric System Public Infrastructure Engineering Vulnerability Assessment Pilot Case Study, which was issued in June 2012.

AECOM Planning, Environment and Resources

Clean Air Partnership, in partnership with
Toronto Hydro-Electric System
Engineers Canada

Toronto Hydro-Electric System Public Infrastructure Engineering Vulnerability Assessment Pilot Case Study

Electrical Distribution Infrastructure

Interim Report, Revision 3

60263582

June 2012

Acknowledgements

AECOM would like to acknowledge the funding contributions of Natural Resources Canada and Engineers Canada which made this project possible. The Toronto region's WeatherWise Partnership is also acknowledged for its work on bringing the issue of climate related threats on electrical infrastructure to the forefront, and for its efforts in bringing about this study. AECOM would like to thank the Clean Air Partnership and Engineers Canada for the opportunity to undertake this study.

AECOM would also like to acknowledge Toronto Hydro-Electric System staff for their time and effort in gathering the necessary inputs and providing insight into the characteristics and functionality of their equipment. Without their valuable contributions, this study could not have proceeded.

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1 Introduction

1.1 Project Background

The Public Infrastructure Engineering Vulnerability Committee (*PIEVC) Engineering Protocol* (the Protocol) is a structured, documented methodology for infrastructure vulnerability assessment and adaptation to a changing climate. It is based on standard risk assessment designed to assist owners and operators of public infrastructure evaluate the risks posed by a changing climate to their infrastructure. The Protocol, currently in version 10, also allows users to evaluate the risks posed by current climate to the infrastructure as part of the overall risk assessment.

Electrical distribution infrastructure is a key asset in the delivery of electricity within Canada's cities. Electrical service is key in virtually countless ways, and vital to a city's socio-economic activities and environment, as well as the health, safety and well-being of its population. However, climate events, such as storms, wind, lightning and flooding, pose threats to the electrical systems and can cause disruptions to service. Furthermore, these threats are changing as a consequence of a changing climate. The need to understand the evolving nature of these threats, and to maintain robust and resilient electrical distribution systems, is clear.

Key stakeholders in the City of Toronto such as the WeatherWise Partnership have recognized the importance of the electrical sector and its vulnerability to a changing climate, and targeted it in 2011 as a priority area for further investigation. As part of this endeavour, Engineers Canada engaged the Clean Air Partnership to work with Toronto Hydro-Electrical System Limited (THESL) in order to **demonstrate the applicability of the Protocol on Toronto Hydro owned electrical distribution infrastructure** in the City of Toronto. THESL is Canada's largest municipal electrical distribution utility. It owns and operates the city's electrical distribution infrastructure system which supplies power to over 700,000 residential, commercial and industrial customers.

This application of the Protocol thus serves as an opportunity for THESL and other main stakeholders in the City of Toronto to better understand the threats posed by climate change on the electrical distribution system. This can lead to the identification of priority areas for further action and investment, thereby allowing THESL to better prioritize its response to climate related threats and continue to provide a safe, reliable supply of electricity to Canada's largest city.

1.2 Project Scope and Objective

The Protocol is composed of five key steps:

- Step 1 – Project Definition;
- Step 2 – Data Gathering and Sufficiency;
- Step 3 – Risk Assessment;
- Step 4 – Engineering Analysis;
- Step 5 – Recommendations and Conclusions.

To accommodate the budget and short time available to conduct this study, the scope of this Protocol case study was purposefully limited to the completion of Steps 1 to 3 of the Protocol, and only evaluates risks posed by current climate. Similarly, activities such as data gathering and analysis were prioritized to focus only on the elements that were necessary to complete the risk assessment workshop, a key step in demonstrating the applicability of the Protocol on electrical systems. The activities undertaken comprise a project referred to in the following report as the **pilot case study**, and represents a subset of the efforts that would normally be required as part of a full Protocol case study. Similarly, this report has been identified as an **interim report** because it represents a subset of the documentation that would normally be required in a full Protocol case study. Additional work required to complete a full Protocol case study is presented at the end of this interim report.

Thus, the objective of this pilot case study is to evaluate the vulnerability of selected THESL distribution infrastructure to current climate, using the Protocol, Steps 1 to 3, to structure the evaluation. The infrastructure components selected by THESL for this project are seven feeder systems from three sub-stations:

- Area A Station: Three 27.6 kV feeders: **A-1**, **A-2** and **A-3**;
- Area B Station: Two 13.8 kV feeders: **B-1**; **B-2**;
- Area C Station: Two 13.8 kV feeders: **C-1**; **C-2**.

The following elements, which are normally part of a full Protocol case study, were not completed as part of the pilot case study:

- Site visit;
- Collection and examination of condition assessments, maintenance records and practices, emergency planning procedures and practices;
- Application of the Protocol using changing climate data projections;
- Steps 4 and 5 of the Protocol;
- Completion of all Protocol worksheets: 1, 2, 4 and 5.

Nonetheless, the pilot case study's objective was still achieved in spite of these limitations, namely the lack of a site visit by AECOM or examination of infrastructure information as described above, due to the contributions, participation and expertise of Toronto Hydro staff throughout the pilot case study.

1.3 Project Team

For this pilot case study, the Clean Air Partnership acted as the contract administrator and client side project manager. CAP retained the services of AECOM Consulting to conduct the risk assessment on the identified THESL electrical distribution infrastructure. Risk Sciences International was retained to provide climate expertise and data on current climate. XTN Sustainable Life-cycle Asset Management Consulting was also retained as facilitator for the workshop that was held as part of this pilot case study.

The members of the project team involved in the completion of this pilot case study are presented in the following table.

Table 1.1 Project Team Members

Organization	Team Member	Role in Team
Clean Air Partnership	Eva Ligeti Kevin Behan Shazia Mirza	Client Side Project Manager Funding Partner
Engineers Canada	David Lapp	Funding Partner and National Vulnerability Assessment Coordinator
Toronto Hydro-Electric System Limited	Sheikh Nahyaan Joyce McLean Mary Byrne John Hecimovic	Infrastructure Owner
Toronto Environment Office	David MacLeod	Project Coordinator
City of Burlington	Sam Sidawi	Project Coordinator

AECOM Consulting	Chee F. Chan Chris Harabaras James Jorgensen	Consultant - Risk Analysis
Risk Sciences International	Heather Auld	Consultant - Climate Analysis
XTN Sustainable Life-cycle Asset Management Consulting	Brian Kyle	Consultant - Workshop Facilitator

2 Infrastructure

The following chapter provides an overview of the infrastructure that is being assessed in this pilot case study. The characteristics, function and geographical context of each infrastructure component are described.

Information about infrastructure components was obtained from the following documents:

- Toronto Hydro Environmental Impact Risk Assessment Study, Mar. 21, 2012;
- Toronto Hydro Distribution System Planning Guidelines, Nov. 28, 2007;
- Distribution Construction Standards – various components (1999 and older);
- Distribution Construction Standards – various components (2000 and newer);
- Overview of Toronto Area Transmission Grid and Distribution Systems, May 2010;
- Overview of Toronto Hydro Distribution Systems, May 2010;
- B-1 (2009), B-2 (2010), C-1(2011), C-2 (2008) Feeder prints;
- 13.8 kV Network System Summer Switching Restrictions Report, April 2010.

2.1 Feeder Systems

Toronto is supplied electricity from its transmission service provider, Hydro One Networks Inc., at two voltages: 230 kV in the areas around downtown Toronto and 115 kV in downtown Toronto. The 230 kV is a newer, high capacity system that supplies customers as well as connects portions of the larger network, including generating stations, together.

Power is delivered by two main 230 kV transmission paths to two transformer stations, Leaside and Manby, which step the voltage down from 230 kV to 115 kV for use in the downtown system. The southernmost point of the 115 kV system is connected to the Portlands Energy Centre, a 550 MW generating facility.

Figure 2.1 Hydro One Toronto Transmission Grid and Terminal Stations

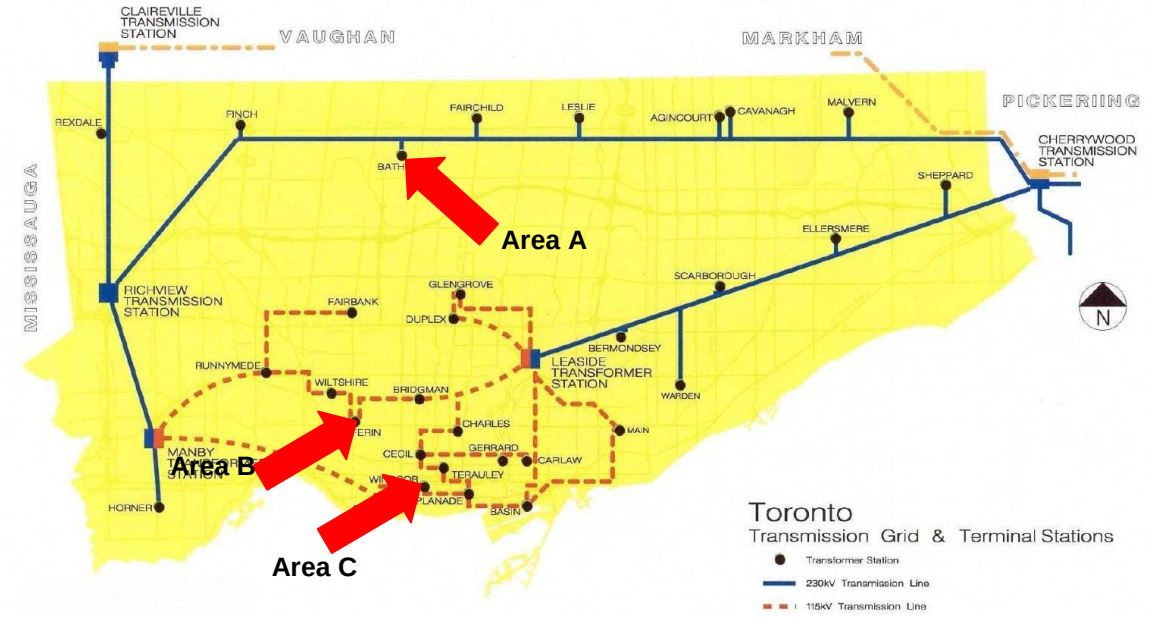


Image source: Toronto Hydro-Electric System

Seven feeders and their components from the Area A, Area B and Area C transformer stations were selected by THESL for this study (see figure 2.1). They were chosen because they are representative of the different types of equipment and electrical configurations that are used by THESL. The feeders are:

- Area A Station: Three 27.6 kV feeders: **A-1**, **A-2** and **A-3**;
- Area B Station: Two 13.8 kV feeders: **B-1**; **B-2**;
- Area C Station: Two 13.8 kV feeders: **C-1**; **C-2**.

For this study, feeders are assumed to operate normally. Loading criteria on any given feeder is generally limited to 400 Amps. Under emergency conditions, a feeder can be loaded as high as 600A although it cannot be maintained for long time durations without causing undue wear or damage to equipment. Ideally, feeders are loaded to 200 – 250 Amps. This operating guideline allows for the entire feeder's load to be transferred to a supporting feeder without causing failure of the latter if the former is taken off-line, either for maintenance or due to electrical fault problems[1].

2.1.1 Area A Station Feeders

The three 27.6 kV feeders from the Area A Station selected for this study are A-1, A-2 and A-3. These feeders serve suburban neighbourhoods in the north end of the City of Toronto.

The feeders are radial, open loop distribution systems with a mix of overhead and underground infrastructure. Feeders have open points (switches) between adjacent feeders that can supply power in the event of a fault on one feeder. Figure 2.2 presents a schematic of the three Area A feeders.

Figure 2.2 Schematic of Area A Feeders A-1, A-2 and A-3

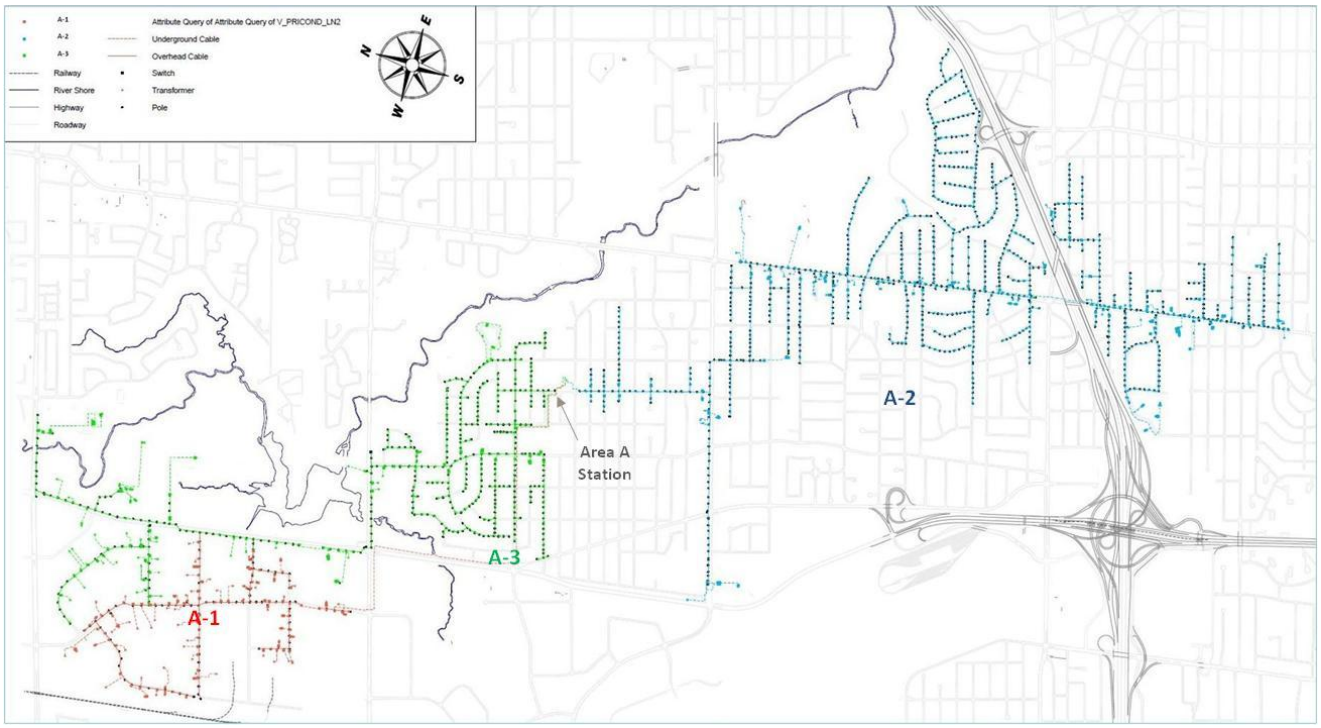


Image source: Toronto Hydro-Electric System

[1] The system is under 'first contingency' when a feeder is taken offline and its load is transferred to another feeder. As feeders are assumed to operate normally for the purposes of this study, first contingency condition is not part of the scope of this assessment.

Feeder A-2 primarily serves a residential neighbourhood to the south of Area A Station. This feeder supplies 3315 customers, including one key account (highest kW: 1256). This feeder is largely an overhead distribution system with a large proportion of equipment (~80%) mounted on poles.

Feeder A-3 serves residential neighbourhoods and an industrial sector to the northwest of Area A Station. This feeder supplies 490 customers, including one key account (highest kW: 2161). Like feeder A-2, feeder A-3 is largely an overhead distribution system with a greater proportion of equipment (~70%) mounted on poles than at grade or underground.

Feeder A-1 serves an industrial sector to the northwest of Area A Station. The main line of the feeder travels northwest of the Area A Station underground before transitioning approximately 3 km later to the overhead feeder system. This feeder supplies 1780 customers, including 3 key accounts who are industrial customers (highest kW: 1452). This feeder is made up of a greater proportion of below-grade equipment (~60%) than at grade or overhead.

2.1.2 Area B Station Feeders

The two 13.8 kV feeders from the Area B Station selected for this pilot case study are B-1 and B-2. These feeders are located in an inner city neighbourhood approximately 5 km to the northwest of downtown Toronto (see figure 2.3).

Figure 2.3 Schematic of Area B Feeders B-1 and B-2

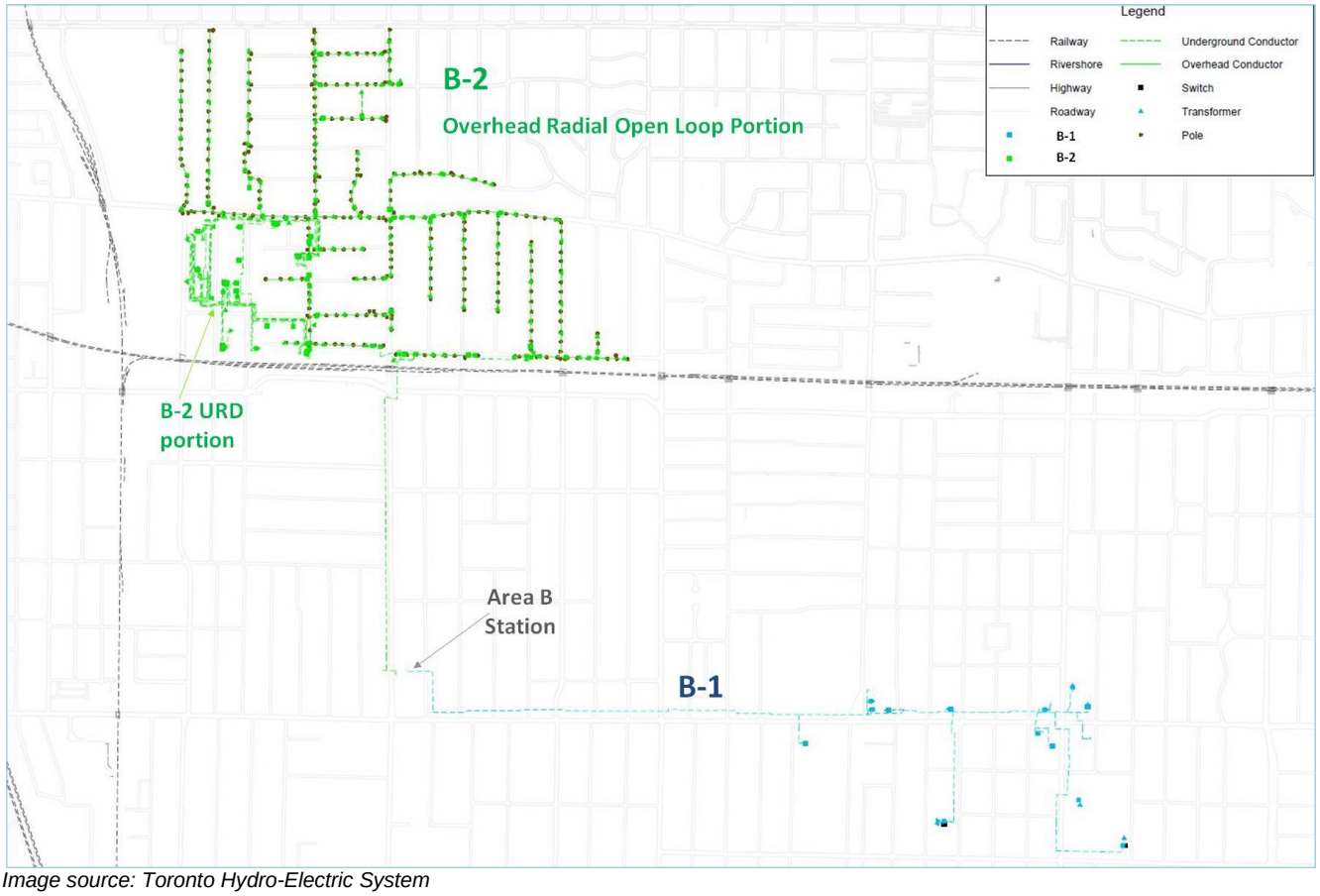


Image source: Toronto Hydro-Electric System

Feeder B-1 is a dual radial underground system that supplies five customers. It includes no key accounts. As a dual radial system, all customers on this feeder have 100% redundancy in their power supply, as this feeder is

backed up by feeder B-3 (not included in this pilot case study). Portions of the feeder also exhibit network reliability, as small spot networks exist around certain customers.

Feeder B-2 is composed of two types of systems, an overhead (OH) open loop distribution system that is similar in character to the Area A feeders, as well as an underground residential distribution system (URD). It supplies 2141 customers, which are generally inner city residential and commercial properties. There are no key accounts on this feeder.

2.1.3 Area C Station Feeders

The two 13.8 kV feeders from the Area C Station selected for this study are C-1 and C-2. These feeders run entirely underground and are located in downtown Toronto. They serve predominantly high-rise buildings (see figure 2.4).

Feeder C-1 is an underground dual radial system. All transformers and switches on this feeder are customer owned and are not within the scope of this pilot case study. THESL is responsible for the cable chambers and underground cables that supply power to customer locations. This feeder supplies 12 customers, including one key account (highest kW: 5745).

Figure 2.4 Schematic of Area C Feeders C-1 and C-2

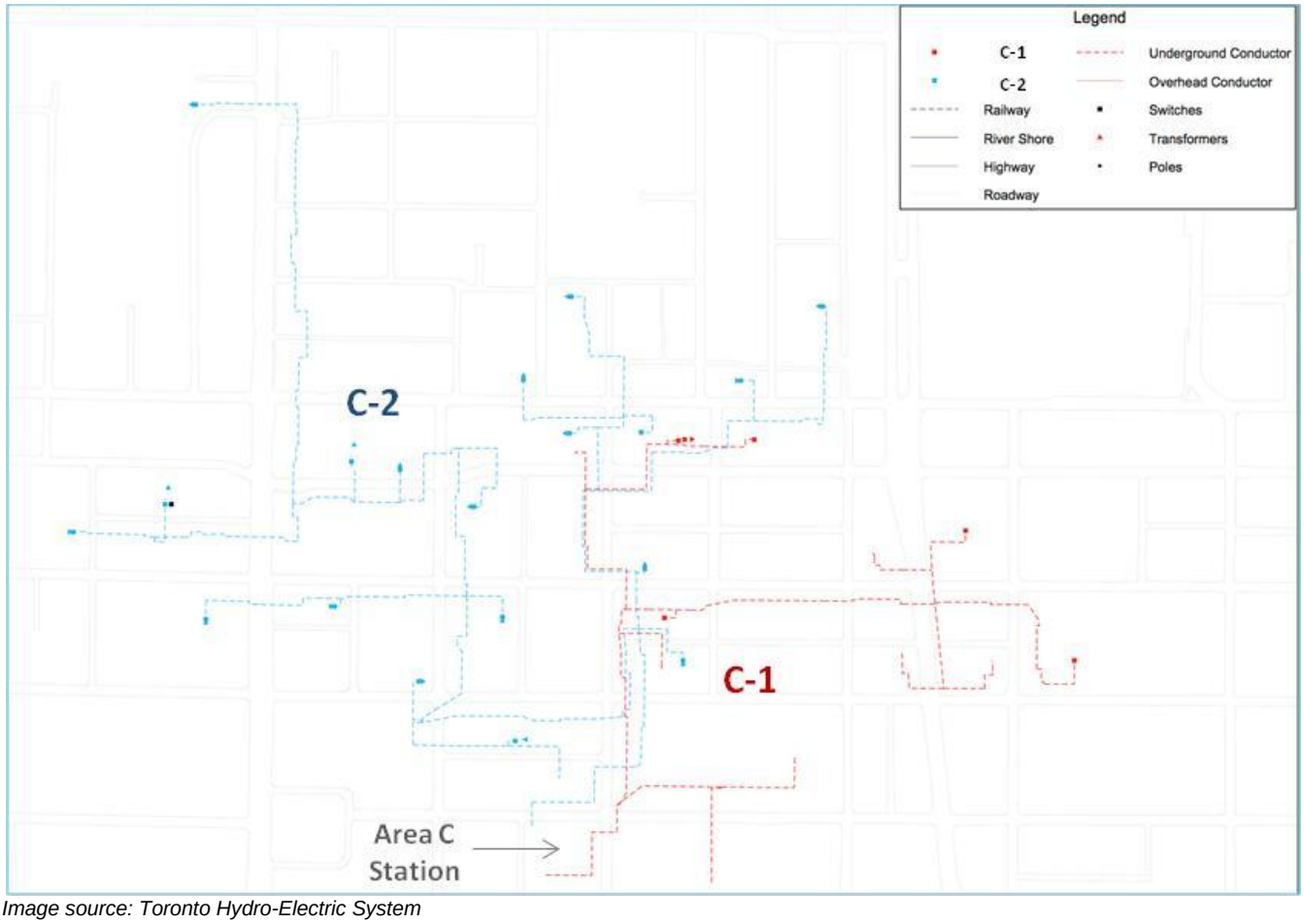


Image source: Toronto Hydro-Electric System

Feeder C-2 is an underground network secondary distribution system. A network secondary system affords a high degree of redundancy and reliability to customers. All equipment on this feeder is owned by THESL. The feeder supplies 5 customers, including 1 key account holder (highest kW: 1664).

Table 2.1 presents several characteristics of each of the seven feeders, as well as loading, outage data and THESL performance indices. In terms of outage performance over the last decade and last year, the Area A Station feeder A-2 performs more poorly than A-3, which in turn performs more poorly than feeder A-1. This is highly correlated to the fact that the three feeders, A-2, A-3 and A-1 respectively, have successively more infrastructure below grade than at-grade or overhead. This same tendency can be observed between the two Area B feeders, as B-1 is entirely underground while B-2 has some overhead distribution. The three underground feeders, two from Area C and one from Area B perform similarly to one another in terms of outage performance.

Table 2.1 Feeder Loading and Performance Characteristics

Feeder	A-2	A-3	A-1	B-1	B-2	C-1	C-2
Number of customers on Feeder	3315	490	1780	5	2141	12	5
# of Key Accounts	1	1	3	0	0	1	1
Average Feeder Loading 2011	12.3 MVA 258 Amps	9.1 MVA 190 Amps	8.6 MVA 180 Amps	4.6 MVA 194 Amps	4.4 MVA 183 Amps	1.92 MVA 81 Amps	3.4 MVA 144 Amps
Number of outages 2001 – Feb 2012	147	71	37	6	51	5	2
FESI[1] - # Outages in last 12 months (up to Feb 2012)	12	8	2	3	4	0	1
Worst Performing Feeder Ranking[2]	15	24	183	566	56	N/A	653
2011 SAIFI - Average number of customer power interruptions[3]	0.031643	0.0083	0.004338	0.000029	0.015217	0	0.0000056
2011 SAIDI - Average duration of customer power interruptions[4]	0.704792	1.048305	0.060144	0.002436	0.64296	0	0.000382

1 FESI – Feeders Experiencing Sustained Interruptions.
2 Based on customers impacted and duration of outages over last 24 months. Rank 1 is worst out of approximately 700 feeders that have a ranking.
3 SAIFI – System Average Interruption Frequency Index.
4 SAIDI – System Average Interruption Duration Index.

2.2 Components

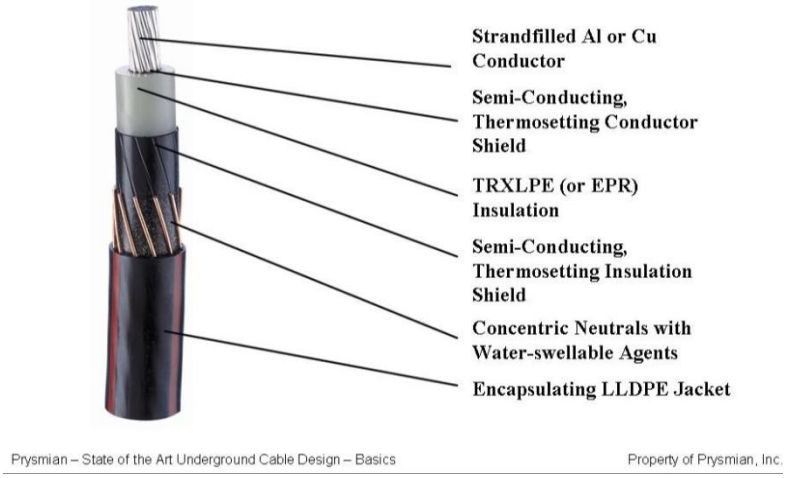
A brief description of infrastructure components is provided in the following section. A detailed breakdown of these components can be found in appendix A.

2.2.1 Primary Conductors

Primary conductors (wires) are used to transmit electricity through the system. Overhead wires suspended between poles employ bare aluminum stranded conductors, or aluminum stranded conductors with a steel reinforced centre cable. Underground conductors in this study are aluminum stranded conductors sheathed with a crosslinked polyethylene (XLPE) insulator. In Area C feeders, older paper-insulated lead-covered copper cables (PILC) are also used (see figure 2.5). Primary conductors in this study all carry high voltage, and underground conductors are fed through polyvinyl chloride (PVC) ducts that are encased in concrete.

Figure 2.5 Underground Cables

Underground XLPE power cables



Underground PILC power cables

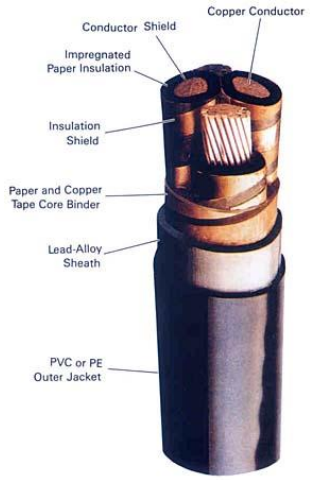
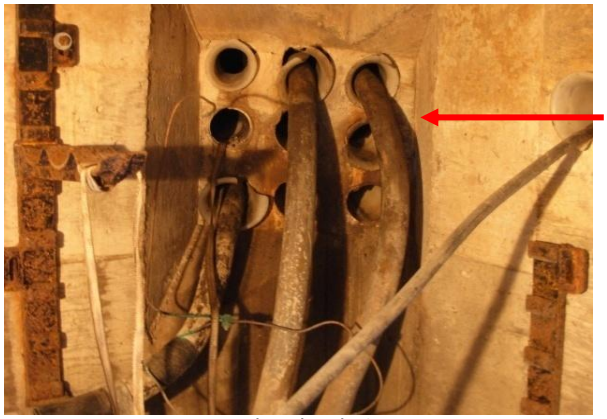


Image source: www.otds.co.uk



Underground cables encased in a concrete duct bank entering a vault

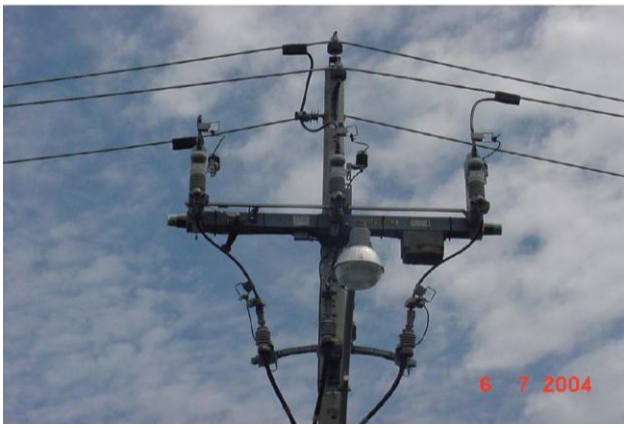
Image source: Toronto Hydro-Electric System

2.2.2 Switches

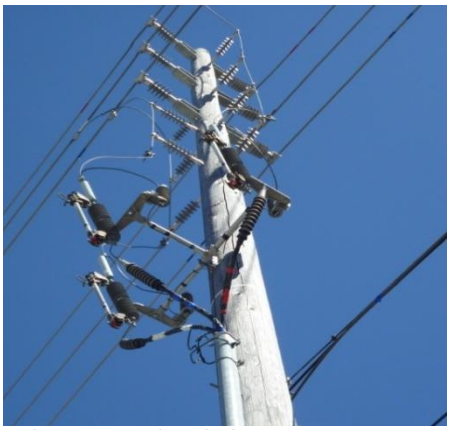
Switches provide control over the routing and distribution of electricity across feeder systems. They allow THESL staff to isolate sections of the electrical distribution system for maintenance or repairs of electrical faults. There are a variety of electrical switch types in place in the feeders under study (figure 2.6). However, the various switch types were not considered as part of this study, as they were not indicative of their sensitivity to climate events. Rather, switches were categorized only according to their location on the feeder, and their construction orientation. For the purposes of this study, the following switch categorizations are used:

- Overhead (pole mounted) main feeder switches – switches located along the primary powerline, or backbone, of the overhead Area A and Area B feeders.
- Overhead (pole mounted) lateral line switches – switches located on branches connected to the main line of overhead Area A and Area B feeders. Lateral lines generally feed a group of customers;
- Overhead (pole mounted) customer switches – switches on powerlines that only feed a single customer;
- Pad mounted switches – switches located at grade in a metal enclosure on a concrete footing;
- Underground switches – switches located below grade in vaults.

Figure 2.6 Switches



Scada Mate Pole mounted switch



Pole mounted switches

SF_6 Pad mounted switch

Mini-rupter switches located below-grade

Image source: Toronto Hydro-Electric System

2.2.3 Transformers

Transformers are used in electrical systems to convert voltages and facilitate the distribution of energy. In a distribution system, transformers step voltages down from the distribution voltage (27.6 or 13.8 kV) to the lower voltages that used by customers (120 – 600V). Transformers, like switches, can be located above grade on poles, at grade in metal enclosures on concrete pads, or in buildings, as well as below grade in vaults (see figure 2.7). Transformers are filled with either mineral or vegetable oil for cooling. Below grade transformers are submersible, as they are sealed in water tight metal enclosures.

Figure 2.7 Transformers

3 phase pole mounted transformers

Pad mounted transformer

Submersible transformer

3 Phase submersible transformer

Image source: Toronto Hydro-Electric System

2.2.4 Network Units

Network units are made up of a transformer, network protector and switch (see figure 2.8). These units are used only in downtown feeders in secondary network distribution systems. The role of the network protector is essentially to act as a low voltage circuit breaker that can automatically cut the electrical connection if power from feeder fails or is taken offline for service. In this study, network units, like below-grade transformers, are located in vaults and are submersible.

Figure 2.8 Network Unit

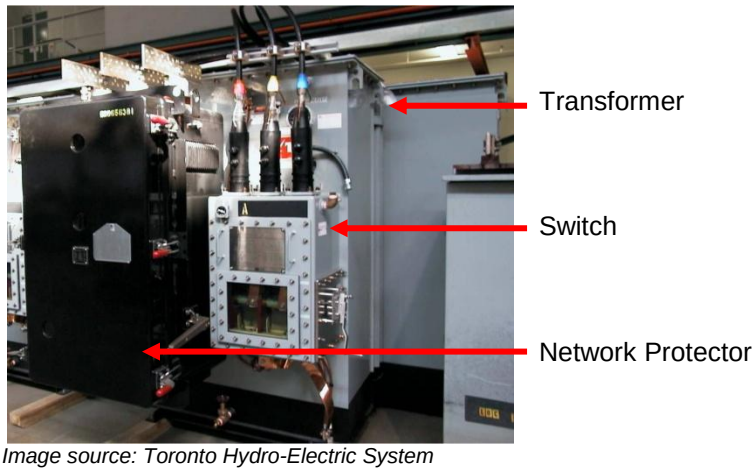


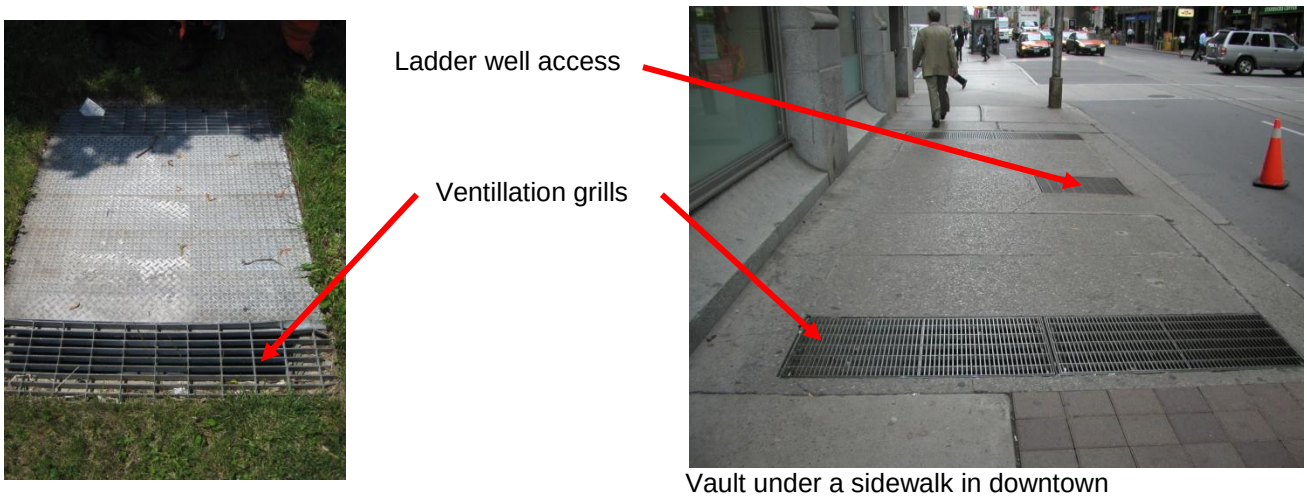
Image source: Toronto Hydro-Electric System

2.2.5 Vaults

Equipment below grade are located in vaults, underground concrete box structures that are accessible through a ladder well (see figure 2.9). Small vault chambers, for example with only one transformer, are generally covered by metal lids. Larger vaults, such as those found in inner city or downtown locations, are covered by concrete slabs. 95% of THESL vaults are naturally ventilated, with grills in the vault ceiling open to the street level. Where grills cannot be located directly in the ceiling due to at-grade infrastructure, air ducts are used to allow air circulation.

Vaults have sumps and drains connected to the storm water or combined storm water and sewer network. Backflow valves are present on drains to prevent drainage backflow from entering the vaults. Sump pumps are also present in some vaults. THESL staff have indicated that drains do become clogged with debris when not regularly maintained.

Figure 2.9 Vaults



Vault under a sidewalk in downtown

View up to ladder well access
Image source: Toronto Hydro-Electric System

Drain and sump

2.2.6 Poles

Poles are used to suspend primary conductors above ground and may also carry transformers and switches (see figure 2.10). Poles are either made from cedar wood tree trunks, concrete or steel, though the majority of poles in this study are made of wood (>99%). In this study, poles are only found in the three Area A feeders and part of the Area B B-2 feeder, and range in height from 30 to 60 ft. Generally, poles of lower height carry less equipment (transformers, switches) than poles of greater height. Conductor cable tension between poles provides some lateral support to poles, while poles at the end of a linear segment or at a street corner may be guyed with steel cables for additional support.

Figure 2.10 Poles

Wood poles
Image source: Toronto Hydro-Electric System

Concrete poles

2.3 Time Horizon

This pilot case study deals with current climate only. The infrastructure design life by component is presented in the table below.

Table 2.2 Useful Design Life

Component	Useful Design Life*	Comments
Overhead **conductor**	63	
Poles	45	All types
Underground TRXLPE **conductor**	50	
Underground PILC **conductor**	75	Downtown Area C Station only
Overhead **switch**	40 – 45	
Pad mount **switch** (PMH)	30	
Underground **switch**	40	
Overhead, pad mount, underground **transformer**	33 – 35	
Underground **network** unit	20	Switch, transformer, network protector
Vault	35	
Network **vault**	60	Downtown Area C Station only. Network vault ceilings are replaced once every 30 years.
Cable Chamber	65	

*values based on THESL Kinetrics useful life modelling system for asset planning and management

Generally, the design life of electrical equipment is in the range of 30 – 40 years. An analysis of the installation date of components in this case study reveal that most were installed in the 1980s and 90s (see table 2.3 below). A detailed breakdown of equipment by date of installation is also presented in appendix A. Based on the design life for equipment and their date of installation, the majority of equipment will be approaching the limits of their design lives by the 2020s.

Table 2.3 Date of Installation for Assets within Feeders Under Study

	Approximate % of assets by period of installation		
Station / Feeder	60s	80s / 90s	After 2000
Area A			
A-2		**O**	o
A-3	O	O	o
A-1	O	o	o
Area B			
B-1	o	O	o
B-2	o	**O**	o
Area C			
C-1		**O**	
C-2	o	**O**	

O ≥ 80% of equipment O ~ 50% of all equipment o < 20% of all equipment

2.4 Jurisdictional Considerations

Some of the jurisdictions, laws, regulations, guidelines and administrative processes, external to Toronto Hydro, that are applicable to the THESL distribution infrastructure are as follows:

Jurisdictions that have direct control/influence on the infrastructure:

- The City of Toronto
- Ontario Energy Board
- Electrical Safety Authority

Laws and bylaws that are relevant to the infrastructure:

Federal

- Transportation of Dangerous Goods Act;

Provincial

- Electricity Act, 1998;
- Ontario Energy Board Act, 1998;
- Green Energy and Green Economy Act;
- Environmental Protection Act;
- Technical Standards and Safety Act;
- Fire Protection and Prevention Act;
- Dangerous Goods Transportation Act;
- Ontario Occupational Health and Safety Act;

Local

- City of Toronto Municipal by-laws;

Regulations that are relevant to the infrastructure:

- OEB Transmission System Code;
- OEB Distribution System Code;

- OEB Standard Supply Service Code;
- Ontario Regulation 22/04 Electrical Distribution Safety
- Ontario Electrical Safety Code;
- Electric Utility Safety Rules;

Industry Standards relevant to the design, operation and maintenance of the infrastructure:

- CSA C22.3 No. 1 and 7National Building Code;
- Ontario Building Code;
- Canadian Electrical Code, Part 1;
- O.Reg. 213/91 Construction Projects;
- Harmonized Electric Utility Safety Association Rulebook;

2.5 Other Potential Changes that May Affect Infrastructure

Planned load transfers, generally for maintenance purposes, will increase loads temporarily on the feeder systems. Increased summertime temperatures will increase load demand for air conditioning. Urban development and the addition of new customers are the largest contributors to increased loads over time. Planned service upgrades may provide new load capacity.

2.6 Data Sufficiency

Given the available study time and budget, data gathering activities during this project were targeted at obtaining information essential to conducting the workshop. The following points illustrate some areas where more data can be gathered towards the completion of a full PIEVC case study assessment:

- No site visit was conducted as part of the assessment;
- Complete information gaps in inventory of elements, such as the quantity, location and/or characteristics of certain components. They are:
    - All Area A feeders (switches, vaults and cable chambers);
    - Area B feeder B-2 (switches, vaults and cable chambers);
    - Area C feeder C-1 (switches).
- Toronto Hydro derived aggregate infrastructure component condition ratings (health indices) were available for only a small proportion of the infrastructure components under study. A fuller examination of information on condition assessments can be undertaken;
- Maintenance records and information on maintenance practices were not collected. This information would be useful to determine whether maintenance has increased or decreased the capacity or useful life of the infrastructure;
- Information on emergency plans, procedures and practices were not collected or analysed;

3 Climate Analysis

The climate analysis used in this pilot case study was carried out by Risk Sciences International. A summary of that analysis is presented in the following chapter while the full text is presented in appendix B.

This pilot case study is concerned with the impacts of current climate on electrical distribution infrastructure. A variety of climate information sources were used to complete the climate analysis. These include:

- The National Building Code of Canada, Appendix C, Climate Information (2010) and CSA/CEA overhead systems standard;
- Environment Canada's Climate Normals; National Climate Archive online access, including CDCD and IDF values, etc.;
- Environment Canada (and partners) Hazards Portal and web site (www.hazards.ca – no longer available);
- Environment Canada (and partners) Climate Change Scenarios website (www.ontario.cccsn.ca) – only a national version now available;
- Environment Canada's Rainfall Intensity - Duration – Frequency (IDF) curves and publications on regional IDF values for southern Ontario;
- Peer-reviewed journal articles on downscaling methodologies for an ensemble of climate change models (>10 international journal articles on projections of ice storm, wind gust, temperature, heat-air quality-mortality risks for the Toronto region);
- Expert climate judgement.

3.1 Climate Parameters and Thresholds

24 climate events were identified in collaboration with THESL for inclusion in this study based on a list of climate events known to affect southwestern Ontario. Thresholds beyond which climate-infrastructure interactions could cause negative impacts were identified for all 24 climate events. Thresholds for temperature (high and low extremes) and wind were specifically known for electrical distribution infrastructure. Some of these were drawn from thresholds for related electrical infrastructure systems such as building code design winds, Canadian Standard Association C22.3 No. 1 "Overhead Systems" and Canadian Electrical Code, Part 1 overhead systems design temperatures. For all other climate events, thresholds were drawn from a previous PIEVC case study, the Toronto and Region Conservation Authority Flood Control Dam Water Resources Infrastructure Assessment (TRCA study). The list of climate events and thresholds used in this pilot case study are presented in the table below.

Table 3.1 Climate Events and Thresholds for Pilot Case Study

	Climate event	Threshold	Threshold Data Source
	Temperature		
1	High Temperature	Average annual # days with T≥ 30°C	CSA
2	Low Temperature	Average annual # days < -20°C	CSA
3	Heat Wave	3 or more days with Tmax ≥ 30°C	Professional judgment
4	Extreme Humidity	# Days with Humidex ≥ 40°C	Professional judgment
5	Severe Heat Wave	3 or more days with Humidex ≥ 40°C	Professional judgment
6	Cold Wave	3 or more days with Tmin ≤20°	Professional judgment

	Climate event	Threshold	Threshold Data Source
7	Temperature Variability	Daily T ranges ≥ 25°C	TRCA study
8	Freeze-thaw cycle	Annual Probability of at least 70 freeze-thaw cycles (Tmax>0 and Tmin<0):	TRCA study
9	Fog	~15 hours/year (average) with visibility <= 0 km	TRCA study
10	Frost	Could not be determined	n/a
	Wind		
11	High wind/downburst	Gusts > 70 km/h (~21days / year at Airport)	Professional judgment
12	High wind/downburst	Gusts > 90 km/h (~2 days / year at Airport)	CSA C22.3 No. 1
13	Tornadoes	Tornado vortex extending from surface to cloud base (near infrastructure)	TRCA study
	Precipitation		
14	Heavy Rain	Daily Rainfall > 50 mm/day	TRCA study
15	Heavy 5 day total rainfall	5 days of cumulative rain > 70 mm of rain	TRCA study
16	Ice Storm	Average annual probability of at least 25 mm of freezing rain per event	TRCA study
17	Freezing Rain	Average annual probability of freezing rain events lasting 6h or more *(i.e. typically more than 10 mm of freezing rain)*	TRCA study
18	Blowing snow/Blizzard	Average # of days / year with blowing snow (7.8 / y)	TRCA study
19	Heavy Snowfall	Snowfall > 10cm *(2-3days/y)*	TRCA study
20	Snow accumulation	Snow on ground with depths ≥ 30 cm and persisting for 5 or more days *(0.17 events/y)*	TRCA study
21	Hail	Average # of hail days (~1.1/y)	TRCA study
	Other		
22	Severe thunderstorms	Average # of Thunderstorm Days (~2.8/y)	TRCA study
23	Lightning	Average # Days/Year with cloud - ground lightning strikes *(~25)*	TRCA study
24	Drought/Dry periods	At least one month at Ontario low water response level II *(i.e. with mandatory water conservation)*	Professional judgment

3.2 Standardized Probability Scoring

The Protocol version 10 methodology for assessing the probability of a climate event exceeding (or triggering) a given threshold is measured on a *standardized probability scoring* scale of 0 – 7. A score of 0 indicates that a climate-infrastructure threshold will likely not be triggered, while a score of 7 indicates that the threshold will certainly be triggered within the service life of the infrastructure.

To convert the probability of a climate event triggering a threshold into the 0 – 7 scale, two methods are suggested by the Protocol, method A and method B. For this pilot case study, method B, the quantitative approach was selected. The quantitative approach is based upon determining the *annualized probability* of a climate event triggering the threshold. This is based on an examination of historical data from the last 10 to 50 years. Once the annualized probability is determined, it can be converted into the 0-7 scale according to method

B as shown in table 3.2. A detailed explanation of this procedure for each of the 24 climate events is presented in appendix B. Standardized probability scores are shown in appendix B and on the risk matrices of appendix D.

Table 3.2 Protocol Probability Scoring Scale

Score	Probability PIEVC Method A	Probability PIEVC Method B
0	Negligible Not Applicable	< 0.1 %, < 1 in 1,000
1	Highly Unlikely Improbable	1% 1 in 100
2	Remotely Possible	5% 1 in 20
3	Possible Occasional	10% 1 in 10
4	Somewhat Likely Normal	20% 1 in 5
5	Likely Frequent	40% 1 in 2.5
6	Probable Often	70% 1 in 1.4
7	Highly Probable Approaching Certainty	> 99% >1 in 1.01

3.3 Data Sufficiency

The climate data used in this study came from a variety of current and historically based data sources. It can be used to determine standardized probability scores with a high degree of confidence given that the analysis was focused on current climate.

Due to study time constraints, specific electrical distribution infrastructure thresholds for some climate events could not be determined. To make up for this shortcoming, many of the thresholds used in this study were adapted from a previous PIEVC TRCA Study. The latter study was chosen because its infrastructure is located adjacent to the Area A feeders under study. It was found that many of the climate events used in the TRCA study were applicable to electrical distribution systems. However, some of the thresholds that were used in the TRCA study, and hence this pilot case study, likely require further fine-tuning to have greater relevance to the power distribution sector. Therefore, it is recommended that future study should involve an analysis of operations and maintenance information, as well as a detailed/forensic review of available outage data to identify thresholds which were more specific to THESL electrical distribution infrastructure.

The impact of potential cumulative or synergistic effects was not adequately evaluated in this pilot case study. Climate events like high wind, freezing rain and/or lightning often occur in tandem. However, it was difficult to generalize about the frequency or magnitude of individual climate parameters within cumulative events. As an example, thunderstorms, an event involving high wind and lighting strikes, was identified. It was difficult to generalize about the magnitude and frequency of high wind and lighting strikes for thunderstorm events due to significant variations that exist between one thunderstorm to the next. This in turn made it difficult to quantify thresholds for thunderstorm events that would trigger an infrastructure response. Further work to assess the impacts of potential cumulative or synergistic effects is recommended within the context of a full PIEVC case study.

4 Risk Assessment

In Step 3 of the Protocol, a risk assessment based around a risk assessment workshop is conducted. The various tasks and results of the risk assessment are documented in the following chapter.

4.1 Preparation for the Risk Assessment Workshop

4.1.1 Risk Assessment Methodology

The Protocol methodology for identifying risks involves multiplying the standardized probability score of a climate event-infrastructure interaction with a severity score for that interaction. The determination of the standardized probability score was described in the previous chapter and in appendix B. The severity score is measured on a scale of 0 – 7; the Protocol version 10 provides two methods for determining the severity score, method D and E. For this pilot case study, method E was selected. As this pilot case study represents the first time the Protocol has been applied to electrical distribution infrastructure, examples of impacts across the 7 point scoring scale were determined in collaboration with THESL. The severity scoring scale and electrical distribution system specific examples of impacts are shown in the table below.

Table 4.1 Protocol Severity Scoring Scale with Electrical Distribution Examples

Score	Severity of Consequences / Description PIEVC Method E	Electrical Distribution System Specific Examples
0	Negligible or Not Applicable	Negligible
1	Very Low - Some Measurable Change	Arrestor failure
2	Low - Slight Loss of Serviceability	Overheating transformer
3	Moderate Loss of Serviceability	One distribution transformer out
4	Major Loss of Serviceability - Some Loss of Capacity	Broken spring in underground switchgear
5	Loss of Capacity - Some Loss of Function	Flooded vault that cannot be pumped
6	Major - Loss of Function	Leaning pole / Downed lines
7	Extreme – Loss of Asset	Downed pole, line and transformers

Next, the reference set of risk tolerance thresholds was reviewed with THESL. The thresholds for risk used in this project follow those set out by the Protocol, as shown in the table below.

Table 4.2 Reference Risk Tolerance Thresholds

Risk Score	Threshold	Response
< 12	Low Risk	No action necessary
12 – 36	Medium Risk	Action may be required; Engineering analysis may be required*
> 36	High Risk	Action required

**Step 4 Engineering analysis is out of scope in this study*

4.1.2 Relevant Infrastructure Performance Responses

For each of the infrastructure components, the most likely responses to climate events as well as impacts arising from climate event-infrastructure interactions were identified. Infrastructure performance responses served as the basis on which to judge the severity of a climate event-infrastructure interaction. The following infrastructure responses were used in this pilot case study:

- Structural design - *Structural integrity, cracking, deformation, foundation anchoring ,etc.*
- Functionality - *Effective load capacity, efficiency, etc.*
- Serviceability - *Ability to conduct maintenance or refurbishment, etc.*
- Operations, maintenance and materials performance - *Occupational safety, worksite access, operations and maintenance practices (frequency and type), etc.*
- Emergency Response - *Planning, access, response time*
- Insurance Considerations (TH perspective) - *claimable for repair, cause 3rd party payment, affect insurance rates*
- Policy and Procedure Considerations - *Planning, public sector, operations, maintenance policies and procedures, etc.*
- Health and Safety - *Injury, death, health and safety of THESL employees, the public, etc.*
- Social Effects - *Use and enjoyment, access, commerce, damage to community assets (buildings), public perception, etc.*
- Environmental Effects - *Release or harm to natural systems (air, water, ground, flora, fauna)*

The infrastructure performance responses were validated during the workshop. The results are presented in the completed risk matrices presented in appendix D.

This study acknowledges that there are consequences to public health and safety, as well as social effects, from electrical equipment damage and failure. However, the extent or severity associated with those consequences was not examined in this case study because they were out of the study's scope and budget. Information was not collected on the presence of key public facilities (hospitals, community centres, schools, water pumps, drainage, etc), their backup power capabilities, or the redundancies provided by other THESL feeders not considered in this study. This study also did not explore the risks to vulnerable populations from weather such as heat waves[2], or the importance and role that the electrical distribution system plays in mitigating these risks. Thus, study participants were asked to exclude consideration of the wider societal impacts of equipment damage or failure when assessing severity. The performance response measures listed above were examined from THESL' perspective in terms of consequences on their assets, planning, operations and maintenance practices.

4.1.3 Yes/No Weather – Infrastructure Interaction Screening

A yes/no screening analysis was done in order to determine whether a given climate event would interact with a given infrastructure component. Where no interaction occurred, no severity or risk score was calculated. The yes/no screening analysis was done as part of workshop activities. The results of the yes/no screening analysis are presented in the completed risk matrix presented in appendix D.

4.2 Risk Assessment Workshop

A full day risk assessment workshop was held on May 11th, 2012 in THESL offices in Toronto. A total of 25 participants from a variety of organizations and disciplines were involved in the workshop. The organizations and experience present at the workshop are listed in the following table.

[2] Populations vulnerable to heat include the elderly, infants and young children, people with pre-existing medical conditions or living alone.

Table 4.3 Organizations and Experience Present at the Workshop

Organization	Expertise
Toronto Hydro-Electric Systems	Standards and Policy Planning System Reliability Planning Strategic Affairs Stations Network Planning Construction Control Centre Dispatch
Hydro One	Electrical Transmission
Engineers Canada	Protocol Specialist
AECOM	Electrical Engineering, Risk Assessment
Risk Sciences International	Climate Sciences
Xtn Sustainable Lifecycle Asset Management	Facilitation and asset management
Clean Air Partnership	Project Management
City of Burlington	Infrastructure asset management
Natural Resources Canada	Natural Resources Planning
Canadian Standards Association	Built Environment and Structures
Toronto Environment Office	Environmental Specialist
Toronto Water	Water Utilities and Resources
Utilities Kingston	Utilities Engineering

Participants were split into four groups. Two groups were assigned one of the two Area A station feeders, A-1 and A-2. One group was assigned to complete the assessment for both Area B station feeders, and the last group was assigned to complete the assessment of the two Area C station feeders. Area A station feeder A-3 was not evaluated during the workshop as there were not enough participants or time to assess the feeder. However, due to the similarities between feeder A-3 and the other two Area A feeders, the results for the latter two should adequately represent results for A-3.

During the morning, participants were provided with an overview of the Protocol, current climate, THESL infrastructure under study and instructions for the workshop exercise. Workshop breakout sessions began late morning on validating infrastructure performance responses, completing the yes/no screening analysis, and the assignment of severity scores to weather-infrastructure interactions. The breakout sessions continued into the afternoon until all tables had completed their assigned feeders. Participants recorded their work on 11x17 risk assessment matrices that were provided. The results of this analysis are presented in the risk matrices in appendix D.

4.3 Assessment Results

4.3.1 General

As described in the Protocol, thresholds represent limits beyond which a climate event can have an adverse impact on the infrastructure. Thresholds were established for all 24 of the climate events of interest. However, only the thresholds for temperature (high and low extremes) as well as wind were known specifically for this THESL electrical distribution infrastructure case study. For the majority of climate events, threshold data was

adapted from a previous PIEVC case study, the TRCA Water Resource Dam infrastructure system. For this reason, the results of this risk analysis should be considered preliminary. For the majority of climate events, there is some uncertainty as to whether climate events that exceed the thresholds used in this analysis actually cause damage to electrical infrastructure. It is recommended that future study include a detailed forensic analysis of outage event data as well as examination of maintenance and operations records in order to refine thresholds for electrical distribution infrastructure.

This analysis attempted to determine whether differences in risk existed between feeders with the same type of infrastructure (e.g. between overhead feeder systems). In terms of severity, this component level risk analysis revealed no significant differences in severity scores between similar types of feeders; the impact of a climate event on an overhead conductor, transformer or switch is no different between an Area A feeder as compared to a Area B feeder[3].

Since many of the infrastructure components were repeated across the different feeders, a range of severity scores were often attributed by different tables to the same infrastructure components. For example, overhead conductors received severity scores ranging from 2 to 4 for high heat (>30°C). These differences cannot be attributed to the differences between overhead feeders or components; for example, no significant differences in the characteristics of overhead conductors, poles or distribution systems could be determined between Area A feeders A-1 and A-2 that would suggest that this variation in severity was feeder specific. As participants brought different types of experiences and expertise to the workshop, discussions about problems and severities likely differed between groups. This is the most likely reason for variations in severity scoring for a given component across different feeders. Nonetheless, while some severity scores were adjusted by AECOM following a review of workshop materials and comments, different severity scores for a given component were not entirely reconciled between different feeders. This was done in order to maintain the diversity of opinions that were expressed in the workshop.

While it may be uncertain whether the numerical differences between two closely scoring risk values represent an actual difference in risk, the Protocol contains a procedure to handle such variations. It does so through the application of a coarser – low, medium and high – risk categorization scheme (see Table 4.2) to group weather-infrastructure interaction risks. By doing so, the small variations in risk scores are de-emphasized and focus is placed on the overall pattern of risk, thereby making it easier for practitioners and decision-makers to identify the most important risks and set priorities. Therefore, the low, medium, high risk categories are reported instead of numerical risks scores in the following sections.

In THESL staff experience, overhead infrastructure is more vulnerable to climate events than underground infrastructure due to the increased likelihood of climate event-infrastructure interactions. The pattern of risks revealed in this case study supports this experience, with the majority of above ground equipment being affected by wind, freezing rain, lightning and other storm events. Below grade infrastructure was found to be vulnerable to some types of climate events as well, with risks arising primarily from heat, rain and snowfall. In general, the pattern of risk indicates that all high risks and higher-medium risks tended to affect feeders with overhead infrastructure, while lower-medium risks and low risks were mostly associated with underground feeder infrastructure. The following section presents specific climate event-infrastructure interactions by risk category, while Table 4.4 at the end of the chapter provides a summary overview of these risks.

4.3.2 Low Risk

Assessment of climate event-infrastructure interactions resulting in risk scores below 12 are considered low risk. Generally, no further action is required. A summary of low risk interactions are presented below.

[3] Differences in risk scores could have arisen from differences in the probability score for a climate event for a downtown location as compared to a suburban location. However, location specific climate data was not always available for all climate events under consideration, and thus the same climate event probability scores were used across all feeder systems.

High Temperature, Heat Waves, Extreme Humidity, and Severe Heat Wave

- Increases in CO_2 and temperature are known to cause the accelerated deterioration of concrete through carbonization. Compounded with increased freeze-thaw cycles and de-icing salt application, concrete structures such as vaults, cable chambers and equipment pads, may deteriorate more quickly. However, knowledge of concrete carbonization is still in its infancy. Furthermore it was suggested that increased rates of deterioration are only perceptible when examining infrastructure lifespan over decades. This, high heat events are only a concern when considering the overall design life of structures, and is considered a low risk;

Low temperature and cold wave

- Low temperatures cause overhead conductor materials to contract, increasing cable tension in overhead conductors. Underground XLPE cables may become brittle and experience reduced life if installed in cold temperatures;
- Vegetable oils used in some newer transformers may not circulate adequately in cold temperatures, causing transformers to overheat;

Freeze-thaw cycles

- Freeze thaw events can cause cracking and deterioration of underground vaults and cable chambers over time;

Temperature variability

- Temperature variability may cause underground cables to fail. However, temperature variability generally presents a low risk;

Fog

- Fog events are linked with issues of visibility and access to overhead equipment. Equipment may be more difficult to locate in heavy fog;

Frost

- Most groups did not judge frost to be an issue as equipment design standards include consideration for frost. However, one group did cite that moisture in the air can freeze within above ground equipment, leading to failure of insulation and electrical faults. Frost generally presents a negligible or low risk;

Blowing snow, heavy snowfall and snow accumulation

- Snowfall events are linked with issues of visibility and access. Equipment may be difficult to find under blizzard conditions, and snow banks and snow accumulation that is pushed aside by snow clearing equipment may bury pad mounted switches and transformers. Time to access equipment is lengthened;
- Snowfall events often lead to the application of road and sidewalk de-icing salts. De-icing salts present a long term corrosion risk to at grade and underground electrical equipment and structures (see special case below, section 4.3.6);
- Snow may block ventilation grills of underground vault;

Heavy Rain and Heavy 5 day total rainfall

- Rainfall generally causes no issues for above ground equipment, but may cause faults in underground cables, where sheathing has been damaged, or at cable splice points (joints);
- Vaults and cable chambers may be flooded if rainfall cannot be drained quickly enough, if drains, sumps or backwater valves are clogged with debris, or if sump pumps are not functioning well. This is an issue in terms of access to below grade equipment, but the impacts on the vault or cable chamber itself are minimal;

Hail

- Hail interacts with overhead equipment, but was considered to be of negligible or low risk;

Lightning strikes on equipment

- Lightning strikes impact all above ground equipment. Direct lighting strikes on pad mounted switches and transformers presented a low risk, as grounding protection can safely dissipate the energy;

Drought periods

- Drought periods may result in loss of soil moisture content. Soil moisture is required for conductivity, which is in turn required for all equipment to be adequately grounded. Loss of soil moisture may cause subsidence, which in turn may weaken support for equipment and foundations. However, workshop participants generally considered drought to pose a negligible or low risk, and did not report any issues with soil subsidence.

4.3.3 Medium Risk

Medium risks arising from infrastructure-weather interactions are those whose risk score falls between 12 and 36. The following list summarizes interactions at medium risk. Further analysis and action may be required.

High Temperature, Heat Waves, Extreme Humidity, and Severe Heat Wave

- Increases load demand for air conditioning. The additional loads increase heat generated by transformers which can lead to shut downs and outages;
- Underground vaults and cable chambers can be uncomfortable for work crews, and collective bargaining agreements restrict worker access when temperatures are too high;
- Overhead cables can be derated, reducing some capacity;

High wind/downburst at 70 km/h and 90 km/h

- Wind can cause trees or tree limbs to fall onto overhead equipment, potentially damaging or bringing down pole-mounted equipment (switches, transformers). Higher wind speeds have the potential to cause greater damage due to increased forces on trees and equipment;

Heavy Rain and Heavy 5 day total rainfall

- Rainfall is a risk to below-grade switches as they are not submersible;
- Vault rooms may be flooded if rainfall cannot be drained quickly enough, if drains, sumps or backwater valves are clogged with debris, or if sump pumps are not functioning well. Access to below grade equipment becomes an issue as equipment cannot be accessed or maintained until water is drained;
- There is an ongoing risk of failure of other city infrastructure due to heavy rainfall, such as culverts washing out, that may lead to damage or failure of electrical distribution equipment. This concern was mentioned in the workshop but was not quantified as part of this study;

Freezing Rain and Ice Storms

- Freezing rain and ice storms leads to ice build up on trees and electrical equipment. Ice buildup does not affect the functionality of electrical equipment until the point where the weight of ice causes conductors or poles to break. Ice buildup on tree limbs can also cause them to break and fall onto overhead equipment in turn potentially damaging or bringing down overhead conductors, pole mounted equipment, or poles themselves;

- Freezing rain and ice storms can freeze vault and cable chamber access covers. Additional tools and time are then required to gain access to underground equipment;
- The risk scores due to freezing rain and ice storms did not vary by pole height or material;

Lightning strikes on equipment

- Lightning strikes impact all overhead equipment, and lightning arrestors usually divert energy safely to ground. However, severe, direct lighting strikes can exceed the capacity of protection equipment, and cause switches and poles to fail. Equipment must be replaced;

4.3.4 High Risk

High risks arising from infrastructure-weather interactions are those whose risk score is above 36. The following high risk interactions were identified:

High wind/downburst at 70 km/h and 90 km/h

- Poles are categorized under high risk for high wind and downbursts as compared with overhead switches and transformers (medium risk) as they bear the brunt of wind forces on the overhead system. Wind on conductors and overhead equipment increase forces on poles. High wind speeds can thus cause poles to snap, bringing down conductors and overhead equipment with them. While poles are designed to withstand winds up to 90 km/h winds, THESL staff experience suggests that poles have leaned or failed when wind was between 70 – 90 km/h.
- Poles greater than 50 ft are of greater risk as they generally carry more overhead equipment. The loss of poles of higher than 50 ft is of greater severity than poles of lower height.
- Wind can cause trees or tree limbs to fall onto overhead conductors and bringing them down. Higher wind speeds have the potential to cause greater damage due to increased forces on trees and tree limbs;

Lightning strikes on equipment

- Lightning strikes impact all overhead equipment, and lightning arrestors usually divert energy safely to ground. However, severe, direct lighting strikes on transformers can exceed the capacity of protection equipment and cause transformers to fail. Transformers must be replaced;

4.3.5 Special Cases – High Severity, Low Probability Events

Tornadoes represent a high severity, low probability event. While the resultant risk category for tornadoes is low, tornadoes were judged to have catastrophic consequences on all above ground infrastructure. Underground infrastructure is not affected by tornadoes. However, underground infrastructure may become inaccessible during a tornado event. A review of emergency procedures and practices should be done in order to ascertain whether further action is required for this special case.

4.3.6 Special Cases - Low Severity, High Probability Events

High probability, low severity events climate event-infrastructure interactions generally have implications for operations and maintenance. Their occurrence on a regular basis presents a weathering hazard that may lead to decreases in the performance, durability and resilience of electrical infrastructure over time. However, as discussed in section 4.3.1 above, the majority of weather thresholds used in this study actually come from another PIEVC Protocol case study on water resource infrastructure. There is uncertainty as to whether any negative impacts on electrical distribution infrastructure are actually triggered by climate events at these thresholds.

Thus, given the patterns of risk that emerge from the above analysis, and the aforementioned caveat on thresholds, this report identifies *blowing snow and heavy snowfall* as two high probability, low severity events that may warrant further study in terms of long term weathering due to de-icing salt application. A review of operations

and maintenance procedures, and equipment condition assessments with respect to snowfall events should be done in order to ascertain whether further action is required for this special case.

Table 4.4 Summary Current Weather Related Risks to Electrical Distribution Infrastructure

Events	Feeders Impacted				Components
	Area A (all)	Area B B-2	Area B B-1	Area C (all)	
Low risk					
High Temp, Heat Wave, Extreme Humidity, Severe Heat Wave	•	•	•	•	All concrete structures – vaults, cable chambers, equipment pads, poles
Low temperature, cold wave	•	•	•	•	Overhead and underground conductors Transformers filled with vegetable oils
Freeze-thaw cycle	•	•	•	•	Vaults and cable chambers
Temperature variability	•	•	•	•	Underground conductors
Fog	•	•			Overhead and at grade equipment
Frost	•	•			Above ground conductors and equipment
Blowing snow, heavy snowfall, snow accumulation	•	•	•	•	Overhead and at-grade equipment Vaults and cable chambers
Heavy Rainfall, Heavy 5 Day Total Rainfall	•	•	•	•	Underground conductors Vaults and cable chambers
Lightning strikes on equipment	•	•			Pad mounted switches and transformers
Drought	•	•	•	•	Grounding of all equipment
Medium Risk					
High Temp, Heat Wave, Extreme Humidity, Severe Heat Wave	•	•	•	•	Transformers Vaults and cable chambers
High Temp, Heat Wave, Extreme Humidity, Severe Heat Wave	•	•			Overhead conductors
High wind/downburst	•	•			Pole mounted switches and transformers
Heavy Rain, Heavy 5 Day Total Rainfall	•	•	•	•	Below-grade switches
Freezing Rain, Ice Storms	•	•			Overhead conductors Pole mounted switches and transformers
Freezing Rain, Ice Storms	•	•	•	•	Vault and cable chambers
Lightning strikes on equipment	•	•			Overhead switches and poles Overhead conductors
High Risk					
High wind/downburst	•	•			Poles Overhead conductors
Lightning strikes on equipment	•	•			Overhead transformers
Special Cases					
Tornadoes	•	•			Above ground equipment and poles Overhead conductors
Blowing snow, heavy snowfall	•	•	•	•	At grade and underground infrastructure

• *dot indicates where an event affects feeder components*

5 Preliminary Conclusions

5.1 Findings and Limitations

This infrastructure vulnerability assessment pilot case study was successful in demonstrating the applicability and utility of the PIEVC Protocol on electrical distribution infrastructure. The results obtained from this assessment reflect and confirm the experiences of workshop participants and provide a useful first screening of the patterns of risk that affect overhead and underground electrical distribution infrastructure. However, the scope of this pilot case study is a subset of the work required to complete a full Protocol case study, and there remain areas that warrant further exploration. The results of this pilot case study, as well as areas of further work are summarized in this chapter.

This pilot case study examined the risks of 24 separate climate events on seven feeder systems. In general, the patterns of risk show that overhead infrastructure is more vulnerable to climate events than underground infrastructure, though the latter are not immune to weather impacts. Climate events resulting in the highest risks are high winds and lightning strikes on equipment, and affect above ground distribution equipment. These risks are especially important in feeders such as Area A, A-1, A-2 and A-3, where the majority of infrastructure is located above ground. Under the medium risk category, freezing rain, heavy rainfall, and high heat (including heat waves, and high humidity events) were the principal climate events affecting both above ground and underground equipment. Tornadoes represented a low probability-high severity risk to all above ground infrastructure. Snowfall events constitute high probability-low severity risks to at grade and underground infrastructure, and constitute a long term weathering issue due to the application of de-icing salts.

Area A feeder A-3 was not examined in the workshop due to time and personnel constraints. However, the risk pattern of feeder A-3 can be assumed to be similar to the other two Area A feeders given the proximity and similarities of the infrastructure components which make up all three feeders.

It was difficult for workshop participants to quantify the impacts of *severe thunderstorms* on electrical equipment as impacts are largely due to the intensity of wind and lightning events. These latter two events were evaluated independently during the workshop. Thunderstorms represent a compound event, for which the thresholds for wind and lightning were not sufficiently defined as to allow workshop participants to adequately evaluate severity.

The climate data used in this exercise can be used with a high degree of confidence as the analysis was focused on current climate. In turn, the derived standardized probability scores, which represent the probability of exceeding a threshold, can be judged accurate with a high degree of confidence. What is less understood is whether, and to what extent, thresholds actual trigger negative impacts and damage to electrical infrastructure. This is due to the fact that the majority of electrical distribution infrastructure specific thresholds were adapted from a previous PIEVC case study; despite the availability of outage data, the short timeline for this study did not allow for more electrical distribution infrastructure specific thresholds to be determined. Thus, to strengthen this exercise, it is necessary to develop a better understanding of the thresholds which trigger damage in electrical infrastructure. This does not however negate the quality of the assessment. The quality, method and results of the severity evaluation remain valid, and the refinement of thresholds should only change probability scores.

Risks at the feeder system level were not explicitly explored in this analysis. This analysis considered the electrical distribution system at the level of the components within each feeder. However, the feeder systems examined in this case study all had one or more adjacent supporting feeders. These supporting feeders provide varying levels of power supply redundancy to customers depending on the electrical configuration of the interconnected systems. The ability and constraints of adjacent supporting feeders to provide power in the event of a fault on one feeder, and thus mitigate the severity of weather related impacts, warrants further analysis. Under such circumstances, the wear and strain on support feeders can also be explored. This would provide a better understanding of climate-related risks at a feeder system level.

For example, area wide climate events with the ability to knock out entire sections of feeders, such as high winds, freezing rain and tornadoes, constitute risks which warrant further exploration at a feeder system level. Another example where a feeder level analysis would be useful is for high heat related events. This pilot case study revealed that high ambient temperatures and/or humidity do not physically affect electrical equipment. However, increased air-conditioning use during these events results in higher load demands on feeders. During the summer time months, the shutdown of inner city and downtown feeders for maintenance purposes are restricted due to heat related load demands that would be transferred to adjacent supporting feeders. Any additional weather related stresses, such as heavy rainfall causing flooding in underground vaults, would thus impact an operationally restricted situation, potentially worsening system level vulnerabilities. Heat related impacts on feeders, and the ability and response of adjacent support feeders to provide power, are areas that warrant further analysis.

This study did not explicitly explore the public health and safety risks arising from damage or failure of THESL equipment and impacts to key public facilities or vulnerable populations. For example, electricity is vital to the operations of key facilities such as hospitals, emergency dispatch facilities and telecommunications. Air-conditioning, and thus electricity, plays an important role in mitigating the impacts of heat on vulnerable populations such as the elderly, young children, infants and individuals with pre-existing medical conditions. While the potential impacts of outages to these facilities and groups were acknowledged during the workshop, participants were asked not to consider these wider public health and safety impacts when evaluating risks because the information necessary to do so was not obtained within the confines of this study; an investigation of the relationship between critical facilities, vulnerable populations, electrical equipment and resultant risks is a complex task. However, it remains an important area of work and requires further consideration in terms of how it may be handled through a Protocol-type or similar study.

The infrastructure components under evaluation were limited to physical pieces of infrastructure, while other crucial infrastructure support components were not considered. These include personnel, telecommunications, supplies and records. For example, threats such as West Nile and Lyme disease from insect vectors are expected to intensify due to warming temperatures and milder winters. These threats to worker health and safety were not investigated. Weather impacts on communications equipment, as well as the ability to obtain replacement parts and supplies may affect THESL's response times to outages. Finally, no analysis of maintenance records, operations, procedures or emergency response plans was completed as part of this study. An analysis of these elements was not essential to conducting the workshop, nor would it likely change the overall patterns of risk revealed through this pilot case study. However, assessing weather impacts on these support components could help to refine the understanding of climate event-infrastructure responses and severities, and thus provide a more nuanced portrait of the patterns of risk.

Finally, climate change is expected to alter the intensity and frequency all climate events, with the exception of cold temperatures, for the worse. In light of the vulnerabilities revealed in this pilot case study, it can be hypothesized that climate change will only increase the vulnerabilities of electrical distribution equipment. The current study provides an excellent baseline on which to evaluate how risks change with a changing climate.

5.2 Additional Work

This pilot case study and interim report present a subset of the efforts and documentation normally required to complete a full Protocol case study. The following elements could be part of further work on completing a full Protocol case study:

- Complete inventory of infrastructure components, particularly on switches, vaults and cable chambers. Consider including infrastructure support components, such as personnel, telecommunications, supplies and records;
- Collect and analyse information on condition assessments;
- Collect and examine maintenance records and information on maintenance practices;
- Collect and analyse information on emergency planning procedures and practices;

- Determine electrical distribution infrastructure specific climate thresholds through analysis of maintenance practices and detailed/forensic review of outage data. This is especially pertinent for cumulative events, such as thunderstorms;
- Identify and define potential cumulative or synergistic events more clearly;
- Conduct portions of Steps 1 to 3 as relevant to a climate change risk assessment;
- Devise feeder system level analysis to account for feeder system redundancies, reactions, and consequences in terms of severity and risk ratings. Consider revising infrastructure feeders and components under study to facilitate feeder system level analysis;
- Complete Steps 4, Engineering Analysis on identified medium risk infrastructure components;
- Complete Step 5, Recommendations for addressing vulnerability of infrastructure components falling into medium and high risk categories;
- Complete all Protocol worksheets.

Appendix A
Detailed Breakdown of Infrastructure Components

Breakdown of Infrastructure Components for Risk Assessment Matrix, Health and Date of Installation

Infrastructure Component	Subcomponent		Quantity	Health Index (HI)	Date of Installation
Area A Station	**27.6 kV feeders**				
Feeder A-2					
Primary Conductors	Overhead		30394.3 m	n/a	113.6 m in 1983 18515.2 m in 1998 11765.5 m after 2000
	Underground		6458.3 m	n/a	195 m in 1983 5659.6 m in 1998 603.7 m after 2000
Switches (202 units)	Overhead		Approx. 136 units	4 with HI above 90% 132 n/a	3 built in 1983, 80 built in '98, and 52 built after 2005
	At grade or underground		Approx. 66	n/a	7 in 1983, 42 in 1998, and 17 after 2010
Transformers (314 units)	Pole		260 units	n/a	129 built in 1998, 131 built after 2000
	Pad		21 units	18 in 80%+ 3 n/a	19 in '98, 2 after 2000
	Submersible		33 units	9 in 80%+ 7 in 60-80% 2 below 60%, 15 n/a	32 in 1998, 1 in 2007
Civil Structures	Vault		n/a	n/a	n/a
	Cable Chambers		n/a	n/a	n/a
Poles (1117 units)	Steel	Wood	Concrete	110 in 80%+ 190 in 60 – 80% 27 less than 60% 790 n/a	4 in 83, 632 in 1998, 481 after 2005
30 < 40 ft	1	154	3		
40 < 50 ft		888	4		
50 to 55 ft		35			
Unknown height		32			
Feeder A-3					
Primary Conductors	Overhead		15272.7m	n/a	4334.5 m in 1963 9516.3 m in 1983 1382.4 m in 1998 39.5 after 2000
	Underground		6395.8m	n/a	2583 m in 1963 2248.9 m in 1983 473.3 m in 1998 299.8 m after 2000
Switches (114 units)	Overhead		Approx 90	n/a	43 in 1963 34 in 1983 13 after 1998
	At grade or underground		Approx 24	n/a	5 in 63, 9 in 83, 10 after 2004
Transformers (150 units)	Pole		103 units	n/a	4 in 63, 84 in 83, 15 after '98
	Pad		19 units	10 in 80%+	7 in 63

Infrastructure Component	Subcomponent		Quantity	Health Index (HI)	Date of Installation
				9 n/a	8 in 83 4 after 98
	Submersible		28 units	11 in 80%+ 14 in 60 – 80% 3 n/a	17 in 63 9 in 83 2 after 2008
Civil Structures	Vault		n/a	n/a	n/a
	Cable Chambers		n/a	n/a	n/a
Poles (427 units)	Steel	Wood	Concrete	106 in 80%+ 113 in 60-80% 112 below 60% 96 n/a	98 in 63 273 in 83 56 after 98
30 < 40 ft	2	223			
40 < 50 ft		144	1		
50 to 60 ft		51			
Unknown height		6			
Feeder A-1					
Primary Conductors	Overhead		4803.4 m	n/a	3897.4 m in 1963 906 m after 2000
	Underground		7676.3 m	n/a	6226.8 m in 1963 776.6 m in 1983 388.9 m in 1998 284 m after 2000
Switches (119 units)	Overhead		Approx 84	83 n/a 1 with 75% HI	69 built in 1963, 15 built after 2000
	At grade		Approx 35	n/a	25 in 63, 10 in 2010
Transformers (78 units)	Pole		15 units	n/a	14 in '63, 1 in '79
	Pad		29 units	25 with 80%+ 3 n/a	27 in 63, 2 after 2005
	Submersible		34 units	15 with 80%+ 16 in 60-80% 1 at 58%, 2 n/a	All built in 63
Civil Structures	Vault		n/a	n/a	n/a
	Cable Chambers		n/a	n/a	n/a
Poles (113 units)	Steel	Wood	Concrete	12 in 80%+ 20 in 60-80% 31 below 60% 50 n/a	90 in 63, 23 after 2007
30 < 40 ft		40	14		
40 < 50 ft		20			
50 to 60 ft		39			
Area B Station	**13.8 kV feeders**				
Feeder B-1					
Primary Conductors	Underground		4214.4 m		655.9 m in 1963 2278.8 m in 1990's 1279.4 m in 2000's
Switches (15 units)	Underground		15 units	n/a	3 in 63, 8 in 93, 4 in 2003
Transformers (13 units)	Submersible only		13 units	7 in 80%+ 2 in 60 – 80% 4 n/a	3 in 63 6 in '93 4 in '2003
Civil Structures	Vault		n/a	n/a	n/a
	Cable Chambers		n/a	n/a	n/a
Feeder B-2					
Primary Conductors	Overhead		8666.8 m		65.9 m in 1951

Infrastructure Component	Subcomponent		Quantity	Health Index (HI)	Date of Installation
					303.8 m in 1963 2715.3 m in 1988 4782 m in 1990's 799.8 m in 2000's
	Underground		11203.6 m		734.3 in 1980's 10395.9 m in 1990's 73.4 m after 2000
Switches (90 units)	Overhead		Breakdown n/a, likely proportional to tx	n/a	1 in 63, 19 in 88, 66 in 93 – 95, 4 after 2000
	At grade				
	Underground				
Transformers (103 units)	Pole		79 units	n/a	9 in 63 25 in 88 45 in 93
	Pad		8 units	7 in 80%+ 1 in 60-80%	1 in 63 7 in 93
	Submersible		16 units	1 in 80%+ 15 n/a	14 in '88 to '93 2 after 2010
Poles (362 units)	Steel	Wood	Concrete	58 in 60-80% 304 n/a	16 in 63, 314 before 2000, 48 after 2000
Unknown height	n/a	n/a	n/a		
Civil Structures	Vault		n/a	n/a	n/a
	Cable Chambers		n/a	n/a	n/a
Area C Station	**13.8 kV feeder**				
Feeder C-1					
Primary Conductors	Underground		2809.6 m	n/a	2416.8 m in 1986 392.8 m after 2000
Switches (3 units)	At grade		Likely all underground	n/a	1 in 90 2 in 2003
	Underground				
Transformers			All transformers are client owned		
Civil Structures	Cable Chamber		43 units	n/a	42 in 1986, 1 in 2008
	Vault		6 units	n/a	5 in 86-90, 1 in 2003
Feeder C-2					
Primary Conductors	Underground		5358.7 m		912.6 m in 1963 2017.2 m in 1986 813 m in 1990's 1615.9 m after 2000
Switches (19 units)	Underground		19 units	n/a	All in 1985
Network Units (17 units)	Submersible		17 units	12 in 80%+ 2 in 60 – 80% 3 n/a	3 in '63, 13 others before 2000, 1 in 2010
Civil Structures (96 units)	Cable Chamber		69 units	n/a	14 in 63, 45 in 86, 8 after 1993
	Vault		18 units	10 in 80%+ 4 in 60 – 80% 4 n/a	4 in 63, 14 in 86-93

Breakdown of Infrastructure Components – Electrical Types

Infrastructure Component	Type	Quantity
Area A Station 27.6 kV feeders		
Feeder A-2		
Primary Conductors	Overhead 1-Phase Conductor	20005.5 m
	Overhead 3 Phase Conductor	10388.8 m
	Underground 1-Phase Conductor	994.3 m
	Underground 3-Phase Conductor	5464 m
Switches	Fused	125 units
	Live Line Opener 1 End	1 unit
	Load Break	9 units
	Load Break Gang Operated	53 units
	Non-Load Break	14 units
Transformers	Pad: 1-3 Phase Delta Delta	1 unit
	Pad: 1-3 Phase Wye Wye	20 units
	Pole: 1-1 Phase	241 units
	Pole: 2-1 Phase Parallel	2 units
	Pole: 3-1 Phase Delta	1 unit
	Pole: 3-1 Phase Wye	16 units
	Submersible: 1-1 Phase	8 units
	Submersible: 1-3 Phase Delta Wye	3 units
	Submersible: 3-1 Phase Wye	22 units
Poles	See table above	1117 units
Feeder A-3		
Primary Conductors	Overhead 1-Phase Conductor	7985.1 m
	Overhead 3 Phase Conductor	7287.6 m
	Underground 1-Phase Conductor	790.8 m
	Underground 3-Phase Conductor	5605 m
Switches	Fused	61 units
	Live Line Opener 1 End	3 units
	Load Break	9 units
	Load Break Gang Operated	36 units
	Non-Load Break	5 units
Transformers	Pad: 1-3 Phase Delta Wye	3 units
	Pad: 1-3 Phase Wye Delta	1 unit
	Pad: 1-3 Phase Wye Wye	15 units
	Pole: 1-1 Phase	95 units
	Pole: 3-1 Phase Wye	8 units
	Submersible: 1-1 Phase	4 units
	Submersible: 1-3 Phase Delta Wye	3 units
	Submersible: 3-1 Phase Wye	21 units
Poles	See table above	427 units
Feeder A-1		
Primary Conductors	Overhead 1-Phase Conductor	9.7 m
	Overhead 3 Phase Conductor	4793.7 m
	Underground 3-Phase Conductor	7676.3 m
Switches	Fused	73 units
	Live Line Opener 1 End	1 unit
	Load Break	10 units

Infrastructure Component	Type	Quantity
	Load Break Gang Operated	29 units
	Non-Load Break	6 units
Transformers	Pad: 1-3 Phase Delta Wye	2 units
	Pad: 1-3 Phase Wye Wye	27 units
	Pole: 1-1 Phase	9 units
	Pole: 3-1 Phase Delta	2 units
	Pole: 3-1 Phase Wye	4 units
	Submersible: 3-1 Phase Wye	34 units
Poles	See table above	113 units
Area B Station 13.8 kV feeders		
Feeder B-1		
Primary Conductors	Underground 3-Phase Conductor	4214.4 m
Switches	Load Break Gang Operated	6 units
	Non-Load Break	9 units
Transformers	Submersible: 1-3 Phase Delta Wye	12 units
	Submersible: 3-1 Phase Delta	1 unit
Feeder B-2		
Primary Conductors	Overhead 1-Phase Conductor	4398.3 m
	Overhead 3 Phase Conductor	4268.5 m
	Underground 1-Phase Conductor	7000.3 m
	Underground 3-Phase Conductor	4203.3 m
Switches	Fused	23 units
	Load Break	17 units
	Load Break Gang Operated	30 units
	Non-Load Break	20 units
Transformers	Pad: 1-3 Phase Delta Delta	4 units
	Pad: 1-3 Phase Wye Wye	4 units
	Pole: 1-1 Phase	69 units
	Pole: 3-1 Phase Wye	10 units
	Submersible: 1-1 Phase	10 units
	Submersible: 1-3 Phase Delta Wye	1 units
	Submersible: 1-3 Phase Wye Wye	2 units
	Submersible: 3-1 Phase Delta	1 units
	Submersible: 3-1 Phase Wye	2 units
Poles	See table above	362 units
Area C Station 13.8 kV feeders		
Feeder C-1		
Primary Conductors	Underground 3-Phase Conductor	2809.6 m
Switches	Load Break Gang Operated	3 units
Civil Structures	Cable Chamber	43 units
	Vault	6 units
Feeder C-2		
Primary Conductors	Underground 3-Phase Conductor	5358.7 m
Switches	Load Break Gang Operated	4 units
	Non-Load Break	15 units
Transformers	Submersible: 1-3 Phase Delta Wye	17 units
Civil Structures	Cable Chamber	69 units
	Vault	18 units

Appendix B
Current Climate Analysis

Current Weather and Climate Hazards for Toronto Hydro's Electrical Distribution System

for Toronto Hydro-Electric System Public Infrastructure Engineering Vulnerability Assessment (PIEVC) Pilot Case Study

Risk Sciences International

Introduction

An examination of Toronto Hydro's 2011 power outages for the sections of the network under consideration highlighted a pattern in the major weather-related of threat to the system. The following events were most frequently associated with power outages and emergencies:

- strong winds generally gusting above 70 km/hr;
- lightning;
- winter storms with mixed precipitation types, freezing rain events;
- heavy rainfalls and flooding; and,
- severe heat waves.
- These weather hazards are consistent with the weather-related hazards identified in a Canadian Standards Association (CSA 2010a, 2010b) studies of transmission systems sensitivities and needs for climate and weather information. The CSA study identified the following weather-related information priorities for above ground transmission line systems: Combined Ice and Wind events (i.e. ice accretion loadings);
- Wet snow;
- Severe Wind Events;
- Temperatures - Variability and Extremes;
- Lightning strikes; and,
- (Flooding) – for electrical distribution systems.

A number of utilities in the CSA study reported that distribution and transmission systems had been increasingly hard-hit by extreme wind events, with convective or thunderstorm downbursts being the most commonly-cited concern. They also reported that combined wind and ice accretion events were the single most significant weather-climate gap needed for the updating of line design standards. Many respondents suggested that lightning has become increasingly problematic over recent years and expressed interest in better understanding trends in the frequency and distribution of lightning strikes for surge protection. Most respondents to the CSA study also identified either variability or extremes in temperature as important. Climates, like those of Toronto, that can bring cold snaps in the winter and excessive heat and humidity in the summer were identified as posing particularly difficult challenges.

Utility operators from across Canada emphasized the importance of having spatially and temporally comprehensive and consistently high quality climate/weather data sets and analyses and suggested "bolstering the baseline" information as a first step to climate change adaptation in order to:

- assist in the updating of climatic design values already included in key codes and standards;
- allow for the development of climate hazards information that still need to be expressly incorporated into key codes and standards. These hazards could become more problematic as the result of climate change.

Toronto Hydro Thresholds

The Engineers Canada PIEVC Protocol typically requires guidance on critical thresholds of significance or risk to the infrastructure system under consideration. Due to time constraints, many of the thresholds identified for this study of current risks were adapted from an earlier PIEVC case study on the Toronto and Region Conservation Authority Flood Control Dam Water Resources Infrastructure Assessment (TRCA Study). While the weather sensitivities of dams may be quite different than those for electrical distribution systems, many of the climate variables were found to also be applicable to the electrical distribution system. However, the climate thresholds and their frequencies that were used in this study may require further fine-tuning to have greater relevance to the power distribution sector. Where related infrastructure breaking point thresholds

were known (e.g. building code design winds, CSA/CEA overhead systems design temperatures), their thresholds were used in for this study.

The climate thresholds of interest to Toronto Hydro are shown in Table 1 and are derived in part from the earlier Toronto dams study.

Toronto Hydro climate thresholds of interest for the PIEVC vulnerability study.

	Category	Category derived parameters	Thresholds for Toronto Hydro	Threshold Data Source
1	**Temperature**	High Temperature	Average annual # days with T≥ 30°C	CEC, Part 1
2		Low Temperature	Average annual # days < -20°C	CSA C22.3 No. 1
3		Heat Wave	3 or more days with Tmax ≥ 30°C	Professional judgment
4		Extreme Humidity	# Days with Humidex ≥ 40°C	Professional judgment
5		Severe Heat Wave	3 or more days with Humidex ≥ 40°C	Professional judgment
6		Cold Wave	3 or more days with Tmin ≤20°	Professional judgment
7		Temperature Variability	Daily T ranges ≥ 25°C	TRCA study
8		Freeze-thaw cycle	Annual Probability of at least 70 freeze-thaw cycles (Tmax>0 and Tmin<0):	TRCA study
9		Fog	~15 hours/year (average) with visibility <= 0 km	TRCA study
10		Frost	Undetermined	
11	**Wind**	High wind/downburst	Gusts > 70 km/h (~21days / year at Airport)	Professional judgment
12		High wind/downburst	Gusts > 90 km/h (~2 days / year at Airport)	CSA C22.3 No. 1
13		Tornadoes	Tornado vortex extending from surface to cloud base (near infrastructure)	TRCA study
14	**Precipitation**	Heavy Rain	Daily Rainfall > 50 mm/day	TRCA study
15		Heavy 5 day total rainfall	5 days of cumulative rain > 70 mm of rain	TRCA study
16		Ice Storm	Average annual probability of at least 25 mm of freezing rain per event	TRCA study
17		Freezing Rain	Average annual probability of freezing rain events lasting 6h or more (i.e. typically more than 10 mm of freezing rain)	TRCA study
18		Blowing snow/Blizzard	Average # of days / year with blowing snow (7.8 / y)	TRCA study
19		Heavy Snowfall	Snowfall > 10cm (2-3days/y)	TRCA study
20		Snow accumulation	Snow on ground with depths ≥ 30 cm and persisting for 5 or more days (0.17 events/y)	TRCA study
21		Hail	Average # of hail days (~1.1/y)	TRCA study
22	**Other**	Severe thunderstorms	Average # of Thunderstorm Days (~2.8/y)	TRCA study
23		Lightning	Average # Days/Year with cloud - ground lightning strikes (~25)	TRCA study
24		Drought/Dry periods	At least one month at Ontario low water response level II (i.e. with mandatory water conservation)	Professional judgment

Climate Data and Analyses

A variety of climate information sources were used in completing the climate hazards study for the Toronto Hydro-Electrical Distribution pilot case study. These include:

- The National Building Code of Canada, Appendix C, Climate Information (2010) and CSA 22.3 No. 1 – "Overhead Systems" standard;
- Environment Canada's Climate Normals; National Climate Archive online access, including CDCD and IDF values, etc.;
- Environment Canada (and partners) Hazards Portal and web site (www.hazards.ca – no longer available);
- Environment Canada (and partners) Climate Change Scenarios website (www.ontario.cccsn.ca) – only a national version now available;
- Environment Canada's Rainfall Intensity - Duration – Frequency (IDF) curves and publications on regional IDF values for southern Ontario;
- Peer-reviewed journal articles on downscaling methodologies for an ensemble of climate change models (>10 international journal articles on projections of ice storm, wind gust, temperature, heat-air quality-mortality risks for the Toronto region);
- Expert climate judgment.

Climate Information for the PIEVC Protocol

Climate hazards can be associated with two types of events, analogous to "shock" and "stress" events: (1) rare, extreme and rapid/sudden-onset hazards or "shock events" and (2) slow onset "creeping" or recurring threats or "stress events". The threats or shock events are factored into codes, standards and practices through use of extreme value or return period climate probabilities. The recurring climate events, on the other hand, occur several times annually and have implications for operations and maintenance. Failure to deal with these recurring climate hazards (e.g. weathering processes) can lead to lost resilience, reduced durability and a decrease in the ability of the system to withstand the extreme events.

Standardized Probability Scores

The PIEVC Protocol makes use of standardized climate probability scores ranging from 0 to 7, with a score of 0 referring to a climate event that likely will not occur while a score of 7 refers to an event that likely will occur over the service life of the structure. For this study, the PIEVC Version 10 Beta Protocol Method B or quantitative approach was used to convert annual probabilities into standardized values.

PIEVC Version 10 Beta Probability Scores based on Methods A and B.

Score	Probability	
	Method A	Method B
0	Negligible Not Applicable	< 0.1 % < 1 in 1,000
1	Highly Unlikely Improbable	1 % 1 in 100
2	Remotely Possible	5 % 1 in 20
3	Possible Occasional	10 % 1 in 10
4	Somewhat Likely Normal	20 % 1 in 5
5	Likely Frequent	40 % 1 in 2.5
6	Probable Often	70 % 1 in 1.4
7	Highly Probable Approaching Certainty	> 99 % > 1 in 1.01

Extreme Winds

High winds and their short duration gusts predominantly affect overhead power lines. The impacts of winds on power lines can be greatly exacerbated by trees and debris being blown onto the lines. Not surprising, the impact of trees and winds on lines is affected by the season, maintenance work carried out on the trees, types of trees (deciduous, coniferous), leaf state of the deciduous trees, length of the growing season and whether the ground is saturated at the time of the high winds. Future projections of wind gusts in the Toronto area under climate change indicates that high winds above thresholds of 70, 80 and 90 km/hr may increase in future.

The CSA study (2009) sought input from the electrical distribution and transmission sectors on critical thesholds for the impacts of windstorms and other atmospheric hazards on electrical distribution and transmission infrastructure. The study found that damage to and failure of power distribution and transmission structures and lines starts to occur at certain wind speed thresholds:

- Trees impact power distribution when wind speeds reach or exceed 50-70 km/h;
- High-voltage power lines will be impacted when wind speeds reach or exceed 80-100 km/h.

The PIEVC study calculated the frequencies of winds reaching or exceeding 70 and 90 km/hr from recent wind speed and gust data for Toronto Pearson International Airport. Wind gusts are measured and the data quality controlled only at a limited number of weather stations in Canada. These wind monitoring stations must meet standard conditions for wind anemometer siting in an open grass-covered area and measured at 10m above ground). Most hourly wind measurements are taken at synoptic weather stations (e.g. airports) and analyses of winds is only valid if the station operated a 24 hour monitoring and recording program. Toronto Pearson Airport was considered the most representative wind monitoring station. While the Toronto Island Airport measures winds, the local wind conditions on Toronto Island are most representative of a Lake Ontario near shore site.

Wind Storms	Historical Annual Probability	Standardized Annual Probability Score (0-7)
NBCC 10 and 50 year return period SUSTAINED WIND pressures	0.34 & 0.44 kPa (82 & 94 kph)	3 & 1 (10 yr) & (50 yr)
Average # days with gusts ≥ 70 kph	21	7
Average # days with gusts ≥ 90 kph	2	7

Windstorms vary in terms of their spatial extent, duration of the extreme winds and the weather processes that generate them. Intense **large-scale** (synoptic scale) **storms** or cyclones can produce damaging winds over large areas, with the highest wind speeds usually associated with low pressure systems that are deepening or intensifying rapidly. Other damaging winds can result from s**evere thunderstorms** that are typically associated with very thunderstorm downbursts, or can be more extensive in spatial coverage along organized squall lines producing what are known as straight-line winds. The storms usually pass through any one location very quickly, with the damaging winds lasting only 20 to 30 minutes. Organized thunderstorms and clusters or lines of thunderstorms can have longer lifespans with damaging winds lasting for several hours.

Lightning

At the time of this study, specific information on critical thresholds of lightning activity for power distribution system failures were not known. The climatological frequency of cloud-to-ground lightning strikes was provided, based on recently updated information. It is likely that lightning activity could occur more often in future due to an increase in days with stronger convection.

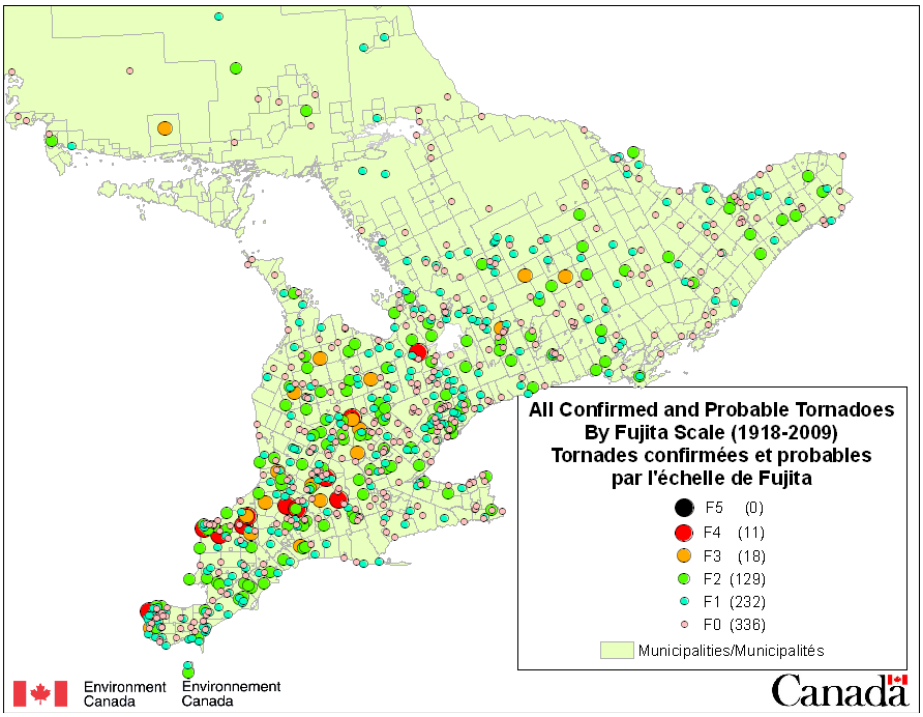
Lightning flashes are detected by the **Canadian Lightning Detection Network** (CLDN), which was established in 1998 as part of the North American Lightning Detection Network. The majority of flashes that are detected are cloud to ground (CG) with a small fraction of cloud to cloud (CC) lightning flashes. Some of the highest lightning flash densities in Canada occur in southwestern and south-central Ontario.

Thunderstorm and Lightning Probabilities	Historical Annual Probability	Standardized annual probability score (0-7)
Average # thunderstorm days (Toronto Pearson A)	28	7
Average # days with hail	1.1	6
Average # days with lightning cloud-ground strikes	~25 (excludes CN Tower strikes)	7
Average annual flash density (flashes/km^2/year)	~1.7	7

Tornado Risks

The most devastating tornadoes to have affected Ontario have been located in a narrow corridor from southwestern Ontario near Lake St Clair, northeastward to Stratford, Shelburne and then to Barrie (King *et al*., 2003; Newark, 1983, 1984) and avoiding the Toronto area. This corridor is often referred to as Ontario and Canada's 'tornado alley'.

Confirmed and Probable Tornadoes by Fujita Scale (1918 - 2009)



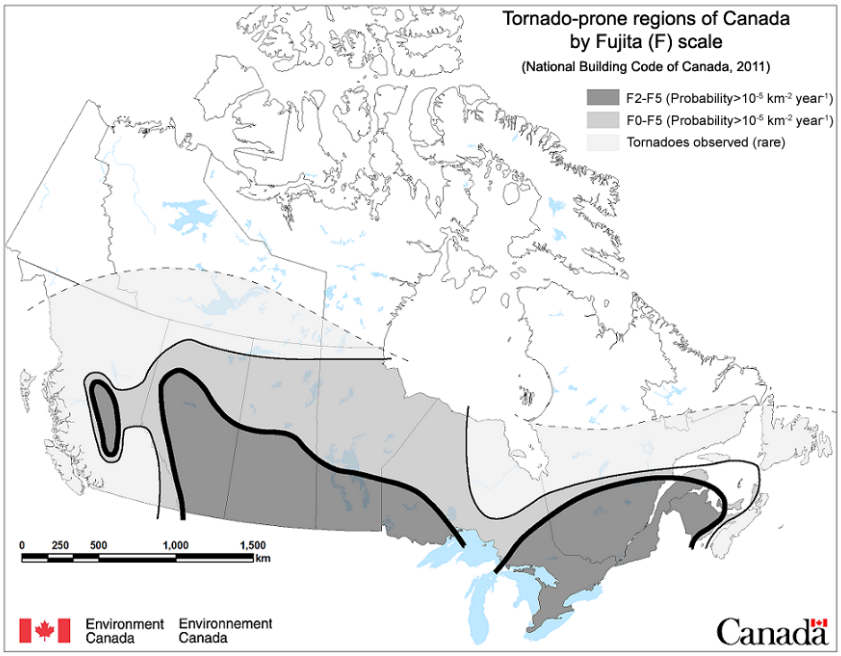
Source: *Environment Canada, 2011c. Internal. Data provided courtesy of David Sills, Severe Weather Scientist, Environment Canada.*

Information on tornado occurrences in a recently updated Ontario tornado database (Environment Canada, 2011a) are based on reports from a variety of sources, including volunteer severe weather observers and an investigation of newspaper archives. The occurrence of tornadoes is verified through several types of evidence, including damage surveys, videos, photographs, and eyewitness accounts. Additional reports of tornadic wind damage from newspapers or through first-hand accounts are sometimes also used to help determine tornado occurrence (Sills, 2002).

TORNADO RISKS	HISTORICAL	STANDARDIZED ANNUAL PROBABILITY (0-7)
Estimated tornado density for a point in downtown Toronto (probabilities higher for linear distances). Note that probabilities would be higher for power lines and linear distances.	$0.00002 km^{-2} yr^{-1}$ ($2X10^{-5}$)	0
Estimated tornado density for point locations just outside of Toronto (suburbs). Note that probabilities would be higher for power lines.	$> 0.0001 km^{-2} yr^{-1}$ ($1X10^{-4}$)	0
2010 NBCC – requirement for implementation of building tornado prone measures	**IN** national tornado prone region	N/A

The 2010 issue of the National Building Code of Canada (NBCC) contains life-proofing structural measures that are required in “tornado-prone” regions of Canada. Toronto lies within this “tornado-prone” region identified in the figure below and taken from the 2010 NBCC.

Tornado-prone regions of Canada by Fujita (F) Scale



Source: *NBC, 2011. Users Guide - National Building Code of Canada (NBC) Structural Commentaries (Part 4 of Division B); issued by the Canadian Commission on Building and Fire Codes, National Research Council of Canada, Ottawa, Ontario. Tornado prone map and commentary contributed by Environment Canada (Adaptation and Impacts Research, Cloud Physics and Severe Weather Research; Science and Technology Branch), Toronto, Ontario.*

Winter Storms with freezing rain, wet snow and ice-wind events

Many winter-time power distribution failures are caused by a combination of freezing rain under light wind conditions or wet snow with stronger winds causing ice or frozen precipitation to accrete on the lines. The climate information used to identify probabilities for the freezing rain hazard were taken from a recent peer-reviewed study of longer-lasting freezing rain storms in the Toronto area and from a study of estimated extreme annual freezing rain amounts for Woodbridge that was undertaken following Ice Storm ’98.

Within Canada, freezing precipitation is defined as freezing rain or drizzle, which falls in liquid form and then freezes upon contact with the ground or a cold object near the ground, forming a coating of ice. The greatest ice accumulations and impacts generally result from freezing rain events. Typically, the occurrence of freezing rain or freezing drizzle is reported at the main synoptic weather stations having 24 hour weather observation programs. The amounts of freezing rain have to be estimated from total daily or 6 hour precipitation amounts while ice buildup amounts typically are estimated from ice accretion models that consider the shape of the object or sometimes from observations.

The amount of ice accumulation is normally directly related to the amount of freezing precipitation. Usually, shorter duration events (i.e. 1-2 hours) will have lower ice accumulation amounts than those of longer duration (i.e. 6-12 hours or longer). The most severe freezing rain events are labeled as 'ice storms” and ice storms of any duration and magnitude can have serious impacts on human safety, critical infrastructure and community emergencies. As the duration of the freezing rain increases, trees, electricity distribution and communications infrastructure can collapse under the weight of the accumulated ice.

Damage and outages in the power distribution system are often caused by broken or weakened and sagged tree limbs. Under the weight of accumulating ice, tree branches can fall or sag into overhead electrical distribution lines. Accumulations of ice can increase the branch weight of trees by 30 times or greater. Small branches and weak tree limbs break with ice accumulations *between ~6-12 mm, while ~12-25 mm* accumulations can cause larger branches to break. If high storm winds are combined with the ice loading, the damage to trees and infrastructure will increase. Without the presence of trees, power outages during ice storms occur at relatively higher ice loads.

An Environment Canada review of severe ice storms that have affected Southern Ontario and the eastern United States over the past century suggests that the risks of major power outages lasting several days in Southern Ontario tends to increase for freezing rain amounts reaching or exceeding approximately 30 mm. Historical evidence indicates that the potential for long power outages and community disasters becomes likely when freezing rain *totals exceed approximately 40 mm* in these regions.

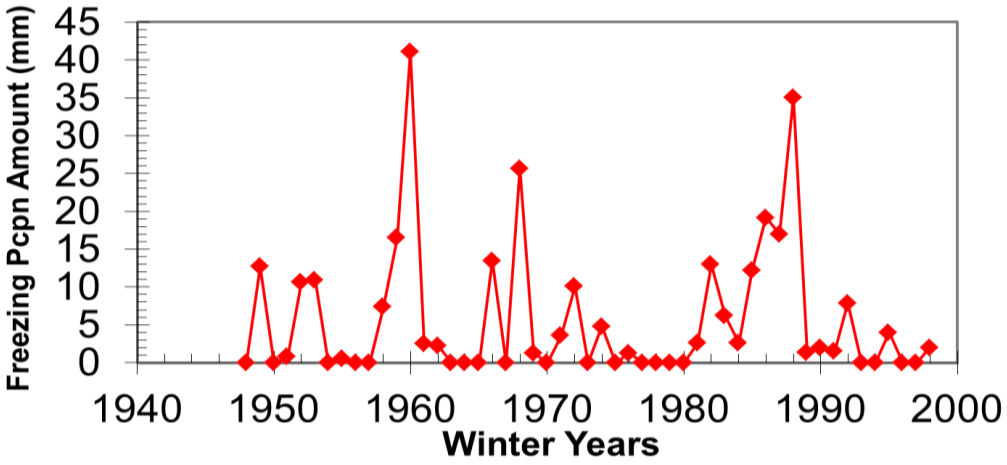
It is expected that climate change will initially increase risks for freezing rain storms. As winter temperatures warm initially, mixed phase precipitation (e.g. wet snow, freezing precipitation) becomes more frequent and winter precipitation amounts as well as number of days with precipitation increase, while mixed phase precipitation becomes more frequent, the frequency and intensity of freezing precipitation events may increase. Recent peer-reviewed studies indicate the potential for longer duration freezing rain storms to increase in the core winter months in the Toronto area under climate change.

Freezing rain and ice storm probabilities	**Historical Annual Probability**	**Standardized annual probability score (0-7)**
Average # Days with freezing rain/drizzle	8.8	7
Average # Days with freezing rain lasting at least 4 hours	1.4	6
Average # Days with freezing rain lasting at least 6 hours	0.65	5
Estimated annual multi-day probability of severe ice storms with ≥ 25 mm of accumulated ice (approaching design amounts)	0.06	2

The hourly weather data for Toronto Pearson Airport was analyzed to determine the average number of days/year with at least one observation of freezing rain or freezing drizzle (averages 8.8 days/year). The hourly data was also analyzed to obtain the frequencies of freezing rain events lasting at least 4 hours and at least 6 hours for the period of record. Typically, light freezing drizzle events accumulate ice on the ground at rates of 0.1-0.3mm/hr while moderate freezing drizzle accumulates ice on the ground at an estimated 0.3mm/hr). Freezing rain events bring much greater ice accumulations, with typical freezing rain rates of around 1.5-2mm/hr for light freezing rain and up to 5 mm/hr for moderate freezing rain. A freezing rain storm lasting 4 hours could be expected to bring 6-8mm of freezing precipitation accumulations and as much as 15mm, causing small tree limbs to start breaking and impacting power cables. Storms lasting 6 hours or more can bring 9-12mm of ice on the ground for light freezing rain precipitation and amounts up to 25mm, resulting in sufficient ice accretion to break large tree branches or impact power lines. Freezing rain amounts of 25 mm or more are approaching ice design criteria for overhead (230kV) cables/lines (although freezing rain amounts and ice accretion amounts are not the same).

The probability of freezing rain amounts exceeding 25 mm was estimated roughly using daily climate data for the Woodbridge weather station located just north of the Toronto boundaries. The results from this rough approximation approach indicate that the most severe ice storms with 25 mm or more of freezing rain have occurred 3 times in 50 years or have an annual probability of ~0.06. The Woodbridge station was chosen since the greatest risks for severe ice storms within the Toronto area lie in locations away from Lake Ontario and the downtown core where freezing rain events tend to be longer lasting (i.e. slower to change to rain). The estimated annual maximum freezing rain amounts were derived using conservative assumptions (i.e methodology assumed that freezing rain resulted on days when rain was measured but temperatures remained below zero). The results of this rough estimation approach were confirmed by a 1960 observation of more than 41 mm of freezing rain at Woodbridge.

Estimated 6 day Duration Annual Maximum Freezing Precipitation for Woodbridge Weather Station



Flooding

Heavy rainfall and in-situ flooding conditions can have impacts for underground components of the system. As a minimum, flooding events can hamper access to underground facilities and delay restoration efforts when underground quarters have to be safety pumped. Peer-reviewed studies indicate that the extreme rainfall conditions may increase in future under climate change.

Ontario's most expensive weather disaster ever, in excess of $500 Million in damages, was the result of organized severe thunderstorms tracking from Kitchener, across and north of Toronto to Oshawa on August 19, 2005. At its worst, the thunderstorm system spawned two F2 tornadoes west of Toronto but brought torrential rains, quarter- to golf-ball size hail, strong winds and flash flooding to Toronto. At its height, 1,400 lightning strikes per minute were reported and rainfall accumulations broke several national rainfall records for the 10, 15 and 30 minute rainfall durations as well as the 2 hour national rainfall record based on Environment Canada's rainfall intensity-duration-frequency network of stations. This amount compares to 53 mm in one hour from Hurricane Hazel in 1954.

PRECIPITATION ELEMENTS	HISTORICAL	STANDARDIZED PROBABILITY - ANNUAL
Average # Days with Rainfall > 50mm	0.53 (City) & 0.47 (Airport)	5
Annual Prob of ≥ 70mm in 5-Day period	0.2 (City)	4
Annual Prob of ≥ 100mm rainfall accumulation in a 5-Day period *(i.e. # 5-day events/30 years)*	0.03 (City) & 0.07 (Airport)	2
10 year return period of 15 minute rainfall – NBCC	~ 25mm (both)	3
50 year return period 24 hour rainfall – NBCC	102 mm (Airport) & 87 mm (City)	1
Average # days with snowfall ≥ 10cm	3.1 (City) & 2 (Airport)	7
Average # days with snow depths ≥ 30cm	2.2 (City) & 1.3 (Airport)	6
Average # days with snow depths ≥ 30cm and persisting for 5 or more days	0.17 (City)	3
Average # days with Blowing Snow	7.8 (Airport)	7

Drought

The severe droughts in Ontario over the past 15 years, coupled with the risk of an increase in severity and frequency of drought under climate change and growing demands on water resources led the province to develop the Ontario Low Water Response (OLWR) Plan in 1999-2000. The Plan was further revised in 2003 and is intended to ensure that provincial and local authorities could be advised of and prepared to take action in the event of low water conditions in watersheds.

Three water level conditions and action points, Levels I, II and III, are defined using specific precipitation and streamflow indicators. The Level II response framework conditions call for Conservation and Restrictions on Non-Essential Use of water at the municipal and regional government scales.

Based on daily rainfall measurements for the warm season from May-September for the Toronto City station, equivalent Ontario Low Water Response Level II low water response criteria lasting at least one month have occurred 18 times in 60 years for a probability of 0.3 while Level III conditions lasting at least one month are quite rare, occurring only twice in the 60 year period. For the Toronto Pearson Airport station, Level II criteria have been reached the same number of times while the Level III conditions have reached thresholds more often (4 occurrences in 60 years). There is no compelling reason for drought conditions to be more frequent near the airport location than the city centre.

DROUGHT (Toronto City)	HISTORICAL	STANDARDIZED PROBABILITY - ANNUAL
Frequency of at least one month in the warm season (May-Sept) meeting **Ontario Low Water Response Level II** (precipitation) criteria (1946-2005)	0.3	4
Frequency of at least one month in the warm season (May-Sept) meeting **Ontario Low Water Response Level III** (precipitation) criteria (1946-2005)	0.033	1

Extreme Heat and Cold

In Toronto, where the increased use of summertime air conditioning can push summer peak loads close to the limit, extreme and prolonged periods of high temperatures and high Humidex values can pose a threat to the demands on equipment and the grid. Building space cooling, lighting and other facility uses tend to be the largest loads in Toronto's commercial sector while space cooling, appliances and home electronics dominate demand in the residential sector. The space cooling electrical demand tends to be on-peak. Space cooling demand is significantly driven by "hot" temperatures and particularly by cooling degree days or accumulated warm temperatures and higher humidities.

As the Table below indicates, the extreme maximum and minimum temperatures as well as cooling and heating degree days vary considerably from the relatively warmer downtown core to the outer boundaries of the Toronto Hydro service area. Where the data allows, frequencies for the City (downtown) and Toronto Pearson Airport are provided as representative of downtown and city border conditions. In addition, the Table also provides NBCC design values of critical importance for the design and operation of buildings in Toronto. Not surprisingly, these building thresholds of 31°C and -20°C match the temperature thresholds provided by Toronto Hydro. The Table also provides frequencies for the more severe heat waves and characterizes these using frequencies above high Humidex thresholds.

TEMPERATURE ELEMENT (Toronto area)	HISTORICAL - ANNUAL	STANDARDIZED PROBABILITY
Average annual # days ≥ 30°C	12.6 (City) & 9.5 (Airport)	7
Average annual # days ≤ -20°C	1.4 (City) & 5.2 (Airport)	6
2.5 percentile July Drybulb Hot temperature – NBCC	31°C	1
2.5 percentile January Drybulb Cold temperature – NBCC	-20°C	1
Heat Wave – 3 or more days with maximum temperatures ≥ 30°C	1.0 (City) & 0.6 (Airport)	6
Cold Wave – 3 or more days with minimum temperatures ≤ -20°C	0.17 (Airport)	3
Variability – Daily temperature ranges ≥ 25 degrees C	0.17 (Airport)	3
Extreme Humidex	50.3 (Airport in 1955) & ~49 (City in 2011)	0
Severe Heat Wave: annual frequency of 3 or more days with Humidex ≥ 40	0.3 (Airport)	4
Extreme Heat Wave: Average Annual # Days with Humidex ≥ 45	0.13 (Airport)	3
Average annual Cooling Degree Days	359 (City) & 252 (Airport)	7
Average Annual Number of incremental heat mortalities	~ 120	5 (expected to increase in future)

The City of Toronto, like many other municipalities in Ontario, has a Heat-Health Alert System in place to warn its population of potentially dangerous hot temperature related conditions and advises vulnerable populations to seek cooler buildings and cooling centres for relief. The Toronto Heat-Health Alert system uses weather map typing or a synoptic/airmass classification approaches together with epidemiological evidence to forecast risks for increased heat-related mortality. These same conditions can be associated with peak electrical demands.

Recently updated climate Normals information indicates that significant warming has taken place in the past few decades in the Toronto region and needs to be considered in planning and operations. The updated (but unofficial) climate temperature Normals or average annual temperatures for Toronto Pearson Airport confirm that the mean annual temperatures for the historical 30-year Normals periods have increased as shown in the Table below. These increasing trends will likely continue into the unforeseeable future. Projections from an ensemble of climate change models indicates that cooling degree days for Toronto's downtown core could double by the 2050s, highlighting trends for electricity building cooling demand.

Toronto Pearson Airport's 30-year climate Normals for various historical reference periods - The results indicate significant warming since 1961.

Normals Period (30 years) for Toronto Pearson Airport	Average Annual Temperature	Average No. Days with mean temperatures above 0°C
1961-1990	7.3°C	212
1971-2000	7.7°C	219
1981-2010	8.8°C	228

Trends for extreme cold temperatures and cold waves are decreasing in Toronto, with days with minimum temperatures below -20°C becoming less common each decade.

Weathering

As well as extreme weather events, the cumulative effects of day-to-day weathering processes can lead to premature deterioration of the electrical grid. These processes include freeze-thaw cycles, use of salt (due to freeze-thaw cycles and snowfall events), UV radiation, fog and deposit of salt on overhead assets, and the impacts of higher temperatures and humidities on deterioration of assets. Many of these processes have the potential to increase through to the 2050s, as indicated in the Table below.

WEATHERING & PREMATURE DETERIORATION	HISTORICAL (usually 1971-2000)	STANDARDIZED PROBABILITY – ANNUAL
Average annual freeze-thaw cycles (Tmin≤0°C and Tmax≥0°C)	55 (City) & 87 (Airport)	7
Annual Probability of at least 70 freeze-thaw cycles (as per Toronto dam study)	0.1 for City but probable in North	3 (City) and 6 (Airport)
Average annual # hours with fog visibilities ~ ZERO	15 hours/year	7
Cement carbonization & deterioration (due to increasing CO_2 and temperatures)	Likely increasing over the long-term	N/A
Other weathering processes – humidities, temperatures, UV, some pollutants, rain wetting days	All increasing or expected to increase into the future	N/A

Climate Change Risks

With the exception of cold temperatures, climate change is expected to exacerbate almost all of the current weather and climate risks. For example, high temperatures and cooling degree day values are all expected to increase in frequency and intensity, leading to potentially more frequent reductions in line capacity, increases in transformer loading and increased line sag. As winter temperatures increase and more moisture becomes available for winter storms, the potential may increase for more icing from more frequent and intense freezing rain and wet snow storms. Summer convective activity and intense rainfall events are also at risk of increasing under climate change, along with day-to-day weathering and carbonization impacts on assets. All of these impacts will require reactive and proactive adaptation risk management actions in the form of changes to codes and standards, increased structural resilience, greater redundancy of assets, increased asset management and changed maintenance, operations and engineering practices.

References

CSA, 2010a. Characterizing the Atmospheric Hazards Information Needs of the Electricity Transmission Sector in Canada. Available from Canadian Standards Association, Mississauga, Ontario. 74pp.

CSA, 2010b. Climatic Information Requirements of Built Infrastructure Codes and Standards and their Users: Report on an Inventory and Expert Interviews Conducted by the Canadian Standards Association. Available from Canadian Standards Association, Mississauga, Ontario, 23pp.

Appendix C
May 11 Workshop Presentations

Appendix D
Risk Assessment Matrices

Toronto Hydro-Electric System Pilot Public Infrastructure Vulnerability Committee Workshop

	Infrastructure Components	Infrastructure Response Considerations									
		Structural Design	Functionality	Serviceability	O/M & Materials Performance	Emergency Response	Insurance Considerations	Policy and Procedure	Public Health and Safety	Social Impacts	Environmental Impacts
		Mark Relevant Responses with ✓									
	Feeder A-2										
	Primary Conductors										
1	Overhead	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	Underground			✓	✓	✓		✓	✓	✓	
	Switches										
3	Overhead - Main Line	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Overhead - Lateral Line	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	Overhead - Customer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	Pad Mount Switches	✓	✓	✓	✓	✓		✓	✓	✓	✓
7	Underground			✓	✓	✓		✓	✓	✓	✓
	Transformers										
8	Pole mounted	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	Pad mounted	✓	✓	✓	✓	✓		✓	✓	✓	✓
10	Submersible			✓	✓	✓		✓	✓	✓	✓
	Civil Structures										
11	Vault				✓	✓		✓	✓	✓	
12	Cable Chamber				✓	✓		✓	✓	✓	
	Poles										
13	30 < 40 ft Steel	✓	✓	✓	✓	✓	✓	✓	✓	✓	
14	30 < 40 ft Wood	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15	30 < 40 ft Concrete	✓	✓	✓	✓	✓	✓	✓	✓	✓	
16	40 < 50 ft Wood	✓	✓	✓	✓	✓	✓	✓	✓	✓	
17	40 < 50 ft Concrete	✓	✓	✓	✓	✓	✓	✓	✓	✓	
18	50 ≤ 60 ft Wood	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Feeder A-1										
	Primary Conductors										
36	Overhead	✓	✓	✓	✓	✓	✓	✓	✓	✓	
37	Underground			✓	✓	✓		✓	✓	✓	
	Switches										
38	Overhead - Main Line	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
39	Overhead - Lateral Lines	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
40	Overhead - Customer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
41	Pad Mount	✓	✓	✓	✓	✓		✓	✓	✓	✓
42	Underground			✓	✓	✓		✓	✓	✓	✓
	Transformers										
43	Pole mounted	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
44	Pad mounted	✓	✓	✓	✓	✓		✓	✓	✓	✓
45	Submersible			✓	✓	✓		✓	✓	✓	✓
	Civil Structures										
46	Vault				✓	✓		✓	✓	✓	
47	Cable Chamber				✓	✓		✓	✓	✓	
	Poles										
48	35 < 40 ft Wood	✓	✓	✓	✓	✓	✓	✓	✓	✓	
49	35 < 40 ft Concrete	✓	✓	✓	✓	✓	✓	✓	✓	✓	
50	40 < 50 ft Wood	✓	✓	✓	✓	✓	✓	✓	✓	✓	
51	50 ≤ 60 ft Wood	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Feeder C-1										
	Primary Conductors										
72	Underground			✓	✓	✓		✓	✓	✓	
	Switches										
73	Underground			✓	✓	✓		✓	✓	✓	✓
	Civil Structures										
74	Vault				✓	✓		✓	✓	✓	
75	Cable Chamber				✓	✓		✓	✓	✓	
	Feeder C-2										
	Primary Conductors										
76	Underground			✓	✓	✓		✓	✓	✓	
	Switches										
77	At grade in customer vault or				✓	✓		✓	✓	✓	✓
78	Underground			✓	✓	✓		✓	✓	✓	✓
	Transformers										
79	Submersible network type			✓	✓	✓		✓	✓	✓	✓
	Civil Structures										
81	Vault				✓	✓		✓	✓	✓	
82	Cable Chamber				✓	✓		✓	✓	✓	

	Infrastructure Components	1 High Temperature				2 Low Temperature				3 Heat Wave				4 Extreme Humidity				5 Severe Heat Wave			
		Average annual # days with T≥ 30°C				Average annual # days < -20°C				3 or more days with Tmax ≥ 30°C				# Days with Humidex ≥ 40°C				3 or more days with Humidex ≥ 40°C			
		Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Feeder A-2	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
1	Overhead	Y	7	4	28	Y	6	1	6	Y	6	5	30	Y	3	4	12	Y	4	5	20
2	Underground	Y	7	4	28	Y	6	1	6	Y	6	5	30	Y	3	4	12	Y	4	5	20
	Switches																				
3	Overhead - Main Line	N	7			Y	6	1	6	N	6			N	3			N	4		
4	Overhead - Lateral Line	N	7			Y	6	1	6	N	6			N	3			N	4		
5	Overhead - Customer	N	7			Y	6	1	6	N	6			N	3			N	4		
6	Pad Mount Switches	N	7			Y	6	1	6	N	6	4		Y	3	3	9	Y	4	4	16
7	Underground	N	7			Y	6	1	6	N	6			N	3			N	4		
	Transformers																				
8	Pole mounted	Y	7	4	28	Y	6	0	0	Y	6	3	18	Y	3	4	12	Y	4	5	20
9	Pad mounted	Y	7	4	28	Y	6	0	0	Y	6	3	18	Y	3	4	12	Y	4	5	20
10	Submersible	Y	7	4	28	Y	6	0	0	Y	6	3	18	Y	3	4	12	Y	4	5	20
	Civil Structures																				
11	Vault	N	7			N	6			N	6			N	3			N	4		
12	Cable Chamber	N	7			N	6			N	6			N	3			N	4		
	Poles																				
13	30 < 40 ft Steel	N	7			Y	6	1	6	N	6			N	3			N	4		
14	30 < 40 ft Wood	N	7			Y	6	1	6	N	6			N	3			N	4		
15	30 < 40 ft Concrete	N	7			Y	6	1	6	N	6			N	3			N	4		
16	40 < 50 ft Wood	N	7			Y	6	1	6	N	6			N	3			N	4		
17	40 < 50 ft Concrete	N	7			Y	6	1	6	N	6			N	3			N	4		
18	50 ≤ 60 ft Wood	N	7			Y	6	2	12	N	6			N	3			N	4		
	Feeder A-1	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
36	Overhead	Y	7	2	14	Y	6	0	0	Y	6	1	6	Y	3	0	0	Y	4	1	4
37	Underground	Y	7	2	14	Y	6	0	0	Y	6	4	24	Y	3	0	0	Y	4	2	8
	Switches																				
38	Overhead - Main Line	N	7			Y	6	1	6	N	6			Y	3	1	3	Y	4	1	4
39	Overhead - Lateral Lines	N	7			Y	6	1	6	N	6			Y	3	1	3	Y	4	1	4
40	Overhead - Customer	N	7			Y	6	1	6	N	6			Y	3	1	3	Y	4	1	4
41	Pad Mount	N	7			Y	6	1	6	N	6			Y	3	1	3	Y	4	1	4
42	Underground	N	7			Y	6	1	6	N	6			Y	3	1	3	Y	4	1	4
	Transformers																				
43	Pole mounted	Y	7	1	7	Y	6		0	Y	6	2	12	Y	3	1	3	Y	4	1	4
44	Pad mounted	Y	7	2	14	Y	6		0	Y	6	2	12	Y	3	2	6	Y	4	2	8
45	Submersible	Y	7	2	14	Y	6		0	Y	6	2	12	Y	3	2	6	Y	4	2	8
	Civil Structures																				
46	Vault	N	7			Y	6	2	12	N	6			N	3			N	4		
47	Cable Chamber	N	7			Y	6	2	12	N	6			N	3			N	4		
	Poles																				
48	35 < 40 ft Wood	N	7			N	6			N	6			N	3			N	4		
49	35 < 40 ft Concrete	N	7			N	6			N	6			N	3			N	4		
50	40 < 50 ft Wood	N	7			N	6			N	6			N	3			N	4		
51	50 ≤ 60 ft Wood	N	7			N	6			N	6			N	3			N	4		
	Feeder C-1	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
72	Underground	N	7			N	6			N	6			N	3			N	4		
	Switches																				
73	Underground	N	7			N	6			N	6			N	3			N	4		
	Civil Structures																				
74	Vault	N	7			N	6			N	6			N	3			N	4		
75	Cable Chamber	N	7			N	6			Y	6	1	6	Y	3	1	3	Y	4	1	4
	Feeder C-2	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
76	Underground	N	7			N	6			N	6			N	3			N	4		
	Switches																				
77	At grade in customer vault or	N	7			N	6			N	6			N	3			N	4		
78	Underground	N	7			N	6			N	6			N	3			N	4		
	Transformers																				
79	Submersible network type	N	7			N	6			Y	6	3	18	Y	3	3	9	Y	4	3	12
	Civil Structures																				
81	Vault	N	7			N	6			N	6			N	3			N	4		
82	Cable Chamber	N	7			N	6			Y	6	1	6	Y	3	1	3	Y	4	1	4

	Infrastructure Components	6 Cold Wave				7 Temperature Variability				8 Freeze-thaw cycle				9 Fog				10 Frost			
		3 or more days with Tmin ≤20°				Daily T ranges ≥ 25°C				Annual Probability of at least 70 freeze-thaw cycles (Tmax>0 and Tmin<0): Standard Prob of 3 for City and 6 for airport				~15 hours/year (average) with visibility <= 0 km				To be discussed			
		Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Feeder A-2	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
1	Overhead	Y	3	1	3	N	3			N	3			N	7			N			
2	Underground	Y	3	1	3	N	3			N	3			N	7			N			
	Switches																				
3	Overhead - Main Line	Y	3	1	3	N	3			N	3			Y	7	2	14	N			
4	Overhead - Lateral Line	Y	3	1	3	N	3			N	3			Y	7	2	14	N			
5	Overhead - Customer	Y	3	1	3	N	3			N	3			Y	7	2	14	N			
6	Pad Mount Switches	Y	3	1	3	N	3			N	3			Y	7	1	7	N			
7	Underground	Y	3	1	3	N	3			N	3			N	7			N			
	Transformers																				
8	Pole mounted	Y	3	0	0	N	3			N	3			Y	7	2	14	N			
9	Pad mounted	Y	3	0	0	N	3			N	3			Y	7	1	7	N			
10	Submersible	Y	3	0	0	N	3			N	3			N	7			N			
	Civil Structures																				
11	Vault	Y	3	1	3	N	3			Y	3	1	3	N	7			N			
12	Cable Chamber	Y	3	1	3	N	3			Y	3	1	3	N	7			N			
	Poles																				
13	30 < 40 ft Steel	N	3			N	3			Y	3	0	0	N	7			N			
14	30 < 40 ft Wood	N	3			N	3			Y	3	0	0	N	7			N			
15	30 < 40 ft Concrete	N	3			N	3			Y	3	1	3	N	7			N			
16	40 < 50 ft Wood	N	3			N	3			Y	3	0	0	N	7			N			
17	40 < 50 ft Concrete	N	3			N	3			Y	3	1	3	N	7			N			
18	50 ≤ 60 ft Wood	N	3			N	3			Y	3	0	0	N	7			N			
	Feeder A-1	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
36	Overhead	Y	3	0	0	N	3			N	3			N	7	0		N			
37	Underground	Y	3	0	0	N	3			N	3			N	7	0		N			
	Switches																				
38	Overhead - Main Line	Y	3	1	3	N	3			Y	3	1	3	Y	7	2	14	N			
39	Overhead - Lateral Lines	Y	3	1	3	N	3			Y	3	0	0	Y	7	2	14	N			
40	Overhead - Customer	Y	3	1	3	N	3			Y	3	0	0	Y	7	2	14	N			
41	Pad Mount	Y	3	1	3	N	3			N	3			Y	7	1	7	N			
42	Underground	Y	3	1	3	N	3			N	3			N	7			N			
	Transformers																				
43	Pole mounted	Y	3		0	N	3			N	3			Y	7	2	14	N			
44	Pad mounted	Y	3		0	N	3			N	3			Y	7	1	7	N			
45	Submersible	Y	3		0	N	3			N	3			N	7			N			
	Civil Structures																				
46	Vault	Y	3	1	3	N	3			Y	3	1	3	N	7			N			
47	Cable Chamber	Y	3	1	3	N	3			Y	3	1	3	N	7			N			
	Poles																				
48	35 < 40 ft Wood	N	3			N	3			N	3			N	7			N			
49	35 < 40 ft Concrete	N	3			N	3			Y	3	1	3	N	7			N			
50	40 < 50 ft Wood	N	3			N	3			N	3			N	7			N			
51	50 ≤ 60 ft Wood	N	3			N	3			N	3			N	7			N			
	Feeder C-1	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
72	Underground	N	3			Y	3	3	9	N	3			N	7			N			
	Switches																				
73	Underground	N	3			N	3			N	3			N	7			N			
	Civil Structures																				
74	Vault	N	3			N	3			N	3			N	7			N			
75	Cable Chamber	N	3			N	3			Y	3	1	3	N	7			N			
	Feeder C-2	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																				
76	Underground	N	3			Y	3	3	9	N	3			N	7			N			
	Switches																				
77	At grade in customer vault or	N	3			N	3			N	3			N	7			N			
78	Underground	N	3			N	3			N	3			N	7			N			
	Transformers																				
79	Submersible network type	N	3			N	3			N	3			N	7			N			
	Civil Structures																				
81	Vault	N	3			N	3			Y	3	1	3	N	7			N			
82	Cable Chamber	N	3			N	3			Y	3	1	3	N	7			N			

Toronto Hydro-Electric System Pilot Public Infrastructure Vulnerability Committee Workshop

	Infrastructure Components	11 High wind/downburst — Gusts > 70 km/h (~21days / year at Airport)				12 High wind/downburst — Gusts > 90 km/h (~2days / year at Airport)				13 Tornadoes — Tornado vortex extending from surface to cloud base (near infrastructure); tornado densities from 2X10-5km-2yr-1 to 1X10-4km-2yr-1.				14 Heavy Rain — Daily Rainfall > 50 mm/day				15 Heavy 5 day total rainfall — 5 days of cumulative rain > 70 mm of rain				16 Ice Storm — Average annual probability of at least 25 mm of freezing rain per event				17 Freezing Rain — Average annual probability of freezing rain events lasting 6h or more (i.e. typically more than 10 mm of freezing rain)				18 Blowing snow/Blizzard — Average # of days / year with blowing snow (7.8 / y)				19 Heavy Snowfall — Snowfall > 10cm (2-3days/y)				20 Snow accumulation — Snow on ground with depths ≥ 30 cm and persisting for 5 or more days (0.17 events/y)				21 Hail — Average # of hail days (~1.1/y)				22 Severe thunderstorms — Average # of Thunderstorm Days (~2-3/y)				23 Lightning — Average # Days/Year with cloud - ground lightning strikes (~25)				24 Drought/Dry periods — At least one month at Ontario low water response level II (i.e. with mandatory water conservation)			
		Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Feeder A-2	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																																					
1	Overhead	Y	7	5	35	Y	7	6	42	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	5	25	Y	7	0	0	Y	7	2	14	Y	3	2	6	Y	6	1	6	?	7		n/a	Y	7	2	14	N	4		
2	Underground	N	7			N	7			Y	1	2	2	Y	5	2	10	Y	4	2	8	N	2			N	5			N	7			N	7			N	3			N	6			N	7			Y	7	2	14	N	4		
	Switches																																																					
3	Overhead - Main Line	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5			N	4			Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	5	35	N	4		
4	Overhead - Lateral Line	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5			N	4			Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	5	35	N	4		
5	Overhead - Customer	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5			N	4			Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	4	28	N	4		
6	Pad Mount Switches	N	7			N	7			Y	1	7	7	N	5			N	4			Y	2	1	2	Y	5	1	5	Y	7	1	7	N	7	1	3	Y	3	1	3	Y	6	0	0	?	7		n/a	Y	7	1	7	N	4		
7	Underground	N	7			N	7			N	1			Y	5	3	15	Y	4	3	12	N	2			N	5			N	7	1		N	7	1		N	3	1		N	6			N	7			N	7			N	4		
	Transformers																																																				
8	Pole mounted	Y	7	3	21	Y	7	3	21	Y	1	7	7	N	5			N	4			Y	2	2	4	Y	5	7	35	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	6	42	N	4		
9	Pad mounted	N	7			N	7			Y	1	7	7	N	5			N	4			Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	1	7	Y	3	1	3	Y	6	0	0	?	7		n/a	Y	7	1	7	N	4		
10	Submersible	N	7			N	7			N	1			Y	5	2	10	Y	4	2	8	N	2			Y	5		0	N	7	1		Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
	Civil Structures																																																				
11	Vault	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	2	14	Y	3	2	6	N	6			N	7			N	7			N	4		
12	Cable Chamber	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	2	14	Y	3	2	6	N	6			N	7			N	7			N	4		
	Poles																																																				
13	30 < 40 ft Steel	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	5	25	N	7			Y	7	0	0	Y	3	0	0	Y	6	0	0	?	7		n/a	Y	7	4	28	N	4		
14	30 < 40 ft Wood	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	5	25	N	7			Y	7	0	0	Y	3	0	0	Y	6	0	0	?	7		n/a	Y	7	4	28	N	4		
15	30 < 40 ft Concrete	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	5	25	N	7			Y	7	1	7	Y	3	1	3	Y	6	0	0	?	7		n/a	Y	7	4	28	N	4		
16	40 < 50 ft Wood	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	5	25	N	7			Y	7	0	0	Y	3	0	0	Y	6	0	0	?	7		n/a	Y	7	4	28	N	4		
17	40 < 50 ft Concrete	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	5	25	N	7			Y	7	1	7	Y	3	1	3	Y	6	0	0	?	7		n/a	Y	7	4	28	N	4		
18	50 ≤ 60 ft Wood	Y	7	7	49	Y	7	7	49	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	6	30	N	7			Y	7	0	0	Y	3	0	0	Y	6	0	0	?	7		n/a	Y	7	4	28	N	4		
	Feeder A-1	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																																				
36	Overhead	Y	7	5	35	Y	7	6	42	Y	1	7	7	N	5			N	4			Y	2	7	14	Y	5	5	25	Y	7	1	7	Y	7	2	14	Y	3	2	6	Y	6	1	6	?	7		n/a	Y	7	2	14	N	4		
37	Underground	N	7	0		N	7			N	1	7		Y	5	1	5	Y	4	1	4	N	2	0		N	5			N	7			N	7			Y	3	1	3	N	6			?	7		n/a	N	7			N	4		
	Switches																																																				
38	Overhead - Main Line	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5	0		N	4			Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	5	35	N	4		
39	Overhead - Lateral Lines	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5	0		N	4			Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	5	35	N	4		
40	Overhead - Customer	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5	0		N	4			Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	4	28	N	4		
41	Pad Mount	N	7			N	7			Y	1	7	7	N	5	0		N	4	0		Y	2	1	2	Y	5	1	5	Y	7		0	Y	7	1	7	Y	3	1	3	Y	6	0	0	?	7		n/a	Y	7	1	7	N	4		
42	Underground	N	7			N	7			N	1			Y	5	3	15	Y	4	3	12	N	2	1		N	5	0		N	7			N	7	1		N	3	1		N	6			?	7		n/a	N	7			N	4		
	Transformers																																																				
43	Pole mounted	Y	7	3	21	Y	7	3	21	Y	1	7	7	N	5	0		N	4			N	2	3		N	5	0		Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	?	7		n/a	Y	7	6	42	N	4		
44	Pad mounted	N	7			N	7			Y	1	7	7	N	5	0		N	4			N	2	3		N	5	0		Y	7	1	7	Y	7	1	7	Y	3	1	3	Y	6	0	0	?	7		n/a	Y	7	1	7	N	4		
45	Submersible	N	7			N	7			N	1			Y	5	2	10	Y	4	2	8	N	2	3		N	5	0		N	7			Y	7	1	7	Y	3	1	3	N	6			?	7		n/a	N	7			N	4		
	Civil Structures																																																				
46	Vault	N	7			N	7			N	1			Y	5	1	5	Y	4	0	0	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	1	7	Y	3	1	3	N	6			?	7		n/a	N	7			N	4		
47	Cable Chamber	N	7			N	7			N	1			Y	5	1	5	Y	4	0	0	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	1	7	Y	3	1	3	N	6			?	7		n/a	N	7			N	4		
	Poles																																																				
48	35 < 40 ft Wood	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5	0		N	4			Y	2	7	14	Y	5	5	25	N	7			N	7			N	3			N	6			?	7		n/a	Y	7	4	28	N	4		
49	35 < 40 ft Concrete	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5	0		N	4			Y	2	7	14	Y	5	5	25	N	7			N	7			N	3			N	6			?	7		n/a	Y	7	4	28	N	4		
50	40 < 50 ft Wood	Y	7	6	42	Y	7	6	42	Y	1	7	7	N	5	0		N	4			Y	2	7	14	Y	5	5	25	N	7			N	7			N	3			N	6			?	7		n/a	Y	7	4	28	N	4		
51	50 ≤ 60 ft Wood	Y	7	7	49	Y	7	7	49	Y	1	7	7	N	5	0		N	4			Y	2	7	14	Y	5	5	25	N	7			N	7			N	3			N	6			?	7		n/a	Y	7	4	28	N	4		
	Feeder C-1	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																																				
72	Underground	N	7			N	7			N	1			Y	5		0	Y	4		0	N	2			N	5			N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
	Switches																																																				
73	Underground	N	7			N	7			N	1			N	5			N	4			N	2			N	5			N	7			N	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
	Civil Structures																																																				
74	Vault	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
75	Cable Chamber	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
	Feeder C-2	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																																				
76	Underground	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	N	2			N	5			N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
	Switches																																																				
77	At grade in customer vault or	N	7			N	7			N	1			N	5			N	4			N	2			N	5			N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
78	Underground	N	7			N	7			N	1			Y	5	3	15	Y	4	3	12	N	2			N	5			N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
	Transformers																																																				
79	Submersible network type	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	N	2			N	5			N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
	Civil Structures																																																				
81	Vault	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		
82	Cable Chamber	N	7			N	7			N	1			Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	N	7			Y	7	1	7	Y	3	1	3	N	6			N	7			N	7			N	4		

Toronto Hydro-Electric System Pilot Public Infrastructure Vulnerability Committee Workshop

	Infrastructure Components	Infrastructure Response Considerations										1 High Temperature				2 Low Temperature				3 Heat Wave				4 Extreme Humidity				5 Severe Heat Wave				6 Cold Wave				7 Temperature Variability				8 Freeze-thaw cycle				9 Fog				10 Frost			
		Structural Design	Functionality	Serviceability	O/M & Materials Performance	Emergency Response	Insurance Considerations	Policy and Procedure	Public Health and Safety	Social Impacts	Environmental Impacts	Average annual # days with T≥ 30°C				Average annual # days < -20°C				3 or more days with Tmax ≥ 30°C				# Days with Humidex ≥ 40°C				3 or more days with Humidex ≥ 40°C				3 or more days with Tmin ≤20°				Daily T ranges ≥ 25°C				Annual Probability of at least 70 freeze-thaw cycles (Tmax>0 and Tmin<0): Standard Prob of 3 for City and 6 for airport				~15 hours/year (average) with visibility <= 0 km				To be discussed			
		Mark Relevant Responses with ✓										Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Feeder B-1											Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																																	
52	Underground			✓	✓	✓		✓	✓	✓		Y	7	2	14	Y	6	0	0	Y	6	2	12	Y	3	2	6	Y	4	2	8	Y	3	0	0	Y	3	0	0	N	3	0		N	7	0		N	6	0	
	Switches																																																
53	Underground			✓	✓	✓		✓	✓	✓	✓	Y	7	0	0	Y	6	1	6	Y	6	1	6	Y	3	1	3	Y	4	1	4	Y	3	1	3	Y	3	0	0	N	3	0		N	7	0		N	6	0	
	Transformers																																															
54	Submersible			✓	✓	✓		✓	✓	✓	✓	Y	7	2	14	Y	6	1	6	Y	6	2	12	Y	3	2	6	Y	4	2	8	Y	3	1	3	Y	3	0	0	N	3	0		N	7	0		N	6	0	
	Civil Structures																																															
55	Vault				✓	✓		✓	✓	✓		N	7	0		N	6	0		N	6	0		N	3	0		N	4	0		N	3	0		N	3	0		Y	3	1	3	N	7	0		N	6	0	
56	Cable Chamber				✓	✓		✓	✓	✓		N	7	0		N	6	0		N	6	0		N	3	0		N	4	0		N	3	0		N	3	0		Y	3	1	3	N	7	0		N	6	0	
	Feeder B-2											Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																															
57	Overhead	✓	✓	✓	✓	✓	✓	✓	✓	✓		Y	7	2	14	Y	6	1	6	Y	6	2	12	Y	3	2	6	Y	4	2	8	Y	3	1	3	Y	3	0	0	N	3	0		Y	7	2	14	Y	6	2	12
58	Underground			✓	✓	✓		✓	✓	✓		Y	7	2	14	Y	6	0	0	Y	6	2	12	Y	3	2	6	Y	4	2	8	Y	3	0	0	Y	3	0	0	N	3	0		N	7	0		N	6	0	
	Switches																																															
59	Overhead - Main Line	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Y	7	0	0	Y	6	1	6	Y	6	1	6	Y	3	1	3	Y	4	1	4	Y	3	1	3	Y	3	0	0	N	3	0		Y	7	2	14	Y	6	2	12
60	Overhead - Lateral Line	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Y	7	0	0	Y	6	1	6	Y	6	1	6	Y	3	1	3	Y	4	1	4	Y	3	1	3	Y	3	0	0	N	3	0		Y	7	2	14	Y	6	2	12
61	Overhead - Customer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Y	7	0	0	Y	6	1	6	Y	6	1	6	Y	3	1	3	Y	4	1	4	Y	3	1	3	Y	3	0	0	N	3	0		Y	7	2	14	Y	6	2	12
62	Pad mounted	✓	✓	✓	✓	✓		✓	✓	✓	✓	Y	7	0	0	Y	6	1	6	Y	6	1	6	Y	3	1	3	Y	4	1	4	Y	3	1	3	Y	3	0	0	N	3	0		Y	7	1	7	Y	6	1	6
63	Underground - URD			✓	✓	✓		✓	✓	✓	✓	Y	7	0	0	Y	6	1	6	Y	6	1	6	Y	3	1	3	Y	4	1	4	Y	3	1	3	Y	3	0	0	N	3	0		N	7	0		N	6	0	
	Transformers																																															
64	Pole mounted	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Y	7	2	14	Y	6	1	6	Y	6	2	12	Y	3	2	6	Y	4	2	8	Y	3	1	3	Y	3	0	0	N	3	0		Y	7	2	14	Y	6	2	12
65	Pad mount	✓	✓	✓	✓	✓		✓	✓	✓	✓	Y	7	2	14	Y	6	1	6	Y	6	2	12	Y	3	2	6	Y	4	2	8	Y	3	1	3	Y	3	0	0	N	3	0		Y	7	1	7	Y	6	1	6
66	Submersible - URD			✓	✓	✓		✓	✓	✓	✓	Y	7	2	14	Y	6	1	6	Y	6	2	12	Y	3	2	6	Y	4	2	8	Y	3	1	3	Y	3	0	0	N	3	0		N	7	0		N	6	0	
	Civil Structures																																															
67	Vault				✓	✓		✓	✓	✓		N	7	0		N	6	0		N	6	0		N	3	0		N	4	0		N	3	0		N	3	0		Y	3	1	3	N	7	0		N	6	0	
68	Cable Chamber				✓	✓		✓	✓	✓		N	7	0		N	6	0		N	6	0		N	3	0		N	4	0		N	3	0		N	3	0		Y	3	1	3	N	7	0		N	6	0	
	Poles																																															
69	Steel	✓	✓	✓	✓	✓	✓	✓	✓	✓		N	7	0		N	6	0		N	6	0		N	3	0		N	4	0		N	3	0		N	3	0		Y	3		0	N	7	0		N	6	0	
70	Wood	✓	✓	✓	✓	✓	✓	✓	✓	✓		N	7	0		N	6	0		N	6	0		N	3	0		N	4	0		N	3	0		N	3	0		Y	3		0	N	7	0		N	6	0	
71	Concrete	✓	✓	✓	✓	✓	✓	✓	✓	✓		N	7	0		N	6	0		N	6	0		N	3	0		N	4	0		N	3	0		Y	3	0	0	Y	3		0	N	7	0		N	6	0	

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		11				12				13				14				15				16				17				18				19				20				21				22				23				24			
	Infrastructure Components	High wind/downburst				High wind/downburst				Tornadoes				Heavy Rain				Heavy 5 day total rainfall				Ice Storm				Freezing Rain				Blowing snow/Blizzard				Heavy Snowfall				Snow accumulation				Hail				Severe thunderstorms				Lightning				Drought/Dry periods			
		Gusts > 70 km/h (~21 days / year at Airport)				Gusts > 90 km/h (~2days / year at Airport)				Tornado vortex extending from surface to cloud base (near infrastructure); tornado densities from 2X10-5km-2yr-1 to 1X10-4km-2yr-1.				Daily Rainfall > 50 mm/day				5 days of cumulative rain > 70 mm of rain				Average annual probability of at least 25 mm of freezing rain per event				Average annual probability of freezing rain events lasting 6h or more *(i.e. typically more than 10 mm of freezing rain)*				Average # of days / year with blowing snow (7.8 / y)				Snowfall > 10cm (2-3days/y)				Snow on ground with depths ≥ 30 cm and persisting for 5 or more days *(0.17 events/y)*				Average # of hail days (~1.1/y)				Average # of Thunderstorm Days (~2.8/y)				Average # Days/Year with cloud - ground lightning strikes (~25)				At least one month at Ontario low water response level II *(i.e. with mandatory water conservation)*			
		Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Feeder B-1	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																																						
52	Underground	N	7	0		N	7	0		Y	1	0	0	Y	5	0	0	Y	4	0	0	N	2	0		N	5	0		N	7	0		N	7	0		Y	3	0	0	N	6	0		N	7	0		N	7	0		Y	4	2	8
	Switches																																																					
53	Underground	N	7	0		N	7	0		Y	1	0	0	Y	5	5	25	Y	4	4	16	Y	2	0	0	Y	5	0	0	N	7	0		N	7	0		N	3	0		N	6	0		N	7	0		Y	7	0	0	N	4	0	
	Transformers																																																				
54	Submersible	N	7	0		N	7	0		Y	1	0	0	Y	5	2	10	Y	4	1	4	Y	2	0	0	Y	5	0	0	N	7	0		Y	7	1	7	Y	3	1	3	N	6	0		N	7	0		Y	7	0	0	N	4	0	
	Civil Structures																																																			
55	Vault	N	7	0		N	7	0		Y	1	2	2	Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	1	7	Y	3	1	3	N	6	0		N	7	0		N	7	0		N	4	1	
56	Cable Chamber	N	7	0		N	7	0		Y	1	2	2	Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	1	7	Y	3	1	3	N	6	0		N	7	0		N	7	0		N	4	1	
	Feeder B-2	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R	Y/N	P	S	R
	Primary Conductors																																																				
57	Overhead	Y	7	6	42	Y	7	7	49	Y	1	7	7	Y	5	1	5	Y	4	1	4	Y	2	7	14	Y	5	5	25	Y	7	2	14	Y	7	2	14	Y	3	2	6	Y	6	1	6	Y	7	2	14	Y	7	2	14	N	4	0	
58	Underground	N	7	0		N	7	0		Y	1	0	0	Y	5	0	0	Y	4	0	0	N	2	0		N	5	0		N	7	0		N	7	0		Y	3	0	0	N	6	0		N	7	0		N	7	0		Y	4	2	8
	Switches																																																				
59	Overhead - Main Line	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5	1		N	4	1		Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	Y	7	5	35	Y	7	5	35	N	4	0	
60	Overhead - Lateral Line	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5	1		N	4	1		Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	Y	7	5	35	Y	7	5	35	N	4	0	
61	Overhead - Customer	Y	7	4	28	Y	7	4	28	Y	1	7	7	N	5	1		N	4	1		Y	2	3	6	Y	5	3	15	Y	7	1	7	Y	7	1	7	Y	3	0	0	Y	6	1	6	Y	7	4	28	Y	7	4	28	N	4	0	
62	Pad mounted	N	7	0		N	7	0		Y	1	7	7	Y	5	1	5	Y	4	1	4	Y	2	0	0	Y	5	0	0	Y	7	0	0	Y	7	1	7	Y	3	1	3	Y	6	0	0	Y	7	1	7	Y	7	1	7	N	4	0	
63	Underground - URD	N	7	0		N	7	0		N	1	0		Y	5	3	15	Y	4	3	12	N	2	0		N	5	0		N	7	0		N	7	1		N	3	1		N	6			N	7			N	7			N	4	0	
	Transformers																																																				
64	Pole mounted	Y	7	3	21	Y	7	3	21	Y	1	7	7	N	5	1		N	4	1		Y	2	3	6	Y	5	3	15	Y	7	2	14	Y	7	2	14	Y	3	2	6	Y	6	1	6	Y	7	6	42	Y	7	6	42	N	4	0	
65	Pad mount	N	7	0		N	7	0		Y	1	7	7	Y	5	1	5	Y	4	1	4	Y	2	0	0	Y	5	0	0	Y	7	1	7	Y	7	1	7	Y	3	1	3	Y	6	0	0	Y	7	0	0	Y	7	1	7	N	4	0	
66	Submersible - URD	N	7	0		N	7	0		N	1	0		Y	5	2	10	Y	4	2	8	Y	2	0	0	Y	5	0	0	N	7	1		Y	7	1	7	Y	3	1	3	N	6			N	7	0		N	7	0		N	4	0	
	Civil Structures																																																			
67	Vault	N	7	0		N	7	0		N	1	2		Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	1	7	Y	3	1	3	N	6	0		N	7	0		N	7	0		Y	4	3	12
68	Cable Chamber	N	7	0		N	7	0		N	1	2		Y	5	1	5	Y	4	1	4	Y	2	1	2	Y	5	1	5	Y	7	1	7	Y	7	1	7	Y	3	1	3	N	6	0		N	7	0		N	7	0		Y	4	3	12
	Poles																																																			
69	Steel	Y	7	6	42	Y	7	7	49	Y	1	7	7	N	5	0		N	4	0		Y	2	7	14	Y	5	7	35	Y	7	2	14	Y	7	2	14	Y	3	2	6	Y	6	0	0	Y	7	0	0	Y	7	0	0	Y	4	3	12
70	Wood	Y	7	6	42	Y	7	7	49	Y	1	7	7	N	5	0		N	4	0		Y	2	7	14	Y	5	7	35	Y	7	2	14	Y	7	2	14	Y	3	2	6	Y	6	0	0	Y	7	0	0	Y	7	0	0	Y	4	3	12
71	Concrete	Y	7	6	42	Y	7	7	49	Y	1	7	7	N	5	0		N	4	0		Y	2	7	14	Y	5	7	35	Y	7	2	14	Y	7	2	14	Y	3	2	6	Y	6	0	0	Y	7	0	0	Y	7	0	0	Y	4	3	12

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 8:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 15, line 13 (updated)

a) In what manner is Toronto Hydro's forecast 2015 capital expenditures or its 2015-2019 average capital expenditures of $500 million per year "comparable" to its average capital expenditure in the last rebasing in 2011 ($440 million per year)? The planned five year average is $60 million, or 13% higher than the average of the 2011-2012 numbers.

b) Please provide the comparable numbers for 2012, 2013, and the 9 and 3 estimate for 2014.

c) What has the 2014 capex been to date?

d) Please compare the 2012, 2013, and 2014 actual capex either Board approved, or settled amounts or amounts incurred for those years, and explain any differences.

e) Please provide the compound growth rate of actual capital expenditures over the 2006-2015 period, and the increase year over year for the same period.

RESPONSE:

a) To clarify, the full statement referenced is as follows: "Toronto Hydro's requested Capital Expenditures for the period 2015-2019 are approximately $500 million per year, which is comparable to the average annual spending since the utility's last rebasing in 2011 (approximately $440 million per year)" [emphasis added]. Therefore, the $440 million per year figure is derived from the annual spending from years 2012 onwards to 2014. Annual spending between 2012 and 2014 was further broken apart as part of Toronto Hydro's response to Interrogatory 1B-SEC-5. This

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

average annual spending figure will exceed the $500 million threshold when focusing on those years containing more complete capital spending activities – 2013 and 2014 respectively.

b) The following table includes actual and forecast capital expenditures incurred in 2012, 2013 and 2014. The September 2014 financial statements have not yet been finalized and therefore actuals are presented as year-to-date June 2014 and a forecast of year-end 2014.

	2012 Actual	2013 Actual	2014 Actual (YTD June)	2014 Forecast (Annual)
Total Capital Expenditures ($M)	$288.0	$445.7	$240.7	$589.2

c) Please see response to part b.

d) The following table represents actual and forecast capital expenditures compared to Board approved amounts for 2012, 2013 and 2014. For programs authorized in Toronto Hydro's previous ICM/IRM application, a discussion of variances can be found in the response to Interrogatory 2B-OEBStaff-39. Please note that the actual/forecast amounts shown in the following table include additional expenditures that were not authorized as part of the previous application (e.g., costs associated with the Operating Centres Consolidation program).

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

	Phase 1: Approved Capex			Phase 2: Approved Capex	Phase 1 + 2: Actual / Forecast		
	2012 Approved Capex	2013 Approved Capex	2014 Approved Capex	2014 Approved Capex	2012 Actual Capex	2013 Actual Capex	2014 Q3 Fcst Capex (Annual)
Total Capital Expenditures ($M)	$203.3	$484.2	$71.6	$327.2	$288.0	$445.7	$589.2

e) The following table represents the year over year percentage growth rate of actual Capital Expenditure for the period 2006 – 2015:

Year	Total Cost ($M)	Year over Year %
2006	$193	-
2007	$276	43%
2008	$234	-15%
2009	$262	12%
2010	$401	53%
2011	$446	11%
2012	$288	-35%
2013	$446	55%
2014	$589	32%
2015	$540	-8%

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

The compound growth rate of actual capital expenditure is 12% for the period 2006 – 2015.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 9:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 15

Please provide a copy of Toronto Hydro's Conditions of Service.

RESPONSE:

Toronto Hydro's current Conditions of Service are attached as Appendix A to this response.

CONDITIONS OF SERVICE

REVISION #13

Effective Date: May 1, 2014

Comments to these revisions can be emailed to: ConditionsofService@torontohydro.com

Customers without e-mail access can submit inquiries through regular mail to:
Standards & Policy Planning Department
Toronto Hydro-Electric System Limited
500 Commissioners Street
Toronto, Ontario
M4M 3N7

To contact Toronto Hydro call (416) 542-8000 or e-mail at: ConditionsofService@torontohydro.com

Toronto Hydro-Electric System Limited

PREFACE

CONDITIONS OF SERVICE

The Distribution System Code (DSC) requires that every distributor produce its own "Conditions of Service" document. The purpose of this document is to provide a means for communicating the types and level of service available to the Customers and Consumers within Toronto Hydro's service area. The Distribution System Code requires that the Conditions of Service be readily available for review by the general public. In addition, the most recent version of the document must be provided to the Ontario Energy Board (OEB), which in turn will retain it on file for the purpose of facilitating dispute resolutions in the event that a dispute cannot be resolved between the Customer and its distributor.

The acceptance of supply of electricity or related services from Toronto Hydro constitutes the acceptance of a binding contract with Toronto Hydro which includes this Conditions of Service ("Conditions") and all terms thereunder. The person so accepting the supply of electricity or related services shall be liable for payment for same, and such contract shall be binding upon the person's heirs, administrators, executors, successors or assigns.

This document follows the form and general content of the Condition of Service template appended to the DSC. The template was prepared to assist distributors in developing their own "Conditions of Service" document based on current practice and the DSC. The text of the template is shown *in italics* throughout this Conditions, right after each of the subheadings. The template outlines the minimum requirements. However, as suggested by the DSC, Toronto Hydro has expanded on the contents to encompass local characteristics and other specific requirements.

Section 2 (Distribution Activities (General)) contains references to services and requirements that are common to all Customer classes. This section covers items such as Rates, Billing, Hours of Work, Emergency Response, Power Quality, Available Voltages and Metering.

Section 3 (Customer Class Specific) contains references to services and requirements specific to the respective Customer class. This section covers items such as Service Entrance Requirements, Delineation of Ownership, Special Contracts, etc.

Other sections include the *Glossary of Terms, Tables* and *References.*

Subsequent changes will be incorporated with each submission to the OEB.

A Revision Summary of the latest revisions to the Conditions of Service is posted on Toronto Hydro's website. Comments to these revisions can be emailed to ConditionsofService@torontohydro.com . Toronto Hydro will file to the Ontario Energy Board a summary of public comments received from customers about the changes.

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Section 1 – INTRODUCTION

1 INTRODUCTION

1.1 Identification of Distributor and Service Area

In this section the distributor should identify its service area as defined in the Distributor's License.

Toronto Hydro-Electric System Limited, referred to herein as "Toronto Hydro," is a corporation incorporated under the laws of the Province of Ontario and a distributor of electricity.

Toronto Hydro is licensed by the Ontario Energy Board ("OEB") to supply electricity to Customers as described in the Electricity Distribution License issued to Toronto Hydro on October 17, 2003 by the OEB and expiring October 16, 2023 ("Distribution License"). Additionally, there are requirements imposed on Toronto Hydro by the various codes referred to in the Distribution License and by the *Electricity Act, 1998* and the *Ontario Energy Board Act, 1998*.

Toronto Hydro may only operate distribution facilities within its Licensed Territory as defined in its Distribution License. This service area is subject to change with the OEB's approval.

Nothing contained in this Conditions of Service ("this Conditions") or in any contract for the supply of electricity by Toronto Hydro shall prejudice or affect any rights, privileges, or powers vested in Toronto Hydro by law under any Act of the Legislature of Ontario or the Parliament of Canada, or any regulations thereunder.

1.1.1 Distribution Overview

Toronto Hydro distributes electrical power through 13.8 kV and 27.6 kV primary distribution systems. On the 27.6 kV system all feeders are arranged to run in an open-loop fashion with open points between adjacent feeders. These feeders supply distribution transformers either directly or through 13.8 kV or 4 kV sub-distribution systems. There are presently four types of distribution design systems at the 13.8kV primary voltage level:

- 13.8 kV underground radial
- 13.8 kV overhead open loop
- 13.8 kV underground open-loop
- 13.8 kV underground network

The underground network system is distinct from the other systems. This low-voltage secondary network system may be available to some Customers in the

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downtown core of the City of Toronto as a source of supply at 120/208 V, depending on the local capacity of the system and the energy requirements of the Customer.

The supply of electricity by Toronto Hydro to any Customer will be at one of the following primary voltage levels: 27.6 kV or 13.8 kV depending on the proximity of the Customer's premises to the nearest distribution facility. For connection of a Customer at 4 kV level, Toronto Hydro will carry out a special study to justify the investment. The cost of this study may be charged to the Customer.

1.2 Related Codes and Governing Laws

This section should reference any legislation that is applicable to the distributor – Customer relationship.

The supply of electricity or related services by Toronto Hydro to any Customer or Consumer shall be subject to various laws, regulations, and codes, including the provisions of the latest editions of the following acts, codes and licences:

1. *Electricity Act, 1998* } part of the Energy Competition
2. *Ontario Energy Board Act, 1998* } Act, 1998
3. Distribution Licence
4. Affiliate Relationships Code
5. Transmission System Code
6. Distribution System Code
7. Retail Settlement Code
8. Standard Supply Service Code

In the event of a conflict between this document and the Distribution License or regulatory codes issued by the OEB, or the Energy Competition Act, 1998 (the "Act"), the provisions of the Act, the Distribution License and associated regulatory codes shall prevail in the order of priority indicated above.

When planning and designing for electricity service, Customers and their agents must refer to all applicable provincial and Canadian electrical codes, and all other applicable federal, provincial, and municipal laws, regulations, codes and by-laws to also ensure compliance with their requirements. Without limiting the foregoing, the work shall be conducted in accordance with the latest edition of the *Ontario Occupational Health and Safety Act* (OHSA), the Regulations for Construction Projects and the harmonized Electric Utility Safety Association (EUSA) rulebook.

1.3 Interpretations

This section should describe the rules for interpretation of the Conditions of Service document.

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In this Conditions, unless the context otherwise requires:

- Headings, paragraph numbers and underlining are for convenience only and do not affect the interpretation of this Conditions;
- Words referring to the singular include the plural and vice versa;
- Words referring to a gender include any gender

1.4 Amendments and Changes

This section should outline the process for making changes to this document. Include any public notice provisions.

The provisions of this Conditions in effect at the time Toronto Hydro signs the contract shall form part of any contract made between Toronto Hydro and any connected Customer, Consumer or Retailer. This Conditions supercedes all previous conditions of service, oral or written, of Toronto Hydro including any of its predecessor municipal electric utilities as of its effective date.

In the event of changes to this Conditions, Toronto Hydro will issue a notice with the Consumer's bill. Toronto Hydro may also issue a public notice in a local newspaper.

The Customer is responsible for contacting Toronto Hydro to obtain the current version of this Conditions. Toronto Hydro may charge a reasonable fee for providing the Customer with a copy of this document. The current version of this document is also posted on the Toronto Hydro website and can be downloaded from www.torontohydro.com.

1.5 Contact Information

This section should provide information on how a Customer can contact the distributor. Include such items as:

- ***Address of the distributor,***
- ***Telephone numbers,***
- ***Normal business hours, and***
- ***Emergency contact numbers.***

Toronto Hydro can be contacted 24 hours a day at 416-542-8000 or such other numbers as Toronto Hydro may advise through its website, invoices or otherwise. Normal working hours is Monday to Friday between 8:30 a.m. and 4:30 p.m. The mailing address is 14 Carlton Street, Toronto Ontario M5B 1K5.

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1.6 Customer Rights

This section should outline the rights and obligations a Customer or embedded generator has with respect to the distributor that are not covered elsewhere in this document.

Toronto Hydro shall only be liable to a Customer and a Customer shall only be liable to Toronto Hydro for any damages that arise directly out of the willful misconduct or negligence:

- of Toronto Hydro in providing distribution services to the Customer;
- of the Customer in being connected to Toronto Hydro's distribution system; or
- of Toronto Hydro or Customer in meeting their respective obligations under this Conditions, their licences and any other applicable law.

Notwithstanding the above, neither Toronto Hydro nor the Customer shall be liable under any circumstances whatsoever for any loss of profits or revenues, business interruption losses, loss of contract or loss of goodwill, or for any indirect, consequential, incidental or special damages, including but not limited to punitive or exemplary damages, whether any of the said liability, loss or damages arise in contract, tort or otherwise.

The Customer shall indemnify and hold harmless Toronto Hydro, its directors, officers, employees and agents from any claims made by any third parties in connection with the construction and installation of an embedded generation facility or other electrical apparatus by or on behalf of the Customer.

1.7 Distributor Rights

This section should outline the rights a distributor has with respect to a Customer or embedded generator that are not covered elsewhere in this document.

1.7.1 Access to Customer Property

Toronto Hydro shall have access to Customer's property in accordance with section 40 of the *Electricity Act, 1998*.

1.7.2 Safety of Equipment

The Customer shall comply with all aspects of the Ontario Electrical Safety Code with respect to insuring that equipment is properly identified and connected for metering and operation purposes and will take whatever steps necessary to correct any deficiencies, in particular cross wiring situations, in a timely fashion. If the Customer does not take such action within a reasonable time, Toronto Hydro may disconnect the supply of electricity to the Customer.

Section 1 – INTRODUCTION

The Customer shall not use or interfere with the facilities of Toronto Hydro except in accordance with a written agreement with Toronto Hydro. Toronto Hydro has the right to seal any point where a connection may be made on the line side of the metering equipment.

The Customer shall not build, plant or maintain or cause to be built, planted or maintained any structure, tree, shrub or landscaping that would or could obstruct the running of distribution lines, endanger the equipment of Toronto Hydro, interfere with the proper and safe operation of Toronto Hydro's facilities or adversely affect compliance with any applicable legislation in the sole opinion of Toronto Hydro. Where an obstruction is discovered, Toronto Hydro will notify the Customer and provide a reasonable time for the Customer to correct any obstructions. If the Customer does not remove such obstruction within the reasonable time designated by Toronto Hydro, Toronto Hydro may disconnect the supply of electricity to the Customer and/or remove, relocate or, in the case of shrubs or other vegetation, trim such obstructions at the Customer's expense, and Toronto Hydro shall not be liable to the Customer for any damages arising as a result thereof, other than physical damage to facilities arising directly from entry on the Customer's property. Toronto Hydro's policies and procedures with respect to the disconnection process are further described in this Conditions.

1.7.3 Tree and Vegetation Management

To ensure public safety and the continued reliable operation of its distribution system Toronto Hydro will maintain clearance around its distribution lines on a cyclical or as-needed basis in close cooperation with the City's forestry department. The tree trimming cycle may vary depending on extent of storm damage, health of trees, and vegetation type.

Toronto Hydro will coordinate and maintain tree clearance around all its distribution lines that are located on public allowance. Toronto Hydro will also maintain tree clearance around its overhead lines over 750 Volts that may be located on private property at no cost to the Customer. Toronto Hydro will endeavour to discuss the planned re-clearing with property owners prior to work being performed in order to mitigate the impacts to the environment and the property. However, in the event of emergencies, Toronto Hydro may be unable to notify the property owner prior to performing the work.

Customers are responsible for all initial tree trimming for all new overhead lines that will be located on private property. Customers are also responsible for continuing tree trimming, tree and brush removal around service lines that are less than 750 Volts that are located on private property as well as around overhead lines over 750 Volts when these lines are owned by the Customer. Clearances must conform to the Electrical Safety Code.

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To permit the safe clearance of trees and vegetation from overhead lines over 750 Volts located on private property Toronto Hydro will, upon at least ten days prior notice from the Customer, once each year during normal business hours, disconnect and reconnect the Customer's supply without charge.

1.7.4 Operating Control

The Customer shall provide a convenient and safe place, satisfactory to Toronto Hydro, for installing, maintaining and operating its equipment in, on, or about the Customer's premises or in, on, or about the public road allowance for non-metered connections. Toronto Hydro assumes no risk and will not be liable for damages resulting from the presence of its equipment on the Customer's premises or in, on, or about the public road allowance for non-metered connections, or approaches thereto, or any acts, omissions or events beyond its control, or the negligence or willful misconduct of any Persons over whom Toronto Hydro has no control.

Unless an employee or an agent of Toronto Hydro, or other Person lawfully entitled to do so, no Person shall remove, replace, alter, repair, inspect or tamper with Toronto Hydro's equipment.

Customers will be required to pay the cost of repairs or replacement of Toronto Hydro's equipment that has been damaged or lost by the direct or indirect act or omission of the Customer or its agents.

The physical location on Customer's premises or the public road allowance for non-metered connections at which a distributor's responsibility for operational control of distribution equipment ends is defined by the Distribution System Code as the "operational demarcation point".

1.7.5 Customer-Owned Equipment, Infrastructure, and Property

The Customer is responsible for providing, inspecting, maintaining, repairing and replacing, in a safe condition satisfactory to Toronto Hydro, all equipment and infrastructure that is owned by the Customer on private property or in the public road allowance for non-metered connections. Equipment and infrastructure includes but is not limited to transformers, cable, switches, poles, fences, gates, duct banks, conduits, cable chambers, cable pull rooms, transformer rooms, transformer vaults, transformer pads, tap boxes, handwells, service masts, and junction boxes.

The Customer is also responsible for maintaining its property in a condition that is safe and that does not inhibit the operation or threaten the integrity or reliability of equipment or infrastructure owned by the Customer or Toronto Hydro. The Customer's responsibility to maintain its property includes, but is not limited to,

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clearing vegetation, keeping storm drains clear and drainage systems fully functional, removing debris, maintaining operational and electrical clearances, and maintaining proper grading and surfaces.

The Customer shall inspect and maintain its equipment, infrastructure, and property at regular intervals. When access to the equipment, infrastructure, or property is under the control of Toronto Hydro (e.g. a transformer vault, a fenced off transformer), the Customer shall contact Toronto Hydro at the phone number posted on Toronto Hydro's website to make appropriate arrangements (e.g. access, temporary disconnection) prior to undertaking any inspections, maintenance, repairs, or replacements.

If the Customer does not inspect, maintain, repair, or replace its equipment, infrastructure, and property as required, Toronto Hydro may disconnect the supply of electricity to the Customer.

Notwithstanding the above, unless otherwise agreed to by the parties, subject to the Customer providing an easement to Toronto Hydro, Toronto Hydro will provide, maintain, repair and replace those civil infrastructure (such as poles, duct banks, conduits, cable chambers, cable pull rooms, transformer vaults, transformer pads, and switching vaults) that are required to house the primary distribution systems built along private streets that supply Customers of Multi-unit Residential developments (part of Class 3B). Effective November 15, 2004, Toronto Hydro will treat such infrastructure in the same way as those located in the public road allowance.

Where Toronto Hydro identifies, through an inspection or other activity, deficiencies relating to the equipment, infrastructure, or property owned by the Customer, such as deficiencies to walls, ceilings, floors, doors, vents, drains, electrical devices or other elements, Toronto Hydro may:

- notify the Customer of the deficiencies;
- provide a reasonable time for the Customer to correct the deficiencies; and
- if circumstances merit, request the Customer to correct the deficiency in a manner that brings the equipment, infrastructure, or property up to current standards even if the equipment, infrastructure, or property was designed, installed, or constructed to an older standard. (Examples of circumstances that may merit the application of a current standard include, but are not limited to, the existence of health or safety hazards, legal or regulatory requirements, and conditions that may impact the integrity, reliability, or operability of the distribution system or any equipment that supplies the Customer.)

If notified of deficiencies, or requested to correct deficiencies in a particular manner, the Customer shall correct the deficiencies and comply with any requests.

Section 1 – INTRODUCTION

If the Customer does not correct the deficiencies within the reasonable time, or if the corrections are not considered adequate by Toronto Hydro or an inspection authority, Toronto Hydro may disconnect the supply of electricity to the Customer or may correct the deficiencies at the Customer's expense, and Toronto Hydro shall not be liable to the Customer for any damages arising as a result of or in the course of disconnecting supply or correcting the deficiencies other than physical damage to facilities arising directly from entry on the Customer's property. Toronto Hydro's policies and procedures with respect to the disconnection process are further described in this Conditions.

1.8 Disputes

Any dispute between Customers or Retailers and the Distributor shall be settled according to the dispute resolution process specified in the Distributor Licence. In this section, the Distributor should outline the Customer Complaint and Dispute Resolution process that has been established as a condition of licence.

If a Customer, Consumer or other market participant has a complaint about Toronto Hydro regarding services provided by Toronto Hydro under its Electricity Distribution License, the Consumer may contact one of Toronto Hydro's Customer Care representatives at 416-542-8000 during regular business hours, between 8:30 AM and 4:30 PM Monday to Friday, or e-mail the complaint to contactus@torontohydro.com.

Upon receipt of a complaint, a Toronto Hydro Customer Care representative will contact the Customer, Consumer or other market participant to acknowledge receipt of the complaint and, if possible, to resolve the complaint, and will investigate and follow-up on the complaint as required to resolve the complaint. If a Customer, Consumer or other market participant complaint cannot be resolved by contacting one of Toronto Hydro's Customer Care representatives, Toronto Hydro will refer the unresolved complaint to an independent third party complaints resolution agency that has been approved by the Ontario Energy Board. Until such time as the Ontario Energy Board approves such an independent third party complaints resolution agency, such complaints will be referred to the Ontario Energy Board, which has assumed this role.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2 DISTRIBUTION ACTIVITIES (GENERAL)

This section should include information that is applicable to all Customer classes of the distributor. Items that are applicable to only a specific Customer class are covered in Section 3.

2.1 Connections - Process and Timing

Under the terms of the Distribution System Code, Toronto Hydro has the obligation to either connect or to make an offer to connect any Customers that lie in its service area. The form of the offer and its terms and conditions may vary in accordance with Toronto Hydro's requirements for connecting a Customer to Toronto Hydro's distribution system.

The Customer or its representative shall consult with Toronto Hydro concerning the availability of supply, the supply voltage, service location, metering, and any other details. These requirements are separate from and in addition to those of the Electrical Safety Authority (ESA). Toronto Hydro will confirm, in writing, the characteristics of the electricity supply.

The Customer or its authorized representative shall apply for new or upgraded electricity services and temporary power services in writing. The Customer is required to provide Toronto Hydro with sufficient lead-time in order to ensure:

- the timely provision of electricity supply to new and upgraded premises or
- the availability of adequate capacity for additional loads to be connected in existing premises.

Toronto Hydro shall make every reasonable effort to respond promptly to a Customer's request for connection. Toronto Hydro shall respond to a Customer's written request for a Customer connection within 15 calendar days of receipt of the written request. Toronto Hydro will make an offer to connect within 60 calendar days of receipt of the written request, unless other necessary information is required from the Customer before the offer can be made.

Toronto Hydro may collect a Design Pre-payment in order to initiate and perform a design review in the preparation of an offer to connect. Upon acceptance of the offer to connect, the Design Pre-payment will be credited towards the Customer's financial obligations for the project. If the Customer does not accept Toronto Hydro's offer to connect, or if the applicant withdraws its application, or if Toronto Hydro is unable to provide an offer to connect, then Toronto Hydro may refund the Design Pre-Payment less any costs incurred by Toronto Hydro.

Toronto Hydro shall make every reasonable effort to respond promptly to another distributor's request for connection. Toronto Hydro shall provide an initial consultation with another distributor regarding the connection process within thirty

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

(30) days of receiving a written request for connection. A final offer to connect the distributor to Toronto Hydro's distribution system shall be made within ninety (90) days of receiving the written request for connection, unless other necessary information outside the distributor's control is required before the offer can be made.

If special equipment is required or equipment delivery problems occur, then longer lead times may be necessary. Toronto Hydro will notify the Customer of any extended lead times.

In addition to any other requirements in this Conditions, the supply of electricity is conditional upon Toronto Hydro being permitted and able to provide such a supply, obtaining the necessary apparatus, material, and easements, and constructing works to provide the service. Should Toronto Hydro not be permitted or able to do so, it is under no responsibility to the Customer whatsoever and the Customer releases Toronto Hydro from any liability in respect thereto.

Requirements regarding Connection Agreements are set forth in Sections 2.1.7.4, 3.7, and in Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements" for load Customer, a Generator, Wholesale Market Participant, and Embedded Distributor.

2.1.1 Building that Lies Along

In this section, the Distributor should describe the standard connection allowance or charge used by the Distributor in its service territory, and describe any variable connection fees that would be charged beyond the standard allowance.
The Distributor also may stipulate in this section other terms and conditions by which a Customer requesting a Connection must abide, as long as it is within the terms of the DSC code.

For the purpose of this Conditions "lies along" means a Customer property or parcel of land that is directly adjacent to or abuts onto the public road allowance where Toronto Hydro has distribution facilities of the appropriate voltage and capacity.

Under the terms of the Distribution System Code, Toronto Hydro has the obligation to connect (under Section 28 of the *Electricity Act, 1998*) a building or facility that "lies along" its distribution line, provided:

a) the building can be connected to Toronto Hydro's distribution system without an expansion or enhancement and,
b) the service installation meets the conditions listed in the Conditions of Service of the distributor that owns and operates the distribution line.

The location of the Customer's service entrance equipment is subject to the approval of Toronto Hydro and the Electrical Safety Authority.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.1.1.1 Connection Charges

Toronto Hydro shall recover costs associated with the installation of connection assets by Customer Class via Basic Connection Costs through the economic evaluation for Expansions and Variable Connection Costs, collected directly from the Customer, as applicable.

The Variable Connection Costs shall be calculated as the costs associated with the installation of Connection assets **above and beyond** the Standard Allowance for Basic Connection as described in Tables 1.1, 1.2, 1.3, and 1.4. Toronto Hydro will recover these Variable Connection Costs, which shall be based on actual cost, directly from the Customer.

2.1.2 Expansions / Offer to Connect

Under the terms of the DSC, a Distributor has the Obligation to make an Offer to Connect any Building that is in the distributor' s service territory that cannot be connected without an expansion, or "lies along" its distribution system, but may be denied connection for the reasons described in subsection 2.1.3 of the distributor's Conditions of Service.

The Offer to Connect must be fair and reasonable and be based on the distributor's design standard. The Offer to Connect also must be made within a reasonable time from the request for connection.

In this section, the Distributor should outline, in detail, the process followed to determine any required capital contributions. This section also should describe any fixed connection fees as well as variable connection fees, by Customer class.

If a Customer requests to connect a new Customer load, either through a new connection or by increasing the load at an existing connection, to Toronto Hydro's distribution system, and the new load necessitates an expansion of Toronto Hydro's distribution system, then Toronto Hydro will provide Customers requesting connections that necessitate an expansion with an offer to connect for expansions ("Offer to Connect"). Toronto Hydro will perform an economic evaluation of the expansion project in accordance with the Capital Contribution policy set out in Section 2.1.2.2. The economic evaluation will determine if the forecasted future revenue ("Estimated Incremental Revenues") from the new load ("Estimated Incremental Demand") and from the Customer(s) will pay for the costs associated with the expansion. The costs associated with the expansion include but are not limited to:

1) the distribution system expansion capital cost *"*Expansion Costs*"*;
2) on-going operating, maintenance and administration costs including those actually incurred and those apportioned in the manner set forth below *"*OM&A Costs*"*; and
3) the basic cost of connection outlined in Tables 1.1, 1.2, and 1.3 "Basic Connection Costs".

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

The Expansion Costs that Toronto Hydro will include in the economic evaluation are capital costs that are associated with the installation of expansion facilities and equipment on Toronto Hydro's main distribution system. The expansion facilities and equipment will typically meet the following criteria:

- Are required to accommodate the new Customer load;
- Are not necessary to serve the needs of existing Customers and their existing loads; and
- Are designed and installed in accordance with Toronto Hydro's planning, design, and construction standards.

For the purpose of determining OM&A Costs, Toronto Hydro will use system average operating, maintenance and administrative costs as a proxy for incremental OM&A Costs associated with the expansion facilities and apportion them as fixed costs (for Rate Class 1 and 2) or as a function of $/kW of demand (for Rate Class 3, 4, and 5).

The Expansion Costs are in addition to any Variable Connection Costs. Refer to Table 1.1, 1.2, and 1.3 in Section 5 for each Customer Class.

For the purpose of establishing the Estimated Incremental Demand to be used in the economic evaluation, the Customer shall provide a valid estimate of the proposed new load (incremental demand) for evaluation and acceptance by Toronto Hydro. If the Customer and Toronto Hydro are unable to agree on a valid incremental demand for new Class 3, 4, and 5 Customers or in the absence of adequate billing history for existing Customers, Toronto Hydro will set the Estimated Incremental Demand to 90% of the incremental installed transformer capacity.

Using the Estimated Incremental Demand, Toronto Hydro shall then calculate the Estimated Incremental Revenues that would be received from the Customer(s) based on the new load. Toronto Hydro will use the "fixed charge" and the "variable charge" that have been approved by the Ontario Energy Board by Rate Class to determine the Estimated Incremental Revenues. For existing Customers Toronto Hydro shall apportion the "fixed charge" based on the ratio between the new (incremental) load and the combined load.

In performing the economic evaluation, should the Net Present Value (NPV) of the costs and revenues associated with the Expansion be less than zero, the Customer shall pay a capital contribution in the amount of the shortfall (i.e. the amount below zero) to Toronto Hydro. Toronto Hydro has elected to collect this shortfall from the Customer in accordance with its Capital Contribution policy as outlined in Section 2.1.2.2.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

For the purposes of connecting a generator, the amount charged by Toronto Hydro to the generator to construct an expansion to connect a generation facility to the Toronto Hydro distribution system shall not exceed the generator's share of the present value of the projected capital costs and on-going maintenance costs for the equipment. Projected revenue and avoided costs from the generation facility shall be assumed to be zero, unless otherwise determined by rates approved by the Ontario Energy Board. In the case of a renewable energy generation facility, Toronto Hydro shall not charge the generator for any costs of the expansion that are at or below the renewable energy expansion costs cap for renewable energy generation facilities as set by the Ontario Energy Board.

The methodology and inputs that Toronto Hydro will use for all new load and new connection economic evaluations are presented in Appendix B of the Distribution System Code.

2.1.2.1 Offer to Connect & Alternative Bid Work

Toronto Hydro will provide one firm Offer to Connect to the Customer, at no expense to the Customer, for plans submitted to Toronto Hydro that necessitate an expansion to Toronto Hydro's main distribution system. If the Customer submits revised plans, Toronto Hydro may provide a new firm Offer to Connect for the revised plans at the Customer's expense.

In the Offer to Connect, Toronto Hydro will advise the Customer of any eligible work for which the Customer has the choice to obtain alternative bids from a qualified contractor. The Customer may obtain an alternative bid to construct the eligible work portions of the expansion and connection facilities:

- that do not make physical contact with Toronto Hydro's distribution system; and
- that only require work to be completed within Toronto Hydro's safe limits of approach to energized facilities or equipment,

unless otherwise directed by Toronto Hydro.

If the Customer chooses to utilize an alternative bid, the Customer shall only use qualified contractors. To qualify to undertake work that is eligible for alternative bid, contractors shall submit a "Construction Contractor Pre-Qualification Application" (refer to Section 6) and meet the requirements no later than 30 business days prior to their selection by the Customer to undertake work that is eligible for alternative bid. To avoid delay in the start of the work that is eligible for alternative bid, the Customer shall engage a contractor that is qualified.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

Toronto Hydro does not make any representation or warranty regarding any contractor selected by the Customer to do any work regardless of whether the contractor has completed the requirements set by Toronto Hydro or not and shall have no liability to the Customer in respect of such work.

Toronto Hydro will also include in the Offer to Connect or by separate document an estimate of any additional costs ("Additional Alternative Bid Costs") that will be incurred by Toronto Hydro in the event that the Customer decides to pursue an alternative bid for the work that is eligible for alternative bid. Additional Alternative Bid Costs may include, but are not limited to, the following:

- costs for additional design, engineering, or installation of facilities required to complete the project;
- costs associated with any temporary de-energization of any portion of the existing distribution system that is required in relation to an expansion that is constructed under the alternative bid option;
- costs associated to review and approve the plans for the design, engineering, layout, and work execution for the work that is eligible for alternative bid to ensure conformance to Toronto Hydro's distribution system planning standards and specifications prior to commencing that work;
- costs for administering the contract between the Customer and the contractor hired by the Customer if Toronto Hydro is asked to administer the contract by the Customer and Toronto Hydro agrees to administer the contract; and
- costs for inspection or approval by Toronto Hydro of the work performed by the contractor hired by the Customer.

Within sixty (60) days of receiving the Offer to Connect, the Customer shall return a signed copy of the Offer to Connect indicating the Customer has accepted the offer, and whether the Customer is electing to pursue an alternative bid. After sixty (60) days, if the Customer has not accepted the Offer to Connect in writing, Toronto Hydro may revoke the Offer to Connect without providing any notification to the Customer.

If the Customer decides to pursue an alternative bid, the Customer and his qualified contractor shall only use materials that meet the same specifications as Toronto Hydro approved materials (i.e. same manufacturers and same part numbers). Once the Customer has hired a qualified contractor, the Customer may request, and if requested, Toronto Hydro shall provide the listing of approved materials that may be required for the alternative bid work.

Upon accepting an Offer to Connect, regardless of whether the Customer will be pursuing an alternative bid or not, the Customer shall provide Toronto

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

Hydro the payables (e.g. costs) and security amounts (e.g. deposits) as required and stipulated in the Offer to Connect.

2.1.2.2 Capital Contribution Policy

The capital contribution policy elected by Toronto Hydro shall be consistent with the policy outlined below for each Customer Class:

Class 1 – Residential Single Service: No Transformation required on private property

- Overhead or Underground: *Capital contribution **not** collected from Customer*

Class 2 - General Service, (Below 50 kW): No Transformation required on private property

- Overhead or Underground: *Capital contribution **not** collected from Customer*

Class 3 - General Service (50 kW – 999 kW): Capital contribution collected from Customer

Class 4 - General Service (1000 kW – 4999 kW): Capital contribution collected from Customer.

Class 5 – Large User (5000 kW and above): Capital contribution collected from Customer

For the purpose of determining the amount of Capital Contribution payable by a Customer the following clarification and exception shall apply:

- Condominium apartments and apartment buildings that have a demand less than 1,000 kW are part of Class 3A General Services
- Condominium townhouse units intended to remain in private property are part of Class 3B General Service
- Townhouse units built (or intended to be) fronting public road allowances are part of Class 3C "Residential Subdivision"
- Townhouse units built as "freehold" (i.e. on property owned by the individual townhouse owner) are part of Class 3C "Residential Subdivision"
- Low-rise residential developments involving more than 5 lots regardless of demand are classified as Class 3C "Residential Subdivision".

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

However, notwithstanding the treatment of capital contribution, Toronto Hydro shall in all cases calculate the "Estimated Incremental Revenues" of new Customers using the "fixed charge" and the "variable charge" that have been approved by the Ontario Energy Board for the Rate Class applicable to each individual new meter installed in connection with the expansion project.

To determine the amount of Capital Contribution required from a Class 3, 4, or 5 Customer for an expansion project, Toronto Hydro will perform an economic evaluation by inputting the project specific information together with a set of standardized assumptions and specific annual parameters into a proprietary "Business Economic Model" developed for Toronto Hydro in accordance with the methodology and inputs outlined in Appendix B of the Distribution System Code ("Economic Evaluation").

2.1.2.2.1 Offer to Connect – Content & Process

Based on the output of its Economic Evaluation, Toronto Hydro will set out in the Offer to Connect the following, as applicable:

(a) Whether the offer is a firm offer or an estimate of costs that would be revised in the final payment to reflect actual costs incurred;

(b) the amount of the capital contribution;

(c) the calculation used to determine the amount of the capital contribution including all of the assumptions and inputs used to produce the economic evaluation;

(d) a statement as to whether the offer includes work for which the Customer may obtain an alternative bid, and, if so, the process by which the Customer may obtain the alternative bid;

(e) a description of, and costs for, the work that is eligible for alternative bid and the work that is not eligible for alternative bid associated with the expansion broken down into the following categories:
   (i) labour (including design, engineering and construction);
   (ii) materials;
   (iii) equipment; and
   (iv) overhead costs (including administration);

(f) the amount for any Additional Alternative Bid Costs;

(g) the amount for the basic cost of connection; and

(h) the expansion deposit amount.

If there is a conflict between an Offer to Connect and this Conditions, the Offer to Connect shall govern.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.1.2.2.2 Transfer Price for Work that is Eligible for Alternative Bid

The transfer price for the expansion work that is eligible for alternative bid shall be the lower of the cost to the Customer ("Customer's Cost") to construct the expansion facilities or the amount set out in the initial Offer to Connect to do the expansion work that is eligible for alternative bid. The Customer's Cost shall mean:

(a) The costs the Customer paid to have the eligible alternative bid expansion work performed, as supported by evidence satisfactory to Toronto Hydro; and
(b) Any costs incurred by Toronto Hydro and charged to the Customer as a result of the Customer selecting to perform expansion work using an alternative bid.

For greater clarity, the cost referred to in (a) does not include any costs associated with completing connection work as identified in the Offer to Connect.

If the Customer does not provide the cost to construct the expansion facilities as referred to in (a), to Toronto Hydro within 30 days of the expansion facilities being energized, then the amount of the transfer price shall be the amount set out in the initial Offer to Connect to do expansion the work that is eligible for alternative bid.

Toronto Hydro will assume ownership of the facilities as of the date that the facilities were energized unless otherwise specified in the Offer to Connect.

2.1.2.2.3 Alternative Bid Final Economic Evaluation & Capital Contribution Settlement

If the Offer to Connect is a firm offer and the Customer has exercised the alternative bid option, Toronto Hydro will carry out a final Economic Evaluation once the expansion facilities are energized. The final Economic Evaluation will be based on the amounts used in the firm offer for costs and forecasted revenues, plus any transfer price to be paid to the Customer. If the required capital contribution amount from the final Economic Evaluation ("Final Capital Contribution") differs from the required capital contribution amount from the initial Economic Evaluation ("Initial Capital Contribution"), the Customer will be responsible for the Final Capital Contribution and not the Initial Capital

Contribution. Toronto Hydro and the Customer shall arrange to settle any amounts owing as necessary, including by way of set off.

Toronto Hydro will provide the Customer with the calculation used to determine the final capital contribution amount including all of the assumptions and inputs used to produce the final Economic Evaluation at no cost to the Customer.

2.1.2.3 Expansion Deposit

As noted above, an expansion to Toronto Hydro's distribution system results in Expansion Costs and OM&A Costs. Given that the capital contribution that the Customer shall pay to Toronto Hydro may not fully offset these costs for Toronto Hydro, Toronto Hydro may require the Customer to provide an expansion deposit in addition to the capital contribution. The expansion deposit is intended to hold Toronto Hydro harmless with respect to the expansion.

For Class 3, 4, and 5 Customers an Offer to Connect may require the Customers to provide an expansion deposit to cover the difference between the Expansion Costs and the amount of the capital contribution paid by the Customer, in accordance with Toronto Hydro's Economic Evaluation of the expansion.

Where a Customer does not intend to pursue the alternative bid option, Toronto Hydro may require the Customer to provide the full expansion deposit, as contained in the Offer to Connect, prior to the commencement of any expansion work or the installation of any connection assets.

Where a Customer intends to exercise the alternative bid option, Toronto Hydro may require the Customer to post an initial expansion deposit in an amount equal to the costs for the expansion work that is ineligible for alternative bid, prior to the commencement of any expansion work or the installation of any connection assets. Once the expansion facilities are energized, and Toronto Hydro has conducted a final Economic Evaluation and determined a final capital contribution amount, Toronto Hydro may require the Customer to post an additional deposit to be added to the initial expansion deposit such that the total expansion deposit, made up of the initial expansion deposit and the additional deposit (collectively the "Total Expansion Deposit") is equal to the difference between the actual Expansion Costs, including the transfer price, and the amount of the final capital contribution.

Toronto Hydro may retain or realize on any expansion deposit from the Customer for the purposes of covering any amounts that the Customer owes to

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

Toronto Hydro pursuant to the Offer to Connect. These amounts may include an outstanding capital contribution, and the costs associated with completing, repairing, or bringing up to standard the expansion facilities (e.g. bringing expansion facilities up to proper design and technical specifications; ensuring that facilities operate properly when energized).

In addition, for Customers that exercise the alternative bid option, Toronto Hydro may retain 10% of the Total Expansion Deposit, for a warranty period of up to two years and may apply such deposit to any work required to repair the expansion facilities within the two-year warranty period. At the end of the warranty period, Toronto Hydro shall return to the Customer the unused portion of the expansion deposit that was retained for the warranty period.

The two-year warranty period begins at the end of the Realization Period. The Realization Period for a project ends:

- For residential developments, upon the first to occur of the materialization of the last forecasted connection in the expansion project, or five (5) years after energization of the expansion facilities,
- For commercial and industrial developments, upon the first to occur of the materialization of the last forecasted demand, or five (5) years after energization of the expansion facilities, or
- For residential developments combined with commercial or industrial developments, upon the first to occur of the materialization of both the last forecasted connection and the last forecasted demand, or five (5) years after energization of the expansion facilities.

The expansion deposit must be either in the form of (i) cash or (ii) an irrevocable commercial letter of credit issued by a Schedule I bank as defined in the *Bank Act*, or (iii) surety bond, but the form of deposit must expressly provide for its use to cover the events for which it is held as a deposit.

Except for the warranty portion of the expansion deposit which shall be retained for the duration of the warranty period, once the facilities are energized, Toronto Hydro shall agree to reduce the expansion deposit amount at the end of each 365-day period.

The amount of the reduction at the end of each 365-day period is calculated by multiplying the expansion deposit (or Total Expansion Deposit in the case of an alternative bid) by a percentage, less any portion that Toronto Hydro has retained or realized. The percentage is derived by dividing the actual connections (for residential developments) or actual demand (for commercial and industrial developments) completed or materialized in that 365-day period, incremental to any connections completed or demand that materialized in any

previous 365-day period, by the total number of connections (for residential developments) or actual demand (for commercial and industrial developments) contemplated in the Offer to Connect. (For example, if twenty percent of the forecasted connections or demand materialized in a year, and Toronto Hydro has not retained or realized any portion of the expansion deposit in accordance with the Offer to Connect, then Toronto Hydro will return to the Customer twenty percent of the expansion deposit.)

However, if after five (5) years from the energization date of the expansion facilities the total number of connections (for residential developments) or the actual demand (for commercial and industrial developments) contemplated by the Offer to Connect have not materialized, Toronto Hydro shall retain any cash held as an expansion deposit, or be entitled to realize on any letter of credit or bond held as an expansion deposit and retain any cash resulting therefrom, with no obligation to return any portion of such monies to the Customer at any time.

If the Customer has provided any expansion deposit in the form of cash, any portion of the expansion deposit held as cash returned to the Customer shall include interest on the returned amount from the date of receipt of the full amount of the expansion deposit at the Prime Business Rate set by the Bank of Canada less 2 percent.

2.1.2.4 Supply Agreement

Class 3, 4 and 5 Customers may be required to enter into a Supply Agreement with Toronto Hydro to clarify the responsibilities of each party pertaining to the construction and maintenance of the expansion and or connection assets.

2.1.2.5 Rebates of Capital Contribution

As noted above, when a new Customer connection or the addition of new load necessitates an expansion to Toronto Hydro's distribution system, Toronto Hydro conducts an economic evaluation. The economic evaluation considers costs associated with the expansion and forecasts revenues that the expansion will enable. If, within five (5) years of the energization of the expansion facilities, a subsequent Customer:

- connects new load to Toronto Hydro's distribution system;
- derives a benefit from the expansion facilities;
- the new load had not been forecasted and not included in the economic evaluation; and
- the subsequent Customer is a Class 3, 4, or 5 Customer,

then the subsequent Customer ("Unforecasted Customer") shall contribute a fair share of the cost that was incurred to construct the expansion. In such a case, Toronto Hydro shall collect the fair share from the Unforecasted Customer and shall provide that share as a rebate to the initial contributor (i.e. the Customer that initially paid the required capital contribution) to the expansion.

The amount of the fair share of the Unforecasted Customer, and therefore the amount of the rebate to the capital contribution of the initial contributor(s), will be determined by Toronto Hydro by apportioning the overall benefits associated with the expansion between the Unforecasted Customer and the initial (or previous) contributor(s). If applicable, Toronto Hydro may consider any or all of the following factors when apportioning the overall benefits:

(a) the relative name-plate rated capacity of the connections;
(b) the relative load levels;
(c) the line length that the Unforecasted Customer requires in comparison to the line length that the initial contributor(s) requires in the context of the expansion;
(d) the proportion of the five (5) year period of time after the energization date of the expansion that the Unforecasted Customer will be connected to the Toronto Hydro distribution system; and
(e) any other factor that Toronto Hydro, in its sole discretion, considers to be relevant to the determination.

2.1.2.6 Feeder Capacity Optimization

Toronto Hydro will provide service to the Customer during the Realization Period based upon the Estimated Incremental Demand indicated in the Offer to Connect that has been signed by the Customer. However, unused capacity will not be reserved past the Realization Period.

After the Realization Period Toronto Hydro reserves the right to examine the Customer's peak demand with a view to optimizing its feeder capacity. If the actual peak demand is lower than the Estimated Incremental Demand, then Toronto Hydro will adjust downwards its internal peak demand forecast and may re-assign any unused capacity if it determines this is appropriate to meet other demand needs.

After the Realization Period the Customer shall obtain the consent of Toronto Hydro prior to effecting any substantial increase its peak demand, regardless of the Estimated Incremental Demand set forth in the Offer to Connect, or through past demand history.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.1.3 Connection Denial

The DSC sets outs the conditions for a Distributor to deny connections. The DSC lists reasons for which a Building that "lies along" a distribution line may be refused connection to that line. This section should describe reasons why a distributor may not be obligated to connect the Customer and provide additional details, where relevant, about specific conditions that may result in a refused connection in accordance with the DSC code. For example, the criteria for establishing an unsafe connection or a connection, which adversely affects the system, should be further documented within the Conditions of Service.

The Distribution System Code provides for the ability of a Distributor to deny connections. Toronto Hydro is not obligated to connect a Customer within its service area if the connection would result in any of the following:

- Contravention of existing laws of Canada or the Province of Ontario, including the Ontario Electrical Safety Code
- Violations of conditions in Toronto Hydro's Licence
- Use of a Toronto Hydro distribution system line for a purpose that it does not serve and that Toronto Hydro does not intend to serve
- Adverse affect on the reliability or safety of Toronto Hydro's distribution system
- Public safety reasons or imposition of an unsafe work situation beyond normal risks inherent in the operation of Toronto Hydro's distribution system
- A material decrease in the efficiency of the Toronto Hydro's distribution system
- A materially adverse effect on the quality of distribution services received by an existing connection
- If the person requesting the connection owes Toronto Hydro money for distribution services
- Potential increases in monetary amounts that already are in arrears with Toronto Hydro
- If an electrical connection to Toronto Hydro's distribution system does not meet Toronto Hydro's design requirements
- Any other conditions documented in Toronto Hydro's Conditions.

If Toronto Hydro refuses to connect a Customer in its service area that lies along one of its distribution lines, Toronto Hydro shall inform the person requesting the connection of the reasons for the denial, and where Toronto Hydro is able to provide a remedy, make an Offer to Connect in accordance with Section 2.1.2 of this Conditions. If Toronto Hydro is not capable of resolving the issue, it is the responsibility of the Customer to do so before a connection can be made.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.1.4 Inspections Before Connections

In this section, the Distributor should state the requirement for inspection by the Electrical Safety Authority prior to the commencement of electricity supply.

All Customer electrical installations shall be inspected and approved by the Electrical Safety Authority and must also meet Toronto Hydro's requirements. Toronto Hydro requires notification from the Electrical Safety Authority of this approval prior to the energization of a Customer's supply of electricity. Where a "Connection Authorization" from the Electrical Safety Authority has been issued to Toronto Hydro, it is valid for the connection of a service for a period of up to six months from the date of issue. If the connection of service has not been completed after six months, a new "Connection Authorization" is required. Services that have been disconnected for a period of six months or longer must also be re-inspected and approved by the Electrical Safety Authority, prior to reconnection.

Temporary services, typically used for construction purposes and for a period of twelve months or less, must be approved by the Electrical Safety Authority and must be re-inspected should the period of use exceed twelve months.

Customer owned substations must be inspected by both the Electrical Safety Authority and Toronto Hydro.

Transformer rooms shall be inspected and approved by Toronto Hydro prior to the installation of Toronto Hydro's equipment.

Duct banks shall be inspected and approved by Toronto Hydro prior to the pouring of concrete and again before backfilling. The completed ducts must be rodded by the site contractor in the presence of a Toronto Hydro inspector and shall be clear of all extraneous material. A mandrel, approved by Toronto Hydro for a nominal diameter of duct, will be passed through each duct. In the event of ducts blocked by ice, the owner's representative will be responsible for clearing the ducts prior to the cable installation. Connection to existing concrete duct banks or cable chamber shall be done only by a contractor approved by Toronto Hydro. All work done on existing Toronto Hydro's plant must be authorized by Toronto Hydro and carried out in accordance with all applicable safety acts and regulations.

Provision for metering shall be inspected and approved by Toronto Hydro prior to energization.

2.1.5 Relocation of Plant

This section should specify the distributor' s policy with respect to requests for relocation of plant and the conditions under which the requestor is or may be required to pay for the relocation of plant should be specified. Sharing arrangements also should be noted.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

When requested to relocate distribution plant, Toronto Hydro will exercise its rights and discharge its obligations in accordance with existing acts, by-laws and regulations including the *Public Service Works on Highways Act*, agreements, easements and law. In the absence of existing agreements, Toronto Hydro is not obligated to relocate the plant. However, Toronto Hydro shall resolve the issue in a fair and reasonable manner. Resolution in a fair and reasonable manner shall include consideration of the impact of the proposed relocation on the other Customers of Toronto Hydro. The response to the requesting party shall explain the feasibility or unfeasibility of the relocation and a fair and reasonable charge for relocation based on cost recovery principles.

The Customer shall contact Toronto Hydro prior to undertaking work that may result in an encroachment on Toronto Hydro plant.

If a Customer proposes to:

a) alter existing buildings, structures or apparatus; or
b) construct new buildings, structures or apparatus

that may result in an encroachment on the electrical and working clearances required by Toronto Hydro for the existing Toronto Hydro distribution plant, the Customer shall:

1) Notify Toronto Hydro; and
2) Toronto Hydro will determine in a fair and reasonable manner whether the relocation of the existing distribution plant is acceptable; and
3) If approved, pay for the relocation costs incurred by Toronto Hydro to have the required Toronto Hydro distribution plant relocated, based on cost recovery principles.

If a Customer encroaches upon the electrical and working clearances set by Toronto Hydro, Toronto Hydro shall determine in a fair and reasonable manner whether the Customer shall be required to remove the encroachment at its own expense, or shall pay, based on cost recovery for work required, the costs incurred by Toronto Hydro to have the required distribution plant relocated.

In the course of maintaining and enhancing Toronto Hydro's distribution plant, Toronto Hydro may need to relocate distribution plant that is owned by Toronto Hydro. Costs associated with such relocation(s) shall be borne by Toronto Hydro, except that, in accordance with Section 3.2(g) hereof, if the Customer requests that such maintenance or construction activities be done outside Toronto Hydro's normal working hours, the Customer shall pay for any incremental costs incurred by Toronto Hydro as a result thereof.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.1.6 Easements

In this section, any requirements for easements should be described.

To maintain the reliability, integrity and efficiency of the distribution system, Toronto Hydro has the right to have supply facilities on private property and to have easements registered against title to the property. Easements are required where facilities serve property other than property where the facilities are located and/or where Toronto Hydro deems it necessary.

The Customer will prepare at its own cost any required reference plan to the satisfaction of Toronto Hydro. Easement documents are prepared by the Toronto Hydro Legal Services Department. Four copies of the deposited reference plan must be supplied to Toronto Hydro prior to the preparation of the easement documents. Details will be provided upon application for service.

2.1.7 Contracts

This section should outline the types of contracts that are available for each type of Customer, including standard, implied and special contracts. Connection agreements and operating agreements should be listed and referenced as appendices to the Conditions of Service, if applicable.

2.1.7.1 Contract for New or Modified Electricity Service

Toronto Hydro shall only connect a Customer for a new or modified supply of electricity upon receipt by Toronto Hydro of the following:

- a completed and signed contract for service in a form acceptable to Toronto Hydro;
- payment to Toronto Hydro of any applicable connection fee;
- an inspection and approval by the Electrical Safety Authority of the electrical equipment for the new service; and
- a Connection Agreement as requested or required pursuant to Section 2.1.7.4.

2.1.7.2 Implied Contract

In all cases, notwithstanding the absence of a written contract, Toronto Hydro has an implied contract with any Customer that is connected to Toronto Hydro's distribution system and receives distribution services from Toronto Hydro. The terms of the implied contract are embedded in Toronto Hydro's Conditions of Service, the Rate Handbook, Toronto Hydro's rate schedules, Toronto Hydro's licence, the Distribution System Code, the Standard Supply Service Code and the Retail Settlement Code, all as amended from time to time.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

The acceptance of supply of electricity or related services from Toronto Hydro constitutes a binding contract with Toronto Hydro, which includes this Conditions and all terms thereunder. The person so accepting the supply of electricity or related services shall be liable for payment for same, and such contract shall be binding upon such person's heirs, administrators, executors, successors or assigns.

2.1.7.3 Special Contracts

Special contracts that are customized in accordance with the service requested by the Customer normally include, but are not necessarily limited to, the following examples:

- construction sites
- mobile facilities
- non-permanent structures
- special occasions, etc.
- embedded generation facilities

2.1.7.4 Connection Agreements

Toronto Hydro may require a Customer to enter into a Connection Agreement in a form acceptable to Toronto Hydro. Until such time as the Customer executes such a Connection Agreement with Toronto Hydro, the Customer shall be deemed to have accepted and agreed to be bound by all of the terms in the Connection Agreement attached to this as Schedule A in Section 6.

A Generator, and a Wholesale Market Participant shall enter into a Connection Agreement as per Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements".

An Embedded Distributor shall enter into a Connection Agreement in a form acceptable to Toronto Hydro. Until such time as the Embedded Distributor executes such a Connection Agreement with Toronto Hydro, the Embedded Distributor shall be deemed to have accepted and agreed to be bound by all of the terms in this Conditions that apply to such Embedded Distributor.

Toronto Hydro shall make a good faith effort to enter into a Connection Agreement with a distributor connected to Toronto Hydro's distribution system in accordance with the requirements in the Distribution System Code issued by the Ontario Energy Board.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

If there is a conflict between a Connection Agreement with a Customer, Generator, Wholesale Market Participant or Embedded Distributor and this Conditions of Service, the Connection Agreement shall govern.

2.1.7.5 Payment by Building Owner

The owner of a Building is responsible for paying for the supply of electricity by Toronto Hydro to the owner's Building except for any supply of electricity to the Building by Toronto Hydro in accordance with a request for electricity by an occupant(s) of the Building.

A Building owner wishing to terminate the supply of electricity to its Building must notify Toronto Hydro in writing. Until Toronto Hydro receives such written notice from the Building owner or its authorized representative, the Building owner and/or the occupant(s), as applicable, shall be responsible for payment to Toronto Hydro for the supply of electricity to such Building. Toronto Hydro may refuse to terminate the supply of electricity to an owner's Building when there are occupant(s) in the Building (i.e. during certain periods of the winter).

Effective April 1, 2011, after closure of an account opened pursuant to a request, directly or indirectly, from an occupant of the property other than the owner or its authorized representative, Toronto Hydro shall not seek to recover any charges for service provided to a rental unit in a residential complex or residential property from the owner of the residential complex or residential property, unless the owner has agreed to assume responsibility for those charges. An owner, either personally or through an authorized representative, may enter into an agreement with Toronto Hydro whereby the owner agrees to assume responsibility for paying for continued service to the rental unit after closure of an occupant account. Where the owner has not agreed to assume responsibility for charges for continued service, Toronto Hydro may disconnect the service without notice. Toronto Hydro will not be responsible for any liabilities or damages, which may occur as a result of the service being disconnected.

Where a non-residential property has been vacated by an occupant of the property, and Toronto Hydro has not been notified that a new occupant should be billed for the electricity supplied to the property and the owner has not submitted a written request to disconnect the electricity supply, Toronto Hydro will bill the owner for the electricity supply to the property until such time as Toronto Hydro is notified by the owner or a new occupant that the occupant should be billed for the electricity supply.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.1.7.6 Opening and Closing of Accounts

A Consumer who wishes to open or close an account for the supply of electricity by Toronto Hydro shall contact Toronto Hydro's Call Centre by phone, by written request (including requests submitted by facsimile), through Toronto Hydro's web site, or other means acceptable to Toronto Hydro.

The Consumer shall be responsible for payment to Toronto Hydro for the supply of electricity to the property up to the date Toronto Hydro is notified of the termination of the account.

2.2 Disconnection

In this section, the Distributor should specify under what circumstances it has the right or obligation to disconnect a Customer. This section also should outline the business processes used by the distributor, including notification and timing provisions.

Toronto Hydro reserves the right to disconnect service for reasons not limited to:

- Contravention of the laws of Canada or the Province of Ontario, including the Ontario's Electrical Safety Code.
- A material adverse effect on the reliability and safety of Toronto Hydro's distribution system.
- Imposition of an unsafe worker situation beyond normal risks inherent in the operation of Toronto Hydro's distribution system.
- A material decrease in the efficiency of Toronto Hydro's distribution system.
- A materially adverse effect on the quality of distribution services received by an existing connection.
- Inability of Toronto Hydro to perform planned inspections and maintenance.
- Failure of the Consumer or Customer to comply with a directive of Toronto Hydro that Toronto Hydro makes for purposes of meeting its licence obligations.
- Overdue amounts payable to Toronto Hydro including the non-payment of a security deposit.
- Electrical disturbance propagation caused by Customer equipment that is not corrected in a timely fashion.
- Any other conditions identified in this Conditions.

Toronto Hydro may disconnect the supply of electricity without notice in accordance with a court order, or for emergency, safety or system reliability reasons.

A Customer intending to demolish any buildings that house Toronto Hydro's distribution equipment shall notify Toronto Hydro at least four (4) months in advance of demolition. The Customer shall pay Toronto Hydro for the costs of removing all electrical equipment owned by Toronto Hydro that is located on private property.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

Provided the Customer has made all necessary arrangements, Toronto Hydro shall remove all its equipment by the date agreed to with the Customer.

2.2.1 Disconnection & Reconnection – Process and Charges

Immediately following the due date, steps will be taken to collect the full amount of the electricity bill. If the bill is still unpaid sixteen calendar days after the due date and ten calendar days after a disconnect notice has been delivered to the Customer, the service may be disconnected and not restored, or a Timed Load Interrupter Device may be installed, until payment arrangements satisfactory to Toronto Hydro have been made, including any costs of reconnection. Such discontinuance or restriction of service does not relieve the Customer of the liability for arrears or other applicable charges for the balance of the term of contract, nor shall Toronto Hydro be liable for any damage to the Customer's premises resulting from such discontinuance or restriction of service, other than physical damage to facilities arising directly from entry on the Customer's property. Disconnect notices will be in writing and if given by mail shall be deemed to be received on the third business day after mailing.

Notwithstanding the foregoing, Toronto Hydro shall not shut off the supply of electricity to a property for non-payment as set forth above during such periods as may be prescribed by regulations under the *Electricity Act, 1998*. Upon discovery that a hazardous condition or disturbance propagation (feedback) exists, Toronto Hydro will notify the Customer to rectify the condition at once. If the Customer fails to make satisfactory arrangements to remedy the condition within seven calendar days after a disconnect notice has been given to the Customer, the service may be disconnected and not restored until satisfactory arrangements to remedy the condition have been made. Toronto Hydro shall not be liable for any damage to the Customer's premises resulting from such discontinuance of service, except for physical damage to facilities arising directly from Toronto Hydro's entry on the Customer's property. Disconnect notices will be in writing and if given by mail shall be deemed to be received on the third business day after mailing.

Notwithstanding the above, in the case of a residential Customer that has provided Toronto Hydro with documentation from a physician confirming that disconnection poses a risk of significant adverse effects on the physical health of the Customer or on the physical health of the Customer's spouse, or dependent family member or other person that regularly resides with the Customer, shall not be disconnected for non-payment until 60 days from the date on which the disconnection notice is delivered.

At the request of a residential Customer, Toronto Hydro shall send a copy of any disconnection notice issued to the Customer for non-payment to a third party designated by the Customer for that purpose provided that the request is made no later than the last day of the applicable minimum notice period. As well, residential

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

Customers may at any time prior to disconnection, designate a third party to also receive any future notice of disconnection.

Upon receipt of a Disconnection request by the Customer, Toronto Hydro will disconnect and/or remove Toronto Hydro's connection assets at the Customer's cost as outlined in Table 2 in Section 5 of this Conditions.

Where Toronto Hydro installs a Timed Load Interrupter Device or disconnects a Customer for non-payment, Toronto Hydro will provide (i) the Fire Safety Notice of the Office of the Fire Marshal; (ii) any other public safety notices or information bulletins issued by public safety authorities and provided to Toronto Hydro, which provide information to consumers respecting dangers associated with the disconnection of electricity service, and when applicable, (iii) written notice to the Customer explaining the effect of a Timed Load Interrupter Device on service, along with a telephone number for the Customer to obtain further information.

Where a Timed Load Interrupter Device is installed or a service is disconnected by Toronto Hydro for non-payment, Toronto Hydro will remove the Timed Load Interrupter Device or reconnect the service within 2 business days of the outstanding account balance being paid in full or the Customer entering into an arrears payment agreement. A Customer may request the continued use of the Timed Load Interrupter Device during the course of the arrears payment agreement.

Customers working within the limits of approach to Toronto Hydro's overhead service conductors shall contact Toronto Hydro Line Protection for a quotation to have the service wires protected. If a disconnection and reconnection is required, Toronto Hydro will provide this service for a fee of $370.00 plus HST ($185.00 plus HST for disconnection and $185.00 plus HST for reconnection) during regular hours, and $830.00 plus HST ($415.00 plus HST for disconnection and $415.00 plus HST for reconnection) after regular hours.

2.2.2 Unauthorized Energy Use

Notwithstanding the provisions of Section 2.1.7.2 (Implied Contract) and Section 2.1.7.5 (Payment by Building Owner), Toronto Hydro reserves the right to disconnect the supply of electricity to a building or property where the building or property has, or appears to have, been used for unlawful purposes, including energy diversion or theft of power. The supply of electricity to the building or property may not be reconnected for the existing customer until Toronto Hydro receives full payment from the existing customer of all reasonable costs and losses incurred by Toronto Hydro arising from the unauthorized energy use, including costs of inspections, repair costs, commodity costs, disconnection costs, and reconnection costs. If other than the existing customer requests reconnection, Toronto Hydro may recover any reconnection charges approved by the Ontario Energy Board.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.3 Conveyance of Electricity

2.3.1 Limitations on the Guaranty of Supply

In this section, the Distributor should specify its limitations on the guaranty of supply. The Distributor also should reference the provisions for "Powers of Entry" described in section 40 of the Electricity Act, 1998.

Toronto Hydro will endeavour to use reasonable diligence in providing a regular and uninterrupted supply of electricity but does not guarantee a constant supply or the maintenance of unvaried frequency or voltage and will not be liable in damages to the Consumer or Customer by reason of any failure in respect thereof.

Consumers or Customers requiring a higher degree of security than that of normal electricity supply are responsible to provide their own back-up or standby facilities. Consumers or Customers may require special protective equipment at their premises to minimize the effect of momentary power interruptions.

Customers requiring a three-phase supply should install protective apparatus to avoid damage to their equipment, which may be caused by the interruption of one phase, or non-simultaneous switching of phases of Toronto Hydro's electricity supply.

During an emergency, Toronto Hydro may interrupt supply to a Consumer in response to a shortage of supply of electricity, or to effect repairs on its distribution system, or while repairs are being made to Consumer or Customer-owned equipment. Toronto Hydro shall have rights to access property in accordance with section 40 of the *Electricity Act, 1998* and any successor acts thereto.

To assist with distribution system outages or emergency response, Toronto Hydro may require a Consumer or Customer to provide Toronto Hydro with emergency access to Consumer or Customer-owned distribution equipment that normally is operated by Toronto Hydro or Toronto Hydro-owned equipment on Consumer's property.

2.3.2 Power Quality

This section should outline the guidelines and policies to which the Distributor will endeavor to adhere to in conveying electricity supply, such as service voltage guidelines and outage notification processes. This section also should indicate the process the distributor uses for handling voltage disturbances and power quality testing and remedial action.

This section also should include conditions under which supply of electricity to Customers may be interrupted. Additionally, conditions under which the supply may become unreliable or intermittent should be described.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.3.2.1 Power Quality Testing

Where a Consumer or Customer provides evidence or data indicating that a power quality or EMI problem may be originating from Toronto Hydro's distribution system, Toronto Hydro will perform investigative analysis to attempt to identify the underlying cause. Depending on the circumstances, this may include review of relevant power interruption data, trend analysis, and power quality monitoring.

Upon determination that the cause resulting in the power quality concern originates from the Toronto Hydro distribution system, where it is deemed a system delivery issue and where industry standards are not met, Toronto Hydro will recommend and/or take appropriate mitigation measures. Toronto Hydro will take appropriate actions to control power disturbances found to be detrimental to the Consumers or Customers. If Toronto Hydro is unable to correct the problem without adversely affecting other Toronto Hydro Consumers or Customers, then it is not obligated to make the corrections. Toronto Hydro will use appropriate industry standards (such as IEC or IEEE standards) and good utility practice as a guideline. If the problem lies on the Customer side of the system, Toronto Hydro may seek reimbursement from the Customer for the costs incurred in its investigation.

2.3.2.2 Prevention of Voltage Distortion on Distribution

Customers having non-linear load shall not be connected to Toronto Hydro's distribution system unless power quality is maintained by implementing proper corrective measures such as installing proper filters, and/or grounding. Further, to ensure the distribution system is not adversely affected, power electronics equipment installed must comply with IEEE Standard 519-1992. The limit on individual harmonic distortion is 3%, while the limit on total harmonic distortion is 5%.

2.3.2.3 Obligation to Help in the Investigation

If Toronto Hydro determines the Customer's equipment may be the source causing unacceptable harmonics, voltage flicker or voltage level on Toronto Hydro's distribution system, the Customer is obligated to help Toronto Hydro by providing required equipment information, relevant data and necessary access for monitoring the equipment.

The Customer shall assist in the investigation and resolution of power quality problems by:

(a) maintaining and providing Toronto Hydro with a detailed log of exact times and dates of poor power quality;

(b) ensuring corrective measures such as filters and/or grounding are installed for non-linear loads connected to the distribution system;
(c) assisting Toronto Hydro in determining whether the Customer's equipment may be a source of undesirable system disturbances; and
(d) ceasing operation of equipment deemed to be the cause of system disturbances until satisfactory remedial action has been taken;

The Consumer or Customer should be aware that some distribution system events such as capacitor switching may cause problems with highly sensitive equipment, and the Consumer or Customer shall be responsible for mitigating these effects.

2.3.2.4 Timely Correction of Deficiencies

If an undesirable system disturbance is being caused by Customer's equipment, the Customer will be required to cease operation of the equipment until satisfactory remedial action has been taken by the Customer at the Customer's cost. If the Customer does not take such action within a reasonable time, Toronto Hydro may disconnect the supply of electricity to the property.

2.3.2.5 Notification for Interruptions

Although it is Toronto Hydro's policy to minimize inconvenience to Consumers, it is necessary to occasionally interrupt a Consumer's supply of electricity to allow work on Toronto Hydro's electrical system. Toronto Hydro will endeavor to provide such Consumers with reasonable notice of planned power interruptions. However, interruption times may change due to inclement weather or other unforeseen circumstances. Toronto Hydro shall not be liable in any manner to such Consumers for failure to provide such notice of planned power interruptions or for any change to the schedule for planned power interruptions.

During an emergency, Toronto Hydro may interrupt supply of electricity to a property without notice in response to a shortage of supply of electricity or to effect repairs on Toronto Hydro's distribution system or while repairs are being made to Customer-owned equipment, or to conduct work of an emergency nature involving the possibility of injury to persons or damage to property or equipment.

2.3.2.6 Notification to Consumers on Life Support

Consumers who require an uninterrupted source of power for life support equipment must provide their own equipment for these purposes. Consumers with life support system are encouraged to inform Toronto Hydro of their

medical needs and their available backup power. These Consumers are responsible for ensuring that the information they provide Toronto Hydro is accurate and up-to-date.

With planned interruptions, the same procedure as prescribed in section 2.3.2.5 will be observed. For those unplanned power interruptions that extend beyond two hours and the time expected to restore power is longer than what was indicated by Consumers (registered on life support) as their available backup power, Toronto Hydro will endeavor to contact these Consumers but will not be liable in any manner to the Consumers for failure to do so.

2.3.2.7 Emergency Interruptions for Safety

Toronto Hydro will endeavour to notify Consumers prior to interrupting the supply of electricity. However, if an unsafe or hazardous condition is found to exist, or if the use of electricity by apparatus, appliances, or other equipment is found to be unsafe or potentially damaging to Toronto Hydro or the public, the supply of electricity may be interrupted without notice.

2.3.2.8 Emergency Service (Trouble Calls)

Toronto Hydro will exercise reasonable diligence and care to deliver a continuous supply of electricity to the Consumer. However, Toronto Hydro cannot guarantee a supply that is free from interruption.

When power is interrupted, the Consumer should first ensure that failure is not due to blowing of fuses within the installation. If there is a partial power failure, the Consumer should obtain the services of an electrical contractor to carry out necessary repairs. If, on examination, it appears that Toronto Hydro's main source of supply has failed, the Consumer should report these conditions at once to Toronto Hydro's Call Centre by calling 416-542-8000.

Toronto Hydro operates a Call Centre 24 hours a day to provide emergency service to Consumers. Toronto Hydro will initiate restoration efforts as rapidly as practicable.

2.3.2.9 Outage Reporting

Depending on the outage, duration and the number of Consumers affected, Corporate Communications of Toronto Hydro may issue a news release to advise the general public of the outage. In turn, news radio stations may call for information on a 24-hour basis when they hear of an outage.

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2.3.3 Electrical Disturbances

This section should outline the guidelines to which the Distributor and the Customer will be expected to adhere to regarding electrical disturbances.

Toronto Hydro shall not be held liable for the failure to maintain supply voltages within standard levels due to Force Majeure as defined in Section 2.3.5 of this Conditions.

Voltage fluctuations and other disturbances can cause flickering of lights and other serious difficulties for Consumers connected to Toronto Hydro's distribution system. Customers must ensure that their equipment does not cause disturbances such as harmonics and spikes that might interfere with the operation of adjacent Consumer equipment. Equipment that may cause disturbances includes large motors, welders and variable speed drives, etc. In planning the installation of such equipment, the Customer must consult with Toronto Hydro.

Some types of electronic equipment, such as video display terminals, can be affected by the close proximity of high electrical currents that may be present in transformer rooms. Toronto Hydro will assist in attempting to resolve any such difficulties at the Customer's expense.

Consumers who may require an uninterrupted source of power supply or a supply completely free from fluctuation and disturbance must provide their own power conditioning equipment for these purposes.

2.3.4 Standard Voltage Offerings

This section should specify the voltages that the distributor may provide to each type of Customer, based on their supply requirements. This section should include both the primary and secondary voltages that are available. Additionally, any physical or geographic constraints on a particular voltage, or conditions under which voltages may not be provided should be detailed in this section.

2.3.4.1 Primary Voltage

The primary voltage to be used will be determined by Toronto Hydro for both Toronto Hydro-owned and Customer-owned transformation. Depending on the voltage of the plant that "lies along", the preferred primary voltage will be at 27.6/ 16 kV grounded wye, three phase, four-wire system. However, in the downtown core of the City of Toronto the primary voltage will be 13.8/8 kV grounded wye, three phase, four wire; or 13.8 kV three phase, three wire, depending on the area.

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2.3.4.2 Supply Voltage

Toronto Hydro's preferred secondary voltage is:

- 120/240 V, single phase, and
- 120/208 V or 347/600 V, three phase.

Depending on the system availability in the area, 120/208 V two phase, three wire may be supplied in place of 120/240 V.

The supply voltage governs the limit of supply capacity for any Customer.

When supply is from secondary street circuits the demand load shall be as follows:

(i) residential: if at 120/240 V, single phase or 120/208 V, two phase, three wire, then up to 200A service size;

residential: if at 120/240 V, single phase or 120/208 V, two phase, three wire, then a 400A service size feeding from the overhead distribution system must be connected directly to transformation via underground supply arrangement;

commercial: if at 120/240 V, single phase or 120/208 V, two phase, three wire, then up to 75 kVA demand load;

(ii) if at 347/600 V, three phase, four wire, then up to 80 kVA demand load;

(iii) if at both 120/240 V, single phase and 347/600 V, three phase, four wire, then up to 100 kVA sum total demand load; or

(iv) if at 120/208 V, three phase, four wire, then up to 100 kVA demand load.

For supply exceeding the above capacity, the Customer is required to provide a transformer, pad mounted or in a building vault, on private property, to receive supply of electricity up to the following capacities:

When a pad-mounted transformer is used the demand load shall be as follows:

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(i) if fed from 4.16/2.4 kV primary at 120/208 V or 347/600 V, three phase, four wire, then supply is available for loads up to 300 kVA demand load;

(ii) if fed from 13.8/8 kV primary at 120/208 V or 347/600 V, three phase, four wire, then supply is available for loads up to 750 kVA demand load; or

(iii) if fed from 27.6/16 kV primary at 120/208 V or 347/600 V, three phase, four wire, then supply is available for loads up to 750 kVA and 1500 kVA demand load respectively.

When a transformer vault is used:

(i) if fed from 4.16/2.4 kV primary at 120/208 V or 347/600 V, three phase, four wire, then supply is available for loads up to 300 kVA demand load;

(ii) if fed from 13.8/8 kV primary at 120/208 V or 347/600 V, three phase, four wire, then supply is available for loads up to 1500 kVA or and 2500 kVA demand load respectively depending on system availability in the area, (i.e. three phase) ; or

(iii) if fed from 27.6/16 kV primary at 120/208 V or 347/600 V, three phase, four wire, then supply is available for loads up to 1500 kVA and 2500 kVA demand load respectively (i.e. three phase).

When the Customer requires voltages other than at the available supply voltage, or demands by a single occupant exceed the limits indicated above, the Customer shall consult with Toronto Hydro. Toronto Hydro may advise the Customer of any special conditions and requirements to obtain such non-standard services. However, Toronto Hydro is under no obligations to provide any non-standard services.

When a Customer is required to provide transformation facilities on private property in accordance with this section, and the Customer is unable to do so or is severely constrained from doing so, the Customer may request Toronto Hydro to provide the transformation facilities from Toronto Hydro's existing underground distribution system. If requested by the Customer, and if Toronto Hydro determines in its sole discretion that it is able to do so, then Toronto Hydro may provide these transformation facilities. By requesting this option, the Customer agrees to pay Toronto Hydro a fee for providing the transformation facilities as part of the Customer's connection costs, in addition to any associated expansion costs.

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2.3.4.3 Multiple Connections to Main Distribution System

Customers will be generally connected to one point of the main Toronto Hydro distribution system. Toronto Hydro may offer a second point of connection to another point of the main Toronto Hydro distribution system when:

a) the Customer is fed by the 13.8 kV underground radial system as defined in section 1.1.1 or
b) the Customer's point load exceeds the maximum set in section 2.3.4.2 for service from a transformer vault.

In the case of Customers supplied from the 13.8 kV underground radial system, Customers will not be eligible to ask for service from Sketch 1(h) unless the demand exceeds the limit set for transformer vaults as set out in section 2.3.4.2.

Where multiple connections exist, and unless otherwise agreed by Toronto Hydro, load should be distributed evenly across all active connections. Load must not be transferred from one active connection to another without the permission of Toronto Hydro.

Toronto Hydro will determine the location of any connection points to its main distribution system. Although Toronto Hydro will give consideration to arguments relating to a need for diversity of supply, it retains the right to determine in its sole discretion, not to allow a second point of connection to another part of the main distribution system.

2.3.5 Voltage Guidelines

This section should specify what voltages the distributor's Customers can reasonably expect, with reference to CSA Standard CAN3-235 current edition.

Toronto Hydro maintains service voltage at the Customer's service entrance within the voltage variation limits shown in the table below:

Nominal Voltage	**Voltage Variation Limits**			
		Extreme Operating Conditions		
		Normal Operating Conditions		
Single Phase				
120/240	106/212	110/220	125/250	127/254
Two Phase 3 Wire				
120/208	110/190	112/194	125/216	127/220
Three Phase 4 Wire				
120/208Y	110/190	112/194	125/216	127/220
240/416Y (*)	220/380	224/388	250/432	254/440
347/600Y	306/530	318/550	360/625	367/635

(*) 240/416Y is no longer a standard voltage offered by Toronto Hydro.

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The Voltage Variation Limits, with the exception of the limits for Two Phase 3 Wire 120/208, are based on C.S.A. Standard CAN3-C235-83. Where voltages lie outside the indicated limits for Normal Operating Conditions but within the indicated limits for Extreme Operating Conditions as noted above, improvement or corrective action will be taken by Toronto Hydro on a planned or programmed basis, but not necessarily on an emergency basis. Where voltages lie outside the indicated limits for Extreme Operating Conditions, improvement or corrective action may be taken on an emergency basis depending on a number of factors, which include, but are not limited to, the location and nature of load or circuit, the extent to which voltage limits are exceeded, and the duration of time for which the limits have been exceeded.

Toronto Hydro shall practice reasonable diligence in maintaining voltage levels, but is not responsible for variations in voltage related to external factors. External factors include, but are not limited to, those factors that necessitate operating contingencies, and exceptionally high loads and low voltage supply from the transmitter or host distributor. Toronto Hydro shall not be liable for any delay or failure in the performance of any of its obligations under this Conditions due to any events or causes beyond the reasonable control of Toronto Hydro, including, without limitation, severe weather, flood, fire, lightning, other forces of nature, acts of animals, epidemic, quarantine restriction, war, sabotage, act of a public enemy, earthquake, insurrection, riot, civil disturbance, strike, restraint by court order or public authority, or action or non-action by or inability to obtain authorization or approval from any governmental authority, or any combination of these causes ("Force Majeure").

2.3.6 Emergency Backup Generation Facilities

Distributors should include the following statements in this section:

- ***Customers with portable or permanently connected emergency generation capability shall comply with all applicable criteria of the Ontario Electrical Safety Code and in particular, shall ensure that Customer emergency generation does not back feed into the Distributor's system.***

- ***Customers with permanently connected emergency generation equipment shall notify their Distributor regarding the presence of such equipment.***

Any other requirements the Distributor imposes on Customers with emergency backup generation facilities should be described in this section.

Emergency backup generation is installed by Customers for backup of load when utility power supply is not available. A Customer with portable or permanently connected emergency backup generation shall comply with all applicable criteria of the Ontario Electrical Safety Code (OESC) and in particular, shall ensure that its Emergency Backup Generation Facility does not back feed into the Distributor's system.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

A Customer with an Emergency Backup Generation Facility in Open-Transition mode shall further ensure that its facility does not parallel with, nor adversely affect Toronto Hydro's distribution system.

Customers who consider installing a Closed-Transition switch shall notify Toronto Hydro and shall submit documentation that satisfies Toronto Hydro's technical requirements. Customers shall obtain written authorization from Toronto Hydro prior to commissioning the switch in Closed-Transition mode. Closed-Transition switches must not operate the generator in parallel with Toronto Hydro's distribution system for longer than 100 ms under any circumstances. Further requirements are specified in Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements", Section 3.2 Emergency Backup Generation Technical Requirements.

For parallel generation refer to Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements".

Customers with a permanently connected Emergency Backup Generation Facility operating in parallel shall notify Toronto Hydro regarding the presence of such equipment and shall enter into a connection agreement as required in Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements".

2.3.7 Metering

This section should specify the options available to a Customer for metering equipment. The Distributor also should outline the technical requirements for meter installations including location and associated main switch.

Toronto Hydro will supply, install, own, and maintain all meters, instrument transformers, ancillary devices, and secondary wiring that are required for revenue metering.

A generation facility on the Toronto Hydro distribution system shall follow the conditions as specified in Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements".

2.3.7.1 General

Describe the Distributor's access to meter installation requirements here.

Toronto Hydro will typically install metering equipment at the Customer supply voltage. The Customer must provide a convenient and safe location, satisfactory to Toronto Hydro, for the installation of meters, wires and ancillary equipment. Meters for new or upgraded residential services will be mounted outdoors on an approved meter socket as specified in Section 6, Reference #6 –

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

"Toronto Hydro Metering Requirements 750 Volts or Less" Table I.

No person, except those authorized by Toronto Hydro, may remove, connect, or otherwise interfere with meters, wires, or ancillary equipment owned by Toronto Hydro.

The Customer will be responsible for the care and safekeeping of Toronto Hydro meters, wires and ancillary equipment on the Customer's premises. If any Toronto Hydro equipment installed on Customer premises is damaged, destroyed, or lost other than by ordinary wear and tear, tempest or lightning, the Customer will be liable to pay to Toronto Hydro the value of such equipment, or at the option of Toronto Hydro, the cost of repairing the same.

The location allocated by the owner for Toronto Hydro metering shall provide direct access for Toronto Hydro staff and shall be subject to satisfactory environmental conditions, some of which are:

- Maintain a safe and adequate working space in front of equipment, not less than 1.2 metres (48") and a minimum ceiling height of 2.1 metres (84")
- Maintain an unobstructed working space in front of equipment, free from, or protected against, the adverse effects of moving machinery, vibration, dust, moisture or fumes

Where Toronto Hydro deems self-contained meters to be in a hazardous location, the Customer shall provide a meter cabinet or protective housing.

Any compartments, cabinets, boxes, sockets, or other workspace provided for the installation of Toronto Hydro's metering equipment shall be for the exclusive use of Toronto Hydro. No equipment, other than that provided and installed by Toronto Hydro, may be installed in any part of the Toronto Hydro metering workspace.

2.3.7.1.1 Metering Requirements for Multi-Unit Residential Rental Buildings and Condominiums

Developers of new multi-unit residential rental buildings and new and existing condominiums (collectively, "MURBs"), or boards of directors of condominiums, or authorized persons in charge of any other applicable class of unit under Ontario Regulation 389/10, may choose to have Toronto Hydro install unit smart metering, or to have Toronto Hydro install a bulk interval meter for the purpose of enabling unit sub-metering by a licensed unit sub-meter provider.

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Installation of Unit Smart Metering by Toronto Hydro

Upon the request of a MURB developer or a condominium board of directors, Toronto Hydro will install unit smart metering that meets the functional specification of Ontario Regulation 425/06 – *Criteria and Requirements for Meters and Metering Equipment, Systems and Technology* (smart metering). In that case, each separate residential and commercial unit, as well as common areas, will become direct individual customers of Toronto Hydro, with the common area accounts held by the developer, condominium corporation or the landlord as the case may be.

The MURB developer or condominium board of directors may choose an Alternative Bid for the installation of unit smart metering. In that case, the MURB developer, landlord or condominium board of directors is required to:

(i) select and hire a qualified contractor;
(ii) ensure all work that is eligible for alternative bid is done in accordance with Toronto Hydro's technical standards and specifications: and
(iii) assume full responsibility for the installation and warranty all aspects for a period of 2 years from date of commissioning.

Where the MURB developer or condominium board of directors transfers the metering facilities installed under the alternative bid option to Toronto Hydro, and provided Toronto Hydro has inspected and approved the facilities installed, Toronto Hydro shall pay the condominium corporation, landlord or developer a transfer price. The transfer price shall be the lower of the cost to the MURB developer or condominium board of directors to install the metering facilities or Toronto Hydro's fully allocated cost to install the metering facilities.

Common Area Metering

Where units in a MURB are to be unit smart metered, the responsible party (MURB developer, condominium board of directors, or landlord) shall enter into a contract with Toronto Hydro for the supply of electrical energy for all common or shared services. Common or shared services typically include lighting of all common areas shared by the tenants, or unit owners, and common services such as heating, air conditioning, water heating, elevators, and common laundry facilities. In such cases, consumption for all common areas will be separately metered.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

Installation of Bulk Interval Metering by Toronto Hydro

Where bulk interval metering is supplied by Toronto Hydro to an exempt distributor for the purpose of enabling unit sub-metering, the responsible party (i.e., the developer, condominium corporation, or landlord, but not the unit sub-meter provider) shall enter into a contract with Toronto Hydro for the supply of electrical energy to the building.

2.3.7.1.2 Main Switch and Meter Mounting Devices

The Customer's main switch immediately preceding the meter shall be installed so that the top of the switch is no higher than 1.83 m and that the bottom of the switch is no lower than 1.0 m from the finished floor and shall permit the sealing and padlocking of:

(a) the handle in the "open" position; and
(b) the cover or door in the closed position.

Meter mounting devices for use on Commercial/Industrial accounts shall be installed on the load side of the Customer's main switch and be located indoor.

The Customer is required to supply and install a Canadian Standards Association (CSA) approved meter socket for the use of Toronto Hydro's self-contained socket meters for the main switch ratings and supply voltages listed in Table 5 in Section 5 of this Conditions.

The Customer is required to supply and install a meter cabinet to contain Toronto Hydro's metering equipment for the main switch ratings and supply voltages listed in Table 6 in Section 5 of this Conditions.

Meter centers installed for individual metering applications must meet the requirements specified in Table 8 in Section 5 of this Conditions.

The Customer shall permanently and legibly identify each metered service with respect to its specific address, including unit or apartment number. The identification shall be applied to all service switches, circuit breakers, meter cabinets, and meter mounting devices.

2.3.7.1.3 Service Mains Limitations

The metering provision and arrangement for service mains in excess of either 600 A or 600 V shall be submitted to Toronto Hydro for approval before building construction begins. Additional standards and requirements for services metered above 600 V can be made available upon request.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.3.7.1.4 Special Enclosures

Specially constructed meter entrance enclosures will be permitted for outdoor use upon Toronto Hydro's approval of a written application for use.

2.3.7.1.5 Meter Cables

The Customer shall provide meter loops having a length of 610-mm in addition to the length between line and load entry points.
Line and load entry points shall be approved by Toronto Hydro prior to installation. Where more than two conductors per phase are used, the connectors shall be provided by the Customer (see Table 6 in Section 5 of this Conditions for required cabinets). Mineral insulated, solid or hard drawn wire conductors are not acceptable for meter loops.

Any variation from the above must first be checked and approved by Toronto Hydro prior to installation.

2.3.7.1.6 Barriers

Barriers are required in each section of switchgear or service entrance equipment between metered and unmetered conductors and/or between sections reserved for Toronto Hydro use and sections for Customer use.

2.3.7.1.7 Doors

Side-hinged doors shall be installed over all live electrical equipment where Toronto Hydro personnel may be required to work (i.e. line splitters, unmetered sections of switchgear, breakers, switches, metering compartments, meter cabinets and enclosures). These hinged doors shall have provision for sealing and padlocking. Where bolts are used, they shall be of the captive knurled type. All outer-hinged doors shall open no less than 135°. All inner-hinged doors shall open to a full 90°.

2.3.7.1.8 Auxiliary Connections

All connections to circuits such as fire alarms, exit lights and Customer instrumentation shall be made to the load side of Toronto Hydro's metering. No Customer equipment shall be connected to any part of the Toronto Hydro metering circuit.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.3.7.1.9 Working Space

Clear working space shall be maintained in front of all equipment and from all side panels in accordance with the Ontario Electrical Safety Code.

2.3.7.2 Current Transformer Boxes

Where current transformers are required, the Distributor should outline the technical requirements to be followed for such installations.

Where instrument transformers are incorporated in low voltage switchgear, the size of the chamber and number of instrument transformers shall be as shown in Table 7 in Section 5 of to this Conditions. A separate meter cabinet must be supplied and installed by the Customer, located to the satisfaction of Toronto Hydro and as close as possible to the instrument transformer compartment.

The cabinet and the compartment will be connected by an empty 1½ inch conduit, the length of which shall not exceed 30 m, and which shall include a maximum of three 90° bends. The conduit will be provided for the exclusive use of Toronto Hydro. No fittings with removable covers are permitted.

The meter cabinet shall be grounded by a minimum #6 copper grounding conductor, not installed in the above conduit. The Customer shall install a strong nylon or polyrope pull line in the conduit, with an excess of 1500 mm loop left at each end.

The final layout and arrangements of components must be approved by Toronto Hydro prior to fabrication of equipment.

Where two or more circuits are totalized, or where remote totalizing is involved, or where instrument transformers are incorporated in high voltage switchgear (greater than 750 V), Toronto Hydro will issue specific metering requirements.

2.3.7.3 Interval Metering

Where interval metering is required or requested, the Distributor should outline the technical requirements to be followed for such installations. Included with the technical specifications should be the conditions under which interval metering will be supplied.

Interval meters will be installed for all new or upgraded services where the peak demand is forecast to be 200 kW or greater, or for any Customer wishing to participate in the spot market pass-through pricing. Prior to the installation of an interval meter, the Customer must provide a ½ inch conduit from their

telephone room to the meter cabinet. Toronto Hydro will arrange for the installation of a telephone line, terminated in the meter cabinet for the exclusive use of Toronto Hydro to retrieve interval meter data. The Customer will be responsible for the installation of the telephone infrastructure and ongoing monthly costs of operating the phone line. The phone line will be Toronto Hydro owned, direct dial, voice quality, active 24 hours per day, and energized prior to meter installation.

Other Customers that request interval metering shall compensate Toronto Hydro for all incremental costs associated with that meter, including the capital cost of the interval meter, installation costs associated with the interval meter, ongoing maintenance (including allowance for meter failure), verification and reverification of the meter, installation and ongoing provision of communication line or communication link with the Customer's meter, and cost of metering made redundant by the Customer requesting interval metering.

2.3.7.4 Meter Reading

This section should outline the requirements for access to meters for the purposes of obtaining readings and the process to be used if a reading is not obtained.

The Customer or Consumer must provide or arrange free, safe and unobstructed access during regular business hours to any authorized representative of Toronto Hydro for the purpose of meter reading, meter changing, or meter inspection. Where premises are closed during Toronto Hydro's normal business hours, the Customer or Consumer must, on reasonable notice, arrange such access at a mutually convenient time.

2.3.7.5 Final Meter Reading

This section should outline any requirements associated with obtaining a final meter reading on termination of a contract for service.

When a service is no longer required, the Customer or Consumer shall provide sufficient notice of the date the service is to be discontinued so that Toronto Hydro can obtain a final meter reading as close as possible to the final reading date. The Customer or Consumer shall provide access to Toronto Hydro or its agents for this purpose. If a final meter reading is not obtained, the Consumer shall pay a sum based on an estimated demand and/or energy for electricity used since the last meter reading, as determined by Toronto Hydro.

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2.3.7.6 Faulty Registration of Meters

In this section, the Distributor should outline the process for dealing with metering errors.

Metering electricity usage for the purpose of billing is governed by the federal *Electricity and Gas Inspection Act* and associated regulations, under the jurisdiction of Measurement Canada, Industry Canada. Toronto Hydro's revenue meters are required to comply with the accuracy specifications established by the regulations under the above Act.

In the event of incorrect electricity usage registration, Toronto Hydro will determine the correction factors based on the specific cause of the metering error and the Consumer's electricity usage history. The Consumer shall pay for all the electricity supplied a reasonable sum based on the reading of any meter formerly or subsequently installed on the premises by Toronto Hydro, due regard being given to any change in the characteristics of the installation and/or the demand. If Measurement Canada, Industry Canada determines that the Consumer was overcharged, Toronto Hydro will reimburse the Consumer for the amount incorrectly billed.

If the incorrect measurement is due to reasons other than the accuracy of the meter, such as incorrect meter connection, incorrect connection of auxiliary metering equipment, or incorrect meter multiplier used in the bill calculation, the billing correction will apply for the duration of the error. Toronto Hydro will correct the bills for that period in accordance with the regulations under the *Electricity and Gas Inspection Act*.

2.3.7.7 Meter Dispute Testing

This section should outline the process by which a Customer can dispute a meter measurement or read and seek redress.

Metering inaccuracy is an extremely rare occurrence. Most billing inquiries can be resolved between the Customer or Consumer and Toronto Hydro without resorting to the meter dispute test.

Either Toronto Hydro or the Customer or Consumer may request the service of Measurement Canada to resolve a dispute. If the Customer or Consumer initiates the dispute, Toronto Hydro will charge the Customer or Consumer a meter dispute fee if the meter is found to be accurate and Measurement Canada rules in favor of the utility.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.4 Tariffs and Charges

2.4.1 Service Connection

The Distributor should outline the rates that have been established for providing the Customer with a connection to the electrical distribution system and all services provided by the Distributor as per the rules and regulations laid out by all applicable codes.

Charges for distribution services are made as set out in the Schedule of Rates available from Toronto Hydro. Notice of Rate revisions shall be published in major local newspapers. Information about changes will also be mailed to all Consumers with the first billing issued at revised rates.

2.4.1.1 Customers Switching to Retailer

There are no physical service connection differences between Standard Service Supply (SSS) customers and third party retailers' customers. The supply of electricity to both types of customers is delivered through Toronto Hydro's distribution system with the same distribution requirements. Therefore, all service connection requirements applicable to the SSS customers are applicable to third party retailers' customers.

2.4.2 Energy Supply

This section should outline the process the Distributor has established for the following:

- ***Provision of Standard Service Supply to the Customer, per the rules and regulations laid out in the Retail Settlement Code and the Standard Service Supply Code.***
- ***Provision of Supply to the Customer through a Retailer, per the rules and regulations laid out in the Retail Settlement Code.***
- ***Wheeling of energy and all associated tariffs.***

2.4.2.1 Standard Service Supply (SSS)

All Toronto Hydro Consumers are Standard Service Supply (SSS) Consumers until Toronto Hydro is informed by the Consumer or the Consumer's authorized retailers of their switch to a competitive electricity supplier. The Service Transfer Request (STR) must be made by the Consumer or the Consumer's authorized retailer.

2.4.2.2 Retailer Supply

Consumers transferring from Standard Service Supply (SSS) to a retailer shall comply with the Service Transfer Request (STR) requirements as outlined in

sections 10.5 through 10.5.6 of the Retail Settlement Code. All requests shall be submitted as electronic file and transmitted through EBT Express. Service Transfer Request (STR) shall contain information as set out in section 10.3 of the Retail Settlement Code.

If the information is incomplete, Toronto Hydro shall notify the retailer or Consumer about the specific deficiencies and await a reply before proceeding to process the transfer.

2.4.2.3 Wheeling of Energy

All Customers or Consumers considering delivery of electricity through the Toronto Hydro distribution system are required to contact Toronto Hydro for technical requirements and applicable tariffs.

2.4.3 Deposits

This section should outline any deposit and prudential requirements the Distributor has established for providing a Customer with Distribution Services, supply through Standard Service Supply or through a Retailer, per the rules and regulations laid out in the Distribution System Code.

Whenever required by Toronto Hydro, including, but not limited to, as a condition of supplying or continuing to supply Distribution Services, Consumers and Customers shall provide and maintain security in an amount that Toronto Hydro deems necessary and reasonable. Toronto Hydro will not discriminate among customers with similar risk profiles or risk related factors except where expressly permitted under the Distribution System Code.

Except for Consumers or Customers who meet the security deposit waiver conditions described below, all Consumers or Customers are required to provide an account security deposit to Toronto Hydro, which, at the Consumer's or Customer's election, must be in the form of (i) cash, cheque or Money Order, or, if approved by Toronto Hydro, Visa or MasterCard or (ii) for non residential Consumers or Customers an automatically renewing irrevocable commercial letter of credit from a bank defined in the *Bank Act, 1991*, c.46. Toronto Hydro will not accept third party guarantees.

The amount of the account security deposit will be based on the billing factor times the estimated average bill during the most recent 12 months. The billing factors are as follows:

- 2.5 for monthly billed Consumers or Customers
- 1.75 for bi-monthly billed Consumers or Customers

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Where there is no established historical electricity consumption information for the service premises, the deposit will be based on a reasonable estimate using information from a like property used for similar purposes.

Where the Consumer or Customer, other than a residential electricity Customer, has more than one disconnection notice in a relevant 12 month period, the highest bill in the period will be used for the calculation of the deposit.

If requested by the Consumer or Customer, Consumers or Customers will be permitted to pay the security deposit in equal installments over a maximum of 4 months, or over a period of 6 months for residential Customers (including where a new security deposit is required due to Toronto Hydro having to apply the existing security deposit against amounts owing).

The security deposit may be waived based on the following criteria:

a) The Consumer or Customer has a good payment history based on the most recent customer history with some portion in the most recent 24 months, during which time the Consumer or Customer:

- had no more than one (1) notice of disconnection; AND
- had no more than one (1) payment returned for insufficient funds ("NSF"); AND
- had no disconnect/collection trip; AND
- had no security deposit applied for amounts owing.

The minimum time period for good payment history is as follows:

- Residential - 1 year
- Non-residential <50 kW demand rate class - 5 years
- All other classes - 7 years

or

b) The Consumer or Customer provides a letter from another electricity or gas distributor in Canada confirming good payment history. The letter must contain information consistent with the good payment criteria described in this document.

or

c) The Consumer or Customer (other than those in a >5000 kW demand rate class) provides a satisfactory credit check at its expense. The acceptable Equifax Credit scores are as follows:

- Residential - Consumer Score of 700 or greater

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- Business - Commercial Score of 20 or lower

or

d) Residential account deposits may be waived where the Consumer or Customer enrolls in the Toronto Hydro's pre-authorized payment plan and supplies at least two pieces of identification information, provided that a deposit will be required if the pre-authorized payment plan is cancelled.
or

e) The customer is a bulk-metered residential condominium as defined in the *Condominium Act*, 1998 and has provided Toronto Hydro with a signed declaration attesting to their legal status as a residential condominium corporation.
or

f) The residential Customer has been qualified as an "eligible low-income customer" and requests a waiver.

The security deposit may be reduced for non residential Consumers or Customers with 50 kW or greater demand, based on the following criteria:

Where the Consumer or Customer has a credit rating from a recognized credit rating agency, (***Dominion Bond Rating Service, Standard & Poor's or Moody's***) the maximum amount of deposit required will be reduced as follows:

Credit Rating (Using Standard & Poor's Rating Terminology)	**Allowable Reduction**
AAA- and above	100%
AA-, AA, AA+	95%
A-, From A, A+ to below AA	85%
BBB-, From BBB, BBB+ to below A	75%
Below BBB-	0%

Equivalent ratings from other bond rating agencies would apply for the same reductions.

In the above case, the commodity price used to calculate the deposit shall be the same as the price used by the IESO for the purpose of determining maximum net exposures and prudential support obligations for market participants other than distributors, low-volume Consumers and designated Consumers.

Interest will accrue monthly on security deposits commencing when the total deposit has been received. The rate shall be at the average Chartered Bank Prime Rate as published on the Bank of Canada Web site, less 2%. The interest rate shall be updated by Toronto Hydro at a minimum on a quarterly basis. The interest will be

calculated and applied to the existing deposit prior to each update and at a minimum on a yearly basis.

Toronto Hydro will undertake an annual review of all security deposit requirements for each Consumer or Customer based on the ***Good Payment History*** described in this document.

- Where it is determined that all or part of the deposit is no longer required, the account will be credited with the amount of the deposit plus accumulated interest.

- Where it is determined that a deposit is now required or needs to be adjusted upward, the amount of the deposit will be added to the next regular bill and is payable by the due date of that bill, except for residential Customers which they shall be permitted to pay the adjusted amount in equal installments paid over a period of at least 6 months. As with all outstanding balances payment arrangements that are satisfactory to Toronto Hydro may be made.

- For Consumers or Customers in the >5000 kW demand rate class, where the Consumer or Customer is in a position to have some or all of the deposit refunded, only 50% of the deposit will be returned. A higher refund requires a credit rating from a recognized credit rating agency based on the criteria previously stated.

  Note: Where no deposit is on file or there is a deposit that does not meet the maximum amount, and the Consumer or Customer meets the good payment history criteria but does not meet the time frame, a new or increased deposit amount will not be added.

Upon closure of the Consumer's or Customer's account with Toronto Hydro, including a Consumer or Customer move from standard supply service ("SSS") to a competitive retailer where the retailer is performing the billing function (retailer consolidated billing), for all accounts types, the balance of the security deposit plus accumulated interest, after all amounts owing are paid, will be returned to the Consumer or Customer within six weeks of the closure of the account.

No earlier than 12 months after the payment of a security deposit or the making of a prior demand for a review, a Consumer or Customer may request in writing that the deposit amount be reviewed to determine whether the entire amount of the security deposit, or some portion of it, should be returned to the Consumer or Customer as it is no longer required.

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

2.4.4 Billing

This section should outline the billing methods and billing cycles the Distributor has established to provide a Customer with Distribution Services, supply through Standard Service Supply or through a Retailer, per the rules and regulations laid out in the Retail Settlement Code.

Toronto Hydro may, at its option, render bills to its Customers on either a monthly, every two months, quarterly or annual basis. Bills for the use of electrical energy may be based on either a metered rate or a flat rate, as determined by Toronto Hydro.

A Customer may elect aggregated billing for multiple services provided all of the following conditions are met:

- the premises and businesses are situated on one contiguous parcel of land i.e. not separated by public roadway
- all premises are under one ownership
- the services are supplied at the same voltage
- the meters are of the interval type, allowing logical totalization of the coincident demands. If interval meters are not already in place, the Customer will install the necessary equipment, at the Customer's own cost, to Toronto Hydro specifications.

The Customer may dispute charges shown on the Customer's bill or other matters by contacting and advising Toronto Hydro of the reason for the dispute. Toronto Hydro will promptly investigate all disputes and advise the Customer of the results.

2.4.5 Payments and Overdue Account Interest Charges

This section should outline payment methods that the Distributor has established to provide the Customer with Distribution Services, supply through Standard Service Supply or through a Retailer as per the rules and regulations laid out in the Retail Settlements Code.

Toronto Hydro accepts payments in the form of a cheque (either mailed or delivered to a Toronto Hydro drop box), and through most financial institutions (either directly or through Pre-Authorized Payments).

Payment plans are available to Customers as per section 2.6.2 of the Standard Supply Service Code. Except where the Customer is in arrears on payment to Toronto Hydro for electricity charges and has not entered into an arrears payment agreement with Toronto Hydro, an equal monthly payment plan option, whereby an equalized payment amount is automatically withdrawn from a Customer's account with a financial institution on a monthly basis, is available for qualifying residential Customers. Except where the Customer is in arrears on payment to Toronto Hydro for electricity charges and has not entered into an arrears payment agreement with Toronto Hydro, an equal monthly billing plan option, whereby a monthly bill is issued to a Customer and the amount due in each bill is equalized over the course of a

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

year, is available to Eligible Low-Income Customers.

Bills are payable in full by the due date; otherwise, overdue interest charges will apply at a rate of 1.5% monthly (compounded) or 19.56% annually**.** Where a partial payment has been made by the Customer on or before the due date, the interest charge will apply only to the amount of the bill outstanding at the due date. The Customer will be required to pay additional charges for the processing of non-sufficient fund (N.S.F.) cheques.

Outstanding bills are subject to the collection process and may ultimately lead to the service being discontinued. Service will be restored once satisfactory payment and/or payment arrangements have been made (refer to section 2.2.1).

2.5 Customer Information

The Conditions of Service shall describe the provision of information with respect to chapter 11 of the Retail Settlement Code. This specifies the rights of Consumers and retailers to access current and historical usage information and related data and the obligations of distributors in providing access to such information. The Conditions of Service should include reference to include information subject to privacy regulations and load profile information.

Any processes for handling requests for information outside of the requirements of the Retail Settlement Code should be described in this section.

A third party who is not a retailer may request historical usage information with the written authorization of the Consumer to provide their historical usage information.

Toronto Hydro will provide information appropriate for operational purposes that has been aggregated sufficiently, such that an individual's Consumer information cannot reasonably be identified, at no charge to another distributor, a transmitter, the IESO or the OEB. Toronto Hydro may charge a fee that has been approved by the OEB for all other requests for aggregated information.

At the request of a Consumer, Toronto Hydro will provide a list of retailers who have Service Agreements in effect within its distribution service area. The list will inform the Consumer that an alternative retailer does not have to be chosen in order to ensure that the Consumer receives electricity and the terms of service that are available under Standard Supply Service.

Upon receiving an inquiry from a Consumer connected to its distribution system, Toronto Hydro will either respond to the inquiry if it deals with its own distribution services or provide the Consumer with contact information for the entity responsible for the item of inquiry, in accordance with chapter 7 of the Retail Settlement Code.

An embedded distributor that receives electricity from Toronto Hydro shall provide load forecasts or any other information related to the embedded distributor's system

Section 2 – DISTRIBUTION ACTIVITIES (GENERAL)

load to Toronto Hydro, as determined and required by Toronto Hydro. A distributor shall not require any information from another distributor unless it is required for the safe and reliable operation of either distributor's distribution system or to meet a distributor's licence obligations.

Section 3 – CUSTOMER CLASS SPECIFIC

3 CUSTOMER CLASS SPECIFIC

The Customer Class Specific section shall contain references to services and requirements, which are specific to individual Customer classes. This section should cover such items as:

- ***Demarcation Point.***
- ***Metering.***
- ***Service Entrance Requirements.***
- ***Delineation of Ownership and Operational Points of Demarcation.***
- ***Special Contracts.***
- ***Other conditions specific to Customer class.***

The following are examples of Customer specific subsections. It is recognized that Customer Classifications are unique to each Distributor. The Distributor is not limited by these examples to the range and scope of their Customer Classifications. Each Distributor therefore should review their current Classifications and ensure that all of their existing Customer Classifications are adequately covered by the Distributor' s Conditions of Service document.

3.1 Residential

Include all items that apply specifically to Residential Customers not covered under the General section.

Refer to Tables 1.1, 1.2 and 1.3 and Table 2 under Section 5 of this Conditions for Point of Demarcation, Standard Allowance and Connection Fees for Residential Services.

3.1.1 Overhead Services

3.1.1.1 Minimum Requirements

In addition to the requirements of the Ontario Electrical Safety Code (latest edition), the following conditions shall apply:

(i) A clevis type insulator is to be supplied and installed by the Customer.

(ii) This point of attachment device must be located:

(a) Not less than 4.5 metres (15 feet) nor greater than 5.5 metres (18 feet) above grade (to facilitate proper ladder handling techniques). Building must have a minimum offset from property line of 1.2 metres (4 feet).

(b) Between 150 millimetres and 300 millimetres (6-12 inches) below the service head.

Section 3 – CUSTOMER CLASS SPECIFIC

(c) Within 914 millimetres (3 feet) of the face of the building.

(iii) Clearance must be provided between utility conductors and finished grade of at least 6 metres (19 feet) over traveled portions of the road allowance and 4.5 metres (15 feet) over all other areas.

A minimum horizontal clearance of 1.0 metres (39 inches) must be provided from utility conductors and any second storey windows.

(iv) A 4 jaw approved meter socket as specified in Section 6, Reference #6 – "Toronto Hydro Metering Requirements 750 Volts or Less" Table I shall be provided. Certain areas will require a 5-jaw socket as determined by Toronto Hydro. The Customer should contact Toronto Hydro to confirm details.

(v) Clear unobstructed access must be maintained to and in front of the meter location.

(vi) Service locations requiring access to adjacent properties (mutual drives, narrow side set-backs, etc.) will require the completion of an easement or written consent from the property owner(s) involved.

Proposed new or service changes in areas with mutual access (such as driveways, walkways) require:

- at least 50% ownership of the walkway or driveway by the property owner requesting the service when the width of the mutual property is less than 2 m. (Right of way access is not considered ownership);
- a minimum of 1 m width (for meter only installation) and a minimum 1.5 m width (for overhead connection access);
- absence of fences or other property separation;
- unobstructed access to service; and
- customer responsibility for disclosure of all property encumbrances.

Toronto Hydro assumes no liability for any property or meter location disputes between owner(s).

(vii) The approved meter socket shall be mounted directly below the service mast such that the midpoint of the meter is 1.7 m (± 100 mm) above finished grade within 914 mm of the face of the building (in front of any existing or proposed fence), unless otherwise approved by Toronto Hydro.

Section 3 – CUSTOMER CLASS SPECIFIC

3.1.1.2 Services Over Swimming Pools

Although the Ontario Electrical Safety Code allows electrical conductors to be located at adequate height, Toronto Hydro will **not** allow electrical conductors to be located above swimming pools.

Where a new swimming pool is to be installed it will be necessary to relocate, at the property owner's expense, any electrical conductors located directly over the proposed pool location.

Where overhead service conductors are in place over an existing swimming pool, Toronto Hydro will provide up to 30 metres of overhead service conductors, at no charge, to allow rerouting of the service. The property owner will pay any other costs.

3.1.2 Underground Services for Individual Residences

Customers requesting an underground service in an overhead area will be required to pay 100% connection costs for the underground service less the Standard Allowance for an overhead service.

The owner shall pay for any necessary road crossings.

The trench route must be approved by Toronto Hydro and is to follow the route indicated on the underground drawing supplied by Toronto Hydro. Any deviation from this route must be approved by Toronto Hydro. The Customer will be responsible for Toronto Hydro's costs associated with re-design and inspection services due to changes or deviations initiated by the Customer or its agents.

The owner will assure the provision for the service entrance and meter meets Toronto Hydro approval.

Where there are other services to be installed (e.g. gas, telephone, and cable) these shall be coordinated to avoid conflict with Toronto Hydro's underground cables. Toronto Hydro's installation will not normally commence until all other servicing and grading have been completed.

It is the responsibility of the owner or his/her contractor to obtain clearances from all of the utility companies (including Toronto Hydro) before digging.

It is the responsibility of the owner to contact Toronto Hydro to inspect each trench prior to the installation of Toronto Hydro's service cables.

The owner shall provide unimpeded access for Toronto Hydro to install the service.

Section 3 – CUSTOMER CLASS SPECIFIC

The owner shall ensure that any intended tree planting has appropriate clearance from underground electrical plant.

3.2 General Service

Include all items that apply specifically to general service Customers not covered under the other sections, and broken down (by load demand).

a) The Customer shall supply the following to Toronto Hydro well in advance of installation commencement:

- Required in-service date
- Proposed Service Entrance equipment's Rated Capacity (Amperes) and Voltage rating and metering requirements
- Propose Total Load details in kVA and/or kW (Winter and Summer)
- Locations of other services, gas, telephone, water and cable TV.
- Details respecting heating equipment, air-conditioners, motor starting current limitation and any appliances which demand a high consumption of electricity
- Survey plan and site plan indicating the proposed location of the service entrance equipment with respect to public rights-of-way and lot lines.
- For General Service (50 – 999 kW and 1000 kW and above) Class Customers, electrical, architectural and/or mechanical drawings as required by Toronto Hydro.

b) The Customer shall construct and install all civil infrastructure (including but not limited to poles, UG conduits, cable chambers, cable pull rooms, transformer room/vault/pad) on private property, that is deemed required by Toronto Hydro as part of its connection assets. All such civil infrastructures are to be in accordance with Toronto Hydro's current standards, practices, specifications and this Conditions and are subject to Toronto Hydro's inspection and acceptance.

Should the Customer construct and install the civil infrastructure related to connection assets, Toronto Hydro shall not include the associated civil component in its calculation of Basic and Variable Connection Fees.

c) Alternatively, the Customer may have Toronto Hydro construct and install the civil infrastructure that forms part of Toronto Hydro's connection assets on private property and the Customer will therefore be responsible for all costs via Basic Connection and Variable connection Fees (as applicable).

d) Toronto Hydro is responsible for the maintenance and repairs of its connection assets but not the transformer room(s) or any other civil structure that is part of the Customer's building.

Section 3 – CUSTOMER CLASS SPECIFIC

e) When effecting changes the Customer shall maintain sufficient clearances between electrical equipment and buildings and other permanent structures to meet the requirements of the Ontario Electrical Safety Code and the *Occupational Health & Safety Act* and Regulations.

f) It is the responsibility of the owner or his/her contractor to obtain clearances from all of the utility companies (including Toronto Hydro) before digging.

g) Provided the existing civil infrastructure has been maintained in satisfactory conditions by the Customer, Toronto Hydro will undertake the necessary programs to enhance its distribution plant at its expense, as part of its planned activities during normal business hours, Monday to Friday.

When a Customer requests that such planned activities be done outside Toronto Hydro's normal business hours, then the Customer shall pay the incremental costs incurred by Toronto Hydro as a result thereof. A Customer contribution may not be required for work performed outside of normal business hours if the work is part of planned maintenance programs on Toronto Hydro distribution system.

In the event that services or facilities to a Customer need to be restored as a result of these construction or maintenance activities by Toronto Hydro, they will be restored to an equivalent condition.

In addition, Toronto Hydro will carry out the necessary construction and electrical work to maintain existing supplies by providing standard overhead or underground supply services to Customers affected by Toronto Hydro's construction activities. If a Customer requests special construction beyond the normal Toronto Hydro standard installation in accordance with the program, the Customer shall pay the additional cost associated therewith, including engineering and administration fees.

h) Toronto Hydro shall install, maintain, and replace, at its own cost, all those civil infrastructures that are part of its main distribution system (i.e. not including connection assets) that may be located on private property and which serve Customers that are located outside of that private property. These Toronto Hydro civil infrastructures will require an easement.

i) The Customer shall install, maintain, and replace, at its own cost, all those civil infrastructures located on private property that are required to house the connection assets (i.e. the electrical equipment owned by Toronto Hydro) that serve Customers that are located on that private property.

Section 3 – CUSTOMER CLASS SPECIFIC

Where changes to Customer's civil infrastructure are part of a Toronto Hydro initiated enhancement project, Toronto Hydro may absorb the costs of modifications to the Customer's civil infrastructure, provided the existing civil infrastructure has been maintained in satisfactory condition by the Customer.

j) The Customer shall maintain in proper working conditions all Customer-owned service disconnecting devices (such as main switch and secondary breakers) that Toronto Hydro may need to operate for safety of its operations. Toronto Hydro shall not be liable if a switch / breaker were become inoperative or get damaged during its operation.

Refer to Tables 1.1, 1.2 and 1.3 and Table 2 of Section 5 of this Conditions for Point of Demarcation, Standard Allowance and Connection Fees for General Service.

3.2.1 Electrical Requirements (as applicable)

For low voltage supply, the Customer's service entrance equipment shall be suitable to accept conductors installed by Toronto Hydro. The Customer's cables shall be brought to a point determined by Toronto Hydro for connection to Toronto Hydro's supply.

The owner is required to supply and maintain an electrical room of sufficient size to accommodate the service entrance and meter requirements of the tenants and provide clear working space in accordance with the Ontario Electrical Safety Code.

In order to allow for an increase in load, the owner shall provide spare wall space so that at least 30% of the Customers supplied through meter sockets can accommodate meter cabinets at a later date.

Access doors, panels, slabs and vents shall be kept free from obstructing objects. The Customer will provide unimpeded and safe access to Toronto Hydro at all times for the purpose of installing, removing, maintaining, operating or changing transformers and associated equipment.

The electrical room must be located to provide safe access from the outside or main hallway, and not from an adjoining room, so that it is readily accessible to Toronto Hydro's employees and agents at all hours to permit meter reading and to maintain electric supply. This room must be locked. The owner shall install a pad bolt with mortise strike (Ackland Hardware, Cat. No. 199-10 or equivalent). Toronto Hydro shall provide a secure arrangement so that Toronto Hydro's padlock can be installed as well as the Customer's lock.

The electrical room shall not be used for storage or contain equipment foreign to the electrical installation within the area designated as safe working space. All stairways leading to electrical rooms above or below grade shall have a handrail on at least one side as per the Ontario Building Code and shall be located indoors.

Section 3 – CUSTOMER CLASS SPECIFIC

Outside doors providing access to electrical rooms must have at least 150-mm clearance between final grade and the bottom of the door. Electrical rooms 'on' or 'below' grade must have a drain including a "P" trap complete with a non-mechanical priming device and a backwater valve connected to the sanitary sewer. The electrical room floor must slope 6-mm/300 mm or 2% towards the drain.

The electrical room shall have a minimum ceiling height of 2.2 m clear, be provided with adequate lighting at the working level, in accordance with Illuminating Engineering Society (I.E.S.) standards, and a 120 V convenience outlet. The lights and convenience outlet noted above and any required vault circuit shall be supplied from a panel located and clearly identified in the electrical room.

3.2.2 Underground Service Requirements

The Customer shall construct or install all civil infrastructure (including but not limited to poles, UG conduits, cable chambers, cable pull rooms, transformer room/vault/pad) on private property, that is deemed required by Toronto Hydro as part of its Connection Assets. All civil infrastructures are to be in accordance with Toronto Hydro's current standards, practices, specifications and this Conditions and are subject to Toronto Hydro's inspection/acceptance.

The Customer is responsible to maintain all its structural and mechanical facilities on private property in a safe condition satisfactory to Toronto Hydro.

The trench route must be approved by Toronto Hydro. Any deviation from this route must also be approved by Toronto Hydro. The Customer will be responsible for Toronto Hydro's costs associated with re-design and inspection services due to changes or deviations initiated by the Customer or its agents or any other body having jurisdiction.

It is the responsibility of the owner or his/her contractor to obtain clearances from all of the utility companies (including Toronto Hydro) before digging.

It is the responsibility of the owner to contact Toronto Hydro to inspect each trench prior to the installation of Toronto Hydro's cables.

3.2.3 Temporary Services (other than Residential)

A temporary service is a normally metered service provided for construction purposes or special events. Temporary services can be supplied overhead or underground. The Customer will be responsible for all associated costs for the installation and removal of equipment required for a temporary service to Toronto Hydro's point of supply. Temporary services may be provided for a period of no more than 12 months. Temporary services must be renewed thereafter if an extension

Section 3 – CUSTOMER CLASS SPECIFIC

is required and the equipment for such temporary service must be reinspected at the end of the 12-month period.

Where a temporary service is to be provided, the Customer shall provide and maintain a designated area for posting Toronto Hydro information. The Customer is responsible to ensure that the posted information is not tampered with or obstructed in any way. The entire site relating to where the temporary service is to be installed, which includes the route to and from all work areas, must be maintained at all times in accordance with all laws and regulations and in a safe condition which allows Toronto Hydro employees and representatives to carry out all work in a safe environment. The Customer shall be responsible for all damages and related costs sustained by any Toronto Hydro employee or representative in carrying out such work.

Subject to the requirements of Toronto Hydro, supply will be connected after receipt of a 'Connection Authorization' from the Electrical Safety Authority, an account opened and payment is received from the Customer.

Where self-contained meter sockets are required, they must be CSA approved and shall be securely mounted on a pole or nominal 152 mm x 152 mm treated wood post (or alternative if approved by Toronto Hydro) so that the midpoint of the meter is 1.73 m (± 100 mm) from finished grade.

In the case of temporary overhead services, the Customer shall leave 760 mm of cable at the masthead for connection purposes.

In the case of temporary underground services, the Customer's cable shall extend to Toronto Hydro's point of supply.

3.3 General Service (Above 50 kW)

Include all items that apply specifically to General Service Customers (above 50 kW) not covered under the General section. Describe the criteria to determine how a Customer is classified as being above 50 kW.

All non-residential Customers with an average peak demand between 50 kW and 999 kW over the past twelve months are to be classified as General Services above 50 kW.

3.3.1 New Residential Subdivisions or Multi-Unit Developments

Customers of new Residential Subdivisions involving the construction of new city streets and roadways, or of Multi-unit Developments that are supplied from primary distribution systems built along private streets, are treated as Non-Residential Class Customers and will be subject to capital contribution for "expansion" work, in addition to any applicable Connection Fees. Should the Economic Evaluation

Section 3 – CUSTOMER CLASS SPECIFIC

identify a shortfall for the Expansion, the Developer has a choice of either completing the portion of plant not yet connected to Toronto Hydro's system or have Toronto Hydro complete this work in accordance with Section 3.3 of the DSC Code, titled "Alternative Bids". The Customer will not be allowed to complete construction work on Toronto Hydro's existing distribution system.

All other Residential Subdivisions or Multi-unit complexes will follow the general terms and conditions for Connection Fees and capital contribution for the appropriate General Class Customers.

In all cases, all of the electrical service must be constructed to Toronto Hydro's standards and in compliance with the Ontario Electrical Safety Code, applicable laws, regulations and codes.

All design work including service locations and trench routes must be approved by Toronto Hydro.

3.3.2 Electrical Requirements

Where the size of the Customer's electrical service warrants, as determined by Toronto Hydro, the Customer will be required to provide facilities on its property and an easement as required (i.e. on the premises to be served), acceptable to Toronto Hydro, to house the necessary transformer(s) and/or switching equipment. Toronto Hydro will provide planning details upon application for service.

Toronto Hydro will supply, install and maintain the electrical transformation equipment within the transformer vault or pad supplied by the Customer, at its expense, on the property. Toronto Hydro has the right to have this equipment connected to its distribution system.

The owner is required to supply and maintain an electrical room of sufficient size to accommodate the service entrance and meter requirements of the tenants and provide clear working space in accordance with the Ontario Electrical Safety Code.

In order to allow for an increase in load, the owner shall provide spare wall space so that at least 30% of the Customers supplied through meter sockets can accommodate meter cabinets at a later date.

The electrical room must be separate from, but adjacent to, the transformer vault. It must be located to provide safe access from the outside or main hallway, and not from an adjoining room, so that it is readily accessible to Toronto Hydro's employees and agents at all hours to permit meter reading and to maintain electric supply. This room must be locked. The owner shall install a pad bolt with mortise strike (Ackland Hardware, Cat. No. 199-10 or equivalent). Toronto Hydro shall

provide a secure arrangement so that Toronto Hydro's padlock can be installed as well as the Customer's lock.

The electrical room shall not be used for storage or contain equipment not related to the electrical installation within the area designated by Toronto Hydro as safe working space. All stairways leading to electrical rooms above or below grade shall have a handrail on at least one side as per the Ontario Building Code, and shall be located indoors.

Outside doors providing access to electrical rooms must have at least 150-mm clearance between final grade and the bottom of the door. Electrical rooms 'on' or 'below' grade must have a drain including a "P" trap complete with a non-mechanical priming device and a backwater valve connected to the sanitary sewer. The electrical room floor must slope 6-mm/300 mm or 2% towards the drain.

The electrical room shall have a minimum ceiling height of 2.2 m clear, be provided with adequate lighting at the working level, in accordance with Illuminating Engineering Society (I.E.S.) standards, and a 120 V convenience outlet. The lights and convenience outlet noted above and any required vault circuit shall be supplied from a panel located and clearly identified in the electrical room.

The owner shall identify each tenant's metered service by address and/or unit number in a permanent and legible manner. The identification shall apply to all main switches, breakers and to all meter cabinets or meter mounting devices that are not immediately adjacent to the switch or breaker. The electrical room shall be visibly identified from the outside.

3.3.3 Technical Information

Where project drawings are required for Toronto Hydro's approval, for items under Toronto Hydro's jurisdiction, the Customer or its authorized representative must ensure that proposal drawings are fully in compliance with Toronto Hydro's standards. Approval of project drawings by Toronto Hydro shall not relieve the Customer of its responsibility in respect of full compliance with Toronto Hydro's standards and all applicable laws, regulations and codes. In all cases, one copy of all relevant drawings must be submitted to Toronto Hydro. Where the Customer requires an approved copy to be returned, two copies of all plans must be submitted.

Prior to the preparation of a design for a service, the Customer will provide the following information to Toronto Hydro as well as the approximate date that the Customer requires the electrical service and the due date that Toronto Hydro's civil construction drawings are required in order to co-ordinate with site construction.

Section 3 – CUSTOMER CLASS SPECIFIC

3.3.3.1 Site & Grading Plans

Indicate the lot number, plan numbers and, when available, the street number. The site plan shall show the location of the Building on the property relative to the property lines, any driveways and parking areas and the distance to the nearest intersection. All elevations shall be shown for all structures and proposed installations.

3.3.3.2 Mechanical Servicing Plan

Show the location on the property of all services proposed and/or existing such as water, gas, storm and sanitary sewers, telephone, et cetera.

3.3.3.3 Floor Plan

Show the service location, other services location, driveway, parking and indicate the total gross floor area of the building.

3.3.3.4 Duct Bank Location

Show the preferred routing of the underground duct bank on the property. This is subject to approval by Toronto Hydro.

3.3.3.5 Transformer Location

Indicate the preferred location on the property for the high voltage transformation. This is subject to approval by Toronto Hydro. Transformation will be vault, pad, submersible type or polemounted depending on the project load requirements.

3.3.3.6 Electrical Meter Room

Indicate preferred location in the building of the meter room and the main switchboard.

3.3.3.7 Single Line Diagram

Show the main service entrance switch capacity, the required supply voltage, and the number and capacity of all sub-services showing provision for metering facilities, as well as the connected load breakdown for lighting, heating, ventilation, air conditioning et cetera. Also, indicate the estimated initial kilowatt demand and ultimate maximum demands. Provide protection equipment information where coordination is required between Toronto Hydro and Customer owned equipment. Fusing will be determined later by Toronto Hydro to co-ordinate with the transformer size selected.

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3.3.3.8 Switchgear

Submit three copies of any service entrance switchgear to be installed for Toronto Hydro's approval, including interlocking arrangement if required.

3.3.3.9 Substation Information

Where a Customer owned substation is to be provided, the owner will be required to provide the following in addition to the site information outlined above.

- All details of the transformer, including kVA capacity, short circuit rating (in accordance with 3.3.4.1), primary and secondary voltages, impedance and cooling details.
- A site plan of the transformer station showing the equipment layout, proposed primary connections, grounding and fence details, where applicable.
- A coordination study for protection review.

3.3.4 Technical Considerations

3.3.4.1 Short Circuit Ratings

16000/27600 V Supply: The Customer's protective equipment shall have a three phase, short circuit rating of 800 MVA symmetrical. The asymmetrical current is 27,000 A (1.6 factor used).

8000/13800 V Supply: The Customer's protective equipment shall have a three phase, short circuit rating of 500 MVA symmetrical. The asymmetrical current is 34,000 A (1.6 factor used.)

2400/4160 V Supply: The Customer's protective equipment shall have a three phase, short circuit rating of 250 MVA symmetrical or 56,000 A asymmetrical (1.6 factor used).

600/347 V Supply: The Customer's protective equipment shall have a minimum short circuit rating of 50,000 A.

208/120 V Supply: Available short circuit current may be obtained upon request to Toronto Hydro.

3.3.4.2 Primary Fusing

All equipment connected to the Toronto Hydro's distribution system shall satisfy the short circuit ratings specified in clause 3.3.4.1. The Customer

and/or the Customer's consultant shall specify the fuse link rating and demonstrate coordination with Toronto Hydro's upstream protection including station breakers and/or distribution fuses. The Customer shall submit, at its expense, a coordination study to Toronto Hydro for verification to ensure coordination with upstream protection including station breakers and/or distribution fuses. The Customer shall maintain an adequate supply of spare fuses to ensure availability for replacement in the event of a fuse blowing.

3.3.4.3 Ground Fault Interrupting

Where ground fault protection is required to comply with the Ontario Electrical Safety Code, the method and equipment used shall be compatible with Toronto Hydro's practice of grounding transformer neutral terminals in vaults. Zero sequence sensing will normally apply. Where ground strap sensing is used, the ground sensing devices shall be set to operate at 600 A if transformer and switchboard buses are not bonded and 400 A if buses are bonded. Ground fault protection proposals for dual secondary supply arrangements shall be submitted to Toronto Hydro for approval, before construction of the switchboard.

3.3.4.4 Lightning Arresters

Customer installations that are directly supplied from Toronto Hydro's primary underground system are not protected with lightning arresters. If the Customer wishes to install lightning arresters they shall be located on the load side of the first protective devices. For Customer installations that are supplied from Toronto Hydro's primary overhead system, Toronto Hydro, at its expense, will install lightning arresters at the pole and the Customer, at its expense, may install lightning arresters in the switchgear on the load side of the incoming disconnect device. The mimic diagram shall indicate the presence of such devices in the switchgear.

3.3.4.5 Basic Impulse Level (B.I.L.)

The Customer's apparatus shall have a minimum Basic Impulse Level in accordance with the following:

2400/4160 supply voltage - 60 kV B.I.L.
8000/13800 supply voltage - 95 kV B.I.L
16000/27600 supply voltage - Delta primary 150 kV B.I.L.
16000/27000 supply voltage - Grounded Wye primary 125 kV B.I.L.

3.3.4.6 Unbalanced Loads

On three-phase service, the unbalance due to single-phase loads shall not exceed 20% of the Customer's balanced phase loading expressed in kilowatts.

Section 3 – CUSTOMER CLASS SPECIFIC

3.4 General Service (Above 1000 kW)

Include all items that apply specifically to General Service Customers (above 1000 kW) not covered under the General section. Describe the criteria to determine how a Customer is classified as being above 1000 kW.

All non-residential Customers with an average monthly demand of 1000 kW or higher, averaged over twelve consecutive months, as determined by Toronto Hydro, are to be classified as Customers over 1000 kW.

3.4.1 Electrical Requirements

Where a primary service is provided to a Customer-owned substation, the Customer shall install and maintain such equipment in accordance with all applicable laws, codes, regulations, and Toronto Hydro's Customer Owned Substation requirements for high voltage installations. Toronto Hydro will provide planning details upon application for service.

Customer owned substations are a collection of transformers and switchgear located in a suitable room or enclosure owned and maintained by the Customer, and supplied at primary voltage: i.e. the Supply Voltage is greater than 750 volts.

High voltage distribution services are three-phase, three-wire or four-wire depending on the supply feeder. The Customer is required to bring out a neutral conductor for connection to the system neutral. If not required for Customer's use, this neutral shall be terminated to the Customer's station ground system. Toronto Hydro will provide Customer interface details and requirements for high voltage supplies.

Customer must provide transformers having voltage taps in their primary windings and configurations as shown in Table 4 in section 5 of this Conditions for all new, upgraded and refurbished installations. Transformers other than listed in Table 4 may be considered in like-for-like repair but shall not be connected without the specific written approval of Toronto Hydro.

Customer owned substations must be inspected by both the Electrical Safety Authority and Toronto Hydro. The owner will provide a pre-service inspection report to Toronto Hydro. A contractor acceptable to Toronto Hydro will prepare the certified report to Toronto Hydro.

The Customer and Toronto Hydro shall inspect their own respective substations in accordance with the Distribution System Code. The minimum inspection cycles for Customer specific substations are one year for open substations and three years for enclosed substations. To facilitate and encourage the maintenance of this equipment, including, without limitation, the installation, maintenance, and testing of vault fire alarm detectors, Toronto Hydro will provide one power interruption annually, at no

Section 3 – CUSTOMER CLASS SPECIFIC

charge. This no-charge service would be scheduled during Toronto Hydro's normal business hours, Monday to Friday, and appointment times are not necessarily guaranteed. Toronto Hydro will charge Customers for power interruptions arranged at times other than as outlined above.

3.4.2 Technical Information and Considerations

The same information and considerations apply as for other General Service Customers. Refer to Subsection 3.3.3 and 3.3.4 for applicable requirements.

3.5 Embedded Generation Facilities

This section should include all terms and conditions applicable to the connection of embedded generation facility to the distributor (e.g., application process, engineering standards and operating agreements).

For the terms and conditions applicable to the connection of a generation facility on the Toronto Hydro distribution system refer to the requirements outlined in Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements".

3.6 Wholesale Market Participant

Criteria for a Customer that is classified as being a Market Participant needs to be established. This section should describe any specific requirements for Customers that also are Market Participants.

Refer to the requirements outlined in Section 6, Reference #3 – "Toronto Hydro Distributed Generation Requirements".

3.7 Embedded Distributor

This section should include all terms and conditions applicable to the connection of an Embedded Distributor.

All embedded distributors within the service jurisdiction of Toronto Hydro are required to inform Toronto Hydro of their status in writing 30 days prior to the supply of electricity from Toronto Hydro. The terms and conditions applicable to the connection of an embedded distributor shall be included in the Connection Agreement with Toronto Hydro.

An Embedded Distributor shall enter into a Connection Agreement in a form acceptable to Toronto Hydro. Until such time as the Embedded Distributor executes such a Connection Agreement with Toronto Hydro, the Embedded Distributor shall be deemed to have accepted and agreed to be bound by all of the terms in this Conditions that apply to such Embedded Distributor.

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3.8 Unmetered Connections

This section will include all terms and conditions applicable to unmetered connection.

Toronto Hydro, at its sole discretion, may provide for new service connections without a meter being installed. These loads would generally be small in size, non-variable, and supply a single device. Examples of services that are considered for unmetered supply include traffic & railway crossing signals, pedestrian x-walk signals/beacons, bus shelters, telephone booths, CATV amplifiers, TTC switching devices and other miscellaneous small fixed loads. Other loads less than 2 kW may also be considered for unmetered connections.

In all cases, the Customer shall contact Toronto Hydro for service supply requirements. The Customer shall provide manufacturer information and documentation with regard to electrical demand and expected hours of operation of the proposed unmetered load. Toronto Hydro may require, at its sole discretion, that the Customer provide at its sole cost, a load study acceptable to Toronto Hydro in order to determine energy consumption.

The Customer shall notify Toronto Hydro prior to making any changes to existing equipment or adding new equipment that is to be supplied from the Toronto Hydro distribution system.

Where installations involve Toronto Hydro owned poles, the method and location of attachment are subject to the approval of Toronto Hydro. Toronto Hydro may, in its sole discretion, require the Customer to enter into agreement with Toronto Hydro governing such attachments.

The Customer shall construct, at its expense, the civil infrastructure (including but not limited to poles, UG conduits, tap boxes) on public road allowances or private property that is deemed required by Toronto Hydro to house or support Toronto Hydro's electrical equipment. These civil infrastructures shall be in accordance with Toronto Hydro's current standards, practices, specifications and this Conditions and are subject to inspection and acceptance by Toronto Hydro. After energization the Customer assets between the supply connection to the demarcation point shall be owned and maintained by Toronto Hydro.

Toronto Hydro will provide, at the Customer's expense, for all breakouts of the Toronto Hydro civil infrastructure (i.e. cable chambers, vaults), which may be required to make the service connection. The Customer's service connection equipment shall be suitable to accept conductors installed by Toronto Hydro. The Customer shall bring its cables to a point determined by Toronto Hydro.

Toronto Hydro shall make all new connections and final disconnections to and from Toronto Hydro's distribution system. The Customer shall pay the applicable

Section 3 – CUSTOMER CLASS SPECIFIC

Connection Fees as outlined in Sections 3.8.1 to 3.8.3 and Table #3. Where "variable connection fees" apply, Toronto Hydro shall provide an estimate of the proposed work to the unmetered Customer. In turn, the unmetered Customer shall provide a response to proceed or not with the proposed work to Toronto Hydro within two weeks.

The Customer shall maintain its civil infrastructure in a safe condition satisfactory to Toronto Hydro. Toronto Hydro will undertake the necessary programs to maintain and enhance its distribution plant. However, if during the course of Toronto Hydro's work, relocation of Customer equipment is necessary, the Customer shall reimburse Toronto Hydro for all costs incurred for in relocating Customer's infrastructure. More specifically, Toronto Hydro will provide standard overhead or underground supply services to unmetered Customers affected by Toronto Hydro's construction activities at its own cost. However, where the unmetered Customer requests special construction beyond the normal Toronto Hydro standard installation in accordance with its program, the unmetered Customer shall pay the additional cost, including engineering and administration fees.

Request for payment shall be subject to Toronto Hydro having provided the unmetered Customer with adequate advance notice, prior to effecting the relocation. The unmetered Customer shall respond within two weeks of its intended plan to modify, upgrade, or remove its plant. Customer's unmetered loads include, but are not limited to the following:

3.8.1 Street Lighting

All services supplied to street lighting equipment owned by or operated for a municipality or the Province of Ontario shall be classified as Street Lighting Service.

In addition to complying with this Conditions, all Street Lighting plant, facilities, or equipment owned by the Customer must comply with all Electrical Safety Authority (ESA) requirements.

The method and location of underground supply to Street Lighting plant from the Toronto Hydro distribution system will be established for each application through consultation with Toronto Hydro.

Charges related to the Connections of Street Lighting will be recovered via a Basic Connection Fee for a Standard Allowance/Basic Connection and a Variable Connection Fee (if applicable) consistent with the Ownership Demarcation Point defined in Table 3 in Section 5 of this Conditions for various Street Lighting Distribution systems.

Section 3 – CUSTOMER CLASS SPECIFIC

3.8.2 Traffic & Railway Crossing Signals, Pedestrian X-Walk Signals/Beacons, Bus Shelters, Telephone Booths, CATV Amplifiers, TTC Switching Devices, and Miscellaneous Small Fixed Loads

The above service types shall be classified as Unmetered Scattered Load Class Customers. Each unmetered location is reviewed individually and is connected to Toronto Hydro's low voltage distribution system. Electrical Safety Authority (ESA) "Authorization to Connect" is required prior to connecting the service.

The nominal service voltage will be 120 Volts, single phase. The method and location of supply will be established for each application through consultation with Toronto Hydro. Supply connections to the municipal or the Province of Ontario's street lighting systems will not be permitted.

The Ownership Demarcation Point for Customer electrical equipment attached to poles owned by Toronto Hydro is as follows:

- For Overhead Supply - the top of the Customer's service standpipe/mast.
- For Underground Supply - the line side of the Customer's circuit breaker panel on the pole (effective as of January 9, 2012).

The Ownership Demarcation Point for Customer owned electrical equipment, which is not attached to Toronto Hydro poles, is at the Customer's disconnect enclosure attached to its structure (effective as of January 9, 2012), or at the top of the Customer's service standpipe/mast.

Toronto Hydro may connect new Unmetered Scattered Load Customers using either an overhead or an underground supply. Overhead supply connections fall into two categories:

1) The source connection is made at an existing Toronto Hydro supply pole and the service mast is located on the same supply pole; or
2) The source connection is made at an existing Toronto Hydro distribution supply pole or line, without any extension of the secondary bus, and the service mast is located within 30 m of the existing pole or lines.

Toronto Hydro will recover the cost of the above two categories of overhead supply connections from the Customer via an Unmetered Basic Connection cost and if necessary, a Variable Connection cost. The Basic Connection cost is different depending on the category of overhead supply connection as described in Table 2 of Section 5 of these Conditions. Variable Connection costs are charged for installing assets that go beyond the assets included in the Basic Connection and are recovered on an actual cost basis. Both the Basic Connection and Variable Connection costs are charged to the Customer on a per location/installation basis.

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For an underground supply connection, Toronto Hydro will recover the actual costs of the connection from the Customer. (As of May 1, 2014, Toronto Hydro does not define a basic connection or charge a Basic Connection cost for underground supply connections.)

Re-design and inspection services are at the expense of the Customer. The Customer is responsible for maintaining and repairing its equipment and/or facilities.

3.8.3 Other Loads (<2 kW) - Decorative Lighting and Tree Lighting Services

This section applies to the distribution and supply of electrical energy for decorative lighting. These installations are typically owned and maintained by a local Business Improvement Association (BIA) as a way to improving streetscape or for specific festive occasions. In addition to complying with this Conditions, all such installations must comply with the Ontario Electric Safety Code and are subject to the approval of ESA.

This section does not apply to decorative lighting that is owned by, or operated for, a municipality or the Province of Ontario.

Decorative Lighting and Tree Lighting connected to Toronto Hydro's distribution system shall have the same terms and conditions as outlined in Section 3.8.2 of this Conditions.

Section 4 – GLOSSARY OF TERMS

4 GLOSSARY OF TERMS

The Conditions of Service document may contain a variety of terms that should be defined in the context of this document. Where possible, glossary terms should reflect definitions in existing documents that apply to the distributor, such as the DSC Code, the Distributor's licence and Standard Supply Service Code. The text of the Conditions of Service document should be used to expand on these definitions as applicable to the Distributor.

Sources for definitions:

A *Electricity Act, 1998,* Schedule A, Section 2, Definitions
MR Market Rules for the Ontario Electricity Market, Chapter 11, Definitions
DSC Distribution System Code Definitions
RSC Retail Settlement Code Definitions
EDL Electricity Distribution Licence

"Accounting Procedures Handbook" means the handbook approved by the Board and in effect at the relevant time, which specifies the accounting records, accounting principles and accounting separation standards to be followed by the distributor; (DSC)

"Affiliate Relationships Code" means the code, approved by the Board and in effect at the relevant time, which among other things, establishes the standards and conditions for the interaction between electricity distributors or transmitters and their respective affiliated companies; (DSC)

"ancillary services" means services necessary to maintain the reliability of the IESO-controlled grid; including frequency control, voltage control, reactive power and operating reserve services; (MR, DSC)

"apartment building" means a structure containing four or more dwelling units having access from an interior corridor system or common entrance;

"apparent power" means the total power measured in kiloVolt Amperes (kVA);

"application for service" means the agreement or contract with Toronto Hydro under which electrical service is requested;

"bandwidth" means a distributor's defined tolerance used to flag data for further scrutiny at the stage in the VEE (validating, estimating and editing) process where a current reading is compared to a reading from an equivalent historical billing period. For example, a 30 percent bandwidth means a current reading that is either 30 percent lower or 30 percent higher than the measurement from an equivalent historical billing period will be identified by the VEE process as requiring further scrutiny and verification; (DSC)

Section 4 – GLOSSARY OF TERMS

"billing demand" means the metered demand or connected load after necessary adjustments have been made for power factor, intermittent rating, transformer losses and minimum billing. A measurement in kiloWatts (kW) of the maximum rate at which electricity is consumed during a billing period;

“Board” or “OEB” means the Ontario Energy Board; (A, DSC)

“building” means a building, portion of a building, structure or facility;

“competitive sector multi-unit residential service” means a service where electricity is used exclusively for residential purposes in a multi-unit residential building, where unit metering is provided using technology that is substantially similar to that employed by competitive sector sub-metering providers;

“complex metering installation” means a metering installation where instrument transformers, test blocks, recorders, pulse duplicators and multiple meters may be employed; (DSC)

“Conditions of Service” means the document developed by a distributor in accordance with subsection 2.4 of the Code that describes the operating practices and connection rules for the distributor; (DSC)

“connection” means the process of installing and activating connection assets in order to distribute electricity; (DSC)

“Connection Agreement” means an agreement entered into between a distributor and a person connected to its distribution system that delineates the conditions of the connection and delivery of electricity to or from that connection; (DSC)

“connection assets” means that portion of the distribution system used to connect a Customer to the existing main distribution system, and consists of the assets between the point of connection on a distributor’ s main distribution system and the ownership demarcation point with that Customer; (DSC)

“Consumer” means a person who uses, for the person’ s own consumption, electricity that the person did not generate; (A, MR, DSC)

“Customer” means a person that has contracted for or intends to contract for connection of a building or an embedded generation facility. This includes developers of residential or commercial sub-divisions; (DSC)

"demand" means the average value of power measured over a specified interval of time, usually expressed in kilowatts (kW). Typical demand intervals are 15, 30 and 60 minutes; (DSC)

Section 4 – GLOSSARY OF TERMS

“demand meter” means a meter that measures a Consumer’s peak usage during a specified period of time; (DSC)

"developer" means a person or persons owning property for which new or modified electrical services are to be installed;

“disconnection” means a deactivation of connection assets that results in cessation of distribution services to a Consumer; (DSC)

“distribute”, with respect to electricity, means to convey electricity at voltages of 50 kilovolts or less; (A, MR, DSC)

“distribution losses” means energy losses that result from the interaction of intrinsic characteristics of the distribution network such as electrical resistance with network voltages and current flows; (DSC)

“distribution loss factor” means a factor or factors by which metered loads must be multiplied such that when summed equal the total measured load at the supply point(s) to the distribution system; (RSC)

“distribution services” means services related to the distribution of electricity and the services the Board has required distributors to carry out; (RSC, DSC)

“distribution system” means a system for distributing electricity, and includes any structures, equipment or other things used for that purpose. A distribution system is comprised of the main system capable of distributing electricity to many Customers and the connection assets used to connect a Customer to the main distribution system; (A, MR, DSC)

“Distribution System Code” means the code, approved by the Board, and in effect at the relevant time, which, among other things, establishes the obligations of the distributor with respect to the services and terms of service to be offered to Customers and retailers and provides minimum technical operating standards of distribution systems; (DSC)

“distributor” means a person who owns or operates a distribution system; (A, MR, DSC)

"duct bank" means two or more ducts that may be encased in concrete used for the purpose of containing and protecting underground electric cables;

“*Electricity Act*” means the *Electricity Act, 1998*, S.O. 1998, c.15, Schedule A; (MR, EDL, DSC)

Section 4 – GLOSSARY OF TERMS

“Electrical Safety Authority” or “ESA” means the person or body designated under the *Electricity Act* regulations as the Electrical Safety Authority; (DSC)

"electric service" means the Customer’s conductors and equipment for energy from Toronto Hydro;

“eligible low-income customer” means a residential electricity customer who has been qualified by a social service agency that partners with Toronto Hydro, based on criteria contained in section 1.2 of the Distribution System Code;

“embedded distributor” means a distributor who is not a wholesale market participant and that is provided electricity by a host distributor; (RSC, DSC)

“embedded generation facility” means a generation facility which is not directly connected to the IESO-controlled grid but instead is connected to a distribution system, and has the extended meaning given to it in section 1.9; (DSC)

“emergency” means any abnormal system condition that requires remedial action to prevent or limit loss of a distribution system or supply of electricity that could adversely affect the reliability of the electricity system; (DSC)

“emergency backup generation facility” means a generation facility that has a transfer switch that isolates it from a distribution system; (DSC)

"energy" means the product of power multiplied by time, usually expressed in kilowatt-hours (kWH);

“*Energy Competition Act*” means the *Energy Competition Act, 1998*, S.O. 1998, c. 15; (MR)

"energy diversion" means the electricity consumption unaccounted for but that can be quantified through various measures upon review of the meter mechanism, such as unbilled meter readings, tap off load(s) before revenue meter or meter tampering;

“enhancement” means a modification to the main distribution system that is made to improve system operating characteristics such as reliability or power quality or to relieve system capacity constraints resulting, for example, from general load growth, but does not include a renewable enabling improvement; (DSC)

“expansion” means a modification or addition to the main distribution system in response to one or more requests for one or more additional customer connections that otherwise could not be made, for example, by increasing the length of the main distribution system, and includes the modifications or additions to the main distribution system identified in section 3.2.30 but in respect of a renewable energy generation facility excludes a renewable enabling improvement; (DSC)

Section 4 – GLOSSARY OF TERMS

"extreme operating conditions" means extreme operating conditions as defined in the Canadian Standards Association ("CSA") Standard CAN3-C235-87 (latest edition);
“four-quadrant interval meter” means an interval meter that records power injected into a distribution system and the amount of electricity consumed by the Customer; (DSC)

"general service" means any service supplied to premises other than those designated as Residential and less than 50kW, Large User, or Municipal Street Lighting. This includes multi-unit residential establishments such as apartments buildings supplied through one service (bulk-metered);

“generate”, with respect to electricity, means to produce electricity or provide ancillary services, other than ancillary services provided by a transmitter or distributor through the operation of a transmission or distribution system; (A, DSC)

“generation facility” means a facility for generating electricity or providing ancillary services, other than ancillary services provided by a transmitter or distributor through the operation of a transmission or distribution system, and includes any structures, equipment or other things used for that purpose; (A, MR, DSC)

“generator” means a person who owns or operates a generation facility; (A, MR, DSC)

“geographic distributor,” with respect to a load transfer, means the distributor that is licensed to service a load transfer Customer and is responsible for connecting and billing the load transfer Customer; (DSC)

“good utility practice” means any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry in North America during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgement in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good practices, reliability, safety and expedition. Good utility practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted in North America; (MR, DSC)

“host distributor” means the distributor who provides electricity to an embedded distributor; (DSC)

"house service" means that portion of the electrical service in a multiple occupancy facility which is common to all occupants, (i.e. parking lot lighting, sign service, corridor and walkway lighting, et cetera);

“IEC” means International Electrotechnical Commission;

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“IEEE” means Institute of Electrical and Electronics Engineers;
“IESO” means the Independent Electricity System Operator;

“IESO-controlled grid” means the transmission systems with respect to which, pursuant to agreements, the IESO has authority to direct operation; (A, DSC)

“interval meter” means a meter that measures and records electricity use on an hourly or sub-hourly basis; (RSC, DSC)

"large user" means a Customer with a monthly peak demand of 5000 kW or greater, regardless the demand occurs in the peak or off-peak periods, averaged over 12 months;

"load factor" means the ratio of average demand for a designated time period (usually one month) to the maximum demand occurring in that period;

“load transfer” means a network supply point of one distributor that is supplied through the distribution network of another distributor and where this supply point is not considered a wholesale supply or bulk sale point; (DSC)

“load transfer Customer” means a Customer that is provided distribution services through a load transfer; (DSC)

“main distribution system” means a distribution system less the connection assets;

"main service" refers to Toronto Hydro’s incoming cables, bus duct, disconnecting and protective equipment for a Building or from which all other metered sub-services are taken;

“market participant” has the meaning prescribed in the Market Rules;

“Market Rules” means the rules made under section 32 of the *Electricity Act*; (MR, EDL, DSC)

“Measurement Canada” means the Special Operating Agency established in August 1996 by the *Electricity and Gas Inspection Act, 1980-81-82-83,* c. 87., and Electricity and Gas Inspection Regulations (SOR/86-131; (DSC)

“meter service provider” means any entity that performs metering services on behalf of a distributor or generator; (DSC)

“meter installation” means the meter and, if so equipped, the instrument transformers, wiring, test links, fuses, lamps, loss of potential alarms, meters, data recorders, telecommunication equipment and spin-off data facilities installed to measure power

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past a meter point, provide remote access to the metered data and monitor the condition of the installed equipment; (RSC, DSC)
"meter socket" means the mounting device for accommodating a socket type revenue meter;

“metering services” means installation, testing, reading and maintenance of meters; (DSC)

“MIST meter” means an interval meter from which data is obtained and validated within a designated settlement timeframe. MIST refers to “Metering Inside the Settlement Timeframe;” (RSC, DSC)

“MOST meter” means an interval meter from which data is only available outside of the designated settlement timeframe. MOST refers to “Metering Outside the Settlement Timeframe;” (RSC, DSC)

"multiple dwelling" means a Building which contains more than one self-contained dwelling unit;

"municipal street lighting" means all services supplied to street lighting equipment owned and operated for a municipal corporation;

“non-competitive electricity costs” means costs for services from the IESO that are not deemed by the Board to be competitive electricity services plus costs for distribution services, other than Standard Supply Service (SSS); (RSC)

"normal operating conditions" means the operating conditions comply with the standards set by the Canadian Standards Association ("CSA") Standard CAN3-C235-87 (latest edition);

“Ontario Electrical Safety Code” means the code adopted by O. Reg. 164/99 as the Electrical Safety Code; (DSC)

“*Ontario Energy Board Act*” means the *Ontario Energy Board Act, 1998*, S.O. 1998, c.15, Schedule B; (MR, DSC)

“operational demarcation point” means the physical location at which a distributor’ s responsibility for operational control of distribution equipment including connection assets ends at the Customer; (DSC)

“ownership demarcation point” means the physical location at which a distributor’ s ownership of distribution equipment including connection assets ends at the Customer; (DSC)

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“performance standards” means the performance targets for the distribution and connection activities of the distributor as established by the Board pursuant to the *Ontario Energy Board Act* and in the Rate Handbook;
"person" includes an individual, a corporation, sole proprietorship, partnership, unincorporated organization, unincorporated association, body corporate, and any other legal entity;

“physical distributor,” with respect to a load transfer, means the distributor that provides physical delivery of electricity to a load transfer Customer, but is not responsible for connecting and billing the load transfer Customer directly; (DSC)

"plaza" means any Building containing two or more commercial business tenants;

“point of supply,” with respect to an embedded generation facility, means the connection point where electricity produced by the generation facility is injected into the distribution system; (DSC)

"power factor" means the ratio between Real Power and Apparent Power (i.e. kW/kVA);

"primary service" means any service which is supplied with a nominal voltage greater than 750 volts;

"private property" means the property beyond the existing public street allowances;

“rate” means any rate, charge or other consideration, and includes a penalty for late payment; (DSC)

“Rate Handbook” means the document approved by the Board that outlines the regulatory mechanisms that will be applied in the setting of distributor rates; (RSC, DSC)

"reactive power" means the power component which does not produce work but is necessary to allow some equipment to operate, and is measured in kiloVolt Amperes Reactive (kVAR);

"real power" means the power component required to do real work, which is measured in kiloWatts (kW);

“Regulations” means the regulations made under the *Ontario Energy Board Act* or the *Electricity Act*;

“reinforcement” means an investment that a distributor makes to increase the distribution system capacity to accommodate new load on the distributor’s

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distribution system, consistent with the distributor's planning, design, and construction standard.

"residential customer" means a Customer that receives either a "residential service" or a "competitive sector multi-unit residential service";

"residential service" means a service where electricity is used exclusively for residential purposes in a separately metered living accommodation, where the "competitive sector multi-unit residential service" is not applicable. Eligibility is restricted to a dwelling unit that consists of a detached house or one unit of a semi-detached, duplex, triplex or quadruplex building, with a residential zoning; a separately metered dwelling within a town house complex or apartment building; and bulk metered residential buildings with six or fewer units;

"retail", with respect to electricity means,

a) to sell or offer to sell electricity to a Consumer
b) to act as agent or broker for a retailer with respect to the sale or offering for sale of electricity, or
c) to act or offer to act as an agent or broker for a Consumer with respect to the sale or offering for sale of electricity; (A, MR, DSC)

"Retail Settlement Code" means the code approved by the Board and in effect at the relevant time, which, among other things, establishes a distributor's obligations and responsibilities associated with financial settlement among retailers and Consumers and provides for tracking and facilitating Consumers transfers among competitive retailers; (DSC)

"retailer" means a person who retails electricity; (A, MR, DSC)

"secondary service" means any service which is supplied with a nominal voltage less than 750 Volts;

"service agreement" means the agreement that sets out the relationship between a licensed retailer and a distributor, in accordance with the provisions of Chapter 12 of the Retail Settlement Code; (RSC)

"service area," with respect to a distributor, means the area in which the distributor is authorized by its license to distribute electricity; (A, EDL, DSC)

"service date" means the date that the Customer and Toronto Hydro mutually agree upon to begin the supply of electricity by Toronto Hydro;

"Standard Supply Service Code" means the code approved by the Board which, among other things, establishes the minimum conditions that a distributor must meet

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in carrying out its obligations to sell electricity under section 29 of the *Electricity Act*; (EDL)

"sub-service" means a separately metered service that is taken from the main Building service;

"supply voltage" means the voltage measured at the Customer's main service entrance equipment (typically below 750 volts). Operating conditions are defined in the Canadian Standards Association ("CSA") Standard CAN3-C235 (latest edition);

"temporary service" means an electrical service granted temporarily for such purposes as construction, real estate sales, trailers, et cetera;

"terminal pole" refers to the Toronto Hydro's distribution pole on which the service supply cables are terminated;

"Timed Load Interrupter Device" means a device that will completely interrupt the customer's electricity intermittently for periods of time and allows full load capacity outside of the time periods that the electricity is interrupted; (DSC)

"total losses" means the sum of distribution losses and unaccounted for energy; (DSC)

"transformer room" means an isolated enclosure built to applicable codes to house transformers and associated electrical equipment;

"transmission system" means a system for transmitting electricity, and includes any structures, equipment or other things used for that purpose; (A, MR, DSC)

"Transmission System Code" means the code, approved by the Board, that is in force at the relevant time, which regulates the financial and information obligations of the Transmitter with respect to its relationship with Customers, as well as establishing the standards for connection of Customers to, and expansion of a transmission system; (DSC)

"transmit", with respect to electricity, means to convey electricity at voltages of more than 50 kilovolts; (A, DSC)

"transmitter" means a person who owns or operates a transmission system; (A, MR, DSC)

"unaccounted for energy" means all energy losses that can not be attributed to distribution losses. These include measurement error, errors in estimates of

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distribution losses and unmetered loads, energy theft and non-attributable billing errors; (DSC)

“unmetered loads” means electricity consumption that is not metered and is billed based on estimated usage; (DSC)

“validating, estimating and editing (VEE)” means the process used to validate, estimate and edit raw metering data to produce final metering data or to replicate missing metering data for settlement purposes; (MR, DSC)

“wholesale market participant”, means a person that sells or purchases electricity or ancillary services through the IESO- administered markets; (RSC, DSC)

Section 5 – TABLES

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TABLE 1.1 Demarcation Points & Charges for Connection Assets and Disconnection

Rate/Customer Class	Ownership Demarcation Point	Standard Allowance (Basic Connection)	Basic Connection Fee (for Std. Allowance)	Variable Connection Fee	Additional Services charged to Customer (as part of Var. Connections)	Service Disconnection Fee (Initiated by customer request)
CLASS 1 Residential - Single service						
Overhead	Top of Customer's service mast	up to 30 m OH service lines from Distributor's "feed" pole or lines. Includes connections at feed pole or lines, at customer's service mast, and equivalent average credit for transformation equipment.	Recovered through Distributor's rates	Customer charged Actual costs for connection assets beyond standard allowance.	Customers requesting an UG service in OH area will be required to pay 100% connection costs less the Standard allowance for an OH service.	Recovered through Distributor's Tariffs or rates. See Table 2
Underground (Not requiring Transformation Facilities on Customer's property)	Line side of Customer's meter base	equivalent credit to Class 1 Residential Overhead Single Service	Recovered through Distributor's rates	Customer charged Actual costs for connection assets beyond standard allowance, including street crossing. *If Customer's load requires transformation facilities on Customer's property, refer to "General Service" Rate Class category for Underground service with Transformation.*		Recovered through Distributor's Tariffs or rates. See Table 2
CLASS 2 General Service 0 < 50 kW						
Overhead - Single Service	Top of Customer's service mast	equivalent credit to Class 1 Residential Overhead Single Service	Recovered through Distributor's rates	Customer charged Actual costs for connection assets beyond standard allowance.	Additional or redesign due to changes in Customer initial proposal; electrical inspections more than standard allowance	Recovered through Distributor's Tariffs or rates. See Table 2
Underground - Single Service	Line side of Customer's main disconnect switch	equivalent credit to Class 1 Residential Overhead Single Service	Recovered through Distributor's rates	Customer charged Actual costs for connection assets beyond standard allowance. Inspections more than standard allowance and all civil inspections.	Additional or redesign due to changes in customer initial proposal; electrical	Recovered through Distributor's Tariffs or rates. See Table 2

Section 5 – TABLES

TABLE 1.2 Demarcation Points & Charges for Connection Assets and Disconnection

Rate/Customer Class	Ownership Demarcation Point	Standard Allowance (Basic Connection)	Basic Connection Fee (for Std. Allowance)	Variable Connection Fee	Additional Services charged to Customer (as part of Var. Connections)	Service Disconnection Fee (Initiated by customer request)
CLASS 3-A General Service 50 kW - 999 kW						
Overhead - Single building Bulk Metered or Suite Metering (Not requiring Transformation Facilities on private property)	Top of Customer's service mast	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance.	Additional or redesign due changes in Customer initial proposal; electrical inspections more than standard allowance	Customer charged fixed, average costs associated with disconnection and/or removal of connection assets up to the demarcation point. See Table 2
Underground - Single Building Bulk Metered or Suite Metering (Not requiring Transformation Facilities on private property)	Line side of Customer's main disconnect switch	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance, including cable chamber(s), UG conduits as required.	Additional or redesign due changes in Customer initial proposal; electrical inspections more than std. allowance and all civil inspections.	Customer charged actual costs associated with disconnection and/or removal of connection assets up to the demarcation point. See Table 2
Overhead - Single Building Bulk Metered or Suite Metering (Requiring Transformation Facilities on private property)	Line side of Customer's main disconnect switch (secondary UG) OR top of Customer's service mast (secondary OH)	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance, including transformer(s), Tx. connections, associated switching equipment, transformer pole(s), cable chamber(s), UG conduits as applicable.	Additional or redesign due changes in Customer initial proposal; electrical inspections more than std. allowance and all civil inspections and related feeder switching/scheduling	Customer charged actual costs associated with the disconnection and/or removal of connection assets including cables, transformers and related vault equipment up to the demarcation point and, related feeder switching and scheduling.
Underground - Single Building Bulk Metered or Suite Metering (Requiring Transformation Facilities on private property)	Line side of Customer's main disconnect switch or Customer's bus	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance, including transformer(s), Tx. connections, associated switching equipment, transformer pads, transformer vaults, cable chambers,cable pull rooms, UG conduits and cabling and road crossing (as applicable).	Additional or redesign due changes in Customer initial proposal; electrical inspections more than std. allowance and all civil inspections and related feeder switching/scheduling	Customer charged actual costs associated with the disconnection and/or removal of connection assets including cables, transformers and related vault equipment up to the demarcation point and related feeder switching and scheduling.

Section 5 – TABLES

TABLE 1.3 Demarcation Points & Charges for Connection Assets and Disconnection

Rate/Customer Class	Ownership Demarcation Point	Standard Allowance (Basic Connection)	Basic Connection Fee (for Std. Allowance)	Variable Connection Fee	Additional Services charged to Customer (as part of Var. Connections)	Service Disconnection Fee (Initiated by customer request)
CLASS 3-B General Service 50 kW - 999 kW						
Underground (Multi-units or Townhouse Complex with Transformation Facilities on private property other than supplied from primary distribution systems built along private streets)	(Bulk meter) First point of connection past transformers on private property as applicable, i.e. a) Tx. Secondary spade b) cable chamber c) tap box d) meter center	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance, including transformer(s), associated switching equipment, transformer pads, transformer vaults, cable chambers, connections in cable chamber(s), tap boxes excess UG conduit & cabling.	Additional or redesign due to changes in Customer initial proposal; electrical inspections more than std. allowance and all civil inspections and related feeder switching/scheduling	Customer charged actual costs associated with the disconnection and/or removal of connection assets including cables, transformers and related vault equipment up to the demarcation point and related feeder switching and scheduling. See Table 2
	(Townhouse individual meter) line side of individual meter base	equivalent credit to Class 1 Residential Overhead Single Service applied to each meter	Recovered through Distributor's rates	Customer charged Actual costs for connection assets beyond standard allowance.		Recovered through Distributor's Tariffs or rates.
Underground (Multi-units or Townhouse Complex with NO Transformation Facilities on private property or supplied from primary distribution system built along private streets)	(Bulk meter) First point of connection past Distributor's system onto private private as applicable I.e. a) cable chamber b) tap box c) meter center	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance, including cable chamber(s), excess UG conduit and cabling.	Additional or redesign due to changes in Customer initial proposal; electrical inspections more than std. allowance and all civil inspections.	Customer charged actual costs associated with the disconnection and/or removal of connection assets up to the demarcation point. See Table 2
	(Townhouse individual meter) line side of individual meter base	equivalent credit to Class 1 Residential Overhead Single Service applied to each meter	Recovered through Distributor's rates	Customer charged Actual costs for connection assets beyond standard allowance.		Recovered through Distributor's Tariffs or rates.
CLASS 3-C Residential Subdivision (development with more than 5 lots)	Line side of customer's meter base (UG) Top of Customer's service mast (OH)	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Blended costs net of basic allowance credit		Recovered through Distributor's Tariffs or rates.
CLASS 4 & 5 General Service 1000kW and Up						
Underground Single/Multiple Building Bulk Metered or Suite Metering (Requiring Transformation Facilities on private property)	Line side of Customer's main bus	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance, including transformer(s), Tx. connections, associated switching equipment, transformer pads, transformer vaults, cable chambers, cable pull rooms, UG conduits, excess cabling and street crossings.	Additional or redesign due to changes in Customer initial proposal; electrical inspections more than std. allowance and all civil inspections and related feeder switching/scheduling	Customer charged actual costs associated with the disconnection and/or removal of connection assets including cables, transformers and related vault equipment up to the demarcation point and related feeder switching and scheduling. See Table 2
Underground Single/Multiple Building Bulk Metered or Suite Metering (Customer owned Sub-Station) (Requiring Transformation Facilities on private property)	Pot head Terminations at line side of Customer's high voltage switchgear	equivalent credit to Class 1 Residential Overhead Single Service	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance, including cable chamber(s), cable pullroom, excess UG conduit and cabling and street crossing.	Additional or redesign due changes in Customer initial proposal; electrical & Swgr inspections more than std. allowance; all civil inspection and related feeder switching/ scheduling; additional Hi-pot, protection & control relays, wiring and relay settings associated with pilot wire prot. or other extra reliability systems	Customer charged actual costs associated with the disconnection and/or removal of connection assets including related feeder switching and scheduling. See Table 2

Note: Individual Suite Metering will negate the Transformer Allowance Discount

Section 5 – TABLES

TABLE 1.4 Demarcation Points & Charges for Connection Assets and Disconnection

Rate/Customer Class	Ownership Demarcation Point	Standard Allowance (Basic Connection)	Basic Connection Fee (for Std. Allowance)	Variable Connection Fee	Additional Services charged to customer (as part of Var. Connections)	Service Disconnection Fee (Initiated by customer request)
Unmetered Connections (excluding street lighting)						
Overhead-Supply						
(1) Source connection is made at Distributor's supply pole and the service mast is located on the same supply pole	a) Top of Customer's service mast; or b) Customer's disconnect enclosure	Source connection is made at Distributor's supply pole	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance	Additional or redesign due to changes in Customer initial proposal.	Customer charged actual costs associated with disconnection and/or removal of connection assets up to the demarcation point.
(2) Source connection is made at Distributor's supply pole (or lines), and the service mast is not located on the same supply pole	a) Top of Customer's service mast; or b) Customer's disconnect enclosure	Source connection (up to 30 m of service lines) from Distributor's supply pole or line to service mast that is not located on the same supply pole	See Table 2	Customer charged Actual costs for connection assets beyond standard allowance	Additional or redesign due to changes in Customer initial proposal.	Customer charged actual costs associated with disconnection and/or removal of connection assets up to the demarcation point.
Underground-Supply						
(1) Customer attachments on Distributor's poles	Line side of Customer's circuit breaker panel on pole	No standard allowance	not applicable	Customer charged Actual costs for connection assets.	Additional or redesign due to changes in Customer initial proposal.	Customer charged actual costs associated with disconnection and/or removal of connection assets up to the demarcation point.
(2) Customer attachments not on Distributor's poles	Customer's disconnect enclosure at Customer's structure	Source connection at Distributor's structure (tap box, cable chamber). No standard allowance	not applicable	Customer charged Actual costs for connection assets.	Additional or redesign due to changes in Customer initial proposal.	Customer charged actual costs associated with disconnection and/or removal of connection assets up to the demarcation point.

Section 5 – TABLES

TABLE 2 Service Connection and Disconnection Fee

IMPORTANT:
The range of services listed below may not be applicable in all districts due to the restrictions imposed by the distribution system in certain areas

Rate/Customer Class	Ownership Demarcation Point	Service Connection Fee (*) (Subject to annual review)	Service Disconnection Fee (Initiated by Customer)
CLASS 1 - Residential - Single Service			
Overhead	Top of Customer's service mast	- Basic Connection Charge recovered through hydro rates ($1,396.00)	(No charge - Recovered through rates)
Underground (Not requiring Transformation Facilities on customer's property)	Line side of Customer's meter base	- Variable Connection Charges collected directly from the Customer	(No charge - Recovered through rates)
CLASS 2 - General Service 0 < 50 kW			
Overhead - Single Service	Top of Customer's service mast	- Basic Connection Charge recovered through hydro rates ($1,396.00)	(No charge - Recovered through rates)
Underground - Single Service (Not requiring Transformation Facilities on customer's property)	Line side of Customer's main disconnect switch	- Variable Connection Charges collected directly from the Customer	(No charge - Recovered through rates)
CLASS 3A - General Service 50 kW - 999 kW		- Basic Connection re Charge covered through hydro rates ($1,396.00)	
Overhead - Single Service	Top of Customer's service mast		All Service sizes: $185.00 during regular hours $415.00 after regular hours
(Not requiring Transformation Facilities on private property)		- Variable Connection Charges collected directly from the Customer	
Underground - Single Service (Not requiring Transformation Facilities on private property)	Line side of Customer's main disconnect switch	- Basic Connection Charge recovered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
(Requiring Transformation Facilities on private property)	Line side of Customer's main disconnect switch or Customer's bus	- Basic Connection Charge recovered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
CLASS 3B - General Service 50 kW - 999 kW			
Underground (Multi-units or Townhouse Complex with Transformation Facilities on private property other than supplied from primary distribution systems built along private streets)	(Bulk meter) First point of connection past transformers on private property a) Tx. Secondary spade b) meter center c) cable chamber d) tap box	- Basic Connection re Charge covered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
	(Townhouse individual meter) Line side of Customer's meter base		(No charge - Recovered through rates)
Underground (Multi-units or Townhouse Complex with NO Transformation Facilities on private property or supplied from primary distribution system built along private streets)	(Bulk meter) First point of connection past Distributor's system onto private a) tap box b) meter base/center c) cable chamber	- Basic Connection re Charge covered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
	(Townhouse individual meter) Line side of Customer's meter base	- Basic Connection Charge recovered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(No charge - Recovered through rates)
CLASS 3C			
Residential Subdivision (development with more than 5 lots)	Line side of Customer's meter base Top of Customer's service mast	- Basic Connection re Charge covered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(No charge - Recovered through rates)

(*) Typical connection costs by Class of Customers are available upon request

Section 5 – TABLES

TABLE 2 (continued) - Service Connection and Disconnection Fee

IMPORTANT:
The range of services listed below may not be applicable in all districts due to the restrictions imposed by the distribution system in certain areas

Rate/Customer Class	Ownership Demarcation Point	Service Connection Fee (*) (Subject to annual review)	Service Disconnection Fee (Initiated by Customer)
CLASS 4 & 5 - General Service 1000 kW and Up			
Underground (Requiring Transformation Facilities on private property)	Line side of Customer's main bus	- Basic Connection Charge recovered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
Underground (Customer owned Sub-Station)	Pot head Terminations at line side of Customer's high voltage switchgear	- Basic Connection Charge recovered through hydro rates ($1,396.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
Unmetered Connections (excluding street lighting)			
Overhead Supply-			
(1) Source connection is made at Distributor's supply pole and the service mast is located on the same supply pole	a) Top of Customer's service mast; or b) Customer's disconnect enclosure	- Unmetered Basic Connection Charge collected directly from the Customer ($446.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
(2) Source connection is made at Distributor's supply pole (or lines), and the service mast is not located on the same supply pole	a) Top of Customer's service mast; or b) Customer's disconnect enclosure	- Unmetered Basic Connection Charge collected directly from the Customer ($1011.00) - Variable Connection Charges collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
Underground Supply-			
(1) Customer attachments on Distributor's poles	Line side of Customer's circuit breaker panel on pole	- Actual connection costs collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)
(2) Customer attachments not on Distributor's poles	Customer's disconnect enclosure at Customer's structure	- Actual connection costs collected directly from the Customer	(Variable Disconnection Charge collected directly from the Customer)

(*) Typical connection costs by Class of Customers are available upon request

Section 5 – TABLES

TABLE 3 New or Upgraded Street Lighting Services – Point of Demarcation and Connection Charges

Types of Street Lighting. Distribution Systems	Ownership Demarcation Point	Standard Allowance	Basic Connection Fee (subject to annual review)	Variable Connection Fee(*)
Municipal Lights attached to Distributor's poles and connected to Distributor's *overhead* 120/240 V secondary bus.	Connections at the overhead bus.	Connections made at Distributor's overhead secondary bus.	$533.36	Customer charged actual costs for connection assets above and beyond the Standard Allowance.
Municipal Lights attached to Distributor's poles (in mixed use urban setting)** and connected to Distributor's *underground* 120/240 V secondary bus.	At the base of the Street Lighting bracket connected to the pole.	Connections made in the pole's handhole.	$573.97	Customer charged actual costs for connection assets above and beyond the Standard Allowance. (e.g. cable chamber/tap box breakout, underground conduit and cables, additional connections)
Municipal Lights attached to Municipality's poles (in residential setting) and connected to Distributor's *underground* 120/240 V secondary bus.	Line side of the protective device (i.e. circuit breaker, fuse) in the pole's handhole.	Connections made in the pole's handhole.	$573.97	Customer charged actual costs for connection assets above and beyond the Standard Allowance. (e.g. cable chamber/tap box breakout, underground conduit and cables, additional connections)

*Consulting and engineering work is not included and may be separately charged.

** mixed use urban setting, where streets are classified as Collector or Arterial.

Section 5 – TABLES

TABLE 4 Customer Owned Transformers (Article 3.4.1)

Transformer Voltage		Recommended Primary Tap Voltage					
Primary	Secondary	+5%	+2½%	0	-2 ½%	-5 %	-7 ½%
27600 grd.Y/16000	less than 750	28980	28290	27600	26910	26220	
27600 grd.Y/16000	13800 grd.Y/8000						
27600	2400/4160 Y		28290	27600	26910	26220	25530
13860	2400/4160 Y		14206	13860	13513	13167	12820
13860	less than 750	14553	14206	13860	13513	13167	
13860 grd.Y/8000							

Section 5 – TABLES

TABLE 5 Meter Sockets (Article 2.3.7.1.2)

SELF-CONTAINED SOCKET METERING			
Voltage	Phase	Wire	Maximum Service Switch Size Rating Amperes
120/240	1	3	200
120/240	1	3	400 *
208/120	2	3	200
208/120	3	4	200
600/347	3	4	200
600 **	3	3	200

* A 400 amp transformer-rated meter socket contains a 3 wire current transformer and transformer type meter. Refer to Section 6, Reference #6 – "Toronto Hydro Metering Requirements 750 Volts or Less" Table I, for a list of manufacturer's meter sockets approved by Toronto Hydro.

** Used only for existing services where grounded supply is not available.

Notes:
1. Only CSA approved meter sockets are to be used.
2. Meter sockets shall be mounted so that the midpoint of the meter is set at 1700 mm ± 100 mm.
3. Where the supply is grounded, 600 V metering shall be 4 wire. Where the Customer does not require a neutral, a full size neutral conductor sized in accordance with Table 17 of the Ontario Electrical Safety Code must be provided to all meter cabinets or sockets. The neutral conductor is to be terminated in the socket (or cabinet) on an insulated block in accordance with the Ontario Electrical Safety Code.

Section 5 – TABLES

TABLE 6 Meter Cabinets (Article 2.3.7.1.2)

METER CABINETS				
Voltage	Phase	Wire	Main Switch Size in Amperes	Meter Cabinets (see description below)
120/240	1	3	Over 400	A
208/120 416/240 600/347	3	4	Over 200 – 800	A
			Over 800	B
600*	3	3	Over 200 – 400	A
			Over 800	B

***** Only for existing services where grounded supply is not available.

Meter Cabinet Descriptions

A – 48" x 48" x 12" complete with removable 44" x 44" backplate.
B – 36" x 36" x 12" connected to switchgear instrument transformer compartment.

Notes: 1. Meter cabinets shall be fabricated of minimum # 16 gauge steel.

2. Cabinets shall have side-hinged doors opening at the center and be equipped with three-point latching and provision for padlocking.

3. The maximum distance from the floor to the top of the cabinet shall be 1830 mm.

4. Where two or more circuits are used in one meter cabinet, Toronto Hydro will issue specific metering requirements.

Section 5 – TABLES

TABLE 7 Instrument Transformers and Enclosures (Article 2.3.7.2)

Metering Transformers and Compartments						
Voltage (Volts)	Phase	Wire	Service Size (Amperes)	Compartment Size	Number of Metering Transformers (Provision for)	
					Current	Voltage
240/120 208/120 N/W	1 3	3 3	Up to 800	A	1 or 2	0
			Over 800 Up to 4000	B		
208 / 120 416 / 240 600 / 347	3	4	Up to 800	A	3	3
			Over 800 Up to 4000	B	3	
600 (*)	3	3	Up to 800	A	2	2
			Over 800 Up to 4000	B	2	
Voltages up to 600	3 (*) 3	3 (*) 4	Over 4000	C	2 3	2 3

***** Only for existing services where grounded supply is not available.

MINIMUM COMPARTMENT SIZES [width x height x depth (from CT mounting plate)]

A - 762mm x 762mm x 210mm (30" x 30" x 8.25")
B - 915mm x 762mm x 324mm (36" x 30" x 12.75")
C - 965mm x 914mm x 381mm (38" x 36" x 15")

NOTES: 1. Instrument transformers will be provided by Toronto Hydro and shall be installed in the switchgear by the manufacturer. The manufacturer shall not disassemble and/or change in any manner the Toronto Hydro equipment sent to the manufacturer.

2. Voltage transformer connections shall be connected on the line side of the current transformers. Current transformers shall be installed with their polarity marks towards the incoming Toronto Hydro supply.

Section 5 – TABLES

TABLE 8 Meter Centres (Article 2.3.7.1.2)

Meter centers may be used for 750 V applications or less, as far as they meet the following specifications:

1) Side-hinged doors or panels shall be installed over all sections of the switchboard where Toronto Hydro may be required to work, such as unmetered sections and those sections containing breakers, switches and meter mounting devices. Hinged doors or panels shall have provision for sealing and padlocking in the closed position. Where bolts are used, they shall be of the captive knurled type. The hinged covers over breakers or switches shall be so constructed that the covers cannot be opened when sealed or padlocked.

2) Breakers or switch handles shall have provision for positive sealing and padlocking in the "off" position.

3) Meter mounting devices shall be wired so as to be on the "load" side of the breakers or switches.

4) Each combination meter socket and breaker panel shall have adequate space for permanent Customer identification with respect to street address and/or unit number.

5) The centre of the bottom row of meter sockets shall be not less than 600 mm from the finished floor. The centre of the top row of meter sockets shall be not less than 1800 mm from the finished floor.

6) The distance between adjacent meter socket rims in the horizontal plane shall not be less than 152 mm.

7) The distance between adjacent meter socket rims in the vertical plane shall be as follows:
    a) For 100 A., 4 or 5 jaw, not less than 76 mm.
    b) For 100 A., 7 jaw, not less than 152 mm.

8) The meter mounting socket and sealing ring shall be acceptable to Toronto Hydro.

9) Where a neutral is required, the meter mounting device shall have a pre-wired, ungrounded neutral connection to the 5th or 7th terminal. The connection, if not made directly to the neutral bus, shall be not less than #12 AWG copper or equivalent.

Section 6 – REFERENCES

6 REFERENCES

1. **Economic Evaluation Model for Distribution System Expansion**
   Refer to Appendix B of the Distribution System Code:
   "Methodology and Assumptions for an Economic Evaluation"

2. **Standard Toronto Hydro Connection Agreements - Terms of Conditions**

   - Schedule A:
     - Toronto Hydro-Electric System Limited Connection Agreement

3. **Toronto Hydro Distributed Generation Requirements**

4. **Toronto Hydro Requirements for the Design and Construction of Customer-Owned High Voltage Substations**

5. **Toronto Hydro Requirements for the Design and Construction of Customer-Owned Structures**

6. **Toronto Hydro Metering Requirements 750 Volts or Less**

7. **Toronto Hydro Metering Requirements for 13.8 kV & 27.6 kV Customer-Owned Substations**

8. **Construction Contractor Pre-Qualification Application**

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 10:

Reference(s):

Exhibit 1A, Tab 2, Schedule 1, page 17, Table 2

a) Please break out the customer services requests from third party requests in line 3 of the table.
b) Please indicate the contributions from third parties to investments made for that reason, by category, e.g., City of Toronto, Go Transit, Province of Ontario, etc.
c) Please explain in detail what is meant by "functional obsolescence". Provide examples.

RESPONSE:

a) According to Exhibit 2B, Section 00, pages 26-27, Table 4, Customer Service Request is the trigger driver for Customer Connections and Load Demand programs. In the same table, Third Party Request is the trigger driver for Externally-Initiated Plant Relocation & Expansion. The table below shows the breakdown of customer service requests and third party requests.

Trigger Driver	2015	2016	2017	2018	2019
Customer Service Requests	51.3	67.7	78.9	72.6	65.8
Third Party Requests	4.0	4.0	4.0	4.0	4.0

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

b) Exhibit 2B, Section E5.3, Table C (page 3) presents forecast aggregate customer contributions from 2015-2019. The forecasted contributions cannot be broken down by specific customer as they are forecasted based on historical customer demand.

c) Exhibit 2B, Section E.6, page 2, Table 1 describes functional obsolescence as "the asset/asset installation is no longer aligned to Toronto Hydro processes and practices such that it can no longer be maintained (e.g., lack of spare parts, lack of accessibility or operational constraints) or utilized as intended in the distribution system". An example of a program which is driven by functional obsolescence is SCADA-Mate R1 Switch Renewal, which is further detailed in Section E6.8 of the Distribution System Plan. Please refer to Exhibit 2B, Section E6.8, Table B (page 2) for discussion of the application of the Functional Obsolescence driver to the SCADA-Mate R1 Switch Renewal program.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 11:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 17, Table 2

The categories of capital expenditures resulting from different drivers peak in different years. For example, Failure Risk, System Maintenance and Capital Support, Capacity Contracts and Mandated Service Obligations related investments peak in 2015. Functional Obsolescence and System Efficiency related investments, Customer Service Requests/Third Party Requests peak in 2017. Failure and reliability driven investments peak in 2019

Please explain the reasons for the differences in the time peak spending related to the various drivers that are the result of plan over the 2015-2019 period. Please explain fully.

RESPONSE:

The finalized spending profiles contained within Table 2 of Exhibit 1A are a product of the individual timing and pacing of each investment program, and do not relate to a specific program driver. Timing and pacing factors and justification are provided for each capital investment program in Sections E5 through to E8 within the Distribution System Plan (Exhibit 2B). The overall investment planning process is discussed in detail in Exhibit 2B, Section D3.1.1.3.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 12:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 19, Tables 5 and 6

Please confirm that the smart grid investments and regional planning investments are included in the capital investments set out in Table 2 (page 17). If not, please explain.

RESPONSE:

Toronto Hydro confirms that the investments presented in Tables 5 and 6 are included in Table 2, which shows all capital expenditures proposed in Exhibit 2B (Distribution System Plan).

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 13:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 17, Table 2

Rate Base – Addition of street lights into rate base

a) Does System Maintenance in line three refer to only maintenance capital or does it include any OM&A costs?

b) What is the trade-off between capital and OM&A requests displayed in the application.

RESPONSE:

a) The System Maintenance & Capital Investment Support line in Exhibit 1A, Tab 2, Schedule 1, Table 2 represents only capital expenditures.

b) The total requested capital investment per year can be found in Exhibit 1A, Tab 2, Schedule 1, Table 2 on page 17. The total requested OM&A investment per year can be found in Exhibit 4A, Tab 1, Schedule 1, Table 1 on page 4. There is no implicit trade-off between capital and OM&A across the application as a whole; however, some OM&A programs may be slightly affected by capital spending, as outlined in the response to Interrogatory 2B-EP-24 part (a).

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 14:

Reference(s): **Exhibit 1A, Tab 2, Schedule 1, page 23, Table 7, entitled "OM&A – 2015-19 Cost Drivers"**

page 23, Table 7, entitled "OM&A – 2015-19 Cost Drivers", but the expenditures/drivers in the table are for the test year, bridge year, and historical years

a) What are the comparable drivers for the period 2016-2019?
b) Are they deemed to be identical to the 2011-2015 period?

RESPONSE:

Please note that Exhibit 1A, Tab 2, Schedule 1, page 23, Table 7 should be corrected and entitled "OM&A – 2011-15 Cost Drivers."

a) Toronto Hydro structured its financial planning process for the 2015-2019 timeframe around the principles of the 4th Generation Incentive Rate Making regime (4GIRM) – that is a single detailed Test Year budget, followed by formulaic increases on the basis of the custom Price Cap Index formula, as discussed in the Exhibit 1B, Tab 2, Schedule 3. Consistent with this approach, Toronto Hydro did not produce detailed operational plans for the period 2016-2019 and consequently is not in a position to provide detailed cost drivers for that period.

b) Please see response to part a) above.

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

INTERROGATORY 16:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 17, Table 2 (corrected)

Please explain the difference between "safety" and "reliability" as a primary and a secondary driver, respectively. What percentage of programs do the 32 and 23 programs represent?

RESPONSE:

All drivers, including safety and reliability, have been defined Toronto Hydro's Distribution System Plan (Exhibit 2B, Section A2.1, Table 2, pages 7-8). As further explained in the Distribution System Plan (Exhibit 2B, Section A2.1, page 8) the primary or trigger driver indicates the primary reason that a particular program must be carried out. However, secondary drivers may be as or more consequential than the trigger driver as explained in the Distribution System Plan:

> For example, a program's trigger driver may be functional obsolescence, meaning that a type of asset can no longer be maintained due to age, availability of parts, and other issues. However, that functional obsolescence may also result in serious safety or reliability issues. The safety or reliability issues would be listed as secondary drivers for the program because they are a consequence of the functional obsolescence of those assets. However, addressing the resulting safety or reliability issues may ultimately be the most pressing reason for Toronto Hydro to proceed with that program, even though those drivers are listed as "secondary." (Exhibit 2B, Section A2.1, page 8).

RESPONSES TO BUILDING OWNERS AND MANAGERS ASSOCIATION, GREATER TORONTO INTERROGATORIES

The Safety driver relates to 32 programs, which constitutes approximately 71% of the 45 capital investment programs in the Distribution System Plan. Similarly the Reliability driver relates to 23 programs, which constitutes 51% of the total number of programs.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 1:

Reference(s): Exhibit 1A

Please provide all materials provided to Toronto Hydro's Board of Directors and Senior Management regarding the Application and underlying budgets and business plans. Please also provide all Business Plans relevant to this Application.

RESPONSE:

Toronto Hydro declines, on the basis of relevance, to provide the materials supplied to Toronto Hydro's Board of Directors and Senior Management regarding the Application.

Toronto Hydro notes that the same types of materials were requested in EB-2010-0008, and EB-2013-0321; in both of these proceedings, the OEB Panels decided that the requested material was not relevant.

In EB-2010-0008, the OEB Panels stated:[2]

> The Board has decided not to order production of the materials sought in the CME and CCC motions. In the Board's view, these materials are not relevant to the determination of the issues before the Board in this proceeding. The Board will make its decision on the application and supporting materials filed by the applicant and the evidence of intervenors, all of which is subject to cross-examination.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

This evidence goes to the financial and operational impacts of the application and of the alternatives which have been considered.

The material which has been sought through the motions includes the communication between OPG's management and its board of directors, seeking approval to file the application, delegated authority to deal with the proceeding, and the analysis of "likely prospects for success". This material does not form part of the application and does not enhance nor detract from the merits of the application. The evidence is that no changes to the business plans and budgets which underpin the application were sought or made as a result of the board of directors' meeting. These plans and budgets have been filed.

Intervenors can explore, through the witness, whether alternatives to the application should have been considered, and the impacts of OPG's choices. None of this relies on what management presented to the board of directors.

Having found that the materials are not relevant and need not be produced, the question of privilege will not be addressed. That concludes the Board's decision, and subject to any questions, we can continue with the cross-examination.

Consistent with Toronto Hydro's business planning cycle, the detailed Business Plan which covers the period of this Application, will be presented to the Board of Directors at its upcoming meeting on November 13, 2014. Once the Business Plan has been approved by the Board of Directors, Toronto Hydro will produce it as part of this proceeding.

[2] EB-2010-0008, Transcript Vol. 1 (October 4, 2010), pages 113-114.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 2:

Reference(s): Exhibit 1A

Please provide all correspondence between Toronto Hydro and the City of Toronto regarding this Application. Did the City of Toronto "approve" the Application and the resulting rates? If not, why not?

RESPONSE:

Toronto Hydro declines to produce the requested documents on the basis of relevance. The correspondence between Toronto Hydro and the City of Toronto formed no part of this application and has no probative value in deciding the issues in this proceeding. Different operational areas of Toronto Hydro communicate regularly with the City of Toronto on a wide range of subjects. It would be a significant effort to sort through all this correspondence to determine which materials contained information regarding the Application.

The City of Toronto did not formally "approve" the Application and the resulting rates because such approval is not required under the Shareholder Direction (Exhibit 1C, Tab 2, Schedule 1, Appendix A). Three members of City Council sit on the Board of Directors, and the City of Toronto received updates and information the about the Application through the normal course of Toronto Hydro's corporate governance activities, which are detailed in Exhibit 1A, Tab 2, Schedule 1.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 3:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 4

The evidence states that much of Toronto Hydro's proposed work has been reviewed and validated by experts and that Toronto Hydro has filed over a dozen third party reports in the application.

a) Please provide a complete list of all of the reports, which sets out for each one, the nature of the work and the contractor, costs incurred to date and the total expected cost. How does Toronto Hydro propose that these costs be recovered?

b) Please explain, in detail, how Toronto determined which areas of the application should be reviewed and validated by external experts and which areas could be reviewed internally.

c) Did Toronto Hydro develop a budget for this work? If so, please indicate what that budget was and how was this budget developed. If now, why not?

d) Please indicate whether each piece of work was subject to an RFP process. In those cases where there was no RFP please explain why.

RESPONSE:

a) Please see table below:

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

Consultant	Nature of the Work / Evidence Reference	Costs to Date
The Conference Board of Canada	**Labour Market and Human Resources Trends - Canadian Utility Sector Study (Exhibit 4A, Tab 4, Schedule 4).** The Conference Board of Canada was retained to provide independent research on current labour market and human resources trends for the utility and related sectors in connection with Toronto Hydro's regulatory submission and rate application.	$43,000
Info-Tech Research Group International Inc.	**ERP Submission Review (Exhibit 2B, Section E8.6, Appendix A).** Info-Tech Research Group International Inc. was retained to review the ERP submission to the Ontario Energy Board and provide an opinion on the feasibility of the approach, the recommendation, and the options for the Ellipse replacement.	$50,737
Kinectrics Inc.	**Asset Condition Assessment (Exhibit 2B, Section D, Appendix A).** Kinectrics Inc. was retained to assess the progress of Toronto Hydro efforts to improve its asset condition assessment practices between 2012 and 2014.	$45,200
Navigant Consulting Inc.	**Review of Proposed Projects and Programs (Exhibit 1B, Tab 2, Schedule 4, Appendix A)**. Navigant Consulting Ltd. was retained to conduct, and prepare a report regarding an independent review of Toronto Hydro's Distribution System Plan ("DSP").	$144,023
Navigant Consulting Inc.	**Working Capital Requirements of THESL's Distribution Business (Exhibit 2A, Tab 3, Schedule 2).** Navigant Consulting Ltd. was retained to prepare a report that is a detailed Lead-Lag Analysis.	$122,055
PWC	**Streetlighting: Assessment of the Valuation Methodology (Exhibit 2A, Tab 5, Schedule 2).** PricewaterhouseCoopers LLP was retained to prepare a report to be used as evidence in connection with Toronto Hydro's proposed rate application, which includes a revised purchase price for certain street lighting assets which Toronto Hydro purchased from its unregulated affiliate, Toronto Hydro Energy Services Inc. on January 1, 2012.	$ 90,442
Power System Engineering Inc.	**Econometric Benchmarking of Historical and Projected Total Cost and Reliability Levels (Exhibit 1B, Tab 2, Schedule 5, Appendix B).** Power System Engineering Inc. was retained to	$151,715

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

Consultant	Nature of the Work / Evidence Reference	Costs to Date
	conduct a benchmarking study of Toronto Hydro's past and projected total cost and reliability performance in reference to the utility's 2015-2019 rate application.	
Power System Engineering Inc.	**Standards Review Study (Exhibit 2B, Section D, Appendix B)** PSE was retained to review Toronto Hydro's standards and to assess whether they advocate the principles of safety, reliability, and efficiency, as well as follow industry best practices.	$49,588
Towers Watson Canada Inc.	**Compensation and Benefits Review (Exhibit 4A, Tab 4, Schedule 6).** Towers Watson Canada Inc. was retained to review Toronto Hydro's market competitive compensation and benefit levels.	$ 49,891
Innovative Research Group, Inc.	**Customer Consultation Report: DSP Review (Exhibit 1B, Tab 2, Schedule 7, Appendix B).** Innovative Research Group Inc. was retained by Toronto Hydro to help the utility design, collect feedback and document its customer engagement and consultation process as part of the development of Toronto Hydro's Distribution System Plan.	$ 259,201
AECOM	**Future Impacts of Climate Change on Toronto Hydro's Distribution System (Exhibit 2B, Section E8.8, Appendix A).** AECOM was retained to assist Toronto Hydro in the assessment of how the impacts of climate change are likely to affect Toronto Hydro's distribution system, and to outline a process through which Toronto Hydro can continue its efforts to better understand the risks relating to climate, and to take proactive steps to manage those risks and enhance the resilience of its system to climate change.	$61,404

The total expected costs of the consultants depends on the work required by these third parties to answer interrogatories, and the extent to which the OEB and intervenors seek to have these third parties attend the hearing and be involved with other procedural steps in this application. Toronto Hydro is unable to speculate as to the exact costs and breakdown, however for the purposes of recovery, Toronto Hydro has included total forecast amounts to be recovered as part of the Rates and

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Regulatory Affairs OM&A budget (Exhibit 4A, Tab 2, Schedule 17). As indicated in Appendix 2-M of that schedule, total consulting costs (which includes the costs of the reports noted above) of $2.6M related to the CIR application are proposed to be amortized over the 2015-19 period.

b) Toronto Hydro used experience and professional judgment in determining which areas of the application would benefit by review and/or validation from external experts. Factors included guidance provided by the RRFE, what may be helpful to the OEB in understanding and assessing Toronto Hydro's application, and precedent from prior proceedings.

c) Toronto Hydro developed an initial high-level budget for this work, which it has updated periodically. The current budget for this work is included in OEB Appendix 2M (Exhibit 4A, Tab 2, Schedule 17). Please also refer to Toronto Hydro's response to interrogatory 4A-CCC-38 part (b).

d) Toronto Hydro did not conduct RFPs for the third party reports provided in this application. A variety of factors drove the selection process for the consultants who provided the reports in this application, including a limited pool of third party expertise and availability to undertake the work on the required timelines and Toronto Hydro's prior experience working with certain selected third parties. For example, Toronto Hydro selected Power System Engineering to prepare a report regarding econometric benchmarking because it has the relevant expertise, understanding of Ontario's regulated electricity sector, experience working in the regulated electricity distribution sector in Ontario as well as regulators and utilities in the United States, has worked with Toronto Hydro in relation to OEB empirical matters the past, and

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was able to undertake highly-specialized econometric and other modelling not readily available elsewhere in the required timeframe.

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INTERROGATORY 4:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, p. 4

The evidence states that the plans and proposals that Toronto Hydro has put forward in this application focus on delivering value-for-money to its customers. Please explain what is meant by "value-for-money" in this context.

RESPONSE:

Toronto Hydro strives to deliver value in the goods and services it provides to its customers. Toronto Hydro plans, constructs and operates its system efficiently and effectively and in compliance with applicable safety standards and regulatory requirements, while making it easier for customers to work with Toronto Hydro, helping them conserve energy, and providing them with the tools and technology to understand their electricity usage and bills.

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INTERROGATORY 5:

Reference(s): Exhibit 1A, Tab 2, Schedule S1, p. 7

"Toronto Hydro's distribution system includes a large and growing backlog of assets that are operating beyond their expected useful lives –an estimated 26% by 2015. If the utility were to invest in a minimal and reactive way (i.e., run-to-failure), this number is forecast to reach 32% by 2020 and reliability would likely deteriorate. (Toronto Hydro projects that a run-to-failure approach would result in SAIFI (System Average Interruption Frequency Index) worsening by approximately 30% and SAIDI (System Average Interruption Duration Index) worsening by approximately 24% from 2015U2019."

a) Please provide the source of the "run-to-failure" percentages.
b) Please provide the source of the changes to the SAIFI and SAIDI percentages above.

RESPONSE:

a) The run-to-failure percentages are based upon both Current-State System Analysis and the Long-Term System Review Process. Please refer to Exhibit 2B, Section D3.1.1.1 and Exhibit 2B, Section D3.1.1.2 for further detail on these processes.

b) The changes to SAIFI and SAIDI percentages presented in A2 are part of the Reliability Projection as outlined in Exhibit 2B, Section D3.1.2.1 (pages 19-20). Defective Equipment trending utilizes the FIM and Long-Term System Review Process to establish trends in failures at the asset level. With no new technology

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introduced into the system, certain cause code degradation is assumed using historical data.

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INTERROGATORY 6:

Reference(s): Exhibit 1A, /Tab 2, Schedule 1, pages 10/22

Pg. 10 "Toronto Hydro's approach to the planning that underlies this application entailed: (a) developing a proposed capital program that balances the needs of the distribution system with a level of rate increases that customers accept; and (b) building an Operations, Maintenance & Administration ("OM&A") plan that, following rebasing, requires the utility to operate with funding that is less than inflation for non-capital expenditures."

Pg. 22 "Toronto Hydro's OM A expense for the test year is $271.1 million, which represents an increase of $33.1 million, or 13.9%, from the utility's last rebasing in 2011. This translates into an average annual increase of approximately 3.3% over the 2011-2015 timeframe."

a) Is this average increase of 3.3% over the 2011-15 timeframe not above inflation?

RESPONSE:

a) Toronto Hydro notes that the above-mentioned 2015 Test Year forecast ($271.1 million) was updated to $269.5 million, as filed with the OEB on September 23, 2014. Accordingly, the updated variance between the last Rebasing Year (2011) and the Test Year (2015) is $31.5 million, or 13.2%.

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In the course of the update, the 2014 Bridge Year OM&A forecast was also updated from $250.2 million to $246.6 million. Accordingly, the updated variance in OM&A between the last Rebasing Year (2011) and the Bridge Year (2014) – the years when Toronto Hydro's rates were adjusted according to the OEB's IRM formula – is $8.5 million. This represents *an average increase of 1.1%*, which is 0.6% below the OEB-derived average inflation levels (1.7%) as calculated for the purposes of IRM rate adjustments in those years.

The updated average year-over-year increase between the last Rebasing Year (2011) and the Test Year (2015) is 3.2%. This value is above the average 2011-2014 inflation rate (1.7%). However, the 2015 Test Year amount contains a number of incremental expenditures associated with new, additional or evolving operational requirements and obligations, beyond those embedded in Toronto Hydro's current base rates.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 7:

Reference(s): Exhibit 1A, Tab 2, Schedule1, p. 13

"Toronto Hydro serves a broad and diverse customer base, with which it engages on a regular basis through ordinary-course interactions. In addition to these ordinary-course interactions, it reached out to its customers regarding the utility's capital plans for 2015-2019. The results of this exercise provided Toronto Hydro valuable insight into its customers' perceptions of the utility's priorities. Among other things, Toronto Hydro learned that customers' preferences align with the central pillars of the utility's capital plan.

a) Please explain what the "central pillars of the utility's capital plan" are.

RESPONSE:

a) The central pillars of Toronto Hydro's proposed capital plan include:
   i) the major drivers of investment during the CIR period (e.g., economic growth; aging infrastructure; public policy responsiveness) and
   ii) the asset management policies and objectives that led to the proposed capital expenditure plan, including, for example:
      a. replacing assets proactively (i.e., at their optimal intervention time) as opposed to adopting a broader run-to-failure policy;
      b. balancing large system renewal needs with non-system needs and opportunities to enhance customer value;

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c. addressing (a) and (b) at a pace that acknowledges customer expectations regarding price increases during the CIR period.

Through the Innovative Research Group ("Innovative") led customer engagement process (Exhibit 1B, Tab 2, Schedule 7, Appendix B), Toronto Hydro found that customer preferences are generally in alignment with these key pillars.

A comprehensive discussion of this process, how it was designed, and the results gathered, including Innovative's detailed report, can be found in Exhibit 1B, Tab 2, Schedule 7. For a detailed discussion of the alignment of Toronto Hydro's proposed DSP to the needs and preferences gathered through customer engagement, refer to Exhibit 2B, Section E2.4.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 8:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, p. 18

"Toronto Hydro's proposed Capital Expenditures over the 2015 to 2019 period include the following costs associated with renewable energy generation ("REG") connections:"
"Table 3: Renewable Enabling Improvements (REI) from 2015 to 2019 ($ Millions)"

a) What is the difference between REG and REI?

RESPONSE:

Section 2 of the *Electricity Act, 1998*[1] defines a "renewable energy generation facility" [REG] as,

> a generation facility that generates electricity from a renewable energy source and that meets such criteria as may be prescribed by regulation and includes associated or ancillary equipment, systems and technologies as may be prescribed by regulation, but does not include an associated waste disposal site, unless the site is prescribed by regulation for the purposes of this definition.

Section 1.2 of the Ontario Energy Board Distribution System Code defines a "renewable enabling improvement" [REI] as,

[1] S.O. 1998, c. 15, Sched. A

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a modification or addition to the main distribution system identified in section 3.3.2 that is made to enable the main distribution system to accommodate generation from renewable energy generation facilities.

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INTERROGATORY 9:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, p. 15
Exhibit 1A, Tab 2, Schedule 1, p. 24

"The majority of the capital programs are continuations of the work programs the OEB approved in the ICM application."

"For the 2015 test year, Toronto Hydro requests a base revenue requirement of $672.3 million, which represents an increase of $150.3 million, or 28.8%, from the base revenue requirement previously approved by the OEB in the utility's last rebasing application."

"The main drivers of the increase in base revenue requirement for the 2015 test year are the additions to rate base due to Toronto Hydro's significant capital program over the 2012-15 period, and an increase in OM&A expenses."

a) Are the 2012, 13 and 14 ICM programs not currently part of Toronto Hydro's significant capital program? How can the ICM be treated in separate proceeding under these circumstances?

RESPONSE:

Toronto Hydro's application treats 2015 as a standard rebasing year, consistent with the OEB's 4GIRM framework, which requires a utility to forecast its year-end PP&E for the bridge year, regardless of how those capital additions were funded in prior years (i.e., whether through base rates or through ICM). In other words, ICM capital additions are

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

treated no differently than any other capital additions for 2015, given that 2015 is a standard rebasing year. Toronto Hydro's forecast for its 2014 year-end and 2015 opening PP&E can be found in Exhibits 2A, Tab 1, Schedule 2, pages 4 and 5.

This approach to additions to ratebase is distinct from the requirements for the ICM True-Up process, which is a revenue-reconciliation process. In particular, the ICM True-Up process is designed to reconcile the variance between the revenue collected through ICM rate riders and the revenue requirement associated with actual in-service ICM amounts over the 2012-14 period. The difference between these amounts will be collected from or refunded to customers. In the OEB's Accounting Order, Toronto Hydro was instructed, at the time of true-up, to "recalculate the revenue requirement impacts… based on actual in-service assets… in Board-approved ICM segments". [1]

As noted in Exhibit 2A, Tab 9, Schedule 1,

> Toronto Hydro does not expect to be able to determine the required 2014 actual expenditures or ISA in concordance with the likely timeframe of this proceeding. Toronto Hydro therefore submits that the true-up of the 2012-2014 ICM activities is most appropriately undertaken in a separate proceeding from this application, following the determination of actual expenditures and ISAs for the full 2012-2014 ICM period.

For a full description of Toronto Hydro's proposal for ICM True-Up, including further details on the rationale for the process occurring in a subsequent proceeding, please see

[1] EB-2012-0064, Decision and Rate Order (May 9, 2013), at Appendix B page 2.

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Exhibit 2A, Tab 9, Schedule 1 and Toronto Hydro's response to interrogatory 2B-OEBStaff-39.

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INTERROGATORY 10:

Reference(s): Exhibit1A, Tab 2, Schedule 1, p.21

"The change in rate base is driven by an increase of approximately $1,026.1 million in the average net book value ("NBV") of property, plant and equipment ("PP E"), which is offset by a decrease of approximately $60.0 million in the working capital allowance ("WCA") component of rate base due to an updated WCA rate, as per Toronto Hydro's updated Lead Lag study. The growth in PP E includes investments Toronto Hydro has made under the ICM framework during the 2012-14 period, as well as the addition of street lighting assets into rate base.

a) Please explain how the Board can approve the above mentioned change in rate base if Toronto Hydro has not trued-up the ICM for 2012 – 14?

RESPONSE:

Please see Toronto Hydro's response to interrogatory 1A-CCC-9.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 11:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, p 26

Please provide the assumptions used with respect to consumption for each rate class on Table 8: Summary of Total Bill Impacts by Rate Class.

RESPONSE:

Consumption assumptions for each class in the referenced table are as follows:

Class	kWh, kW, kVA assumption
Residential	800 kWh
Competitive Sector Multi-Unit Residential	334 kWh
General Service < 50 kW	2,000 kWh
General Service 50-999 kW	150,000 kWh, 349 kW, 388 kVA
General Service 1,000-4,999 kW	800,000 kWh, 1,600 kW, 1,778 kVA
Large Use	4,500,000 kWh, 8,491 kW, 9,434 kVA
Street Lighting	60 kWh, 0.165 kW, 0.165 kVA
Unmetered Scattered Load	365 kWh

For a full set of detailed bill impacts for various consumption levels, please see Exhibit 8, Tab 7, Schedule 1 – Bill Impacts.

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INTERROGATORY 12:

Reference(s): Exhibit 1A, Tab 3, Schedule 1, p. 6

Toronto Hydro has provided a link to its Conditions of Service. Please indicate what changes have been made to the Conditions of Service since Toronto Hydro's last cost of service proceeding.

RESPONSE:

Please find attached the following summaries of changes that have been made to the Toronto Hydro's Conditions of Service since the utility's last rebasing application (EB-2010-0142):

- Appendix A – Revision Summary 10, effective January 1, 2011;
- Appendix B – Revision Summary 11, effective January 9, 2012;
- Appendix C – Revision Summary 12, effective January 7, 2013; and
- Appendix D – Revision Summary 13, effective May 1, 2014.

CONDITIONS OF SERVICE (2011 Rev.#10) REVISION SUMMARY		
Section	**Section Title**	**Summary of Changes to Toronto Hydro's Conditions of Service**
Front page		Revised date, revision number, and contact person.
Preface		Revised to inform a Revision Summary of the latest revisions to the Conditions of Service is posted on Toronto Hydro's website.
1	Introduction	Updated the table of contents.
2.1	Connections – Process and Timing	Inserted wording to refer to Reference document "Toronto Hydro Distributed Generation Requirements" for generation connection agreements.
2.1.2	Expansions / Offer to Connect	Deleted wording that referred to "enhancement costs".
2.1.2.1	Offer to Connect & Alternative Bid Work	Changed Reference document content and title to "Construction Contractor Pre-Qualification Application". Replaced the word "contestable" with "that is eligible for alternative bid".
2.1.2.2.1	Offer to Connect – Content & Process	Replaced the words "contestable" to "that is eligible for alternative bid", and "uncontestable" to "that is not eligible for alternative bid".
2.1.2.2.2	Transfer Price for Work that is Eligible for Alternative Bid	Revised section title. Replaced the word "contestable" with "that is eligible for alternative bid".
2.1.2.2.3	Final Economic Evaluation & Capital Contribution Settlement	Replaced the words "contestable" to "that is eligible for alternative bid", and "uncontestable" to "that is not eligible for alternative bid".
2.1.2.3	Expansion Deposit	Replaced the word "contestable" with "that is eligible for alternative bid".
2.1.7.4	Connection Agreements	Inserted wording to refer to Reference document "Toronto Hydro Distributed Generation Requirements" for generation connection agreements.
2.2.1	Disconnection & Reconnection – Process and Charges	Revised to reflect updated cost figures and the Harmonized Sales Tax, and the number of days after a disconnect notice is delivered. Inserted residential customers'conditions for disconnection notices.
2.3.6	Emergency Back-up Generation Facilities	Inserted wording to refer to Reference document "Toronto Hydro Distributed Generation Requirements" for back-up generation facilities.

2.3.7	Metering	Revised to refer to Reference document "Toronto Hydro Distributed Generation Requirements" for metering.
2.3.7.1.1	Metering Requirements for Multi-Unit Residential Rental Buildings and Condominiums	Replaced the word "contestable" with "that is eligible for alternative bid".
2.4.3	Deposits	Inserted residential customers' conditions for security deposits, and how security deposits affect good payment history.
2.4.5	Payments and Overdue Account Interest Charges	Inserted an equal monthly payment plan for residential customers.
3.5, 3.5.1 – 3.5.7	Embedded Generation Facilities	Deleted entire sections 3.5.1 – 3.5.7, and replaced the wording in section 3.5 to refer to Reference document "Toronto Hydro Distributed Generation Requirements" for generation connections.
3.6	Wholesale Market Participant	Replaced the wording in section 3.6 to refer to Reference document "Toronto Hydro Distributed Generation Requirements".
3.8.2	Traffic & Railway Crossing Signals and Pedestrian X-Walk Signals/Beacons	Revised to reflect updated basic connection costs and tax rate.
Section 4	Glossary of Terms	Revised and deleted terms.
Section 5 -Tables	Table2 – Service Connection and Disconnection Fee	Revised basic connection fee, and disconnection fee.
Section 5 - Tables	Table 3 – New or Upgraded Street Lighting Services – Point of Demarcation and Connection Charges	Revised basic connection fees.
Section 5 - Tables	Table 9 – Toronto Hydro Distribution Construction Standards Price List	Revised to reflect the harmonized sales tax.
Section 6 - References	Toronto Hydro Distributed Generation Requirements	Previous Reference document "Toronto Hydro Parallel Generation Requirements" is in the appendices of "Toronto Hydro Distributed Generation Requirements".
Section 6 - References	Construction Contractor Pre-Qualification Application	Revised document (version 1.5, dated February 1, 2010) to reflect a changed contact person and updated contact information.
Section 6 – References	Standard Toronto Hydro Connection Agreements – Terms of Conditions	Deleted four connection agreements from Reference document #2, and included these connection agreements into Reference document #3 (Toronto Hydro Distributed Generation Requirements).

CONDITIONS OF SERVICE Revision #11 (2012) **REVISION SUMMARY**		
Section	**Section Title**	**Summary of Changes to Toronto Hydro's Conditions of Service**
Front page		Revised date, and revision number.
1	Introduction	Updated the table of contents.
2.1.1.1	Connection Charges	Inserted "Table 1.4" to the second paragraph.
2.1.2.3	Expansion Deposit	Deleted reference to reducing the expansion deposit.
2.1.7.2	Implied Contract	Deleted third paragraph, which indicated who is responsible for payment.
2.1.7.5	Payment by Building Owner	Inserted third paragraph, which describes when an owner of property is responsible for payment.
2.2.1	Disconnection & Reconnection – Process and Charges	Inserted that a Timed Load Interrupter Device may be installed when a bill is unpaid. Revised disconnection and reconnection fees.
2.3.6	Emergency Backup Generation Facilities	Inserted paragraphs describing the conditions and requirements for Emergency Backup Generation Facilities on Toronto Hydro's system.
2.3.7.1.1	Metering Requirements for Multi-Unit Residential Rental Buildings and Condominiums	Inserted who are "authorized persons" as identified in Ontario Regulation 389/10. Revised to reflect "unit smart metering" and "unit sub-metering".
2.4.3	Deposits	Deleted last sentence in fifth paragraph regarding the amount of a bill, and deleted seventh paragraph regarding disconnection for an unpaid security deposit. Inserted bullet (f), additional criteria to when a security deposit may be waived.
2.4.5	Payments and Overdue Account Interest Charges	Inserted payment methods and interest charges, and payment plan options available to customers. Deleted last paragraph, which listed special charges. Deleted third paragraph, which statements are present in section 2.2.1.
3.2.3	Temporary Services (other than Residential)	Inserted second paragraph that Customer must provide a designated area to post Toronto Hydro information, and maintain a safe working site.
3.8	Unmetered Connections	Deleted civil infrastructure items and inserted statement regarding ownership and maintenance on assets, in the fifth paragraph.
3.8.1	Street Lighting	Deleted last sentence in first paragraph, which referred to Schedule of Rates.

3.8.2	Traffic & Railway Crossing Signals, Pedestrian X-Walk Signals/Beacons, Bus Shelters, Telephone Booths, CATV Amplifiers, TTC Switching Devices, and Miscellaneous Small Fixed Loads	Revised section title to include items from section 3.8.3. Revised service classification to be Unmetered Scattered Load class customers, ownership demarcation points, and basic connection fees.
3.8.3	Bus Shelters, Telephone booths, CATV Amplifiers, TTC Switching Devices, and Miscellaneous Small Fixed Loads	Deleted section 3.8.3 and combined it with section 3.8.2.
3.8.4	Other Loads (<2 kW) - Decorative Lighting and Tree Lighting Service	Section 3.8.4 is now section 3.8.3. Revised last paragraph to reflect terms and conditions as noted in section 3.8.2.
Section 4	Glossary of Terms	Inserted the term “timed load interrupter device” and “eligible low-income customer”.
Section 5 - Tables	Table 1.4 - Demarcation Points & Charges for Connection Assets and Disconnection	Added new table 1.4 to reflect unmetered connections.
Section 5 - Tables	Table 2 - Service Connection and Disconnection Fee	Inserted fees associated with unmetered connections.
Section 5 - Tables	Table 3 - New or Upgraded Street Lighting Services – Point of Demarcation and Connection Charges	Revised basic connection fees.
Section 5 - Tables	Table 7 - Instrument Transformers and Enclosures	Revised compartment dimensions.
Section 5 - Tables	Table 9 – Toronto Hydro Distribution Construction Standards Price List	Deleted Table 9.
Section 6 - References	Economic Evaluation Model for Distribution System Expansion	Updated reference document #1 (dated November 7, 2011). Updated to include the latest version of the Distribution System Code Appendix B “Methodology and Assumptions for An Economic Evaluation”, revised October 21, 2009.
Section 6 - References	Toronto Hydro Distributed Generation Requirements	Updated reference document #3 (Revision #1, dated December 8, 2011). Revisions included: updated application forms, added new and revised construction standards & sketches, added information regarding fit projects, revised emergency backup generation wording, deleted “Indirect Series Connection” section, and revised commissioning & testing requirements.

Section 6 - References	Toronto Hydro Requirements for the Design and Construction of Customer-Owned High Voltage Substations	Updated reference document #4 (Revision #4, dated August 15, 2011). Revisions included: updated table of contents, revised wording in sections (feeder termination, substation drawings, guarding of electrical equipment, separate compartments, hinged access doors, screen approval, types of cables and terminations, materials supplied by Toronto Hydro for PILC and polymeric cables, types of barriers, dual fuses, minimum ratings, grounding facilities, metallic parts, pilot wire protection and remote tripping, associated publications).
Section 6 - References	Toronto Hydro Requirements for the Design and Construction of Customer-Owned Structures	Updated reference document #5 (Revision #1, dated December 6, 2011). Revisions included: updated construction standards with the latest revisions, added new construction standards to the document.
Section 6 - References	Toronto Hydro Metering Requirements 750 Volts or Less	Updated reference document #6 (Revision #6, dated October 27, 2011). Revisions included: added new section “Specialty Sockets”, updated definitions, revised Appendix-Diagram #2 and compartment dimensions, grammatical corrections.
Section 6 - References	Toronto Hydro Metering Requirements for 13.8 kV & 27.6 kV Customer-Owned Substations	Updated reference document #7 (Revision #4, dated October 27, 2011). Revisions included: updated definitions, grammatical corrections.

CONDITIONS OF SERVICE Revision #12

REVISION SUMMARY

Section	Section Title	Summary of Changes to Toronto Hydro's Conditions of Service
Front page		Revised date, and revision number.
1.7.6	Repairs of Customer's Physical Structures	Revised contact information for customers to make arrangements prior to inspections.
2.1.4	Inspections Before Connections	Added a "Connection Authorization" is valid for a period of up to six months from the date of issue.
2.3.7.1	General	Revised the approval of meter sockets.
2.3.7.1.2	Main Switch and Meter Mounting Devices	Revised mounting dimensions for the placement of the customer's main switch.
3.1.1.1	Minimum Requirements	Revised the approval of meter sockets.
3.2.3	Temporary Services (other than Residential)	Revised the customer requirements which need to be performed prior to Toronto Hydro connecting the customer. Revised the meter socket installation requirements.
3.4.1	Electrical Requirements	Revised to include three-wire supply feeders.
Section 5 - Tables	Table 3 - New or Upgraded Street Lighting Services – Point of Demarcation and Connection Charges	Revised connection charges and point of demarcation.
Section 5 - Tables	Table 5 – Meter Sockets (Article 2.3.7.1.2)	Revised the approval of meter sockets.
Section 6 - References	Toronto Hydro Distributed Generation Requirements	Updated reference document #3 (Revision #2, dated August 15, 2012). Revisions included: Added (Section 3.5 "Control and Monitoring", appendix 6.3 (v) Net Metering Connection Application Guidelines"). Revised (cover page, table of contents, section 1.4 "Contact Information", section 4.7.4 "Commissioning and Testing", appendix 6.3 (i) "Embedded Generation Connection Application Form", appendix 6.3 (ii) "Connection Impact Assessment Generator Form", appendix 6.3 (iii) " MicroFIT Connection Application Guidelines and Form", appendix 6.3 (iv) "FIT Connection Application Guidelines", appendix 6.4 (iv) "Sketch of Commercial Feed-in Tariff Parallel Connection Outline", appendix 6.4 (vi) "Toronto Hydro Requirements and Recommendations for FIT Projects", appendix 6.4 (vii) "Distribution Availability Test (DAT) Information").

CONDITIONS OF SERVICE Revision #12 REVISION SUMMARY		
Section	**Section Title**	**Summary of Changes to Toronto Hydro's Conditions of Service**
Section 6 - References	Toronto Hydro Metering Requirements 750 Volts or Less	Updated reference document #6 (Revision #7, dated July 24, 2012). Revisions included: Added (section 8 "Metering Requirements for Multi-Residential Buildings", Diagram #5 "Typical Single Building Condominium with Toronto Hydro Suite Metering", definition "Meter-Mounting Devices"). Revised (cover page, index, section 7.2.2 "Meter Instrument Transformer Enclosures", Table I "Minimum Meter Cabinet Size for Meters and Approved Meter Sockets", section 7.5.1 "General", section 7.9.1 "Customer Supplied Equipment", section 7.9.3 "Rating", section 7.12.8 "Specialty Meter Sockets").

CONDITIONS OF SERVICE Revision #13

REVISION SUMMARY

Section	Section Title	Summary of Changes to Toronto Hydro's Conditions of Service
Front page		Revised date, and revision number.
Table of Contents		Deleted section 1.7.5 Repairs of Defective Customer Electrical Equipment. Section 1.7.6 re-numbered as 1.7.5 and re-titled as Customer Owned Equipment, Infrastructure, and Property.
1.7.5	Customer Owned Equipment, Infrastructure, and Property	Revised by combining previous sections 1.7.5 and 1.7.6 to indicate customers are responsible to repair and maintain customer owned facilities.
2.1	Connections - Process and Timing	Revised to include reference to Design Pre-payments, and there are different types of an offer to connect.
2.1.2	Expansions / Offer to Connect	Revised with statements referring to Offer to Connect agreements related to expansion work, and regarding charges related to renewable energy generation connections.
2.1.2.1	Offer to Connect & Alternative Bid Work	Revised to indicate: - a formal Offer to Connect will be offered only when there is expansion type work - identify what part of the work is eligible for alternative bid - define what type of work is considered "Additional Alternative Bid Costs" - when an Offer to Connect may be revoked - upon accepting an Offer to Connect the customer shall pay certain payments
2.1.2.2.1	Offer to Connect – Content & Process	Revised the wording in clause (f) from "additional costs for alternative bid work" to "Additional Alternative Bid Costs". Deleted the wording in clause (h) that refers to collecting 10% as the expansion deposit for alternative bid work.
2.1.2.2.2	Transfer Price for Work that is Eligible for Alternative Bid	Revised how the transfer price for work that is eligible for alternative bid is determined, and when Toronto Hydro assumes ownership of the work completed through alternative bid.
2.1.2.2.3	Alternative Bid Final Economic Evaluation & Capital Contribution Settlement	Revised to indicate in the case of alternative bid, how the Capital Contribution amount will be determined.
2.1.2.3	Expansion Deposit	Revised to describe: - an expansion deposit may be required from the customer - the expansion deposit amount that will be collected from the customer for alternative bid work - what the expansion deposit collected can be used for - retaining 10% of the expansion deposit for warranty - when the realization period ends for residential developments that are combined with commercial or industrial developments - how the expansion deposit may be returned to the customer

CONDITIONS OF SERVICE Revision #13 REVISION SUMMARY		
Section	**Section Title**	**Summary of Changes to Toronto Hydro's Conditions of Service**
2.1.2.5	Rebates of Capital Contribution	Revised to describe the mechanism on how the capital contribution is rebated to the customer.
2.2.1	Disconnection & Reconnection – Process and Charges	Revised disconnection and reconnection charges.
2.3.4.2	Supply Voltage	Revised the conditions when a customer is required to provide transformation facilities on private property and is unable to do so.
2.3.5	Voltage Guidelines	Revised to include two-phase, three wire 120/208 V connection.
3.8.2	Traffic & Railway Crossing Signals, Pedestrian X-Walk Signals/Beacons, Bus Shelters, Telephone Booths, CATV Amplifiers, TTC Switching Devices, and Miscellaneous Small Fixed Loads	Revised the cost structure for overhead and underground unmetered scattered load connections.
Section 4 – Glossary of Terms	Glossary of Terms	Revised the definition of "residential service". Added the definitions of "competitive sector multi-unit residential service" and "residential customer".
Section 5 - Tables	Table 1.4 Demarcation Points & Charges for Connection Assets and Disconnection	Revised the cost structure for overhead and underground unmetered scattered load connections.
Section 5 - Tables	Table 2 Service Connection and Disconnection Fee	Revised the cost structure for overhead and underground unmetered scattered load connections, and disconnection charges for class 3A customers.
Section 6 - References	Toronto Hydro Distributed Generation Requirements	Updated reference document #3 (Revision #3, dated November 28, 2013). Added (terms added to "Glossary of Terms", new Appendix 4 (viii) "Distributed Generation Monitoring and Control Requirements") Revised content in sections (3.2 "Emergency Backup Generation Technical Requirements", 3.5 "Control and Monitoring", 4.3.1 "Offer to Connect", 3.5.3.3. "Medium and Protocol", 4.4.1.2 "Removal of Capacity Allocation", and 4.4.2.1 "Connection of Micro-Generation Facilities"), and to appendices (Appendix 3(i) - Embedded Generation Connection Application Form, Appendix 3(ii) - Connection Impact Assessment Generator Form, Appendix 3(iii) - MicroFIT Connection Application Guidelines and Form, Appendix 3(iv) - FIT Connection Application Guidelines, and Appendix 4(vi) - Toronto Hydro Requirements and Recommendations for FIT Projects).

CONDITIONS OF SERVICE Revision #13 REVISION SUMMARY		
Section	**Section Title**	**Summary of Changes to Toronto Hydro's Conditions of Service**
Section 6 - References	Construction Contractor Pre-Qualification Application	Updated reference document #8 (Version 2.1, dated August 12, 2013). Revised content in "Selection of Contractors" and "Enquiries", and in section 6 "Health and Safety Information.
Section 6 - References	Toronto Hydro Requirements for the Design and Construction of Customer-Owned High Voltage Substations	Updated reference document #4 (Revision #6, dated December 17, 2013). Added new section 5.2 "incoming Supply", Table 6 Sketches Applicability Matrix, and new sketches 1(C-2), 1(E-2), 1(F-2), 1(H-2), 1(J-1), 1(J-2) and 1(J-3). Deleted section 9.17.6 "Incoming Circuit Breaker and Isolating Switch". Revised sections 5.1.3 "Dedicated Feeder Supply", 5.3 "Automatic Load Transfer (Automatic Transfer Switch)", 6.5 "Compliance with Requirements", 8.2.1 "Means of Egress and Exit Door Requirements", 8.3 "Cable Pulling", 8.4 "Cable Racks and Conduits", 8.6.6 "Illumination of Equipment", 9.9 "Lighting Arresters", 9.17.2 "Incoming Isolating Switch", and Isolating Switch", and 9.17.8 "Incoming Circuit Breaker and Isolating Switch", and sketches 1(A-1), 1(D-1), 1(E-1), 1(F-1), 1(G-1), 1(H-1), 1(I-1) and 5(A-1).
Section 6 - References	Toronto Hydro Requirements for the Design and Construction of Customer-Owned Structures	Updated reference document #5 (Revision #2, dated February 4, 2014). Revised the following Customer-Owned Structures documents: 1. 31-6000 Rev.4 Design and Construction Requirements 2. 31-6010 Rev.5 Vault Design Requirements 3. 31-6020 Rev.7 Above-Grade Walk-In Vault 4. 31-6030 Rev.8 Below-Grade Walk-In Vault 5. 31-6040 Rev.3 Stair and Access Well Detail For Below-Grade Vaults 6. 31-6050 Rev.3 Louver Details For Vent Openings 7. 31-6060 Rev.2 Bird Screen Details 8. 31-6070 Rev.3 Cable Pull Rooms Typical Installation of High and Low Voltage Cables 9. 31-6080 Rev.4 4.16 kV – 13.8 kV Transformer Vaults Added new Customer-Owned Structures document number 31-6035 Rev.1 Above-Grade Walk-In or Below-Grade Switching Vault.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 13:

Reference(s): Exhibit 1A

Toronto Hydro is currently engaged in the Central Toronto Regional Planning Process and other Regional Plans involving Toronto Hydro will be initiated over the next several years. Please explain what is involved in the current Central Toronto Regional Planning process. To what extent does Toronto Hydro have costs included in its forecasts related to this process? Please explain how that process, or other Regional Planning initiatives may impact the plans and priorities which are the basis for this application.

RESPONSE:

The Central Toronto Regional Planning Process is described in detail in Exhibit 2B, Section B2.1. The purpose of the Integrated Regional Resource Plan ("IRRP") is to ensure that the electricity service requirements of central Toronto are served by an appropriate combination of demand and supply options that reflect the priorities of the community. Planning activities include forecasting the expected growth in electricity demand for the next 25 years, investigating the costs and benefits of conservation, distributed generation, and transmission and distribution options in meeting the future electricity needs of customers in the central Toronto area. The outcome of the planning process will be an integrated plan, with a long-term perspective, which recommends a balance of options that account for costs, reliable electricity service, and mitigation of environmental impacts.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

The impact of the IRRP is discussed in Exhibit 2B, Section E1.4. The IRRP is still in progress but the Ontario Power Authority ("OPA") has confirmed a long identified issue of capacity shortfalls in the Runnymede TS, Manby TS and Copeland TS areas. Toronto Hydro has been planning remedies for these shortfalls and has discussed and shared alternatives with the OPA and Hydro One Networks Inc. ("HONI") as part of the planning effort. The projects contained within the Stations Expansion capital investment program, further detailed in Exhibit 2B, Section E7.9, reflect the regional planning consultations to date for Central Toronto.

RESPONSES TO CONSUMERS COUNCIL OF CANADA INTERROGATORIES

INTERROGATORY 14:

Reference(s): **Exhibit 1A**

PARTIAL Decision and Order – EB-2012-0064 April 2, 2013

Pg.75 "With respect to the "trueUp" of ICM capital spending and rate riders, the Board notes that the policy does not specifically speak of a true-up. Rather the policy requires reporting of the actual spend on the approved ICM projects versus what was approved by the Board. The Board, at the time of rebasing, whether this is through a cost of service review as part of 4th Generation IR, or through a Custom IR application, will determine whether any overspending should be allowed in rate base, or whether any underspending should be returned to ratepayers.

The Board does share the concerns of certain Intervenors that the monies allocated for ICM projects must be tracked separately and reported separately. Unlike the "envelope" approach often adopted in cost-of-service proceedings, the monies must be reported per project segment as outlined above."

a) Please provide the separate tracking and reporting for each element of the ICM that was part of the decision.

RESPONSE:

a) Please see Toronto Hydro's response to interrogatory 1B-SEC-9.

RESPONSES TO SCHOOL ENERGY COALITION INTERROGATORIES

INTERROGATORY 1:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 3

Please confirm that the Applicant plans to continue capital spending at forecast levels beyond 2019. Please advise at what point in the future capital expenditures are expected to get below 150% of annual depreciation.

RESPONSE:

As explained in Exhibit 2B, Section E2, Toronto Hydro faces a significant backlog of assets operating beyond economic end-of-life. While it would be economically optimal to renew these assets as quickly as possible, doing so entirely within the five-year CIR period would be infeasible from both a rate impact and program execution perspective.

The "paced" capital investment strategy proposed in this application is intended to address renewal needs (and other important capital needs/opportunities) in a manner that is sensitive to execution capacity and customer expectations. As a result of the proposed pace of investment during the CIR period, Toronto Hydro anticipates that capital expenditures will continue, past 2019, at levels comparable to those within the 2015-2019 period. However, actual expenditure levels post-2019 will depend on numerous factors including, but not limited to, system and equipment reliability performance, load growth capacity requirements, City and regional development trends, external demand requirements and rate impacts.

RESPONSES TO SCHOOL ENERGY COALITION INTERROGATORIES

Toronto Hydro does not have a specific forecast of when future capital expenditures will be below 150% of depreciation; however, the utility notes that the timing of this event depends not only on the size of its capital program, but also the size of its depreciation expense. While Toronto Hydro anticipates that capital expenditure needs of approximately $500M/year will persist for some time due to system renovation requirements, as the system is renewed, the utility's depreciation levels will increase. As a result, Toronto Hydro expects that the rate impacts associated with its capital program will begin to stabilize such that over time, its ordinary annual capital expenditures will be closer to depreciation, and thus the utility will generally need less incremental capital funding over and above IRM levels.

RESPONSES TO SCHOOL ENERGY COALITION INTERROGATORIES

INTERROGATORY 2:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 23

Please identify the component in each of the drivers in Table 7, in each year, that is caused by changes in accounting rules or principles, either due to external changes, or due to a change in accounting method. For each such amount, please identify the accounting change or method that caused the impact.

RESPONSE:

None of the significant cost drivers identified in Table 7 was a result of a change in accounting rules or principles, either due to external changes or due to a change in accounting method.

RESPONSES TO SCHOOL ENERGY COALITION INTERROGATORIES

INTERROGATORY 3:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, p.29

Please confirm that, in the current Application, the Applicant is only seeking to set rates for four years and eight months.

RESPONSE:

Confirmed. As indicated in Exhibit 8, Tab 1, Schedule 1, section 4.0, Toronto Hydro is seeking rates related to the 2015 rebasing year to be effective May 1, 2015. Rates for the 2016 year under the proposed custom Price Cap would be effective January 1, 2016.

RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORIES

INTERROGATORY 1:

Reference(s): Exhibit 1, all

a) For all adjustments made as part of the interrogatory process please provide a tracking table showing the adjusted revenue requirement, the category under which the adjustment is made (rate base, OM&A etc.) and a reference to the interrogatory for which that change was made. An example of this form of table is shown below.

Reference	Item	Regulated Return on Capital	Regulated Rate of Return	Rate Base	Working Capital	Working Capital Allowance	Amortization	PILs	OM&A	Service Revenue Requirement	Base Revenue Requirement	Gross Revenue Deficiency
OEB IR# 24 (a) & (b)	**Original Submission August 2010**	**$10,824,124**	**7.08%**	**$152,808,317**	**$125,598,185**	**$18,839,728**	**$7,816,331**	**$1,212,310**	**$10,183,838**	**$30,036,603**	**$28,980,640**	**$5,012,440**
EP IR# 13 (e)	Adjust Infrastructure Ontario Debt to 1 Day Change	**$11,168,599** $344,475	**7.31%** 0.23%	**$152,808,317** $0	**$125,598,185** $0	**$18,839,728** $0	**$7,816,331** $0	**$1,212,310** $0	**$10,183,838** $0	**$30,381,077** $344,475	**$29,325,115** $344,475	**$5,356,914** $344,475
EP TCQ # 9 & EP IR # 19 (a)	PILs Correction - Input Error - Bldg amount in Class 1b Change	**$11,168,599** $0	**7.31%** $0	**$152,808,317** $0	**$125,598,185** $0	**$18,839,728** $0	**$7,816,331** $0	**$1,213,484** $1,175	**$10,183,838** $0	**$30,382,252** $1,175	**$29,326,289** $1,175	**$5,358,089** $1,175
EP TCQ # 9 & VECC TCQ # 1 (b) & (c)	AFUDC Rate on Capitalized Interest Change	**$11,196,054** $27,455	**7.31%** $0	**$153,183,959** $375,642	**$125,598,185** $0	**$18,839,728** $0	**$7,823,920** $7,589	**$1,213,336** -$148	**$10,183,838** $0	**$30,417,147** $34,896	**$29,361,185** $34,896	**$5,392,984** $34,896
EP IR # 11 (b) & VECC TCQ # 1 (a)	Adjust Purchase kWh for CDM Adjmts Change	**$11,196,054** $0	**7.31%** $0	**$153,183,959** $0	**$125,598,185** $0	**$18,839,728** $0	**$7,823,920** $0	**$1,213,336** $0	**$10,183,838** $0	**$30,417,147** $0	**$29,361,185** $0	**$5,279,238** -$113,746
	Adjust Purchase kWh for CDM Adjmts @ Application Power Rates Change	**$11,204,832** $8,778	**7.31%** $0	**$153,304,058** $120,099	**$126,398,846** $800,661	**$18,959,827** $120,099	**$7,823,920** $0	**$1,215,199** $1,863	**$10,183,838** $0	**$30,427,788** $10,641	**$29,371,826** $10,641	**$5,289,879** $10,641
VECC TCQ # 1 (b) & (c)	Adjust Oct 15/10 Navigant Numbers, Power, GA & $68.38 RPP Rates Change	**$11,202,097** -$2,735	**7.31%** $0	**$153,266,641** -$37,417	**$126,149,397** -$249,449	**$18,922,410** -$37,417	**$7,823,920** $0	**$1,214,619** -$580	**$10,183,838** $0	**$30,424,473** -$3,315	**$29,368,510** -$3,315	**$5,286,564** -$3,315
Decision EB-2010-0002	Adjust NW & CN kW for Purchase & CDM Adjmts Change	**$11,212,740** $10,642	**7.31%** $0	**$153,412,249** $145,608	**$127,120,117** $970,720	**$19,068,018** $145,608	**$7,823,920** $0	**$1,216,877** $2,259	**$10,183,838** $0	**$30,437,374** $12,901	**$29,381,412** $12,901	**$5,299,465** $12,901
OEB IR # 21	Adjust NW & CN kW for IESO & HONI January 1, 2011 Price Increases Change	**$11,221,588** $8,848	**7.31%** $0	**$153,533,306** $121,057	**$127,927,161** $807,044	**$19,189,074** $121,057	**$7,823,920** $0	**$1,218,755** $1,878	**$10,183,838** $0	**$30,448,100** $10,726	**$29,392,137** $10,726	**$5,310,191** $10,726
EP IR 23 (c) / 29 (a) & (b)	OMERS increase for 2012 & 2013 Change	**$11,222,972** $1,384	**7.31%** $0	**$153,552,243** $18,938	**$128,053,411** $126,250	**$19,208,012** $18,938	**$7,823,920** $0	**$1,219,049** $294	**$10,310,088** $126,250	**$30,576,028** $127,928	**$29,520,065** $127,928	**$5,438,118** $127,928
EP TCQ 14 (a)	Removal of Street Light Return & PILs Change	**$11,222,972** $0	**7.31%** $0	**$153,552,243** $0	**$128,053,411** $0	**$19,208,012** $0	**$7,823,920** $0	**$1,219,049** $0	**$10,310,088** $0	**$30,576,028** $0	**$29,586,071** $66,006	**$5,504,124** $66,006
EP IR 40 & EP TCQ 21 (a)	PILs - Computer Hardware to Correct CCA Account Change	**$11,222,972** $0	**7.31%** $0	**$153,552,243** $0	**$128,053,411** $0	**$19,208,012** $0	**$7,823,920** $0	**$1,193,531** -$25,518	**$10,310,088** $0	**$30,550,510** -$25,518	**$29,560,553** -$25,518	**$5,478,606** -$25,518
EP IR 41 / EP TCQ 21(b)	PILs - Land Rights CCA Change	**$11,222,972** $0	**7.31%** $0	**$153,552,243** $0	**$128,053,411** $0	**$19,208,012** $0	**$7,823,920** $0	**$1,192,976** -$555	**$10,310,088** $0	**$30,549,955** -$555	**$29,559,998** -$555	**$5,478,051** -$555

RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORIES

RESPONSE:

Please see table below. The only identified changes were a minor increase to PILs and an increase to total Revenue Offsets.

Summary of Changes ($M)

Reference	Item	Rate Base	Working Capital Allowance	Amortization	PILs	OM&A	Service Revenue Requirement	Revenue Offsets	Base Revenue Requirement	Gross Revenue Deficiency
Original Submission	23-Sep-14	3,312.4	241.7	208.2	22.4	265.1	707.3	45.1	662.2	-107.4
OEB Staff 78	Changes to Ontario Small Business Tax	3,312.4	241.7	208.2	22.5	265.1	707.4	45.1	662.3	-107.5
Change ($)					**62,680**		**62,680**		**62,680**	**62,680**
3-SIA-30	Correction to Revenue Offsets from Specific	3,312.4	241.7	208.2	22.5	265.1	707.4	46.1	661.4	-106.6
Change ($)								**963,700**	**-963,700**	**-963,700**
Revised Submission	14-Nov-14	3,312.4	241.7	208.2	22.5	265.1	707.4	46.1	661.4	-106.6
Change ($)					**62,680**		**62,680**	**963,700**	**-901,020**	**-901,020**

RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORIES

INTERROGATORY 3:

Reference(s): Exhibit 1A, Tab 2, Schedule 1, page 27

a) Please provide the THESL's CPI actual/forecast for each of the years 2012 through 2019. Please provide the source for these figures.

RESPONSE:

Please refer to response to interrogatory 2A-SEC-14, part b.

RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORIES

INTERROGATORY 4:

Reference(s): Exhibit 1A

a) Based on THESL's current forecasts please provide a chart showing the annual bill of a residential customer at 1000kWh/month for each of the years 2010 through 2019. Please show the forecast/assumptions.

b) Please prepare a graph which compares this annual amount to the actual and forecast CPI.

RESPONSE:

a) The table below shows the annual bill of a residential customer at 1,000 kW from 2010 to 2019:

Year	Annual Residential Bill*	Percentage Increase
2010	$1,615.56	N/A
2011	$1,663.68	3.0%
2012	$1,757.28	5.6%
2013	$1,871.16	6.5%
2014	$1,949.94	4.2%
2015	$1,978.51	1.5%
2016	$2,256.93	14.1%
2017	$2,303.31	2.1%

RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORIES

Year	Annual Residential Bill*	Percentage Increase
2018	$2,386.97	3.6%
2019	$2,413.41	1.1%

Annual residential bills are calculated with the following assumptions:

i) Annual bill is calculated based on average Time-of-Use rates and OEB-approved distribution rate order of the calculating year.

ii) Annual bill includes applicable taxes (GST/HST) & Ontario Clean Energy Benefit which commenced January 1, 2011 and is assumed to expire on December 31, 2015.

iii) Where applicable, 1,000 kWh is adjusted for the OEB-approved Total Loss Factor of 3.76% for Toronto Hydro to obtain the appropriate billing determinant.

iv) Global Adjustment and any OEB approved Global Adjustment rate riders are not applicable to the Residential class on Time-of-Use rates.

v) The May 1, 2014 Time-of-Use rates are used in the calculation of the annual bill from 2014-2019, consistent with Bill Impact tables in Exhibit 8A, Tab 7, Schedule 1.

b) The graph below compares the Residential Annual Bill percentage increases and the Toronto CPI percentage increases, from 2011 to 2019.

RESPONSES TO VULNERABLE ENERGY CONSUMERS COALITION INTERROGATORIES