Hydro One Logo

# Renewable Energy Generation Facility

# Application to Request a Connection Assessment

**This *application* streamlines the connection assessment process for renewable energy generation facilities. It is considered complete when:**

This is an application to the Independent Electricity System Operator (“*IESO*”) and to your transmitter (“*Hydro One*”) REQUESTING a connection assessment FOR your proposed new or modified CONNECTION TO THE *IESO*-CONTROLLED GRID. This is not an application for an LDC connection impact assessment.

MCj04247780000[1] The *IESO* is in receipt of your **System Impact Assessment** (“*SIA*”) and **Customer Impact Assessment** (“C*IA*”) questionnaires, attached hereto, completed with all necessary data;

MCj04247780000[1] The *IESO* and *Hydro One* are in receipt of your impact assessment payments;

MCj04247780000[1] The *IESO* is in receipt of your executed *SIA* agreement which will be provided to you within two business days of the IESO receiving this application;

MCj04247780000[1] If you are an electricity LDC applying on behalf of a generator, your LDC connection impact assessment report has been received by the *IESO*; and

MCj04247780000[1] If you have retained a consultant to perform the SIA studies on your behalf, the consultant’s studies have been received by the *IESO* in their final form and satisfactory to the *IESO.*

**Note:** Did you retain a consultant to perform the SIA studies? Yes  No

**Upon completing this *application* form, please send it to the *IESO*:**

**By** **Email to:** [connection.assessments@ieso.ca](mailto:connection.assessments@ieso.ca)

To the extent possible, the documents and drawings should be submitted in .pdf format. Signed documents should be scanned in .pdf format. Connection applicants intending to send documents in a different format are encouraged to contact the IESO in advance.

Hard copies of the application forms and supporting documents are not required. Where the supporting documentation (e.g. single line diagram) is not suitable for email submission, it should be submitted by mail or courier to the following address:

**By Courier to: Independent Electricity System Operator**

2635 Lakeshore Rd. West

Mississauga, ON

L5J 4R9

**Attn: Connection Assessments**

## About Your Connection Assessment

Your connection assessment will consist of a system impact assessment to be performed by the *IESO* in accordance with the *IESO’s* *market rules* and acustomer impact assessment to be performed by *Hydro One* in accordance with the Ontario Energy Board’s Transmission System Code.

The *IESO* will provide you with the final connection assessment for your proposed new renewable generation facility(the “*project”*) within 150 days of receiving your completed *application.* The *IESO* will promptly advise you of the date on which your *application* is considered to be “complete”.

**To ensure that your connection assessment is carried out within the prescribed time, the *IESO* and *Hydro One* intend to work closely with you.**

## SIA and CIA Questionnaires

The SIA and CIA questionnaires included in this *application* form identify the specific pieces of data that the *IESO* and *Hydro One* consider essential (and those that are considered not essential) prior to undertaking the connection assessment for your *project*. Your *application* will not be considered complete until all essential data pertaining to your *project* is provided.

If, at the time you file your *application*, you do not have the actual values for your *project* for the pieces of data that are considered not essential, the *IESO* or *Hydro One*, as applicable, will use typical (and generally conservative) values as a proxy. In such instances, it will be your responsibility to ensure that the *project* (and, specifically, the equipment that is eventually installed) meets or exceeds the typical values.

Applicants are encouraged to use this form for the assessment of spare equipment on site or on order from manufacturers to replace major components (e.g. main power transformers, turbine components, inverters etc.) in case of failure or while undergoing refurbishments.

## Use of Information

The information that you submit with this *application* will be used by the *IESO* and *Hydro One* in support of their obligations under the *Electricity Act, 1998*, the *Ontario Energy Board Act, 1998,* the *IESO*’s *market rules*, the Transmission System Code and their respective licenses. Your information will be treated in accordance with the standards, procedures, and confidentiality policies of the *IESO* and *Hydro One*.

By submitting this *application*, you consent to the sharing of your information between the *IESO* and *Hydro One* and agree to the posting of such information on the *IESO’s* website in accordance with the *market rules*.

## Next Steps

The *IESO* and *Hydro One* intend to work closely with you. Please take note of the following key next steps in your connection assessment process for your proposed new renewable generation facility.

1. Within two business days from receiving your *application*, the *IESO* will provide you with an *SIA* agreement (you can find the [template of the *SIA* agreement](http://ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-manuals/connecting/IMP-AGR-0002-SIA-Agreement.pdf?la=en) on [the FIT page of the *IESO* web site](http://www.ieso.ca/en/Sector-Participants/Feed-in-Tariff-Program/Overview)). You will be required to execute the *SIA* agreement and promptly return it to the *IESO*.
2. Your *application* will be reviewed by the *IESO* and *Hydro One* for completeness. Within ten days of having received your *application*, the *IESO* will contact you to confirm whether it is complete or incomplete. If it is considered incomplete, the *IESO* will also provide you with the details of the incomplete piece(s) of data. If significant data is missing, the *IESO* may require that you submit a new *SIA* and *CIA* questionnaire(s) containing all of the essential information. **In the event that you submit new or modified data subsequent to the filing of your *application*, your *application* will be deemed complete effective as of the date that the last relevant document or material change is received by the *IESO*.**
3. Within 75 days from having received your complete *application*, the *IESO* will provide a list of *SIA* requirements to *Hydro One*, who shall then be in a position to proceed with the *CIA*. You will be required to have an executed *CIA* Agreement with *Hydro One* in place as of that date.

## Part 1 – General Information

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| **Provide the following information about the connection assessment *applicant*:** |
| Organization Name (Generator): |
| Organization Short Name: (Maximum 12 keystrokes): |
| *Project* Name[[1]](#footnote-1): |
| OPA/IESO Reference Number: |
| Location of *Project*: |

|  |  |
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| **Authorized Representative** | |
| Name: | |
| Position/Title: | |
| Company: | |
| Address: | |
| City/Town: | |
| Province/State: | |
| Postal/Zip Code: | Country: |
| Telephone No.: | Fax No.: |
| Email Address: | |
| *Hydro One* Account Number:  (Only for existing customers intending to install generation for load displacement.) | |

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| Primary Contact | |
| Name: | |
| Position/Title: | |
| Company: | |
| Address: | |
| City/Town: | |
| Province/State: | |
| Postal/Zip Code: | Country: |
| Telephone No.: | Fax No.: |
| E-mail Address: | |

## Part 2 – Payment of Applicable Deposit ($30,000 for transmission Connected Facility Or $20,000 for Embedded Generation Facility) to IESO for System Impact Assessment (SIA)

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| Method of Payment (choose one) | | |
| Certified cheque payable to the *IESO* | Attached | |
| Deposit to *IESO* Account | Receipt Attached | |
| Electronic Wire Payment to *IESO* Account | Receipt Attached | |
| For direct deposit or electronic wire payments, reference the following *IESO* account:  **TD Bank, Institution ID # 0004, Transit # 10202, Account # 0690-0429444** | | |
| **Purchase Order (PO) #** (if applicable) | | (The PO # will be referenced on the final invoice and is not a replacement for the deposit) |

## Part 3 – Payment of $15,000 (Plus HST) Fee to Hydro One for Customer Impact Assessment (CIA)

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| Method of Payment (choose one) | |
| Deposit to *Hydro One* Account | Receipt Attached |
| Electronic Wire Payment to *Hydro One* Account | Receipt Attached |
| **Purchase Order #** (if applicable)  For direct deposit or electronic wire payments, reference the following *Hydro One* account:  **TD Bank, Toronto, Institution ID # 0004, Transit # 10202, Account # 0690-5202411, SWIFT code TDOMCATTTOR** | |

## Part 4 – Certification

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| The *applicant* has read, understands and agrees with the foregoing and hereby declares that the information submitted in this *application* is complete and accurate to the best of the *applicant’s* knowledge. By signing below, the undersigned represents having the authority to make this *application* on behalf of the *applicant.* | | |
| Name (Please Print) |  | Title |
| Signature |  | Date |

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| Generic Information | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| Facility Type | ***Specify if generation facility will be registered as self-scheduled, intermittent or dispatchable.*** |  |
| Intent of Generation | *Specify if the facility will be used as load displacement or for sale of electricity.* |  |
| *Project* Dates | *Start of construction* |  |
| ***Electrical backfeed (energized stations)*** |  |
| *In-service dates (first synchronization of each unit)* |  |
| ***Commercial in-service date*** |  |
| **Protection System Description** | ***An overview of the protective relaying schemes to be employed together with an explanation of the manner in which they are to be deployed.***  ***A simplified tripping matrix as per schedule E, exhibit E-2 of the Transmission System Code (TSC), appendix 1 for generator customers.*** | Attach file |
| **Operating Philosophy** | ***An overview explaining how the facility will be operated outlining possible operating modes. Include details on generation facility start-up procedure. Indicate if the generation facility is subject to any common mode of failure (loss of station service or failure of a single element: bus, breaker, transformer, pump, etc. that forces the entire generation facility out of service) that cannot be identified on the facility’s single line diagram.*** | Attach file |
| **Detailed Single-Line Diagram(s)** | ***A detailed single-line diagram showing the equipment and the protection and telemetry points. The locations of the proposed connections on to existing lines, or into existing transformer/switching stations, are also to be included.***  ***Details are to be included of any existing facilities that are to be replaced or removed from service. Out-of-service dates are to be provided whenever these do not coincide with the in-service dates for the new facilities.***  ***Provide details of LDCs between the generator and the transmission system.*** | Attach file |
| **Geographic Map including GPS Coordinates** | ***A large-scale map or drawing showing the location of the exact point of the proposed interconnection with Hydro One facilities (or other transmitters including lot number and concession number for the project).***  ***Attachments for wind farm projects must include the configuration and grouping of individual units, including GPS coordinates of each turbine, physical dimensions and turbine nomenclature.*** | Attach file |
| **Collector System** | ***a. Does your project require you to establish joint use on Hydro One poles? (i.e. generator’s collector lines attached to Hydro One poles on municipal right of way, to the PCC)?***  ***b. If you answer No to “a” above, is your project going to own poles + wires on municipal right of way?*** | Yes  No  Yes  No |
| **Control Schemes** | ***Describe any control schemes that are to be used to automatically change the tap positions for any of the transformers, or to automatically switch into-service or out-of-service any reactive compensation devices.*** | Attach file |

All files and diagrams provided as attachments are to be signed and sealed by a Professional Engineer.

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| Generation Facilities - Synchronous | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Unit Data**  Complete one table for each different type of generator  **Note**:  For wind and solar farms facilities, use the next section | ***Number and identifier of identical units (e.g., 3 units - G1, G2, G3)*** | | | | | | | |  | | | | |
| Manufacturer | | | | | | | |  | | | | |
| ***Type (e.g. salient pole, round rotor, induction, inverter based, e.g. solar)*** | | | | | | | |  | | | | |
| ***Frequency (Hz)*** | | | | | | | |  | | | | |
| Speed (RPM) | | | | | | | |  | | | | |
| ***Machine base (MVA)*** | | | | | | | |  | | | | |
| ***Rated voltage (kV)*** | | | | | | | |  | | | | |
| ***Power Factor*** | | | | | | | |  | | | | |
| ***Maximum Continuous Rating (MCR)*** | | | ***(MW) - summer at 35°C[[2]](#footnote-2)*** | | | | |  | | | | |
| ***(MW) - winter at 10°C*** | | | | |  | | | | |
| Capability above MCR (MW), sustainability per event (hrs) | | | | | | | |  | | |  | |
| NERC Unit type | | | | Refer to the link on next page | | | |  | | | | |
| NERC Status | | | | | | | |  | | | | |
| NERC Cooling Water Source | | | | | | | |  | | | | |
| NERC Fuel Type (primary, alternate) | | | | Refer to the link on next page | | | |  | | |  | |
| NERC Fuel Transportation (primary, alternate) | | | | | | | |  | | |  | |
| NERC primary fuel heat rate at full load (BTU/kWh) | | | | | | | |  | | | | |
| ***Unsaturated reactances in pu based on machine base (Xo required only if unit transformer provides a zero sequence path)*** | | | | | | | | | | | | |
| ***Xd*** | ***X’d*** | ***X’’d*** | | | ***Xq*** | ***X’q*** | ***Xl*** | | | ***X2*** | | ***Xo*** |
|  |  |  | | |  |  |  | | |  | |  |
| ***Open circuit time constants (s)*** | | | | | | | | | | | | |
| ***T’do*** | | ***T’’do*** | | | | ***T’qo*** | | | | ***T’’qo*** | | |
|  | |  | | | |  | | | |  | | |
| ***Station load (MW, Mvar)*** | | | | | | | | |  | | | |
| Minimum power (MW) | | | | | | | | |  | | | |
| Normal loading and unloading ramp rates (MW/min) | | | | | | | | |  | |  | |
| Emergency loading and unloading ramp rates (MW/min) | | | | | | | | |  | |  | |
| ***Armature (Ra) and field resistance (Rfd[[3]](#footnote-3)) (Ohms)*** | | | | | | | | |  | |  | |
| ***Total rotational inertia of generator and turbine(s)*** | | | | | | | | |  | | | |
| ***Saturation at rated voltage (S1.0) and 20% above (S1.2)*** | | | | | | | | |  | |  | |
| Damping | | | | | | | | |  | | | |
| ***Base field current (A)*** | | | | | | | | |  | | | |
| ***Base field voltage (volts)*** | | | | | | | | |  | | | |
| Losses at 1.0 and 0.9 power factor (MW) | | | | | | | | |  | |  | |
| **Characteristics**  (must be provided for each different type of generator) | ***Open circuit saturation curve*** | | | | | | | | | Attach file | | | |
| ***Short circuit curve*** | | | | | | | | | Attach file | | | |
| V curves | | | | | | | | | Attach file | | | |
| ***Capability curve*** | | | | | | | | | Attach file | | | |

All files and diagrams provided as attachments are to be signed and sealed by a Professional Engineer.

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| Generation Facilities – Synchronous (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
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| **EXCITATION SYSTEM MODEL** |  |
| ***A block diagram\* suitable for stability studies or an IEEE standard model type with all in-service parameter values for the exciter. Models for stabilizers, under-excitation limiters and over-excitation limiters shall be provided where applicable.*** | Generation facility directly connected to the *IESO-controlled grid* |
| **GOVERNOR AND PRIME MOVER SYSTEM MODEL** | |
| ***A block diagram\* suitable for stability studies or an IEEE standard model type with all in service parameters values for the governor and prime mover (turbine). More detailed models would be required if off-nominal frequency or shaft torsional studies are required.*** | Generation facility directly connected to the IESO-*controlled grid*, generation facility  greater than 50 MW, or generation unit greater than 10 MW |
| **FACILITY MODEL - EQUIVALENT** | |
| ***An equivalent model representing the proposed facility as being connected to the low voltage bus of the transmission connection facility, operated at the nominal voltage level of the low voltage bus, to be used by IESO and Hydro One for steady state and transient simulations (attach files).*** | For generation facilities comprised of multiple small size units (such as wind farms, solar PV) and distribution connected generation |

\* The block diagram must be compatible with PSS/E model libraries. Please check with the IESO regarding the software version currently in use.

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| **Wind Turbine/**  **PV Inverter** | |  | | | | | | **Type 1** | | | | **Type 2** | | |
| ***Manufacturer*** | | | | | |  | | | |  | | |
| ***Model*** | | | | | |  | | | |  | | |
| ***Technology*** | | | | | |  | | | |  | | |
| ***Rated Voltage*** | | | | | |  | | | |  | | |
| ***Rated MVA*** | | | | | |  | | | |  | | |
| ***Rated MW*** | | | | | |  | | | |  | | |
| ***Qmax (MVAr)*** | | | | | |  | | | |  | | |
| ***Qmin (MVAr)*** | | | | | |  | | | |  | | |
| ***Xd’’/Id’’ (pu)*** | | | | | |  | | | |  | | |
| ***Reactive Capability Curve*** | | | | | | Attach file | | | | Attach file | | |
| ***Voltage Protection*** | | | | | | Attach file | | | | Attach file | | |
| ***Frequency Protection*** | | | | | | Attach file | | | | Attach file | | |
| **GSU**  **Transformer** | | | **Voltage Ratio** | | |  | | | |  | | |
| **MVA** | | |  | | | |  | | |
| **R (%)** | | |  | | | |  | | |
| **X (%)** | | |  | | | |  | | |
|  | |  | | |  | | |  | | | |  | | |
| **Collector**  **System** | **ID** | | **Total**  **MW** | **# of**  **Type 1** | | **# of**  **Type 2** | **Equivalent Positive-Sequence Impedance[[4]](#footnote-4)** | | | | **Equivalent Zero-Sequence Impedance[[5]](#footnote-5)** | | | | |
| **R1** | | **X1** | **B1** | **R0** | | **X0** | **R0** | |
| **C1** | |  |  | |  |  | |  |  |  | |  |  | |
| **C2** | |  |  | |  |  | |  |  |  | |  |  | |
| **C3** | |  |  | |  |  | |  |  |  | |  |  | |
| **C4** | |  |  | |  |  | |  |  |  | |  |  | |
| **C5** | |  |  | |  |  | |  |  |  | |  |  | |
| **C6** | |  |  | |  |  | |  |  |  | |  |  | |
| **C7** | |  |  | |  |  | |  |  |  | |  |  | |
| **C8** | |  |  | |  |  | |  |  |  | |  |  | |
| **Cn** | |  |  | |  |  | |  |  |  | |  |  | |

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| **Functional description of voltage control system** | Attach file |
| **Functional description of frequency control system** | Attach file |
| **Parameters for PSS®E standard models \*** | Attach file |

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| Generation Facilities – Wind or Solar | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

\*User-defined models will not be accepted if PSS®E standard models are available. However, the IESO reserves the right to request user-defined models at its sole discretion under some specific circumstances. Any user-defined model provided shall be in both PSS/E and DSA tools format.

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| Generation Facilities – Wind or Solar (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Additional information required for protection impact assessment** | **The following data is required for all doubly-fed induction generators and full inverter interfaced generators.** | | | | | | | |
| ***Maximum current contribution to symmetrical 3-phase fault at HV side of Generator Step-Up (GSU) Transformer*** | | | | | | | |
|  | ***Specify start and end times (cycles or ms)*** | | ***Positive sequence current, I1***  *(A or per unit – if in pu specify base)* | ***I1 Angle***  *(range in degrees with respect to phase voltage)* | ***Negative sequence current, I2***  *(range in % of I****1****)* | ***Zero sequence current, I0 `***  *(range in % of I****1****)* | |
| ***Time Period 1*** |  |  |  |  | N/A | N/A | |
| ***Time Period 2*** |  |  |  |  | N/A | N/A | |
| ***Time Period 3*** |  |  |  |  | N/A | N/A | |
| ***Maximum current contribution to asymmetrical fault at HV side of GSU transformer*** | | | | | | | |
| ***Time Period 1*** |  |  |  |  |  | |  |
| ***Time Period 2*** |  |  |  |  |  | |  |
| ***Time Period 3*** |  |  |  |  |  | |  |
| ***Current contribution in scenarios other than the maximum scenario above:***  *For example, current contribution vs. grid residue voltage curve or the effects of pre-fault load level. Data shall be provided for all the three periods above.* | | | | | | | Attach file |
| ***Decrement curves (minimum of 100 ms)***  *Time-domain three phase current waveforms for symmetrical and single-phase-to-ground faults at HV side of GSU transformer.* | | | | | | | Attach file |
| ***Current contribution at 30 cycles***  *For symmetrical and singe-phase-to-ground faults at HV side of GSU transformer.* | | | | | | | Attach file |
| ***Description of inverter operation during fault conditions:***  *For example, rotor side crow-bar action or converter blocking.* | | | | | | | Attach file |
| **Results of the short circuit study for the facility** | | | | | | | Attach file |

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| Connection (Transmission) Facilities | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| If the connection from the generator to the transmitter consists of different sections, then the applicant must complete a table for each overhead circuit section and for each underground circuit section.  Provide a detailed single line diagram of the connection facilities. | | | | | | |
| **Transmission connection** | ***Point of connection to IESO controlled grid:***  ***- circuit operating nomenclature or terminal station name*** | |  | | | |
| ***- circuit section*** | |  | | | |
| ***- tower number*** | |  | | | |
| ***- GPS coordinates*** | |  | | | |
| **Overhead circuit section**  Complete one table for each overhead circuit section | ***Identifier (to be provided on drawing)*** | |  | | | |
| ***Voltage (kV)*** | |  | | | |
| ***Length (km)*** | |  | | | |
| Phase conductor size (kcmil) | |  | | | |
| Phase conductor type (ASC, ACSR, ACSS, ACCR, etc)**[[6]](#footnote-6)** | |  | | | |
| Phase conductor stranding (# of Al strands/ # of Steel strands) | |  | |  | |
| Phase conductors per bundle, spacing if more than one (mm) | |  | |  | |
| Geometry of all phase and sky wires for each tower type (m) | |  | | | |
| Ground resistivity (ohm-meters) | |  | | | |
| Skywire size (kcmil) | |  | | | |
| Skywire type (Alumoweld, EHS, HS)**[[7]](#footnote-7)** | |  | | | |
| Skywire stranding (# of Al strands/ # of Steel strands) | |  | |  | |
| Skywire number if more than one | |  | | | |
| ***Positive sequence impedance***  *R, X in ohms and B in mhos*  *if in per unit specify bases* | | **R in ohms** | **X in ohms** | | **B in mhos** |
|  |  | |  |
| **R in pu** | **X in pu** | | **B in pu** |
|  |  | |  |
| ***Zero sequence impedance***  *Ro, Xo in ohms and Bo in mhos*  *if in per unit specify bases* | | **Ro in ohms** | **Xo in ohms** | | **Bo in mhos** |
|  |  | |  |
| **Ro in pu** | **Xo in pu** | | **Bo in pu** |
|  |  | |  |
| ***Mutual Impedance (parallel circuit identifier)***  *Rm, Xm in ohms and Bo in mhos*  *if in per unit specify bases* | | **Rm in ohms** | **Xm in ohms** | | **Bm in mhos** |
|  |  | |  |
| **Rm in pu** | **Xm in pu** | | **Bm in pu** |
|  |  | |  |
|  | | **Base Voltage VB** (Applicable to positive & zero sequences and mutual impedances) ***All values in per km*** |  | | | |
| **Base MVAB** (Applicable to positive & zero sequences and mutual impedances) ***All values in per km*** |  | | | |

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| Connection (Transmission) Facilities (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Overhead circuit section cont’d**  Complete one table for each overhead circuit section | ***Winter thermal ratings: Continuous, Long-term, Short-term (A)***  ***(see table below for rating assumptions)*** |  |  |  |
| ***Summer thermal ratings: Continuous, Long-term, Short-term (A)***  ***(see table below for rating assumptions)*** |  |  |  |

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| **Overhead Transmission Lines - Rating Assumptions for System Impact Assessment studies** | | | | |
| **Rating** | **Conductor Temperature** | **Pre-load** | **Ambient Temp** | **Wind Speed** |
| **Continuous** | 93°C  (or sag temperature if lower) | N/A | **Summer**  35°C South of Barrie  &  30°C North of Barrie  **Winter**  10°C | 0 to 4 km/hr  15 km/hr  within 50 km of wind farm |
| **Long-Term Emergency**  **(Limited to 50 hr/year on all conductors)** | 127°C  (or sag temperature if lower) | N/A |
| **Short-Term Emergency**  **(15-minute limited-time rating)** | 150°C  (or sag temperature if lower)  (Limited to 127°C for High Aluminum Content (HAC) conductors) | Continuous Rating at 93°C |

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| Connection (Transmission) Facilities (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Underground Circuit Section**  Complete one table for each underground circuit section | | ***Identifier (to be provided on drawing)*** | |  | | |
| ***Voltage (kV)*** | |  | | |
| ***Length (km)*** | |  | | |
| BIL rating | |  | | |
| Phase conductor size (kcmil) | |  | | |
| Distance from the “from” terminal (km) | |  | | |
| Maximum operating temperature (°C) | |  | | |
| Phase conductor type**[[8]](#footnote-8)** | |  | | |
| Insulation type | |  | | |
| Semiconductor shield type | |  | | |
| Shield grounding | |  | | |
| Metallic sheath type | |  | | |
| External layer type | |  | | |
| Geometry of all phases | |  | | |
| Ground resistivity (ohms-meters) | |  | | |
| Cable construction | |  | | |
| ***Installation type (e.g. direct buried, in duct, etc.)*** | |  | | |
| ***Positive sequence impedance (R, X in ohms, B in mhos or if in per unit specify bases)*** | |  |  |  |
| ***Zero sequence impedance (Ro, Xo in ohms, Bo in mhos or if in per unit specify bases)*** | |  |  |  |
| ***Continuous, 15-Minute and 24-Hour thermal ratings (A)*** | ***Winter*** |  |  |  |
| ***Summer*** |  |  |  |
| **Main Buses**  Complete one table for each bus | | Identifier (to be provided on drawing) | |  | | |
| Station | |  | | |
| ***Voltage (kV)*** | |  | | |
| ***Summer continuous (A)*** | |  | | |
| ***Winter continuous (A)*** | |  | | |
| Maximum operating temperature (°C) | |  | | |
| Conductor size (kcmil) | |  | | |
| Conductor type (ASC, ASCR, Al tube) | |  | | |
| Surge Arresters | Identifier | | |  | | |
| Station | | |  | | |
| Manufacturer | | |  | | |
| Serial number | | |  | | |
| Voltage rating (kV) | | |  | | |
| Type (e.g. ZnO, SiC) | | |  | | |
| Class (e.g. secondary, distribution, intermediate, station) | | |  | | |

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| Connection (Transmission) Facilities (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Transformers**  Complete one table for each transformer | ***Number and Identifier of identical units (e.g., 3 units - T1, T2, T3)*** | | | | | |  | | | | | | | | | | | |
| ***Station*** | | | | | |  | | | | | | | | | | | |
| **Serial Number**  (must be provided prior to Connection) | | | | | |  | | | | | | | | | | | |
| **Manufacturer** | | | | | |  | | | | | | | | | | | |
| **Configuration (e.g. 3 phase unit or three single phase units)** | | | | | |  | | | | | | | | | | | |
| **Phase Location if single phase (e.g. R, W, B)** | | | | | |  | | | | | | | | | | | |
| ***Cooling types ( e.g. ONAN, ONAF, OFAF)*** | | | | | |  | | | |  | | | | |  | | |
| ***Associated Thermal Rating for each cooling type (MVA)*** | | | | | |  | | | |  | | | | |  | | |
| Winter (10°C) continuous, 10-DAY and 15-MIN thermal ratings | | | (A) | | |  | | | |  | | | | |  | | |
| (MVA) | | |  | | | |  | | | | |  | | |
| ***Summer (35°C) continuous, 10-DAY and 15-MIN thermal ratings[[9]](#footnote-9)*** | | | (A) | | |  | | | |  | | | | |  | | |
| (MVA) | | |  | | | |  | | | | |  | | |
| ***Connection for each winding H, X, Y (e.g. wye, delta, zig-zag)*** | | | | | |  | | | |  | | | | |  | | |
| ***Rated voltage for each winding, e.g. HV, LV, tertiary (kV)*** | | | | | |  | | | |  | | | | |  | | |
| **Rated capability for tertiary winding, if applicable (A, MVA)** | | | | | |  | | | | | | |  | | | | |
| **Impedance to ground for each winding H, X, Y (ohms)**  **(U – Ungrounded; R – Resistance; X – Reactance, e.g. 16 R)** | | | | | |  | | | |  | | | | |  | | |
| ***Off–load taps (kV)*** | |  | | |  | | |  | | | |  | | | | |  |
| ***In-service off-load tap position (kV)*** | | | |  | | | | | | | | | | | | | |
| ***Under-load taps: max tap (kV), min tap (kV), number of steps*** | | | |  | | | | |  | | | | |  | | | |
| **Positive Sequence Impedance** | (see IEEE C57.12.90 for measurement techniques) | ***Positive Sequence Impedance (%)*** | | | ***HX*** | | | | | ***HY*** | | | | | ***XY*** | | | |
| ***R*** | | |  | | | | |  | | | | |  | | | |
| ***X*** | | |  | | | | |  | | | | |  | | | |
| ***Base MVA*** | | |  | | | | |  | | | | |  | | | |
| **Zero Sequence Impedance**  (only required for transformers with 1 or 2 external neutrals) | H winding energized  all others open | Closed Tertiary | | | H | | | X | | | | HX | | | | | XH | |
| R | | |  | | |  | | | |  | | | | |  | |
| X | | |  | | |  | | | |  | | | | |  | |
| Base MVA | | |  | | |  | | | |  | | | | |  | |
| H winding energized  X winding shorted | Open Tertiary | | | H | | | X | | | | HX | | | | | XH | |
| R | | |  | | |  | | | |  | | | | |  | |
| X | | |  | | |  | | | |  | | | | |  | |
| Base MVA | | |  | | |  | | | |  | | | | |  | |

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| Connection (Transmission) Facilities (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Shunt Capacitors**  Complete one table for each type of shunt capacitor | ***Identifier*** |  |
| ***Station*** |  |
| Manufacturer |  |
| **Serial number** (must be provided prior to Connection) |  |
| ***Rated voltage (kV)*** |  |
| ***Rated capability (Mvar)*** |  |
| ***Discharge time (ms)*** |  |
| Current limiting reactor (mH or Ω) |  |
| Bank arrangement (e.g. delta, wye, double-wye, etc) |  |
| ***Surge capacitor (µF)*** |  |
| Description of automatic switching | Attach file |
| Anticipated switching restrictions | Attach file |
| **Shunt Reactors**  Complete one table for each type of shunt reactor | ***Identifier*** |  |
| ***Station*** |  |
| Manufacturer |  |
| **Serial number** (must be provided prior to Connection) |  |
| ***Rated voltage (kV)*** |  |
| ***Rated capability (Mvar)*** |  |
| Winding configuration (e.g. delta, wye) |  |
| Description of automatic switching | Attach file |
| ***Description of anticipated switching restrictions*** | Attach file |

All files and diagrams provided as attachments are to be signed and sealed by a Professional Engineer.

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| Connection (Transmission) Facilities (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Circuit Breakers**  Complete one table for each type of circuit breaker | ***Identifier*** |  |
| ***Station*** |  |
| Manufacturer |  |
| **Serial number** (must be provided prior to Connection) |  |
| ***Maximum continuous rated voltage (kV)*** |  |
| Interrupting time (ms) |  |
| ***Interrupting media (e.g. air, oil, SF6)*** |  |
| ***Rated continuous current (A)*** |  |
| ***Rated symmetrical and asymmetrical short circuit capability (3 second rating in kA)*** |  |
| **Circuit Switchers**  Complete one table for each type of circuit switcher | ***Identifier*** |  |
| ***Station*** |  |
| Manufacturer |  |
| **Serial number** (must be provided prior to Connection) |  |
| ***Maximum continuous rated voltage (kV)*** |  |
| ***Interrupting time (ms)*** |  |
| ***Interrupting media (e.g. air, oil, SF6)*** |  |
| ***Rated continuous current (A)*** |  |
| ***Rated symmetrical short circuit capability (3 sec rating in kA)*** |  |
| **Disconnect Switches/Mid Span Openers**  Complete one table for each disconnect switch/mid span opener with different technical specifications | ***Identifier*** |  |
| ***Station*** |  |
| Manufacturer |  |
| **Serial number** (must be provided prior to Connection) |  |
| ***Maximum continuous rated voltage (kV)*** |  |
| ***Continuous current rating (amps) (Non-Ground Switches only)*** |  |
| ***Rated symmetrical short circuit capability (3 sec rating in kA)*** |  |
| **Wavetraps** | Identifier |  |
| Station |  |
| Manufacturer |  |
| **Serial number** (must be provided prior to Connection) |  |
| Continuous current rating (amps) |  |
| **DC Lines** | ***Identifier*** |  |
| ***Complete steady state (loadflow) parameters and dynamic parameters*** |  |
| **FACTS Devices**  (e.g., dynamic reactive devices, series compensation, etc.) | ***Identifier*** |  |
| ***Complete steady state (loadflow) parameters and dynamic parameters*** |  |

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| LDC Facilities for Embedded Generation | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| Provide the following information for each LDC existing between the new facility point of connection and the transmitter facilities.  Provide a detailed single line diagram of the connection facilities. | | | | | | | | |
| **Transmission connection** | ***Point of connection to Transmitter:***  ***- circuit operating nomenclature or terminal station name*** | | |  | | | | |
| ***- tower number*** | | |  | | | | |
| ***- GPS coordinates*** | | |  | | | | |
| **Overhead circuit section**  Complete one table for each section | ***Identifier (to be provided on drawing)*** | | |  | | | | |
| ***Voltage (kV)*** | | |  | | | | |
| ***Length (km)*** | | |  | | | | |
| ***Positive sequence impedance (R, X, B) (R, X in ohms, B in mhos or if in per unit specify bases)*** | | |  | |  | |  |
| ***Zero sequence impedance (Ro, Xo, Bo) (Ro, Xo in ohms, Bo in mhos or if in per unit specify bases)*** | | |  | |  | |  |
| **Mutual Impedance (parallel circuit identifier, Rm, Xm in ohms or if in per unit specify bases)** | | |  | |  | |  |
| **Underground Circuit Section**  Complete one table for each underground circuit section | ***Identifier (to be provided on drawing)*** | |  | | | | | |
| ***Voltage (kV)*** | |  | | | | | |
| ***Length (km)*** | |  | | | | | |
| BIL rating | |  | | | | | |
| Phase conductor size (kcmil) | |  | | | | | |
| Distance from the “from” terminal (km) | |  | | | | | |
| Maximum operating temperature ( °C) | |  | | | | | |
| Phase conductor type**[[10]](#footnote-10)** | |  | | | | | |
| Insulation type | |  | | | | | |
| Semiconductor shield type | |  | | | | | |
| Shield grounding | |  | | | | | |
| Metallic sheath type | |  | | | | | |
| External layer type | |  | | | | | |
| Geometry of all phase | |  | | | | | |
| Ground resistivity (ohms) | |  | | | | | |
| Cable construction | |  | | | | | |
| ***Installation type (e.g. direct buried, in duct, etc.)*** | |  | | | | | |
| ***Positive sequence impedance (R, X, B)*** ***(R, X in ohms, B in mhos or if in per unit specify bases)*** | |  | |  | |  | |
| ***Zero sequence impedance (Ro, Xo, Bo) (Ro, Xo in ohms, Bo in mhos or if in per unit specify bases)*** | |  | |  | |  | |
| ***Continuous, 15-Minute and 24-Hour thermal ratings (A)*** | ***Winter*** |  | |  | |  | |
| ***Summer*** |  | |  | |  | |

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| LDC Facilities for Embedded Generation (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *Hydro One* - to be provided prior to Connection |
|  | Typical values will be assumed if data not provided |
|  | Only required upon request |

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| **Transformers**  Complete one table for each transformer | ***Number and Identifier of identical units (e.g., 3 units - T1, T2, T3)*** | | | | | | | | |  | | | | | | | | | |
| ***Station*** | | | | | | | | |  | | | | | | | | | |
| **Serial Number**  (must be provided prior to Connection) | | | | | | | | |  | | | | | | | | | |
| **Manufacturer** | | | | | | | | |  | | | | | | | | | |
| **Configuration (e.g. 3 phase unit or three single phase units)** | | | | | | | | |  | | | | | | | | | |
| **Phase Location if single phase (e.g. R, W, B)** | | | | | | | | |  | | |  | | | | |  | |
| ***Cooling types ( e.g. ONAN, ONAF, OFAF)*** | | | | | | | | |  | | |  | | | | |  | |
| ***Associated Thermal Rating for each cooling type (MVA)*** | | | | | | | | |  | | |  | | | | |  | |
| Winter (10°C) continuous, 10-Day and 15-Minute thermal ratings | | | (A) | | | | | |  | | |  | | | | |  | |
| (MVA) | | | | | |  | | |  | | | | |  | |
| ***Summer (35°C) continuous, 10-Day and 15-Minute thermal ratings[[11]](#footnote-11)*** | | | **(A)** | | | | | |  | | |  | | | | |  | |
| **(MVA)** | | | | | |  | | |  | | | | |  | |
| ***Connection for each winding H, X, Y (e.g. wye, delta, zig-zag)*** | | | | | | | | |  | | |  | | | | |  | |
| ***Rated voltage for each winding, e.g. HV, LV, tertiary (kV)*** | | | | | | | | |  | | |  | | | | |  | |
| ***Rated capability for tertiary winding, if applicable (A, MVA)*** | | | | | | | | |  | | | | | | |  | | |
| **Impedance to ground for each winding H, X, Y (ohms)**  **(U – ungrounded or R – Resistance; X – Reactance, e.g. 16 R)** | | | | | | | | |  | | |  | | | | |  | |
| ***Off–load taps (kV)*** | |  | | |  | | | | |  | | |  | | | | |  |
| ***In-service off-load tap position (kV)*** | |  | | | | | |  | | | | | |  | | | | |
| ***Under-load taps: max tap (kV), min tap (kV), number of steps*** | |  | | | | | | | | | | | | | | | | |
| **Positive Sequence Impedance** | (see IEEE C57.12.90 for measurement techniques) | ***Positive Sequence Impedance (%)*** | | | ***HX*** | | | ***HY*** | | | | | | | ***XY*** | | | | |
| ***R*** | | |  | | |  | | | | | | |  | | | | |
| ***X*** | | |  | | |  | | | | | | |  | | | | |
| ***Base MVA*** | | |  | | |  | | | | | | |  | | | | |
| **Zero Sequence Impedance**  (only required for transformers with 1 or 2 external neutrals) | H winding energized  all others open | Closed Tertiary | | | H | | X | | | | | HX | | | | XH | | | |
| R | | |  | |  | | | | |  | | | |  | | | |
| ***X*** | | |  | |  | | | | |  | | | |  | | | |
| ***Base MVA*** | | |  | |  | | | | |  | | | |  | | | |
| H winding energized  X winding shorted | Open Tertiary | | | H | | X | | | | | HX | | | | XH | | | |
| R | | |  | |  | | | | |  | | | |  | | | |
| ***X*** | | |  | |  | | | | |  | | | |  | | | |
|  | ***Base MVA*** | | |  | |  | | | | |  | | | |  | | | |

1. If your project is a new facility to be connected to the IESO controlled grid, please consult with the transmitter and IESO Market Registration ([market.registration@ieso.ca](mailto:market.registration@ieso.ca)) regarding your proposed facility name prior to submitting this application. [↑](#footnote-ref-1)
2. If the location of the *project* is north of the City of Barrie, then provide summer ratings based on 30°C and 0 to 4 km/hr wind speed. [↑](#footnote-ref-2)
3. Field resistance should be specified at 75ºC for hydro-electric units and at 100ºC for thermal units. [↑](#footnote-ref-3)
4. Reduction approach is based on equal loss criteria. [↑](#footnote-ref-4)
5. Optional upon request [↑](#footnote-ref-5)
6. If the conductor type is new then additional information may be required. [↑](#footnote-ref-6)
7. If the conductor type is new then additional information may be required. [↑](#footnote-ref-7)
8. If the conductor type is new then additional information may be required. [↑](#footnote-ref-8)
9. If the location of the *project* is north of the City of Barrie, then provide summer ratings based on 30°C and 0 to 4 km/hr wind speed. [↑](#footnote-ref-9)
10. If the conductor type is new then additional information may be required. [↑](#footnote-ref-10)
11. If the location of the *project* is north of the City of Barrie, then provide summer ratings based on 30°C and 0 to 4 km/hr wind speed. [↑](#footnote-ref-11)