# IESO LogoSystem Impact Assessment Application (IESO)/

# Customer Impact Assessment Application (transmitter)

# for Generation and Electricity Storage Facilities

Submit this form to the **Independent Electricity System Operator** and also to the applicable ***transmitter*** to inform about your new connection or modification to an existing connection**:**

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| **Independent Electricity System Operator**  [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 or electronically signed by a method accepted by the IESO (if using electronic signature contact Connection Assessments to confirm the method is acceptable). Connection applicants intending to send documents in a different format are encouraged to contact Connection Assessments in advance.  Hard copies of the application forms and supporting documents are not required. Where the supporting documentation is not suitable for email submission, contact Connection Assessments via email for instructions. | **Select the transmitter:**  **Hydro One Networks Inc.**  [LargeAccounts@HydroOne.com](mailto:LargeAccounts@HydroOne.com)  **Hydro One Sault Ste. Marie LP**  [LargeAccounts@HydroOne.com](mailto:LargeAccounts@HydroOne.com)  **Canadian Niagara Power Inc.**  [Engineering@fortisontario.com](mailto:Engineering@fortisontario.com)  **Five Nations Energy Inc.**  [tiserhoff@fivenations.ca](mailto:tiserhoff@fivenations.ca)  **Upper Canada Transmission, Inc.**  [jeff.damen@nexteraenergy.com](mailto:jeff.damen@nexteraenergy.com)  **Wataynikaneyap Power LP**  [WatayRegulatory@wataypower.ca](mailto:WatayRegulatory@wataypower.ca)  **Other Transmitter**  Name (fill in):  Note: This is not an application form for a Connection Impact Assessment by a licensed electricity distributor. |

**Subject: System Impact Assessment Application (IESO)/ Customer Impact Assessment Application (*transmitter*) for Generation and Electricity Storage Facilities**

All information submitted in this process will be used by the Independent Electricity System Operator (IESO) and the *transmitter* solely in support of their obligations under the *Electricity Act, 1998*, the *Ontario Energy Board Act, 1998,* the *Market Rules*, the Transmission System Code and associated policies, codes, standards and procedures and their licenses. All information submitted will be treated in accordance with the IESO's and the *transmitter’s* confidentiality policies. The undersigned consents to the sharing of all such information between the IESO and the *transmitter*.

Since specific equipment data may not yet be available for this Project, the accompanying data sheets have been modified to identify those data that are essential for the IESO and the *transmitter* to be able to undertake both Assessments. The data sheets also identify those data for which the IESO or the *transmitter* will use suitable typical values should the Applicant not provide them.

Whenever it is necessary for the IESO or the *transmitter* to use typical (generally conservative) values for the Assessment of the Connection Application, then it will be the responsibility of the Applicant to ensure that the equipment that is eventually installed meets or exceeds these values.

Applicants should 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

Applicants are responsible for providing as-built equipment data prior to connection, for the equipment that is constructed and is to be put into service. Timelines for providing as-built data are specified on the IESO website. Contact the *transmitter* for their timelines to provide as-built data.

## Part 1 – General Information

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| Connection Applicant’s Organization Name: |
| Generator/Electricity Storage Organization Name (if project is embedded in a licensed electricity distributor’s distribution system): |
| Project Name[[1]](#footnote-1): |
| Facility Name (if existing and connected directly to the IESO-controlled grid): |
| Distributor’s Transformer Facility Name (if an embedded generator/electricity storage is connecting to a licensed electricity distributor’s distribution system, i.e. TS, DS or MTS name): |
| Address or GPS coordinates in decimal degrees of the Project (if a new or embedded facility): |

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| **Authorized Representative (For existing market participants, this person must be registered in Online IESO. For non-market participants, this person must have the authority to bind the company.)** | |
| Name: | |
| Position / Title: | |
| Company: | |
| Address: | |
| City/Town: | Province/State: |
| Postal/Zip Code: | Country: |
| Telephone No.: |  |
| Email Address: | |
| Transmitter’s Account Number (if applicable):  (Only for existing customers intending to install generation or electricity storage for load displacement.) | |

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| Project Contact (This person will be the contact to provide technical information for the project. This person may be a third party consultant.) | |
| Name: | |
| Position/Title: | |
| Company: | |
| Address: | |
| City/Town: | Province/State: |
| Postal/Zip Code: | Country: |
| Telephone No.: |  |
| E-mail Address: | |

## Part 2 – Required Deposit ($30,000 for Transmission Connected Facility or $20,000 for Embedded Facility) to IESO for System Impact Assessment (SIA).

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| The payment of the deposit must be submitted, if required, after the IESO accepts the application form and assigns a unique CAA ID. The notification email containing the CAA ID will contain further instructions on how to submit the deposit payment. |

## Part 3 – Payment to the transmitter

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| Payment to the transmitter along with the terms and conditions will be outlined in the Study Agreement, which will be discussed between the connection applicant and transmitter upon receipt of the application form. Contact your transmitter for details. |

## Part 4 – Certification

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| The undersigned hereby declares that the information contained in and submitted in support of this document is, to the best of the connection applicant’s knowledge, complete and accurate. By signature the connection applicant agrees that information may be provided to the affected transmitter(s) and posted on the *IESO* website as stipulated in the applicable Market Manual pertaining to connection assessment and approval. | | |
| Name of Authorized Representative |  | Title |
| Signature |  | Date |

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

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| Facility Type | ***Specify if the facility will be registered as:***   * ***self-scheduling generation,*** * ***intermittent generation,*** * ***dispatchable generation,*** * ***non-dispatchable electricity storage; or,*** * ***dispatchable electricity storage*** |  |
| Intent of Generation or Electricity Storage | *Specify if the facility will be used for:*  * ***load displacement; and/or*** * ***sale of electricity*** |  |
| Project Dates | *Start of construction* |  |
| ***Electrical backfeed (energized stations)*** |  |
| *In-service dates (first synchronization of each unit)* |  |
| ***Permanent 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 or electricity storage facility start-up procedure. Indicate if the 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 or electricity storage 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.*** | 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 the transmitter’s facilities (or other impacted 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 |
| **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 or Electricity Storage Facilities | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
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| **Unit Data**  Complete one table for each different type of generation or electricity storage unit  **Note**:  For non-synchronous machine generation (e.g. wind and solar) or electricity storage 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*** | | | |  | | | |
| ***(MW) - winter at 10°C*** | | | |  | | | |
| ***Primary Fuel Type (bio-fuel, gas, oil, steam, uranium, water, wind, solar, other)*** | | | | | | |  | | | |
| Alternate Fuel Type (if applicable) | | | | | | |  | | | |
| Configuration (cogeneration, combined cycle, simple cycle, not applicable) | | | | | | |  | | | |
| ***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*** | | | | | | | | | | |
| ***T’do*** | | ***T’’do*** | | | ***T’qo*** | | | ***T’’qo*** | | |
|  | |  | | |  | | |  | | |
| ***Station load (MW, Mvar)*** | | | | | | |  | | | |
| Minimum loading point (MW) | | | | | | |  | | | |
| ***Qmax at rated active power (Mvar)*** | | | | | | |  | | | |
| ***Qmin at rated active power (Mvar)*** | | | | | | |  | | | |
| ***Qmax at zero active power (Mvar)*** | | | | | | |  | | | |
| ***Qmin at zero active power (Mvar)*** | | | | | | |  | | | |
| ***Qmax at minimum loading point (Mvar)*** | | | | | | |  | | | |
| ***Qmin at minimum loading point (Mvar)*** | | | | | | |  | | | |
| Normal loading and unloading ramp rates (MW/min) | | | | | | |  | |  | |
| Emergency loading and unloading ramp rates (MW/min) | | | | | | |  | |  | |
| ***Armature (Ra) and field resistance (Rfd 1) (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 generation or electricity storage unit) | ***Open circuit saturation curve*** | | | | | | | Attach file | | | |
| ***Short circuit curve*** | | | | | | | Attach file | | | |
| V curves | | | | | | | Attach file | | | |
| ***Capability curve*** | | | | | | | Attach file | | | |

1 Field resistance should be specified at 75ºC for hydro-electric units and at 100ºC for thermal units.

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| Generation/Electricity Storage Facilities (continued) | *Bold-Italic* | Essential |
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Provide the following lists of parameters that are applicable to the generation or electricity storage technology proposed. The list of parameters must be for one of the acceptable dynamic models listed in [Market Manual 1.6 – Performance Validation](https://www.ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-manuals/connecting/PerformanceValidation.ashx). Please contact the IESO for further instructions if the equipment intended to be installed cannot be modelled sufficiently accurate with any of the accepted dynamic models in this manual.

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| **GENERATOR MODEL** |  |
| ***A list of parameters suitable for stability studies with all in-service parameter values for the generator.*** | Generation or electricity storage facility |

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| **EXCITATION SYSTEM MODEL** | |  |
| ***A list of parameters suitable for stability studies 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 or electricity storage facility directly connected to the *IESO-controlled grid* ***1*** |
| **GOVERNOR AND PRIME MOVER SYSTEM MODEL** | | |
| ***A list of parameters suitable for stability studies with all in service parameters values for the governor and prime mover (turbine).*** | | Generation or electricity storage facility |
| **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 the transmitter for steady state and transient simulations (attach files).*** | For generation or electricity storage facilities comprised of multiple small size units (e.g. wind, solar or electricity storage) and distribution connected generation | |

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| **INVERTER-BASED RESOURCE MODELS** |  |
| ***A list of parameters suitable for stability studies with all in-service parameter values for the inverter-based resource (generator model, electrical model, plant controller model, etc.).*** | Generation or electricity storage facility directly connected to the *IESO-controlled grid* ***1*** |

1 Models for embedded or load displacement units may be requested as the studies progress.

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| Generation/Electricity Storage Facilities (continued) | *Bold-Italic* | Essential |

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| Generation/Electricity Storage Facilities (continued) | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
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| **Wind Turbine/**  **PV Inverter/Electricity Storage Inverter** | |  | | | | | | **Model 1** | | | | **Model 2** | | |
| ***Manufacturer*** | | | | | |  | | | |  | | |
| ***Model*** | | | | | |  | | | |  | | |
| ***Technology*** | | | | | |  | | | |  | | |
| ***Rated Voltage*** | | | | | |  | | | |  | | |
| ***Rated MVA*** | | | | | |  | | | |  | | |
| ***Rated MW*** | | | | | |  | | | |  | | |
| ***Qmax at rated active power (Mvar)*** | | | | | |  | | | |  | | |
| ***Qmin at rated active power (Mvar)*** | | | | | |  | | | |  | | |
| ***Qmax at zero active power (Mvar)*** | | | | | |  | | | |  | | |
| ***Qmin at zero active power (Mvar)*** | | | | | |  | | | |  | | |
| ***Xd’’/Id’’ (pu)*** | | | | | |  | | | |  | | |
| ***Reactive Capability Curve*** | | | | | | Attach file | | | | Attach file | | |
| ***Voltage Protection*** | | | | | | Attach file | | | | Attach file | | |
| ***Frequency Protection*** | | | | | | Attach file | | | | Attach file | | |
| **Generator Step-up (GSU)**  **Transformer** | | | **Voltage Ratio** | | |  | | | |  | | |
| **MVA** | | |  | | | |  | | |
| **R (%)** | | |  | | | |  | | |
| **X (%)** | | |  | | | |  | | |
|  | |  | | |  | | |  | | | |  | | |
| **Collector**  **System[[2]](#footnote-2)** | **ID** | | **Total**  **MW** | **# of**  **Model 1** | | **# of**  **Model 2** | **Equivalent Positive-Sequence Impedance[[3]](#footnote-3)** | | | | **Equivalent Zero-Sequence Impedance[[4]](#footnote-4)** | | | | |
| **R1** | | **X1** | **B1** | **R0** | | **X0** | **R0** | |
| **C1** | |  |  | |  |  | |  |  |  | |  |  | |
| **C2** | |  |  | |  |  | |  |  |  | |  |  | |
| **C3** | |  |  | |  |  | |  |  |  | |  |  | |
| **C4** | |  |  | |  |  | |  |  |  | |  |  | |
| **C5** | |  |  | |  |  | |  |  |  | |  |  | |
| **C6** | |  |  | |  |  | |  |  |  | |  |  | |
| **C7** | |  |  | |  |  | |  |  |  | |  |  | |
| **C8** | |  |  | |  |  | |  |  |  | |  |  | |
| **Cn** | |  |  | |  |  | |  |  |  | |  |  | |

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| **Additional information required for protection impact assessment and short circuit study** | **The following data is required for all doubly-fed induction generators and full inverter interfaced generators.** | | | | | | | |
| ***Maximum current contribution to a balanced 3-phase fault at HV side of 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 a line-to-ground 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 |

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

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| Connection Facilities | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
| Normal | Typical values will be assumed if data not provided |
| Normal | Only required upon request |

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| If the connection from the generation or electricity storage unit 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 including circuit section and tower number or terminal station name)*** |  | | | | | |
| **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) 1 |  | | | | | |
| 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)1 |  | | | | | |
| 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, 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** |  | | | | | |
| ***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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| Connection Facilities (continued) | *Bold-Italic* | Essential |
| Bold | Essential for *the transmitter* - to be provided prior to Connection |
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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  **Winter**  10°C | 0 to 4 km/h |
| **Long-Term Emergency**  **(Limited to 50 h/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 93oC |

1 If the conductor type is new then additional information may be required.

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| Connection Facilities (cont) | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
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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 ( ºC) | |  | | |
| Phase conductor type 1 | |  | | |
| 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 (ºC) | |  | | |
| Conductor size (kcmil) | |  | | |
| Conductor type (ASC, ASCR, Al tube) | |  | | |
| Surge Arresters | Identifier | |  | | |
| Station | |  | | |
| Manufacturer | |  | | |
| Serial number | |  | | |
| Duty cycle voltage rating (kV) | |  | | |
| Type (e.g. ZnO, SiC) | |  | | |
| Class (e.g. secondary, distribution, intermediate, station) | |  | | |

1 If the conductor type is new then additional information may be required.

|  |  |  |
| --- | --- | --- |
| Connection Facilities (cont) | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
| Normal | Typical values will be assumed if data not provided |
| Normal | 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 (10ºC) continuous, 10-DAY and 15-MIN thermal ratings | | | (A) | | |  | | | |  | | | | |  | | |
| (MVA) | | |  | | | |  | | | | |  | | |
| ***Summer (35ºC) continuous, 10-DAY and 15-MIN thermal ratings*** | | | (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 Facilities (cont) | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
| Normal | Typical values will be assumed if data not provided |
| Normal | 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 |

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| Connection Facilities (cont) | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
| Normal | Typical values will be assumed if data not provided |
| Normal | 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)*** |  | | |
| ***Maximum 30 minute rated voltage (kV)*** |  | | |
| ***Interrupting time (ms)*** |  | | |
| ***Interrupting medium (e.g. air, oil, SF6)*** |  | | |
| ***Rated continuous current (A)*** |  | | |
| ***Rated symmetrical and asymmetrical short circuit capability (kA)*** |  |  | |
| **Circuit Switchers**  Complete one table for each type of circuit switcher  (typically used for taps only – asymmetrical may not be necessary) | ***Identifier*** |  | | |
| ***Station*** |  | | |
| Manufacturer |  | | |
| **Serial number** (must be provided prior to Connection) |  | | |
| ***Maximum continuous rated voltage (kV)*** |  | | |
| ***Maximum 30 minute rated voltage (kV)*** |  | | |
| ***Interrupting time (ms)*** |  | | |
| ***Interrupting medium (e.g. air, oil, SF6)*** |  | | |
| ***Rated continuous current (A)*** |  | | |
| ***Rated symmetrical and asymmetrical short circuit capability (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)*** |  | | |
| ***Maximum 30 minute rated voltage (kV)*** |  | | |
| ***Rated continuous current (A) (Non-Ground Switches only)*** |  | | |
| ***Rated symmetrical short circuit withstand capability (kA)*** |  | | |
| **Wavetraps** | Identifier |  | | |
| Station |  | | |
| Manufacturer |  | | |
| **Serial number** (must be provided prior to Connection) |  | | |
| Continuous current rating (amps) |  | | |
| **DC Lines** | ***Identifier*** |  | | |
| ***Complete steady state (load flow) parameters and dynamic parameters*** |  | | |
| **FACTS Devices**  (e.g., dynamic reactive devices, series compensation, etc.) | ***Identifier*** |  | | |
| ***Complete steady state (load flow) parameters and dynamic parameters*** |  | | |

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

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| Licensed Distributor’s Facilities for Embedded Generation or Electricity Storage | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
| Normal | Typical values will be assumed if data not provided |
| Normal | Only required upon request |

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| Provide the following information for each licensed distributor who owns installations between the new facility’s point of connection and the transmitter’s 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)*** | |  | | | | |
| **Overhead circuit section (includes circuit from the generation or storage facility to the distributor’s station bus)**  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 (includes circuit from the generation or storage facility to the distributor’s station bus)**  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 ( ºC) | |  | | | | |
| Phase conductor type 1 | |  | | | | |
| 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*** |  |  | |  | |

1 If the conductor type is new then additional information may be required.

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| --- | --- | --- |
| Licensed Distributor’s Facilities for Embedded Generation or Electricity Storage | *Bold-Italic* | Essential |
| Bold | Essential for the transmitter - to be provided prior to Connection |
| Normal | Typical values will be assumed if data not provided |
| Normal | 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 or three single phase)** | | | | | |  | | | | | | | | | | | |
| **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 (10ºC) continuous, 10-Day and 15-Minute thermal ratings | | (A) | | | |  | | | |  | | | | |  | | |
| (MVA) | | | |  | | | |  | | | | |  | | |
| ***Summer (35ºC) continuous, 10-Day and 15-Minute thermal ratings*** | | **(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*** | | | |  | | |  | | | |  | | | | |  |

1. If your project is a new facility to be connected to the IESO-controlled grid, the transmitter and IESO Market Registration ([market.registration@ieso.ca](mailto:market.registration@ieso.ca)) must approve the facility name prior to registration. [↑](#footnote-ref-1)
2. Each collector represents the Thevenin equivalent of a feeder with multiple generation units connected, terminating at the LV bus of the main step-up transformer. [↑](#footnote-ref-2)
3. Reduction approach is based on equal loss criteria. [↑](#footnote-ref-3)
4. Optional upon request [↑](#footnote-ref-4)