

General Transmission System Design Guidelines for the Interconnection of New Generating Facilities to the Northeast Utilities Transmission System

Introduction

These Guidelines supplement the Independent System Operator-New England ("ISO-NE") "General Transmission System Design Requirements for the Interconnection of New Generators (Resources) to the Administered Transmission System" dated 2/01/05. In this document New Generators are individually referred to as Interconnecting Customers ("IC"). Contained here are Northeast Utilities' ("NU") general criteria for ICs to connect to the transmission systems of its Transmission Owner ("TO") subsidiaries: The Connecticut Light and Power Company, Western Massachusetts Electric Company, and Public Service Company of New Hampshire. The acronym "TO" is used throughout this document except where it is more appropriate to refer to "NU" in relation to its uniform policies, procedures, standards and practices.

1. Basic Access Issues

- A. Point of Interconnection (P.O.I.)
 - 1) An IC can be connected to the transmission system at a new or existing substation or switching station. Such new station may be located at the IC site, or at the junction of new interconnection transmission line(s) with the existing TO transmission system, as determined by good utility practice, and conforming to the Engineering Standards detailed in Section 3.
 - 2) An IC will endeavor to connect to the nearest appropriate TO substation or switching station commensurate with the generator output power, transmission system constraints and plans, and regulatory and siting considerations. Generation output of more than 200 MVA will likely need to interconnect with multiple 115-kV lines or with the 345-kV system.
 - 3) The IC may present a more remote alternative transmission line interconnection for consideration which it believes has less environmental or socioeconomic impact.
- B. Change of Ownership & Asset Transfer
 - 1) Ownership of new assets installed by the IC to modify ISO-NE Administered Transmission System (ATS) facilities, or interconnection transmission lines not integral to the ATS, after testing and commissioning and prior to commercial service, shall be transferred to the TO, unless otherwise negotiated between the TO and the IC.
 - 2) The ownership and asset transfer requirement does not apply to the portion of non-ATS transmission interconnections on the IC site, and in appropriate situations with TO concurrence, on contiguous properties, to but not including the first public way crossing, over which the IC has rights. However, if the IC and the TO agree it would be appropriate, the

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IC may transfer ownership of the entire interconnection transmission line(s) to the TO.

- 3) Agreement over ultimate ownership is a critical element in early scoping to assure proper planning, regulatory approvals and allocation of resources.
- 4) If the IC wants the TO to maintain any IC-owned assets, the TO will have the exclusive authority to accept or reject such a request for maintenance responsibility. Such requests will be granted only in unusual and/or unique circumstances.

C. Physical Access and Safety

- 1) The TO may provide the IC, its contractors and its subcontractors permission to access its easements for visual and non-intrusive data collection by means of an Early Entry Agreement document either as an appendix to an ISO-NE interconnection study agreement (See Sec. 2.B), or as an independent agreement. This will provide whatever assignable rights exist for third party access onto private property, and provide guidelines for safe conduct of IC personnel.
- 2) The TO may authorize access into its substations or switching stations (with advance notification) for IC contractors who have been pre-qualified by the TO for engineering, procurement or construction work, under terms of the Interconnection Agreement. Prequalification is required to provide for quality of construction, safety of personnel, and protection of TO equipment and continued reliable customer service throughout the construction period.

D. Railroads, pipelines, other third-party facilities

- 1) ICs will be responsible for coordinating with the owners of any and all third-party facilities along the routes of new transmission interconnection lines and modified transmission facilities. This could extend to nearby unmodified facilities where electrical effects will be greater because of the IC's operation.
- 2) ICs will be responsible for conducting the necessary electrical effects studies according to TO practices, which the TO will provide under the appropriate ISO-NE Agreement. Where ICs propose to share or expand upon an existing third-party corridor, the IC must obtain the necessary rights in a form acceptable to the TO and transferable to the TO.
- 3) Where sufficient vehicular access would not exist along the third-party corridor, supplemental access across adjacent properties for maintenance purposes must be obtained and transferred to the TO.

E. TO Transmission Easement and Fee areas

- 1) ICs may consider expanding TO transmission easements and fee areas into a joint-use corridor. The TO will consider the IC's proposal to expand a TO corridor only if it does not eliminate the capability of existing rights to support a future transmission line or lines.
- 2) Typically an existing ROW will need to be expanded by 50' for a 115-kV interconnection line, and 85' for a 345-kV interconnection line. A new ROW typically will be 100' wide for a 115-kV line and 170' wide for a 345-kV line. These approximate widths are presented for pre-study

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estimating. During detailed studies, the TO will determine the precise expansion width requirement for each proposal based on NU standards.

2. Financial Policies and Procedures

A. NU Credit Policy

The NU Credit policy is located on the OASIS site (<http://oasis.iso-ne.com/documents/NU/INFO.HTM>, select the Credit Worthiness Policy option). The Policy contains all information the IC needs to meet NU's requirements and may be modified from time to time in accordance with the requirements for amending business practices.

B. ISO-NE Procedures

The ISO-NE Policies and Procedures are contained on its home page (http://www.iso-ne.com/regulatory/tariff/sect_2/index.html). In general, Schedule 22 and 23 of the ISO-NE OATT contain the requirements any IC will need to follow in the interconnection process.

C. Cost responsibility

Cost responsibility is detailed in Schedules 11, 22 and 23 of the ISO-NE OATT. In general, the IC will be required to pay for all costs to connect to the ISO-NE Administered Transmission System. This would include, but is not limited to; study costs, land or easement acquisitions, engineering and design, and construction of transmission lines, substation upgrades at the point of interconnection, any upgrades on the remainder of the system determined in the studies, and all legal costs associated with the development and approvals of all agreements.

- 1) The IC will be responsible for ongoing costs related to the interconnection facilities including, but not limited to; taxes, O&M, replacements and repairs. The annual O&M cost has typically been between 2% and 4% of the capital investment cost. The TO provides this information for early IC study estimating only and not as an upper or lower bound. The actual amount or cost methodology that will apply to any interconnection will be established in its Interconnection Agreement.
- 2) The cost responsibility will be documented in the Interconnection Agreement.

3. Engineering Standards

A. Transmission lines and Rights of Way (ROW):

- 1) As described in Section 1.A above, Points of Interconnection should be to the TO 115-kV, 230-kV or 345-kV system. A limited number of 230-kV facilities exist in New Hampshire. Also a limited number of 69-kV facilities exist in Massachusetts and Connecticut, most either prebuilt or convertible to 115kV. Any 69-kV interconnection proposed will be designed and prebuilt for 115kV.
- 2) Interconnecting by means of a "T-tap" making an existing two-terminal transmission circuit into a three-terminal circuit (or n-terminal into an n+1 terminal circuit) is not acceptable.
- 3) All TO transmission facilities constructed or modified by the IC must be designed, materials procured and constructed in full conformance with

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NU standards, details to be provided under the appropriate ISO/ TO agreement or agreements.

- 4) All easements acquired for transmission facilities shall use the TO standard easement form and shall be acceptable to the TO. TO facilities on IC sites shall be covered by another permanent easement form. Licenses or leases are not acceptable.
- 5) Any interconnection transmission facility that would be owned by the IC must be in conformance with Schedule 22 and the Interconnection Agreement.
- 6) The TO's review of the IC's engineering, design, procurement and construction will be commensurate with the standards set forth in the initial scoping decisions and ultimately in the Interconnection Agreement.
- 7) Whatever transmission line facilities are used to interconnect to the transmission system within the ROW must not block or hamper future expansion/rebuild of the transmission system within the ROW.
- 8) No substation, switching station or other fenced facility will be allowed within an existing transmission ROW. The service roadway may cross the ROW only if consistent with 3.A.7 above and other NU ROW use guidelines.

B. Substations and Switchyards:

- 1) The minimum configuration for a IC to connect into the TO PTF and non-PTF transmission system is a three-breaker ring bus. The IC may request this be relaxed to a single breaker for connecting up to 50 MVA to non-PTF facilities only if the system impact study (SIS) shows no impacts; acceptance is at the sole discretion of the TO.
- 2) No IC-owned facilities shall be located within TO substations or switchyards except for interconnection facility protection equipment which may be owned by the IC. Acceptance of such IC protection equipment is at the sole discretion of the TO.
- 3) Any necessary interconnection facilities or network upgrades needed within existing TO substations will be engineered, designed and constructed by the TO or its contractors under direct contract to the TO. The IC has the right to review the design and construction.
- 4) Any interconnection substation and switchyard facilities and materials for those facilities will be designed, procured and constructed in full conformance with NU standards; details to be provided under the appropriate ISO agreement or agreements.
- 5) The TO will configure, with input from the IC, the protection schemes for any interconnection facilities for which the zones of protection extend beyond the Point of Change of Ownership. Relays/teleprotection used for this purpose will conform to the standards of the TO, with the TO having the final decision authority.
- 6) Any property acquired for a switchyard off the IC site shall be in fee simple; permanent easements are not acceptable.
- 7) Off-road switchyards shall be accessed by an all-weather roadway.

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Roadways servicing switchyards shall have a minimum 15' width with 2' wide shoulders on each side of the roadway with a minimum horizontal curve radius of 80'. A maximum slope for an unpaved roadway shall not be greater than 5% and no more than 8% for a paved road. Additional details are called out in a NU engineering standard.

8) Estimated switchyard size for scoping purposes shall consider an unencumbered vehicle access area between the open-air buswork/equipment footprint and the fence, and a 30' clearing perimeter between the fence and mature vegetation.

C. Electrical issues for parallel facilities such as gas lines and railroads

- 1) Construction of transmission lines parallel to fossil fuel and other metallic pipelines and electrified and non-electrified railroads raises complex electrical effects that could present possible safety hazards and reliability issues. These include conductive, inductive and cathodic protection effects that the IC must thoroughly study, quantify, and if necessary mitigate in the interconnection design.
- 2) ICs must obtain an electrical safety study report by a recognized expert in joint corridor uses of electric transmission and non-electric facilities. The TO will provide guidance on its practices in this area, provide the necessary existing baseline electric transmission facility characteristics, and review the expert's report.

D. Protection and Control (P&C)

- 1) The TO may require the IC to modify or replace protection at remote line terminals to facilitate the interconnection.
- 2) As a minimum, the IC shall provide two protection schemes for short circuit protection of all interconnection facilities at the transmission voltage. These relays shall be designed to meet the performance requirements of the ATS.
- 3) If the interconnection facility is determined to be part of the Bulk Power System (as defined by NPCC Document A-10), the protection system design shall conform to the requirements of NPCC Document A-5.
- 4) ICs' underfrequency protection must be set to operate below the curve in Figure 1 of NPCC Document A-3 (Directory #2).
- 5) ICs' protective relay settings must be coordinated with the protection on the transmission system and shall be submitted to the TO for approval. The approval by the TO is limited to those settings required to coordinate with the transmission system. Settings required solely for the protection of the IC equipment will not be subject to TO approval.

E. Fiber Optic communication

- 1) Any new transmission line shall be installed with lightning shield wires containing optical fibers intended for present or future protection and control (P&C) and other communications needs, whether the fiber is initially dark, or actively used for IC interconnection. P&C communications will be established during scoping.
- 2) Connecting one or more existing transmission lines into a new switchyard or adding underground cable into an overhead line may require

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installation of optical fiber by replacing one shield wire to the line's remote substations.

- 3) The Point of Change of Ownership of fiber facilities at the IC's facility may be different than with the transmission line facilities.
- 4) Design must be coordinated with and approved by the TO.

4. Metering

Metering shall be on the low voltage side of the IC generator step-up transformer, compensated to the high side.

5. Siting

Transmission interconnections are most expediently sited as part of the IC's regulatory work with the TO supporting the applicant under terms of one of the ISO-NE OATT Schedule 22 and 23 pro-forma agreements, or some other separate agreement. When an appropriate agreement is in place, the TO will share its detailed proprietary standards for the IC's use for design of interconnection transmission facilities and determination of ROW and easement requirements for siting approval purposes.

6. Successor Documents

These requirements may be modified from time to time by revision, or by other documents which will be appended to this document for subsequent revision.

Revision 0

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Glossary

Word or phrase Definition

ATS – Administered Transmission System - That portion of the transmission system which the ISO administers. This includes the PTF (pooled transmission facilities) and the non-PTF and distribution facilities that are subject to the Tariff.

FERC – Federal Energy Regulatory Commission

GF – Generating Facility

IC – Interconnection Customer ISO or ISO -NE – Independent System Operator of New England. It has operating authority as defined in the Transmission Operating Agreement (TOA) and is the FERC designated regional transmission organization (RTO) for New England

NU – The Northeast Utilities System; Subsidiaries of Northeast Utilities include Transmission Owners: Connecticut Light and Power (CL&P), Public Service of New Hampshire (PSNH), Yankee Gas and Western Massachusetts Electric Company (WMECO), and the Northeast Utilities Service Company (NUSCO).

OATT – Open Access Transmission Tariff (often called “the Tariff ”).

POI – Point of Interconnection

PTF – pooled transmission facilities

Transmission – voltages equal or greater than 69-kV nominal phase to phase voltage.

Schedule 22 – An administrative procedure for Large Generator Interconnection; for GFs greater than 20 MW.

Schedule 23 – An administrative procedure for Small Generator Interconnection; for GFs no larger than 20 MW. Included in this is ISO-New England, along with NU, verification that the GF is a Certified Inverter base no larger than 10 kW.

TO – Transmission Owner, this may be either CL&P, WMECO or PSNH.