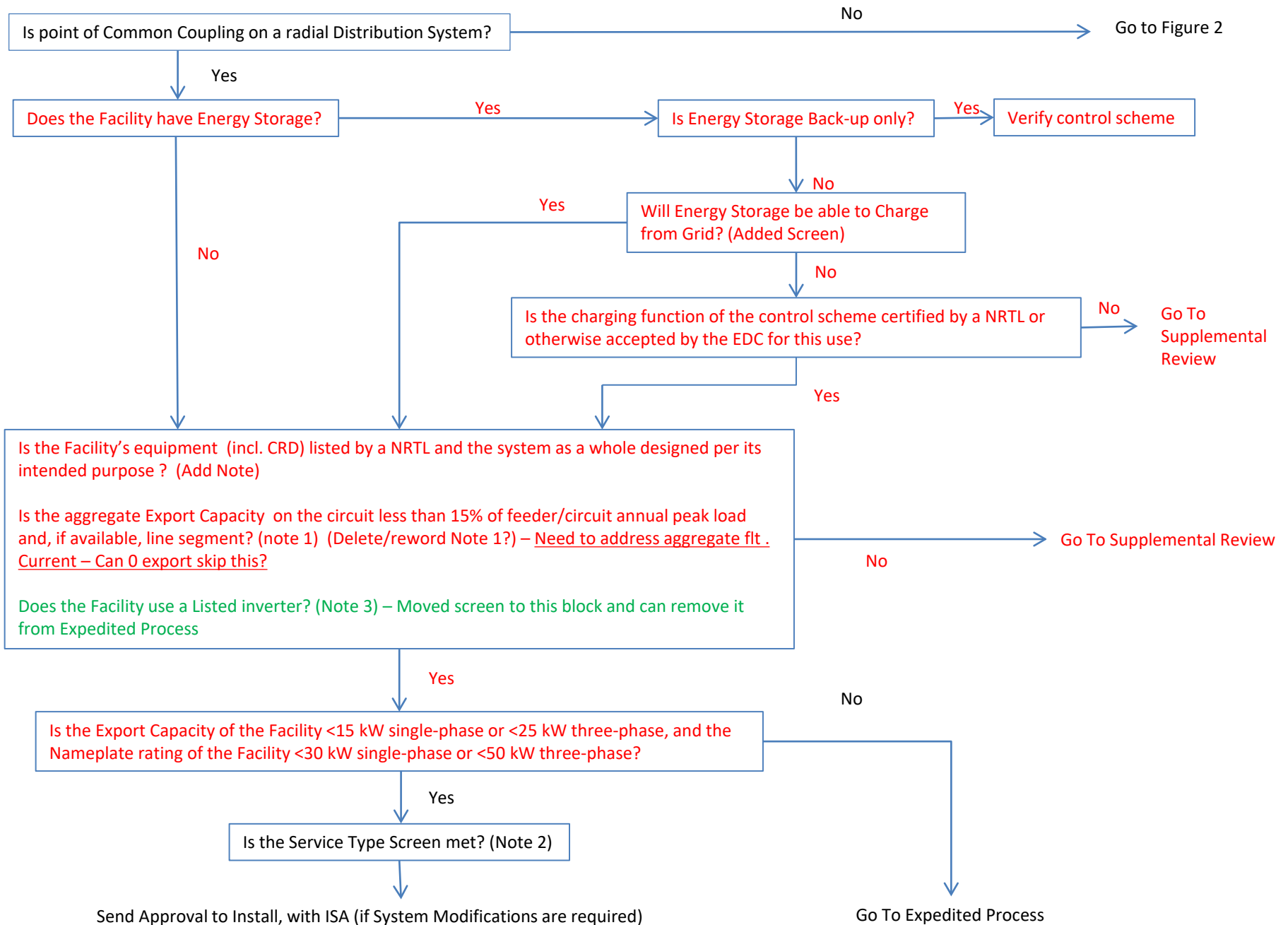


TSRG Meeting Feb. 11, 2020

Discussion of revision to
DG Tariff Screens



Expedited Process

Are all the following screens met?

Is the Service Type Screen met?
(Note 2)

Is the Facility Listed per (Note 3)?
(This screen is redundant and can be removed)

Is the Starting Voltage Screen met?
(Note 4)

Is the Fault Current Contribution
Screen met? (Note 5)

Is the Service Configuration Screen
met? (Note 6)

Is the Transient Stability Screen met?
(Note 7)

No

→ To Supplemental Review

Supplemental Review

Does the Facility pass the following screens? (Note 8)

A. Penetration Test

B. Power quality & Voltage test

C. Safety & reliability test

Notes

Note 1. On a typical radial distribution EPS circuit (“feeder”) the annual peak load is measured at the substation circuit breaker, which corresponds to the supply point of the circuit. A circuit may also be supplied from a tap on a higher-voltage line, sometimes called a subtransmission line. On more complex radial EPSs, where bidirectional power flow is possible due to alternative circuit supply options (“loop service”), the normal supply point is the loop tap.

Note 2. This screen includes a review of the type of electrical service provided to the Interconnecting Customer, including the service transformer configuration and service type to limit the potential for creating unacceptable voltage imbalance, over-voltage or under-voltage conditions, or service equipment overloads on the Company EPS due to a mismatch between the size and phasing of the energy source, the service loads fed from the service transformer(s), and the service equipment ratings. - Does this need clarification?

Note 3. A Listed Facility has successfully passed all pertinent tests to conform with IEEE Standard 1547. IEEE Standard 1547 includes design specifications, operational requirements, and a list of tests that are required for Facilities. IEEE Standard 1547.1 describes how to conduct tests to show compliance with provisions of IEEE Standard 1547. ~~To meet Screen 3 or 4,~~ Interconnecting Customers must provide information or documentation that demonstrates how the Facility is in compliance with the IEEE Standard 1547.1. A Facility will be deemed to be in compliance with the IEEE Standard 1547.1 if the Company previously determined it was in compliance. Interconnecting Customers who can demonstrate Facility compliance with IEEE Standard 1547.1, with the testing done by a nationally recognized testing laboratory, will be eligible for the Expedited Process, and may be eligible for the Simplified Process upon review by the Company.

Massachusetts has adopted UL1741 (Inverters, Converters and Charge Controllers for Use in Independent Power Systems) and UL2200 (Stationary Engine Generator Assemblies) as the standard for power systems to comply with IEEE Std 1547 and 1547.1. Equipment listed to UL1741 or UL2200 by a nationally recognized testing laboratory will be considered in compliance with IEEE Std 1547 and 1547.1. An Interconnecting Customer should contact the Facility supplier(s) to determine if it has been listed to either of these standards.

Note 4. This Screen only applies to Facilities that start by motoring the generating unit(s) or the act of connecting synchronous generators. The voltage drops should be less than the criteria below. There are two options in determining whether Starting Voltage Drop could be a problem. The option to be used is at the Company's discretion:

Option 1: The Company may determine that the Facility's starting inrush current is equal to or less than the continuous ampere rating of the Facility's service equipment.

Option 2: The Company may determine the impedances of the service distribution transformer (if present) and the secondary conductors to the Facility's service equipment and perform a voltage drop calculation.

Alternatively, the Company may use tables or nomographs to determine the voltage drop. Voltage drops caused by starting a generating unit as a motor must be less than 2.5% for primary interconnections and 5% for secondary interconnections.

Note 5. The purpose of this Screen is to ensure that fault (short-circuit) current contributions from all Facilities will have no significant impact on the Company's protective devices and EPS. All of the following criteria must be met when applicable:

The proposed Facility, in aggregation with other generation on the distribution circuit, will not contribute more than 10% to the distribution circuit's maximum fault current under normal operating conditions at the point on the high voltage (primary) level nearest the proposed PCC.

The proposed Facility, in aggregate with other generation on the distribution circuit, will not cause any distribution protective devices and equipment (including but not limited to substation breakers, fuse cutouts, and line reclosers), or Interconnecting Customer equipment on the EPS to exceed 85% of the short-circuit interrupting capability. In addition, the proposed Facility will not be installed on a circuit that already exceeds 85% of the short-circuit interrupting capability.

When measured at the secondary side (low side) of a shared distribution transformer, the short-circuit contribution of the proposed Facility must be less than or equal to 2.5% of the interrupting rating of the Company's service equipment.

Coordination of fault-current protection devices and systems will be examined as part of this Screen.

Note 6. This Screen includes a review of the type of electrical service provided to the Interconnecting Customer, including line configuration and the transformer connection to limit the potential for creating over voltages on the Company EPS due to a loss of ground during the operating time of any anti-islanding function.

Primary Distribution Line Type	Type of Interconnection to Primary Distribution Line	Result/Criteria
Three-phase, three wire	3-phase or single phase, phase-to-phase	Pass Screen
Three-phase, four wire	Effectively-grounded 3 phase or single-phase, line-to-neutral	Pass Screen

If the **proposed Facility** is to be interconnected on a single-phase transformer shared secondary, the **aggregate Export Capacity** on the shared secondary, including the proposed **Facility's Export Capacity**, will not exceed 20 kilovolt-ampere ("kVA").

If the proposed **Facility** is single-phase and is to be interconnected on a center tap neutral of a 240 volt service, **the addition of its Nameplate Rating** will not create an imbalance between the two sides of the 240 volt service of more than 20% of **nameplate the** rating of the service transformer.

The following redlines were submitted to the Department by IREC and were not discussed at the Feb. 11 TSRG meeting

Note 7. The proposed Facility, in aggregate with other Facilities interconnected to the distribution low voltage side of the substation transformer feeding the distribution circuit where the Facility proposes to interconnect, will not exceed a Nameplate Rating of 10 MW in an area where there are known or posted transient stability limitations to generating units located in the general electrical vicinity (e.g., 3 or 4 transmission voltage level buses from the PCC).

The following redlines were submitted to the Department by IREC and were not discussed at the Feb. 11 TSRG meeting

Note 8. Below are the three Screens that are included in the Company's Supplemental Review of an Expedited Project.

The Supplemental Review consists of Supplemental Review Screens A through C. If any of the Screens are not passed, a quick review of the failed Screen(s) will determine the requirements to address the failure(s) or that an Impact Study is required. In certain instances, the Company may be able to identify the necessary solution and determine that an Impact Study is unnecessary. Some examples of solutions that may be available to mitigate the impact of a failed Screen are:

- i) Modifying the project by adding an Energy Storage System to control Export Capacity, changing the Operational Profile of the Facility, or utilizing smart inverter capabilities.
- ii) Replacing a fixed capacitor bank with a switched capacitor bank
- iii) Adjustment of line regulation settings
- iv) Simple reconfiguration of the distribution circuit

The following redlines were submitted to the Department by IREC and were not discussed at the Feb. 11 TSRG meeting

Screen A: Penetration Test

Where 12 months of line section minimum load data is available, can be calculated, can be estimated from existing data, or determined from a power flow model, is the aggregate ~~Generating Facility capacity~~Export Capacity on the Line Section less than 100% of the minimum load for all line sections bounded by automatic sectionalizing devices upstream of the ~~Generating Facility?~~Facility? Facilities with no Export Capacity (i.e. Non-Exporting systems) skip this screen.

< If yes (pass), continue to Screen B.

< If no (fail), a quick review of the failure may determine the requirements to address the failure and, if so, continue to Screen B; otherwise Interconnecting Customer will go to the Standard Process.

The intent of the modifications to this screen are such that Non-Exporting projects, aka those with zero Export Capacity, will essentially skip this screen. Only the export past the PCC for Limited-Export projects will be considered.

Note 1: The type of generation will be taken into account when calculating, estimating, or determining circuit or Line Section minimum load relevant for the application of this screen. ~~Solar~~For example, solar generation systems with no ~~battery storage~~Energy Storage System use daytime minimum load (i.e. 10 am to 4 pm for fixed panel systems and 8 am to 6 pm for PV systems utilizing tracking systems), while all other generation uses absolute minimum load. The Company shall apply this screen using the Operating Profile and system design designated in the Interconnection Application and accompanying attachments. For example, the utility shall evaluate the maximum Export Capacity during the hours or season designated by the customer and shall take into account any Limited Export or other export controls if designed in accordance with Section 4.3.

Note 2: Distribution Provider will not consider as part of the aggregate generation for purposes of this screen ~~Generating Facility capacity~~Export Capacity known to be already reflected in the minimum load data.

Note 3: Load that is co-located with load-following, Non-Exporting or Limited-Export generation should be appropriately accounted for.

- Significance: Penetration of ~~Generating~~ Facility installations that does not result in power flow from the circuit back toward the substation will have a minimal impact on equipment loading, operation, and protection of the Distribution System.

The following redlines were submitted to the Department by IREC and were not discussed at the Feb. 11 TSRG meeting

Screen B: Power Quality and Voltage Tests

In aggregate with existing generation on the line section,

- a) Can it be determined within the Supplemental Review that the voltage regulation on the line section can be maintained in compliance with current voltage regulation requirements under all system conditions?
- b) Can it be determined within the Supplemental Review that the voltage fluctuation is within acceptable limits as defined by IEEE 1453 or utility practice similar to IEEE1453?
- c) Can it be determined within the Supplemental Review that the harmonic levels meet IEEE 519 limits at the Point of Common Coupling (PCC)?

< If yes to all of the above (pass), continue to Screen C.

< If no to any of the above (fail), a quick review of the failure may determine the requirements to address the failure and, if so, continue to Screen C; otherwise the Interconnecting Customer will go to the Standard Process.

Significance: Adverse voltages and undesirable interference may be experienced by other Customers on Distribution Provider's Distribution System caused by operation of the ~~Generating~~ Facility(ies).

The following slides contain redlines submitted to the Department by IREC and were not yet discussed by the TSRG

Screen C: Safety and Reliability Tests

Does the location of the proposed ~~Generating~~ Facility or the aggregate generation capacity on the Line Section create impacts to safety or reliability that cannot be adequately addressed without a group or Impact Study?

- < If yes (fail), review of the failure may determine the requirements to address the failure; otherwise the Interconnecting Customer will go to the Standard Process.
- < If no (pass), Supplemental Review is complete.

Significance: In the safety and reliability test, there are several factors that may affect the nature and performance of an Interconnection. These include, but are not limited to:

- Generation energy source
- Modes of synchronization
- Unique system topology
- Possible impacts to critical load Customers
- Possible safety impacts

The specific combination of these factors will determine if any system study requirements are needed. The following are some examples of the items that may be considered under this screen:

- Does the Line Section have significant minimum loading levels dominated by a small number of Customers (i.e. several large commercial Customers)?
- Is there an even or uneven distribution of loading along the feeder?