

PSEGLI Hosting Capacity Review: Summary & Comments on Historic Initiatives, & Questions Regarding Substation Backfeeding

*Prepared by Industry for PSEGLI-IWG meeting 11 Feb 2021.
Ver. 20 Feb 2021 (with misc updates post meeting)*

1. Preface Notes & Discussion Goals

- A. This presentation is part of the ongoing series of presentations/discussions regarding hosting capacity limitations on PSEGLI's network.
- B. Some key goals of this document/presentation include
 - a. Summarize select presentations & published documentation to date on this topic. This enables all to see key highlights in a single document without having to open/search multiple sources.
 - b. Obtain clarity on PSEGLI's stance on substation backfeeding. Determine whether PSEGLI's position differs from that of other utilities within and external to the JU.
- C. This presentation is part of NYSEIA's "Red to Green Initiative".
- D. Note: The "[PSEG Long Island's Smart Grid Small Generator Interconnection Technical Requirements and Screening Criteria for Operating in Parallel with LIPA's Distribution System](#)" is referred to as the "**Interconnection Technical Requirements**" or "**ITR document**" herein.
- E. **Key questions and potential action items** are outlined in dark red
- F. Please note that it is not expected that PSEGLI respond to all of the questions highlighted in a single presentation. We understand and respect that these are complex topics that may take multiple presentations to review as part of this working group.

2. Reasons For Heightened Concern & Key Industry Observations

- A. We are thankful for the HCM, but it shows a majority of dark red and red.



- B. A notable increase in the requirement for CESIR analysis and heightened requirements. PSEGLI has noted the following:
 - a. The primary reason is increased DER penetration on LIPA distribution systems overall, and the selection of feeders for projects by developers that already have existing DER.
 - b. Preliminary screens were modified in the 1 October 2020 ITR document. Some requirements were loosened and others were tightened to address gaps and to achieve implementation of IEEE 1547-2018. Overall, the screening is not significantly more stringent.

Key Industry Observations

- The trend is that it is increasingly difficult and costly to install solar (& DG) systems
- Increasing hosting capacity is vital to the current and future success of our businesses
- Increasing hosting capacity is in alignment with CLCPA mandates

3. Overview of Prior Select ITWG (JU) & IWG Hosting Capacity Related Presentations & Followup Industry Comments

2016-04-29 (U) ITWG JU Substation Transformer Backfeeding

Reference: ITWG website, April 29, 2016, Presentation title: [JU Presentation](#). See pages titled: "Substation Transformer Backfeeding"

- **Drivers behind Substation Transformer Backfeeding**
 - *Due to increased DER developer activity, substation transformer backfeeding has more potential to occur.*
 - *During low load periods, generation output from DERs can reverse current flows from the substation transformer into transmission system.*
- **Substation Transformer Backfeeding – Issues and Concerns**
 - *The electric system was designed for one-way power flow. Circuit protection and voltage regulation assumes that power flows in one direction only.*
 - *Some substation designs require reverse power flow relays looking into the transformers, which will trip if the relay senses reverse power flow.*
 - *Load tap changer (LTC) and feeder head voltage regulator controllers were designed to control voltage in the forward direction only.*
 - *Radially-supplied or tapped substations with delta-wye wined transformers may experience phase over-voltage during a ground fault.*
 - *Protection and voltage control scheme re-designs will often be needed to allow backfeed into substation transformers.*
- **JU's current state for Substation Transformer Backfeeding**
 - ***All overhead radial systems in NY allow substation transformer backfeeding, with design modifications as needed.***
 - *Substation transformer backfeeding will generally occur at lower levels of DER penetration and have greater impact on smaller substation transformers in more rural areas.*
 - *Voltage violations are likely to become a critical issue before substation transformer backfeeding.*
- **Common Approaches by JU**
 - *LTC controllers to be replaced for where substation transformer backfeeding is anticipated, if not capable of bi-directional regulation with generation.*
 - *3Vo protection is explored for delta-wye wined transformers fed by a single source transmission line (either radial or tapped transmission lines) where there is a risk for voltage rise due to ground fault.*
 - *Preliminary benchmarking with other jurisdictions indicates that the JU's approach is similar in many respects to what has been adopted elsewhere.*

2019-11-05 (I) Feeder & Substations Hosting Capacity Asmt

Initial presentation given by Greg Sachs on this topic after IWG was formed. Key updated observations as follows:

- Hosting capacity is still a major concern for LI businesses and developers
- Latest NYS CLCPA progress (as of October 2020)
 - Current NYS estimate, 2.63 GW-DC solar
 - In order to achieve 6 GW by the end of 2025 we need to install $(6 \text{ GW} - 2.63 \text{ GW}) / 5 \text{ yrs} = 0.67 \text{ GW/yr}$ (2021-2025)
 - Current installation rate is about 0.45 GW per year
 - Need to install ~150% faster than we are now (0.67/0.45)
- If we are not doing 150% now, it will require increasing rates in subsequent years, such as 175% in 2022, etc to achieve the 2025 goal.
- The more challenging goal is the "70% electric sector decarbonization" by 2030, which still needs to be explicitly defined.
- Industry proposed a multi phased approach for channeling our joint efforts to achieving increased hosting capacity and penetration ratios
 - Phase 1- Initial Launch of HCM- COMPLETED!
 - Phase 2- Examination and prioritization of key limiting factors
 - Phase 3- Examine each generally in priority order
 - Phase 4- Review/acknowledge infrastructure upgrades and potential pathways

2020-04-07 (I) Substation (Feeder) Backfeeding

Presentation by Shay Banton about PSEGLI feeder backfeeding technical policies. Note that the title of this presentation should have been "Feeder Backfeeding" not "Substation Backfeeding".

2020-04-07 (U) Main Factors Affecting DER Limits

As requested in the Industry November 2019 presentation, PSEGLI Distribution Planning responds with brief outline of the "Main Factors Affecting DER Limits" as follows:

- A. VOLTAGE CRITERIA: +/- 5% OF NOMINAL VOLTAGE 120V
- B. AVAILABLE INTERCONNECT POSITION
- C. POWER FACTOR: 98%
- D. GEOGRAPHIC LOCATION ON CIRCUIT: FRONT, MID, END
- E. THERMAL LIMITATION:
 - a. NORMAL
 - b. CONTINGENCY- CONCERNS DURING RECONFIGURATION OF CKT.
- F. SIZE OF DER INJECTION: Contingency/Bank LTC regulation

Industry considers this information part of "Phase 2", although the information lacks a sense of frequency of each limitation and actionable information for us to prioritize our efforts.

2020-06-30 (U) DER Feeder Interconnection Limit Considerations

PSEGLI gives a followup presentation on proposed, revised feeder backfeeding, with the key points, summarized as follows:

- A. Previously a limit of 3MW aggregate was allowed on feeders, & anything more required a dedicated feeder
- B. In summary, the reason was "load masking" caused by the injection of DER. If the DER was lost, then thermal overloads would be reached.
- C. Current maximum DER penetration is 3 to 4 MW until new rules implemented

Scenario	DER Single Injection Limit for Non Dedicated Feeder	Maximum allowed DER penetration per feeder	SCADA Requirement (Preliminary)
Existing	3 MW	3 - 4 MW	1 MW
Proposed	5 MW*	Case by Case basis *	500 kW**

*Provided all applicable study requirements are met and dependent on existing DER penetration on that specific feeder. Specific location of DER on the feeder will also vary this limit

11 Feb 2021 Edit -- As discussed at the meeting, the benefit of this change has already been implemented as of October 2020. As such, the "Proposed" settings are currently active. As such, the following strikethrough notes are not applicable.

~~Industry questions regarding proposed short and long term solutions are as follows~~

~~A. Short Term (ST)~~

- ~~a. Implement manual operational procedure to select feeders based on its DER penetration

 - ~~i. Please confirm that this is an operational procedure at the PSEGLI network operations center (not for the system owner/operator).~~
 - ~~ii. What is the status of this manual operational procedure implementation?~~
 - ~~iii. Can we get a list of the select feeders or annotate on the HCM pop-up for that feeder?~~~~
- ~~b. A list will be made available to operators for select DER injections

 - ~~i. Is this the same list of select feeders in "a" above?~~~~
- ~~c. Operating maps should show DER size and location~~
- ~~d. Do not energize/restore DER facility on feeder during emergency conditions as applicable~~

~~B. Additional Industry Questions related to all ST solutions:~~

- ~~a. It is unclear whether these ST solutions fully achieve the "Proposed" targets in the summary table above. Please share what the increase in penetration is for during this "ST solution" period.~~
- ~~b. It is unclear what the timeframe is for implementation of these ST solutions. Please advise on status.~~
- ~~c. Once implemented, will these be incorporated into the HCM calculations? If already implemented, please advise how many feeders this is implemented for.~~

~~C. Long Term~~

- ~~a. Procure DER visibility platform/functionalities~~
- ~~b. Provides exact location of DER~~
- ~~c. Real time Capability to observe the output/status of the DER units~~
- ~~d. Ability to control the units via SCADA control (optional)~~
- ~~e. Included in 2020 U2.0 filing~~

- ~~i. Noted and observed on executive summary pages xvii and xviii, Chapter 4.2.3, etc. Please see the next section for related questions.~~
- ~~f. Bring existing DERs with SCADA into DER visibility platform, followed by any new ones that gets added onto the system~~
- ~~g. Go Live Date: 06/2022~~
- ~~h. Total cost over 5 year period: \$8.5 M~~

D. General industry questions on this presentation

- a. Where can I find a list of this and other technical limitations?
 - i. For example, how is this limitation manifest ITR procedures?
 - ii. Note that we also do not see any reference to this limit in the June 2019 presentation on "[DER Technical Requirements](#)"?
- b. Is this simply part of the "perform CESIR analysis" section 6 and thus not expressly outlined? (See also the request below to provide detailed information regarding CESIR analysis.)
- c. Are these revised feeder limitations in alignment with practices with other members of the JU?

4. Review of 2020 Utility 2.0 Filing, NYS Power Grid Study & Related Documents

DER Visibility Platform Initiative

11 Feb 2021 Edit -- As discussed at the meeting, the "short term" solution is already in place as of October 2020. As such, the final rollout of the DER Visibility Platform will not further enable the increased penetration of DERs onto the non-dedicated feeders, the questions posed in this section are not urgent.

Based on Industry's review of the 2020 Utility 2.0 document, the proposed initiative with the most direct impact on increasing hosting capacity is the "New Initiative Proposed for 2021: DER Visibility Platform", detailed in section 4.2.3. In particular, the proposed project schedule is as follows:

Utility 2.0 Long Range Plan

Chapter 4: Evolve into a Customer-Centric DSP

Table 4-6. Project Schedule – DER Visibility Operational Platform

Stage	Q1 2021	Q2 2021	Q3 2021	Q4 2021	2022+
Market Solicitation	[Bar spanning Q1 2021 to Q2 2021]				
Platform Installation	[Bar spanning Q2 2021 to Q4 2021]				
IT Integration	[Bar spanning Q2 2021 to Q3 2021]				
Configuration	[Bar spanning Q2 2021 to Q3 2021]				
Installation	[Bar spanning Q3 2021 to Q4 2021]				
Functional Testing and Launch	[Bar spanning Q3 2021 to Q4 2021]				
Functional Testing	[Bar spanning Q3 2021 to Q4 2021]				
Launch	[Bar spanning Q3 2021 to Q4 2021]				
Ongoing Maintenance	[Bar spanning Q4 2021 to 2022+]				

Related key industry questions are:

- A. Can you please explain the funding source for the estimated \$8.5 M over 5 years and what, if anything must be approved prior to the stated start date of Q1 2021?

- B. According to the U2.0 plan the first step is Market Solicitation. Can you please provide an update as to whether this program is still on track?
- C. Are all other items intended to begin implementation on 1 April?

Other Hosting Capacity Increasing Initiatives in U2.0?

There are references which are referenced, which do not directly cite the goal of increasing hosting capacity:

- The importance of enhanced grid operations (section 4.3)
- Indirect benefits from increased familiarity and use of energy storage (section 4.4, etc)

We observe that, aside from the DER Visibility Platform, there are really no additional objective initiatives outlined in the U2.0 document related to increasing hosting capacity.

New York Power Grid Study & Others?

It is our understanding that the following other initiatives have taken place or are underway that also pertain to increasing hosting capacity. LIPA/PSEGLI was a participant in the T&D Investment Working Group.

- 2 November 2020 - [Utility Transmission and Distribution Investment Working Group Report](#) Published.
- 18 January 2021 - [NYSEIA \(& others\) respond with comments](#)
- 19 January 2021 - [Initial Report on the New York Power Grid Study](#) published. (Note that this report contains information from the Utility T&D IWG report. Comments due 22 March 2021.)

Key industry questions

- A. To what extent does the general and LIPA specific suggestions impact on PSEGLI distribution side hosting capacity?
- B. How may the suggested activities in these reports influence the priorities we select to pursue in this group and how will that ultimately impact the SGIP or ITR documents?
- C. Are there any OTHER initiatives or activities that PSEGLI is involved in that may influence hosting capacity?

5. Industry Observations & Questions Regarding PSEGLI Policy on Substation Backfeeding

Please know that many in the industry have an impression that PSEGLI does not allow backfeeding power flow from substation distribution to transmission systems. It is our goal that this conversation will provide clarity on current PSEGLI technical policies.

For reference, below is an excerpted description of Penetration Ratio (PR):

For the purposes of the preliminary screening process specified in this document, DER penetration is defined as the aggregate DER capacity installed on the particular feeder section or distribution system divided by the minimum concurrent load level for the same feeder section or distribution system.

Given this definition, please affirm or correct the following statement as it pertains to solar DER:
In the event that feeder and/or substation solar backfeeding is allowed, that feeder or substation would have a penetration ratio of greater than 100%. In other words, for example, the aggregated solar DER capacity installed on the feeder or substation would be greater than the minimum concurrent daytime load.

Review of the ITR shows that none of the preliminary screens prohibit a penetration ratio of greater than 100%, rather it says that if a certain threshold is exceeded a CESIR must be performed or could go to a supplementary screen if desired. Similarly, none of the supplemental screens prohibit a PR of greater than 100%, but outline many factors that could potentially limit the size of a new project, such as: limits on repetitive voltage variation; excessive operation of load tap changer; loss/return over/under voltage limits; misc impacts on other customers, etc. **In conclusion, while there is no language that explicitly prohibits backfeeding, it appears that many other factors may limit the ability for DER of a certain size to connect.**

Please note that there is no guidance in the CESIR analysis section which provides insight into how it is performed and what the specific limits are, such as the 3 to 4 MW feeder limit previously described. This topic is continued in the "CESIR Analysis Details Request" section below.

As observed in the 2016 ITWG presentation, the JU has a published position on the topic of reverse power flow at substations. It is also our understanding that other JU members have explicit technical policies which may allow for substation backfeeding up to 75% of the substation transformer nameplate ratings, and/or provide specific guidance on backfeeding limits based thermal, protection, or other factors.

In review of this discussion and observations, the industry requests additional guidance as follows:

- A. Please provide a clear explanation of PSEGLI's technical policy regarding the maximum allowable substation backfeeding limit.
 - a. PSEGLI Meeting Note: PSEGLI does not prohibit backfeeding. Estimate 75% or 80% of transformer rating. Will be confirmed.
- B. As a meaningful benchmark to track, please specify what percentage of PSEGLI network feeders and substations have a PR of greater than 100%.

6. CESIR Analysis Details Request

Presently the ITR Document, Section 6, provides no information regarding how a CESIR analysis is performed.

6. Coordinated Electric System Interconnection Review (CESIR)

DER interconnection applications that do not pass the supplemental screening process may, at the discretion of the applicant, be subjected to a Coordinated Electric System Interconnection Review (CESIR). A CESIR is a detailed engineering study and often requires system simulation and modeling.

Note that we do acknowledge some additional background technical information is provided in the inaugural IWG presentation given June 2019 titled "[DER Interconnection Technical Requirements](#)".

- Scopes of CESIR are defined on a case-by-case basis depending on:
 - Characteristics and rating of DER systems
 - Characteristics of LIPA system at the proposed point of interconnection
 - Specific criteria failed in the screening process
- Coverage of CESIR in the document is presently a limited placeholder

Industry questions & requests

- A. Please know that the ITWG industry is currently undergoing a comprehensive review of each utility's CESIR analysis assumptions. [This online document](#) summarizes all the analysis and to date feedback from each JU member of this ongoing initiative. The analyses are also embodied in the [JU Standardized CESIR Template \(August 2018\)](#) document, section 5.0 "System Impact Analysis". In a similar item by item fashion, the industry requests a concise outline of each of its analysis, assumptions, limits, etc.
- B. What other unpublished technical limitations exist and are incorporated into the CESIR analysis (such as the feeder limit that would have otherwise been unknown)?
- C. Please share in what scenarios is system modeling software utilized and what modeling software does PSEGLI use for each scenario?
- D. Please provide any other information relevant to performing CESIR analysis.

7. Outline of Future, Potential "Next Steps"

- A. Continued examination of policies and processes which determine whether a DER of a certain size can connect and at what costs
- B. Discussion about necessary additional benchmarking metrics which provide insight into the current state of aggregate DER connection, such as what percentage of feeders and substations currently have a PR of greater than 100%. (This is related to HCM development, but unique.)
- C. Technically define all terms as they pertain to this topic, including the foundational term "hosting capacity".
- D. Obtain a clearer understanding of what other groups and activities are proceeding regarding the topic of increasing hosting capacity. Invite shared exchange of information and findings from each side, and how they impact IWG activities.

This is an important and critical initiative as part of our collective future success. Thank you.

PSEGLI In-Meeting Comments