Comparison of PSEG-Long Island and JU Interconnection Requirements

Long Island Interconnection Working Group Meeting
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Disclaimer

Requirements for interconnection of DER to the LIPA system are defined in the *PSEG Long Island's Smart Grid Small Generator Interconnection Technical Requirements and Screening Criteria for Operating in Parallel with LIPA's Distribution System* document, as currently published. This presentation is intended to be informative, only, and does not modify, supplement, or interpret the requirement document as currently published.

Background

- The investor-owned utilities operating in NY State (the Joint Utilities – JU) have created a spreadsheet comparing the DER interconnection requirements of each member utility
  http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B6B8911A8-5B3C-40ED-8DC8-07C78089FB2F%7D

- This presentation compares, topic by topic, the range of JU requirements with the PSEG-Long Island interconnection requirements specified in *PSEG Long Island's Smart Grid Small Generator Interconnection Technical Requirements and Screening Criteria for Operating in Parallel with LIPA's Distribution System* document. Cost topics are not addressed in this presentation.

Substation Transformer Backfeed

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Substation Transformer Backfeed

Common definition and criterial for neutral overvoltage protection

JOINT UTILITIES

- 3V0 protection required for reverse power flow through substation power transformer when:
  - Substation is radially fed from a single source.

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- Screening criterion is substation penetration >80% triggers CESIR
- CESIR evaluates risk and specifies mitigation if needed

Substation Transformer Backfeed

Criteria for where 3V0 protection is required

JOINT UTILITIES

- Most of JU indicates this situation is rarely encountered and no specific threshold is established
- National Grid's criterion is 67% DER nameplate penetration relative to minimum load after N-1 contingency

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- Screening will identify risk of this issue
  - Failed screen drives project to CESIR where issue is investigated and mitigation identified
- Backflow unlikely due to per-substation DER limit of 25% of substation bank capacity
- Otherwise not explicitly addressed in document

Substation Transformer Backfeed

Document providing additional information on this issue

JOINT UTILITIES

- JU utilities list their applicable reference documents
- Exception is O&R which states that they are working on their document
  - May have been completed subsequent to posting of JU requirements matrix in mid-2018

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- Screening criteria are provided in PSEG-LI's interconnection requirements document
- Section on CESIR study details is in development

Monitoring & Control

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Differences in M&C requirements from *Interim JU Monitoring and Control Criteria (Sept., 2017)*

JOINT UTILITIES

- Other than Con Edison, JU indicate no differences
- Con Edison requirements differ for 4 kV and low-voltage isolated network interconnections
- JU requirements:
  - Monitoring for all DER > 50 kW
  - Control may be required for > 50 kW
  - Interconnection recloser for DER > 500 kW

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- Thresholds for enhanced M&C are 500 and 1000 kVA
- For DER between 500 & 1000 kVA, monitoring not required except for exceptional circumstances
- Typically no control required for DER < 1000 kW
- Interconnection breaker for DER > 500 kVA

Islanding Mitigation

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Islanding Mitigation

Differences in anti-islanding requirements from *Interim JU Anti-Islanding Criteria (Feb., 2017)*

JOINT UTILITIES

- Other than Con Edison, JU indicate no differences
- Con Edison lists additional measures beyond those stated in JU document

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- Unlike most of JU, instantaneous feeder breaker reclosing is used on LIPA system
- On-board anti-islanding detection is only tested for response within 2 seconds
- Penetration > 50% on feeder section triggers CESIR
  - CESIR determines if penetration can exceed 50% on entire feeder for any possible configuration and if DTT is required

Allowed DTT communication media, where DTT is required

JOINT UTILITIES

- Avangrid & Con Ed specify either leased telecomm line or fiber
- CHG&E, NG, and O&R allow leased telecomm line or fiber and also allow radio after analyzing path

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- T1 leased telecomm circuit
- Developer may also install their own dedicated fiber
  - This has historically been a prohibitively expensive option
- Protection-speed radio infrastructure is not established on the LIPA system

Islanding Mitigation

Installation of reclose blocking on one mid-line recloser

JOINT UTILITIES

- Extent of work depends on whether only a setting change is needed, or if a new recloser is required

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- Line reclosers are not typically used on the LIPA system. The small number deployed are not configured to block reclose

Islanding Mitigation

Installation of reclose blocking on substation breaker

JOINT UTILITIES

- Avangrid, NG, and O&R indicate "N/A", presumably meaning that this option is not available or necessary
- CHG&E and Con Edison indicate that this option is available

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- Reclose blocking is not feasible in almost all LIPA substations due to lack of space in existing switchgear for necessary PTs
- Replacement of switchgear is prohibitively expensive

Effective Grounding with Grounded-Wye Grounded-Wye Interconnection Transformer

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Effective Grounding with Yg-yg Transformer

Calculations, software, or criteria to determine effective grounding

JOINT UTILITIES

- Most utilities indicate they use Aspen (however, it is well known that Aspen cannot analyze the isolated system configuration for which grounding is critical)
- CHG&E indicates that they use IEEE C62.92.6 calculation procedures (hand calculation)
- O&R uses DEW software

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- Supplemental screening formulas are based on C62.92.6 for inverters
- Aspen is used for rotating generators

Effective Grounding with Yg-yg Transformer

Minimum system size where additional grounding will always be required

JOINT UTILITIES

- Most JU indicate “N/A”
- National Grid requires supplemental ground sources for all DER > 500 kW

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- No such rigid criterion is used.
- There are different grounding requirements between inverter and rotating generator DER

Effective Grounding with Yg-yg Transformer

Minimum system size where grounding is evaluated

JOINT UTILITIES

- Most JU indicate 50 kW
- National Grid's criterion is 250 kW
- Con Edison evaluates all DER, regardless of rating

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- DER > 50 kVA are screened, but screening is based on aggregate DER rating, not just the reviewed project

Effective Grounding with Yg-yg Transformer

What grounding configuration is allowed when the interconnection transformer is Yg-yg?

JOINT UTILITIES

- Generally, grounding transformers connected to either the MV or LV side of interconnection transformer is allowed

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- DER > 50 kVA are screened, but screening is based on aggregate DER rating, not just the reviewed project

Effective Grounding with Yg-yg Transformer

What document is used to guide parameters of grounding devices?

JOINT UTILITIES

- Other than CHG&E, JU cites no documents
- CHG&E cites a paper by M. Ropp

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- Guidance by the applicable IEEE standards
  - C62.92.1
  - C62.92.6

Effective Grounding with Yg-yg Transformer

Is project placed on hold if proposed grounding is unacceptable

JOINT UTILITIES

- Avangrid: provides parameters
- CHG&E: strives to not put on hold
- Con Edison: CESIR determines parameters
- NG: Industry assumptions are used in CESIR and provided to DER developer. Authorization to construct component may be withheld
- O&R: No hold at CESIR level, but no authorization to construct device

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- Developer required to perform a grounding study.
- Project not put on hold if there is a disagreement, but not authorized to energize until requirements are satisfied

Effective Grounding with Wye-Delta Interconnection Transformer

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Effective Grounding with Yg-Δ Transformer

Minimum system size where neutral impedance will always be required

JOINT UTILITIES

- Most JU indicate “reviewed on a case by case basis”
- Con Edison: 500 kW and greater; neutral impedance may be required and requirement may change over time

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- Reviewed on a case-by-case basis

Effective Grounding with Yg-Δ Transformer

Minimum system size where neutral impedance is always evaluated

JOINT UTILITIES

- Most JU indicate 50 kW
- Con Edison: DER ≥ 250 kW

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- DER > 50 kVA
- In practice, evaluation is for developer's benefit to avoid risk to transformer from distribution system ground faults and load imbalance

Effective Grounding with Yg-Δ Transformer

Maximum ground fault current contribution of the system

JOINT UTILITIES

- Reviewed on a case-by-case basis

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- Aggregate distribution system ground current < 400 A

Effective Grounding with Yg-Δ Transformer

Protection concerns with this configuration, other than single-phase open contingencies

JOINT UTILITIES

- Ground fault protection coordination due to desensitizing of upstream protective devices
- Avangrid and CHG&E require ground source to be removed when not generating

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- Upstream protection desensitization and coordination

Mitigation methods for protection concerns related to this configuration

JOINT UTILITIES

- Appropriate transformer sizing
- Neutral resistor or reactor
- Disconnection of ground source

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- Use minimum grounding admittance
- Appropriate modeling of sources (consider IEEE C62.92.6 for inverters)

Single-Phase Open Contingencies

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Single Phase Open

Is single-phase open protection required?

JOINT UTILITIES

- Except for CHG&E, “not yet evaluated”
- CHG&E: “Yes”

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- Compliance with IEEE 1547
- Requires open-phase detection at PCC or DER terminals
- DER > 500 kVA also requires negative sequence protection (except for inverters and induction machines)

Single Phase Open

Mitigation methods.

JOINT UTILITIES

- Except for CHG&E, “not yet evaluated”
- CHG&E: Customer owned relay and recloser with negative sequence and zero sequence relay elements

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- DER > 500 kVA also requires negative sequence protection (except for inverters)

DER Capacity Limits

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DER Capacity Limits

Feeder limits

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- Constrained by performance issues such as voltage level, flicker, etc.

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- Based on difference between normal and emergency ratings
- Necessary due to actively reconfigurable distribution system

DER Capacity Limits

Substation limits

JOINT UTILITIES

- No published limits

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- 25% of aggregate distribution substation transformer bank capacity
- Based on difference between normal and emergency ratings
- Necessary due to actively reconfigurable distribution system

Summary

- General similarity and comparability of PSEG-LI and JU requirements
- Better understanding of inverter sources reflected in PSEG-LI requirements
- Unique characteristics of LIPA system drive feeder and substation level DER capacity limits

Questions?

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