

# Criteria Limits for Distributed Energy Resource Connections to the ACE, DPL and Pepco Distribution Systems (less than 69kV) 5/2020

## 1. Single Phase Limit

The largest capacity single phase generator or DER (battery) operating in parallel with the grid is 100kW. Above that size, a balanced 3 phase system is required. If 3 phase is available, balanced 3 phase shall be used.

## 2. Voltage Limits

DERs are permitted to cause up to 3% (primary) or 5% (secondary) voltage fluctuation at the Point of Interconnection and ½ the band width of any voltage regulator or ½ the net dead band of a capacitor bank. DERs in maximum output, are permitted to raise feeder voltage to the ANSI or state limit whichever is more conservative. An absorbing PF may be required to mitigate voltage rise or fluctuation impact.

## 3. Existing Distribution Circuit Capacity Limits

The aggregate limit of “large” generators running in parallel with a single, existing distribution circuit is:

| Circuit Voltage | Aggregate Limit | Large DER Size |
|-----------------|-----------------|----------------|
| 4 kV            | 1 MW            | 250 kW         |
| 12 – 13.8 kV    | 3 MW            | 250 kW         |
| 23 – 25 kV      | 6 MW            | 500 kW         |
| 33.26 – 34.5 kV | 10 MW           | 1 MW           |

## 4. Express Circuit Capacity Limits

Distributed generation installations which exceed the limit for an existing circuit require an express circuit.

The maximum generator size for express circuits shall be:

| Circuit Voltage | DER Limit |
|-----------------|-----------|
| 4 kV            | 1 MW      |
| 12 – 13.8 kV    | 10 MW     |
| 23 – 25 kV      | 10 MW     |
| 33.26 – 34.5 kV | 20 MW     |

Note: Maximum Demand Loss and Annual Energy Loss both must be less than 3% for the express feeder

## 5. Telemetry requirements

On radial circuits that have or can incorporate Distribution Automation, telemetry is required on all systems 250kW and greater.

## 6. Distribution Power Transformer Limit

The aggregate of “large” DER will be limited to 50% of the substation transformer normal rating. In the case of transformers paralleled on the low side, the limit is 50% of the sum of the transformer normal ratings. This usually ensures that the LTC does not operate excessively. Note that small systems (less than the large system size for the circuits’ voltage class), may continue to be interconnected when these distribution transformer limits are reached.

The absolute net reverse power limit is 40% of the transformer normal rating. This ensures that locations with transfer capability can operate safely where one transformer load automatically transfers to the remaining transformer upon outage of one transformer

## 7. Express Circuit Length Limit

The maximum circuit length is limited to 5 miles for 12/13 kV, 7 miles for 25 kV, and 10 miles for 34 kV.

Note: For ACE and Pepco, no 34 kV Express Circuits will be built as that voltage level is being retired. 4 kV Express Circuits will not be built in any PHI jurisdiction.

If there is no more injection capacity or space for an additional transformer at the closest substation, the next closest substation will be considered.

## **8. When a New Substation is Required**

If a distribution express circuit can't be built from an existing substation for a project, it will be necessary to construct a new distribution substation with a standard ring bus design. It will be supplied by extending existing transmission lines. In NJ, it is the developer's responsibility to verify eligibility of this configuration for solar renewable energy certificates with New Jersey's Clean Energy Program if desired.

All limits, given above in MWs, are subject to more detailed study to ensure feasibility.

## **9. Secondary and Spot Networks**

DER systems less than or equal to 50 kW can be approved if the DER maximum generation is  $\leq 5\%$  of the area network peak load. Monitoring and control will not be required. PHI has the right to revise the maximum export level in case of changed conditions or future negative impacts.

DER systems larger than 50 kW will be required to provide local monitoring of net power (import or export) and control of generation through control relays, or a combination of inverter and dedicated controller. Net power limits will be set to prevent reverse power on any area network protector.<sup>1</sup> In some cases a minimum net import (into the facility) may be required.

Telemetry will be required for systems larger than 150 kW to collect and provide PHI the monitored data. For systems larger than 50 kW and up to and including 150 kW, telemetry and related interoperability may be required where the system, during daytime hours, operates within 30% of the point where a network protector would inadvertently operate.

In Atlantic City Electric service territory aggregate PV generation connected to an area network shall not exceed 10% of minimum annual load or 500 kW, whichever is less. The minimum load is calculated based on minimum load occurring during an off-peak daylight period for PV or any off-peak minimum for other generation types. Depending on size, all PHI monitoring and telemetry requirements apply in Atlantic City.

**NOTE: To allow for more PV to be put on a secondary network, Pepco has come up with the following criteria that would accommodate larger systems that are greater than the minimum daytime load of a facility at certain times of the year:**

- For an LVAC Spot Network there must be a minimum import limit:
  - Minimum import Limit (M.I.L) is the minimum amount of power delivered to the customer from the utility.
  - The limit is (a) 20% of day-time min load, or (b) to be determined by planner in special cases.
- For an LVAC Grid Network there must be a maximum export limit:
  - The maximum export limit allows a customer on an LVAC grid network to export excess generation to the grid without causing reverse power to the network protectors at any time.

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<sup>1</sup> The setting is determined based on a 20% safety buffer below the import that would cause network protector operation or cycling. This margin is 20% of the maximum excess generation, or 15 kW, whichever is larger.

The limit is equal to 80% of the export (i.e. excess) generation of the customer's system (at the grid minimum load condition), before causing reverse power to any of the network transformers/protectors in the grid network. The PV system/facility being evaluated is evaluated with all other active and pending generation represented in the network.

## **10. Direct Transfer Trip**

For all DERs, 750kW and greater, DTT will be required. There are other scenarios where DERs smaller than 750kW will require DTT. Considerations for synchronous generators are different than inverter based.

### **Explanation of the Reviewed Impacts**

Voltage Fluctuation – This is a metric used to represent the DER's impact on distribution feeder voltage. It quantifies the difference in feeder voltage between when the system is running at full output and then after the generation has been suddenly lost. Larger systems and systems connected further from a substation tend to have a higher voltage fluctuation value. If this criterion can't be met with power factor mitigation, an impact study will be required to ensure that voltage can be maintained within applicable standards.

Steady State High Voltage – A simulation is performed which predicts how high the voltage will rise at a point in time when energy consumption is lowest on the feeder and the DER is injecting power. The system is simulated in a normal, steady state and abnormalities are not accounted for. In some cases, steady state high voltage can be mitigated by changing settings on voltage regulation equipment.

Reverse Power Flow – Some devices may require setting changes, a re-evaluation of their control scheme, or replacement. The lowest daytime (9am - 3pm) load going thru the lowest loaded phase of a voltage regulator or distribution power transformer must be 20% greater than the aggregate solar output downstream of the respective equipment or mitigation is required.

### **Explanation of Restricted Circuits**

Fully Restricted Circuits – any size – Given current technology, each distribution circuit will have a limit to the amount of distributed generation that can be accommodated. When the installed generation on a circuit has reached its maximum, (generally just before the point of voltage violations), no further applications can be accepted for DER's, regardless of size, unless the customer is willing to pay for the needed upgrades. Potential DER owners may request, at their expense, to pay for upgrades that would allow them to install their system. In many cases, the required upgrade costs may make an installation cost prohibitive.

Restricted Circuits – to LT Large – Circuits which have active and/or pending generation that exceeds the amount that can be accommodated may be restricted to generators with AC ratings based on the voltage level. Typically, this is done in the case where distributed generation requests exceed set criteria limits in order to avoid closing the circuit entirely. (See: 3. Existing Distribution Circuit Capacity Limits)