Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AC1-093

"Cedar Creek 138 kV III"

December 2019

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed.

The System Impact Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The Interconnection Customer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

Freepoint Solar LLC, the Interconnection Customer (IC), has proposed an 18.8 MW (7.1 MWC) solar generating facility to be located in Townsend, New Castle County, Delaware. PJM studied the AC1-093 project as an 18.8 MW injection into the Delmarva Power and Light Company (DPL) system at the Cedar 138 kV Substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2020.

Point of Interconnection

The Interconnection Customer requested AC1-093 utilize the same Point of Interconnection as their prior queue projects AC1-091 and AC1-092 at DPL's Cedar Creek 138 kV Substation (see Attachment 1).

Transmission Owner Scope of Direct Connection Work

It is assumed that all of the Transmission Owners attachment facilities work was completed as part of the AC1-091 project so no additional work is required for AC1-093.

Required Relaying and Communications

New protection relays are required for the new terminal. An SEL-487 will be required for primary protection and an SEL-387 will be required for back-up protection. One 20" relay panel for each line terminal will be required for front line and back-up protection.

An SEL-451 relay on a 10” breaker control panel will be required for the control and operation of each new 138 kV circuit breaker.

The project will require re-wiring and adjustment of existing relay schemes to accommodate the new 138 kV terminal.

The cost of the required relay and communications is included in the Substation Interconnection Estimate.

Metering

Three phase 138 kV revenue metering points will need to be established. DPL will purchase and install all metering instrument transformers as well as construct a metering structure. The secondary wiring connections at the instrument transformers will be completed by DPL’s metering technicians. The metering control cable and meter cabinets will be supplied and installed by DPL. DPL will install conduit for the control cable between the instrument transformers and the metering enclosure. The location of the metering enclosure will be determined in the construction phase. DPL will provide both the Primary and the Backup meters. DPL’s meter technicians will program and install the Primary & Backup solid state multi-function meters for each new metering position. Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one meter DNP output for each meter. DPL will own the metering equipment for the interconnection point, unless the IC asserts its right to install, own, and operate the metering system.

The Interconnection Customer will be required to make provisions for a voice quality phone line within approximately 3 feet of each Company metering position to facilitate remote interrogation and data collection.

It is the IC’s responsibility to send the data that PJM and DPL requires directly to PJM. The IC will grant permission for PJM to send DPL the following telemetry that the IC sends to PJM: real time MW, MVAR, volts, amperes, generator status, and interval MWH and MVARH.
The estimate for DPL to design, purchase, and install metering as specified in the aforementioned scope for metering is included in the Substation Interconnection Estimate.

Interconnection Customer Scope of Work

The Interconnection Customer is responsible for all design and construction related to activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report, and is the responsibility of the IC. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff.

DPL Interconnection Customer Scope of Direct Connection Work Requirements

- DPL requires that an IC circuit breaker is located within 500 feet of Cedar Creek substation to facilitate the relay protection scheme between DPL and the IC at the Point of Interconnection (POI).

Special Operating Requirements

1. DPL will require the capability to remotely disconnect the generator from the grid by communication from its System Operations facility. Such disconnection may be facilitated by a generator breaker, or other method depending upon the specific circumstances and the evaluation by DPL.

2. DPL reserves the right to charge the Interconnection Customer operation and maintenance expenses to maintain the Interconnection Customer attachment facilities, including metering and telecommunications facilities, owned by DPL.

Summer Peak Analysis - 2020

Transmission Network Impacts

Potential network impacts are as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

None

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

1. (DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 98.23% to 100.39% (AC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 12.50 MW to the thermal violation.

```
CONTINGENCY 'DBL_4NC'                    /* RED LION-CEDAR CREEK
230;RED LION-CARTANZA 230
 OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
 OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
 END
```

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. (DP&L - DP&L) The AB2-135 TAP-CHURC_69 69 kV line (from bus 924820 to bus 232203 ckt 1) loads from 112.58% to 115.43% (AC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 2.77 MW to the thermal violation.

```
CONTINGENCY 'DBL_4NC'                    /* RED LION-CEDAR CREEK
230;RED LION-CARTANZA 230
 OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
 OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
 END
```

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

Stability Analysis

No issues identified. See Attachment 2 for full report.

Short Circuit

No issues identified.

Affected System Analysis & Mitigation

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

None

Light Load Analysis - 2020

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

System Reinforcements

Short Circuit

None

Stability and Reactive Power Requirement

None

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

1. The existing PJM Baseline Network Upgrade B2633.10 relieves the Milford to Steel 230 kV circuit overload.

   PJM Baseline Network Upgrade B2633.10 scope: Interconnect the new Silver Run 230 kV Substation with the existing Red Lion to Cartanza and Red Lion to Cedar Creek 230 kV lines.

   In Service Date: 6/01/2020

   Note: AC1-093 does not have cost responsibility for this upgrade. However, AC1-093 will need this upgrade in-service to be deliverable to the PJM system. If AC1-093 intends to come into service prior to completion of the upgrade, it will need an interim study.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

1. The existing PJM Baseline Network Upgrade B2633.10 relieves the AB2-135 TAP to Church 69 kV circuit kV overload.

   PJM Baseline Network Upgrade B2633.10 scope: Interconnect the new Silver Run 230 kV Substation with the existing Red Lion to Cartanza and Red Lion to Cedar Creek 230 kV lines.

   In Service Date: 6/01/2020

   Note: AC1-093 does not have cost responsibility for this upgrade. However, AC1-093 will need this upgrade in-service to be deliverable to the PJM system. If AC1-093 intends to come into service prior to completion of the upgrade, it will need an interim study.

Light Load Load Flow Analysis Reinforcements

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None

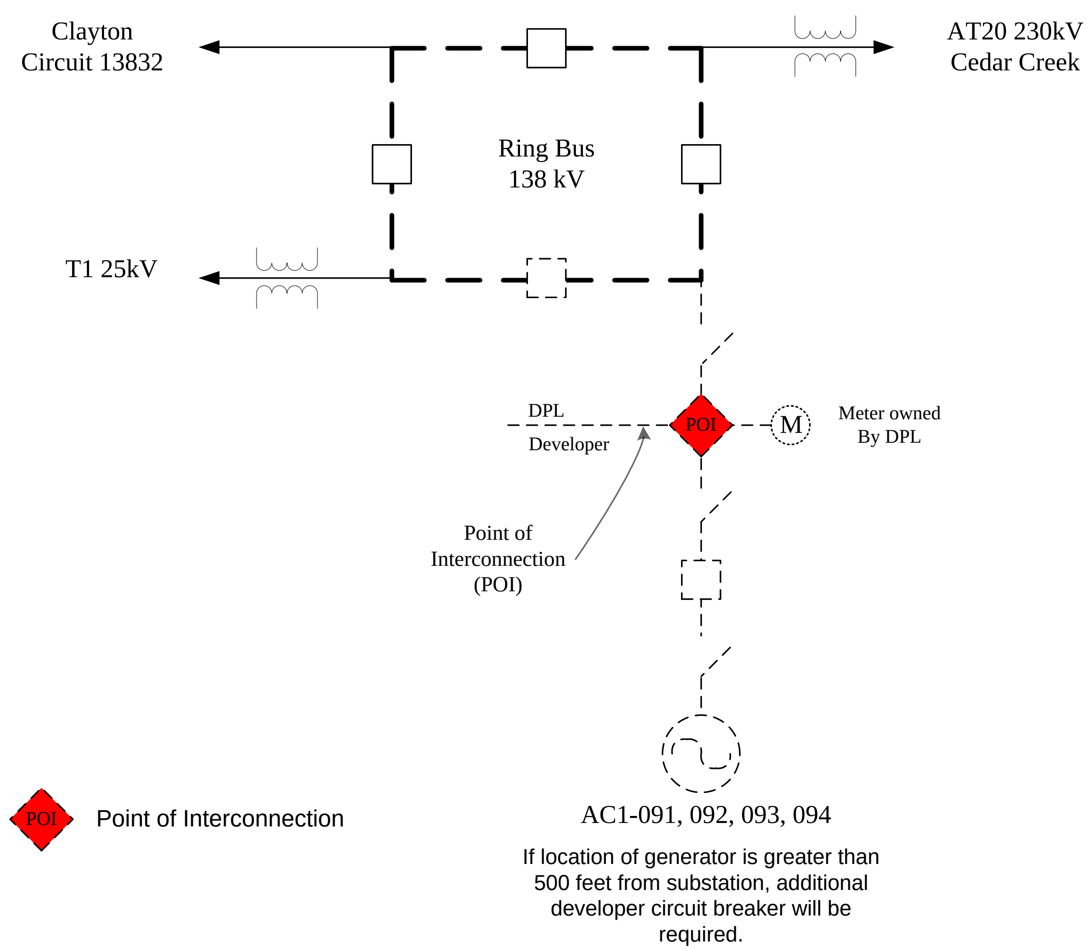
Facilities Study Estimate

A Facilities Study is required, the estimated duration and cost estimate to perform Facilities Study is:

12 months; $50,000

Attachment 1

Cedar Creek 138 KV Substation



Attachment 2

AC1-091/092/093/094/095

System Impact Study

Dynamic Simulation Analysis

June 29th, 2017

Version 0

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Executive Summary

Generator Interconnection Requests AC1-091/092/093/094/095 are for a combined 85.2 MW Maximum Facility Output (MFO) solar powered generating facility with a Point of Interconnection (POI) at the existing Cedar Creek 138 kV Substation in the Delmarva Power and Light transmission system, New Castle County, Delaware.

This report describes a dynamic simulation analysis of AC1-091/092/093/094/095 as part of the overall system impact study.

The load flow scenario for the analysis was based on the RTEP 2020 Summer Peak case, modified to include applicable queue projects. AC1-091/092/093/094/095 has been dispatched online at maximum power output, with POI voltage of (1.014 p.u.), consistent with the default generator reference voltage specified in PJM Manual 03 Transmission Operations Section 3.3.3 for generator connections to the PJM 138 kV system.

The AC1-095 queue project was tested for compliance with NERC, PJM and other applicable criteria. The range of contingencies evaluated was limited to that necessary to assess compliance and each was limited to a 20-second simulation time period.

Simulated NERC Standard TPL-001 faults include:

1. Three-phase (3ph) fault with normal clearing (Category P1)
2. Operating of a line section w/o a fault, Single-line-to-ground (slg) on Bus Section and Breaker. (Category P2)
3. Single-line-to-ground (slg) with delayed clearing as a result of breaker failure (Category P4)
4. Single-line-to-ground (slg) with delayed clearing as a result of protection failure (Category P5)
5. Single-line-to-ground (slg) with normal clearing for common structure (Category P7)

Note: For generator interconnection studies, Category P3 and P6 faults will be studied on an as needed basis. In this study, P2 contingencies are covered by P1 and P4 contingencies.

The system was tested for a system intact condition and the fault types listed above. Specific fault descriptions and breaker clearing times used for this study are provided in the result table.

No relevant High Speed Reclosing (HSR) contingencies were identified.

For all simulations, the queue project under study along with the rest of the PJM system were required to maintain synchronism and with all states returning to an acceptable new condition following the disturbance.

For the remaining fault contingencies tested on the 2020 Summer Peak case:

a) Post-contingency oscillations were positively damped with a damping margin of at least 4% for local modes and 3% for inter-area modes.

b) The AC1-091/092/093/094/095 generator was able to ride through all faults (except for faults where protective action trips a generator(s)).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

No mitigations were found to be required.

1. Introduction

Generator Interconnection Requests AC1-091/092/093/094/095 are for a combined 85.2 MW Maximum Facility Output (MFO) solar powered generating facility with a Point of Interconnection (POI) at the existing Cedar Creek 138 kV Substation in the Delmarva Power and Light transmission system, New Castle County, Delaware.

This analysis is effectively a screening study to determine whether the addition of AC1-091/092/093/094/095 will meet the dynamic requirements of the NERC, PJM and Transmission Owner reliability standards.

In this report the AC1-095 project and how it is proposed to be connected to the grid are first described, followed by a description of how the project is modeled in this study. The fault cases are then described and analyzed, and lastly a discussion of the results is provided.

2. Description of Project

Generator Interconnection Requests AC1-091/092/093/094/095 are for a combined 85.2 MW Maximum Facility Output (MFO) solar powered generating facility with a Point of Interconnection (POI) at the existing Cedar Creek 138 kV Substation in the Delmarva Power and Light transmission system, New Castle County, Delaware.

Figure 1 shows the simplified one-line diagram of the AC1-091/092/093/094/095 load flow models. Table 1 through to Table 5 list the parameters given in the impact study data and the corresponding parameters of the AC1-091/092/093/094/095 load flow models.

The dynamic models for the AC1-091/092/093/094/095 plant are based on the SMASC_C131_33_IVF111 PSS/E version 33 user defined model supplied by the Developer in the attachments to the System Impact Study (SIS) Data Sheets.

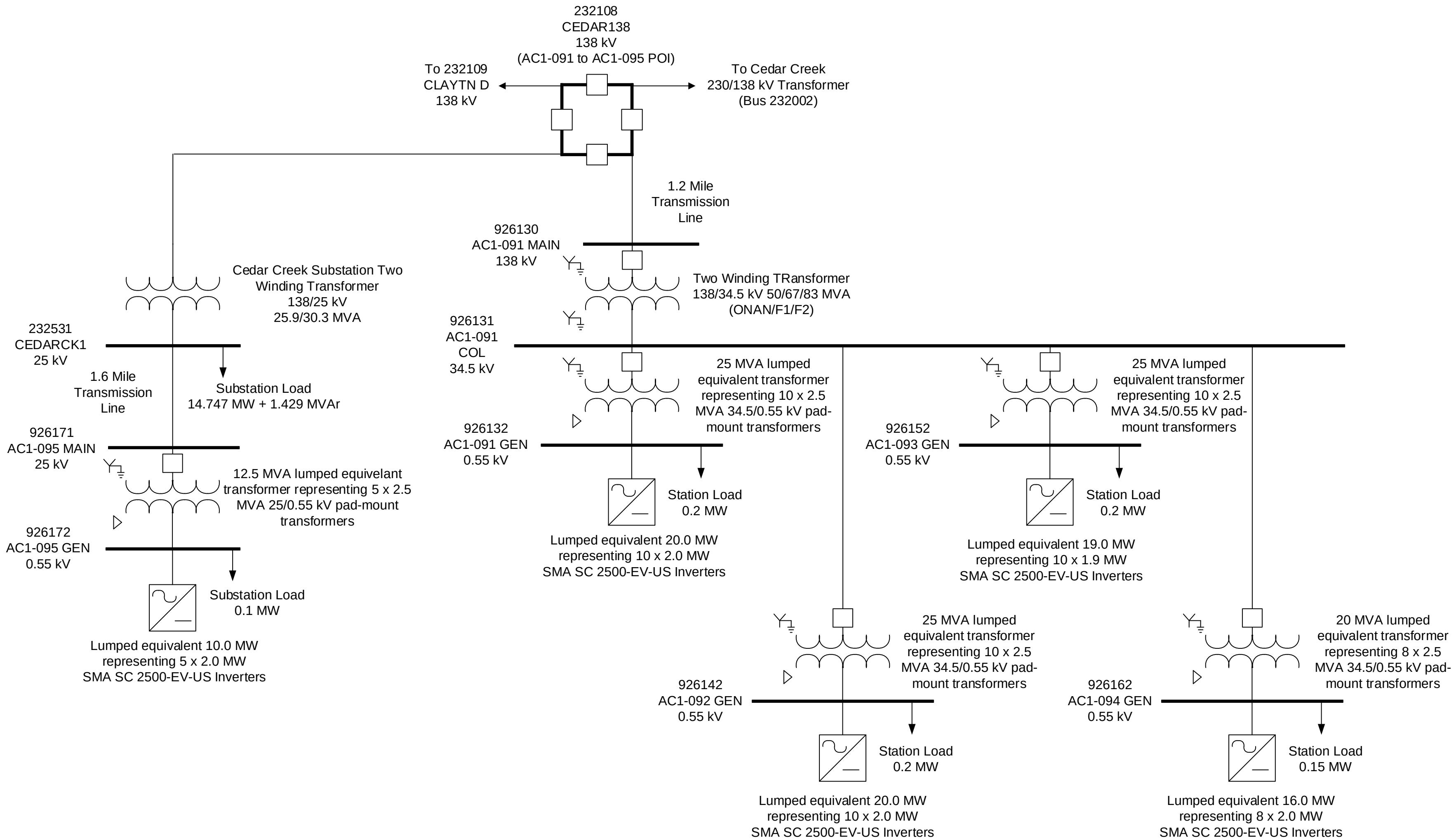


Figure 1: AC1-091/092/093/094/095 Plant Model

Table 1: AC1-091 Plant Model

	Impact Study Data	Model
Inverters	10 × 2.0 MW SC 2500-EV-US PV Inverters MVA base = 2.1 MVA Terminal voltage = 0.55 kV	Lumped equivalent representing 10 × 2.0 MW SC 2500-EV-US Inverters Pgen 20.0 MW Pmax 20.0 MW Pmin 0 MW Qmax 6.6 MVAr Qmin -6.6 MVAr Mbase 21.0 MVA Zsorce 0.0 + j10000 pu @Mbase
GSU transformer	10 x 34.5/0.55 kV two winding transformers Transformer MVA base = 2.5 MVA Rating = 2.5 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = N/A Tap step size = N/A	Lumped equivalent representing 10 x 34.5/0.55 kV two winding transformers Transformer MVA base = 25.0 MVA Rating = 25.0 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = 5 Tap step size = 2.5 %
Collector step-up transformer	138/34.5 kV two winding transformer Rating = 50/67/83 MVA (OA/F1/F2) Transformer MVA base = 50 MVA Impedance = 0.0030 + j0.0899 pu @ MVA base Number of taps = N/A Tap step size = N/A	138/34.5 kV two winding transformer Rating = 50/67/83 MVA (OA/F1/F2) Transformer MVA base = 50 MVA Impedance = 0.0030 + j0.0899 pu @ MVA base Number of taps = 5 Tap step size = 2.5 %
Auxiliary load	N/A	Not modeled
Station load	0.2 MW + 0.0 MVAr	0.2 MW + 0.0 MVAr modeled at the inverter bus
Transmission line	Length = 1.2 miles Impedance = 0.0006 + j0.0048	Length = 1.2 miles Impedance = 0.0006 + j0.0048

Table 2: AC1-092 Plant Model

	Impact Study Data	Model
Inverters	10 × 2.0 MW SC 2500-EV-US PV Inverters MVA base = 2.1 MVA Terminal voltage = 0.55 kV	Lumped equivalent representing 10 × 2.0 MW SC 2500-EV-US Inverters Pgen 20.0 MW Pmax 20.0 MW Pmin 0 MW Qmax 6.6 MVAr Qmin -6.6 MVAr Mbase 21.0 MVA Zsorce 0.0 + j10000 pu @Mbase
GSU transformer	10 x 34.5/0.55 kV two winding transformers Transformer MVA base = 2.5 MVA Rating = 2.5 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = N/A Tap step size = N/A	Lumped equivalent representing 10 x 34.5/0.55 kV two winding transformers Transformer MVA base = 25.0 MVA Rating = 25.0 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = 5 Tap step size = 2.5 %
Auxiliary load	N/A	Not modeled
Station load	0.2 MW + 0.0 MVAr	0.2 MW + 0.0 MVAr modeled at the inverter bus

Table 3: AC1-093 Plant Model

	Impact Study Data	Model
Inverters	10 × 1.9 MW SC 2500-EV-US PV Inverters MVA base = 2.0 MVA Terminal voltage = 0.55 kV	Lumped equivalent representing 10 × 1.9 MW SC 2500-EV-US Inverters Pgen 19.0 MW Pmax 19.0 MW Pmin 0 MW Qmax 6.3 MVAr Qmin -6.3 MVAr Mbase 20.0 MVA Zsorce 0.0 + j10000 pu @Mbase
GSU transformer	10 x 34.5/0.55 kV two winding transformers Transformer MVA base = 2.5 MVA Rating = 2.5 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = N/A Tap step size = N/A	Lumped equivalent representing 10 x 34.5/0.55 kV two winding transformers Transformer MVA base = 25.0 MVA Rating = 25.0 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = 5 Tap step size = 2.5 %
Auxiliary load	N/A	Not modeled
Station load	0.2 MW + 0.0 MVAr	0.2 MW + 0.0 MVAr modeled at the inverter bus

Table 4: AC1-094 Plant Model

	Impact Study Data	Model
Inverters	8 × 2.0 MW SC 2500-EV-US PV Inverters MVA base = 2.1 MVA Terminal voltage = 0.55 kV	Lumped equivalent representing 8 × 2.0 MW SC 2500-EV-US Inverters Pgen 16.0 MW Pmax 16.0 MW Pmin 0 MW Qmax 5.3 MVAr Qmin -5.3 MVAr Mbase 16.8 MVA Zsorce 0.0 + j10000 pu @Mbase
GSU transformer	8 x 34.5/0.55 kV two winding transformers Transformer MVA base = 2.5 MVA Rating = 2.5 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = N/A Tap step size = N/A	Lumped equivalent representing 8 x 34.5/0.55 kV two winding transformers Transformer MVA base = 20.0 MVA Rating = 20.0 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = 5 Tap step size = 2.5 %
Auxiliary load	N/A	Not modeled
Station load	0.15 MW + 0.0 MVAr	0.15 MW + 0.0 MVAr modeled at the inverter bus

Table 5: AC1-095 Plant Model

	Impact Study Data	Model
Inverters	5 × 2.0 MW SC 2500-EV-US PV Inverters MVA base = 2.1 MVA Terminal voltage = 0.55 kV	Lumped equivalent representing 5 × 2.0 MW SC 2500-EV-US Inverters Pgen 10.0 MW Pmax 10.0 MW Pmin 0 MW Qmax 3.3 MVAr Qmin -3.3 MVAr Mbase 10.5 MVA Zsorce 0.0 + j10000 pu @Mbase
GSU transformer	5 x 25.0/0.55 kV two winding transformers Transformer MVA base = 2.5 MVA Rating = 2.5 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = N/A Tap step size = N/A	Lumped equivalent representing 5 x 25.0/0.55 kV two winding transformers Transformer MVA base = 12.5 MVA Rating = 12.5 MVA Impedance = 0.007 + j0.057 pu @ MVA base Number of taps = 5 Tap step size = 2.5 %
Auxiliary load	N/A	Not modeled
Station load	0.1 MW + 0.0 MVAr	0.1 MW + 0.0 MVAr modeled at the inverter bus
Transmission line	Length = 1.6 miles Impedance = 0.0037 + j0.0091	Length = 1.6 miles Impedance = 0.0037 + j0.0091

3. Loadflow and Dynamics Case Setup

The dynamics simulation analysis was carried out using PSS/E Version 33.7.

The load flow scenario and fault cases for this study are based on PJM's Regional Transmission Planning Process[1].

The selected load flow scenario is the RTEP 2020 Summer Peak case with the following modifications:

a) Addition of all applicable queue projects prior to AC1-095.

b) Addition of AC1-091/092/093/094/095 queue project.

c) Removal of withdrawn and subsequent queue projects in the vicinity of AC1-095.

d) Dispatch of units in the PJM system to maintain slack generators within limits.

The AC1-091/092/093/094/095 initial conditions are listed in **Table 3**, indicating maximum power output, with AC1-091/092/093/094/095 regulating POI voltage of (1.014 p.u.), consistent with the default generator reference voltage specified in PJM Manual 03 Transmission Operations Section 3.3.3 for generator connections to the PJM 138 kV system.

Table 3: AC1-095 machine initial conditions

Bus	Name	Unit	PGEN (MW)	QGEN (MVAR)	ETERM (p.u.)	POI Voltage (p.u.)
926132	AC1-091 GEN 0.5500	1	20.0000	4.3	1.0488	1.014
926142	AC1-092 GEN 0.5500	1	20.0000	4.3	1.0488	1.014
926152	AC1-093 GEN 0.5500	1	19.0000	4.3	1.0486	1.014
926162	AC1-094 GEN 0.5500	1	16.0000	4.3	1.0511	1.014
926172	AC1-095 GEN 0.5500	1	10.0000	3.3	1.0622	1.014

Generation within the vicinity of AC1-091/092/093/094/095 has been dispatched online at maximum output (PMAX). The dispatch of generation in the vicinity of AC1-091/092/093/094/095 is given in Attachment 3.

[1] Manual 14B: PJM Region Transmission Planning Process, Rev 33, May 5 2016, Attachment G : PJM Stability, Short Circuit, and Special RTEP Practices and Procedures.

4. Fault Cases

Tables 3 listed the contingencies and results that were studied, with representative worst case total clearing times provided by PJM. Each contingency was studied over a 20 second simulation time interval.

Simulated NERC Standard TPL-001 faults include:

1. Three-phase (3ph) fault with normal clearing (Category P1)
2. Operating of a line section w/o a fault, Single-line-to-ground (slg) on Bus Section and Breaker. (Category P2)
3. Single-line-to-ground (slg) with delayed clearing as a result of breaker failure (Category P4)
4. Single-line-to-ground (slg) with delayed clearing as a result of protection failure (Category P5)
5. Single-line-to-ground (slg) with normal clearing for common structure (Category P7)

Note: For generator interconnection studies, Category P3 and P6 faults will be studied on an as needed basis. In this study, P2 contingencies are covered by P1 and P4 contingencies.

The system was tested for a system intact condition and the fault types listed above. No relevant High Speed Reclosing (HSR) contingencies were studied.

5. Evaluation Criteria

This study is focused on AC1-091/092/093/094/095, along with the rest of the PJM system, maintaining synchronism and having all states return to an acceptable new condition following the disturbance. The recovery criteria applicable to this study are as per PJM's Regional Transmission Planning Process and Transmission Owner criteria:

a) The system with AC1-091/092/093/094/095 included is transiently stable and post-contingency oscillations should be positively damped with a damping margin of at least 4% for local modes and 3% for inter-area modes.

b) The AC1-091/092/093/094/095 is able to ride through faults (except for faults where protective action trips AC1-091/092/093/094/095).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

6. Summary of Results

Plots from the dynamic simulations are provided in Attachment 4, with results summarized in Table 3.

The frequency protection was disabled due to the PSSE deficiency in calculating frequencies for 3ph fault at POIs.

For the fault contingencies tested in this study:

a) Post-contingency oscillations were positively damped with a damping margin of at least 4% for local modes and 3% for inter-area modes.

b) The AC1-095 generator was able to withstand all contingencies.

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of that fault.

7. Mitigations

No mitigations were found to be required.

Table 4: Fault list

P0: Steady State

Fault ID	Duration
P0.00	Steady State 20 sec run

P1: Three Phase Faults with normal clearing

Fault ID	Fault description	Clearing Time Normal (Cycles)	Results
P1.00	3ph @ AC1-091 Main – Cedar Creek 138kV line, normal clear loss of AC1-091/092/093/094	9	Stable
P1.01	3ph @ Cedar Creek 138/25kV TF, normal clear loss of AC1-095	9	Stable
P1.02	3ph @ Cedar Creek 138/230kV TF	9	Stable
P1.03	3ph @ Cedar Creek – Clayton 138kV line	9	Stable
P1.04	3ph @ Cedar Creek – Red Lion 230kV line	7	Stable
P1.05	3ph @ Cedar Creek – Cedar Creek Reactor 230kV line, normal clear Reactors	7	Stable
P1.06	3ph @ Cedar Creek – Milford 230kV line	7	Stable
P1.07	3ph @ Clayton – Demecsmy 138kV line, normal clear loss of SMYRNA unit 1 and 2	9	Stable
P1.08	3ph @ Clayton – Jones – Cheswold 138kV line	9	Stable
P1.09	3ph @ Cheswold – Felton 138kV line	9	Stable
P1.10	3ph @ Cheswold 138/69kV TF	9	Stable
P1.11	3ph @ Cheswold 138kV capbanks, normal clear loss of all Cheswold 138kV capbanks	9	Stable

P4: SLG Stuck Breaker (SB) Faults at Backup Clearing

Fault ID	Fault description	Clearing Time Normal/Delayed (Cycles)	Results
P4.01	SLG @ Cedar Creek 138/25kV TF, normal clear loss of AC1-095. SB @ Cedar Creek 138kV, delayed clear loss of AC1-091 Main – Cedar Creek 138kV line, loss of AC1-091/092/093/094.	9/21	Stable
P4.02	SLG @ Cedar Creek 138/25kV TF, normal clear loss of AC1-095. SB @ Cedar Creek 138kV, delayed clear loss of Cedar Creek – Clayton 138kV line.	9/21	Stable
P4.03	SLG @ Cedar Creek – AC1-091 Main 138kV line, normal clear loss of AC1-091/092/093/094. SB @ Cedar Creek 138kV, delayed clear loss of Cedar Creek 138/230kV TF	9/21	Stable
P4.04	SLG @ Cedar Creek 138/230kV TF, SB @ Cedar Creek 138kV, delayed clear loss of Cedar Creek – Clayton 138kV line, loss of AC1-091 to AC1-095	9/21	Stable
P4.05	SLG @ Cedar Creek 230/138kV TF, SB @ Cedar Creek 230kV, delayed clear loss of Cedar Creek – Cedar Creek Reactor 230kV line, loss of Cedar Creek 230kV reactors	9/17.5	Stable
P4.06	SLG @ Cedar Creek 230/138kV TF, SB @ Cedar Creek 230kV, delayed clear loss of Cedar Creek – Milford 230kV line	9/17.5	Stable
P4.07	SLG @ Cedar Creek – Red Lion 230kV line, SB @ Cedar Creek 230kV, delayed clear loss of Creek – Milford 230kV line	7/17.5	Stable
P4.08	SLG @ Cedar Creek – Red Lion 230kV line, SB @ Cedar Creek 230kV, delayed clear loss of Cedar Creek – Cedar Creek Reactor 230kV line, loss of Cedar Creek 230kV reactors	7/17.5	Stable
P4.09	SLG @ Clayton 138/25kV TF1, SB @ Clayton 138kV, delayed clear loss of Clayton – Cedar Creek 138kV line	9/21	Stable
P4.10	SLG @ Clayton 138/25kV TF1, SB @ Clayton 138kV, delayed clear loss of Clayton – Jones – Cheswold 138kV line	9/21	Stable
P4.11	SLG @ Clayton 138/25kV TF2, SB @ Clayton 138kV, delayed clear loss of Clayton – Jones – Cheswold 138kV line	9/21	Stable
P4.12	SLG @ Clayton 138/25kV TF2, SB @ Clayton 138kV, delayed clear loss of Clayton – Demecsmy 138kV line, loss of SMYRNA unit 1 and 2	9/21	Stable

P4.13	SLG @ Clayton – Cedar Creek 138kV line, SB @ Clayton 138kV, delayed clear loss of Clayton – Demecsmy 138kV line, loss of SMYRNA unit 1 and 2	9/21	Stable
P4.14	SLG @ Cheswold 138/25 TF3, SB @ Cheswold 138kV, delayed clear loss of Cheswold – Felton 138kV line	9/21	Stable
P4.15	SLG @ Cheswold 138/25 TF3, SB @ Cheswold 138kV, delayed clear loss of Clayton – Jones – Cheswold 138kV line	9/21	Stable
P4.16	SLG @ Cheswold 138/69kV TF AT1, SB @ Cheswold 138kV, delayed clear loss of Cheswold – Felton 138kV line	9/21	Stable
P4.17	SLG @ Cheswold 138/69kV TF AT1, SB @ Cheswold 138kV, delayed clear loss of Cheswold 138kV capbanks	9/21	Stable
P4.18	SLG @ Cheswold 138kV Capbanks, SB @ Cheswold 138kV, delayed clear loss of Clayton – Jones – Cheswold 138kV line	9/21	Stable

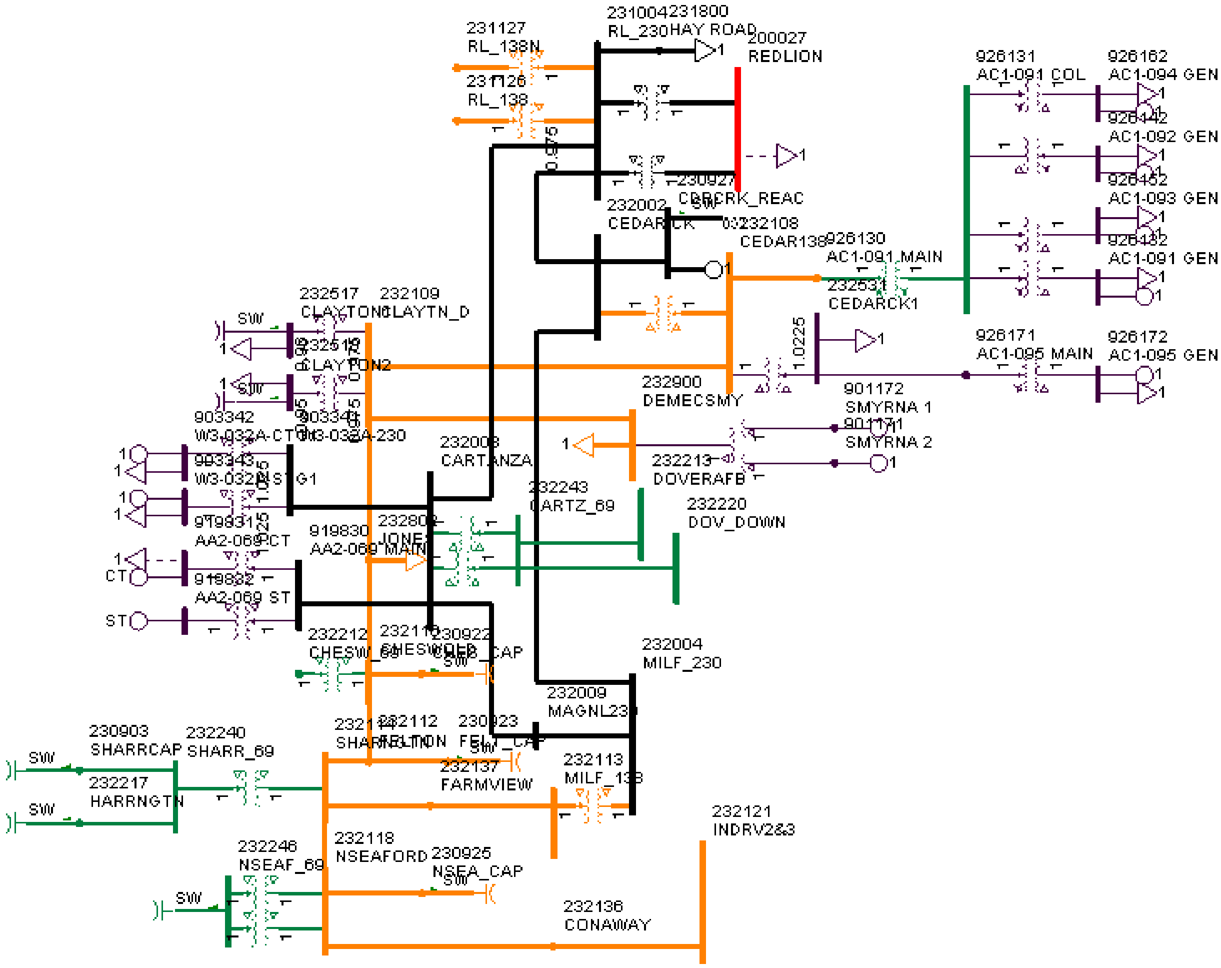
P5: SLG Fault with Delayed (Zone 2) Clearing

Fault ID	Fault description	Clearing Time Normal/Delayed (Cycles)	Results
P5.01	SLG @ 80% of Cedar Creek – Clayton 138kV line	9/37	Stable
P5.02	SLG @ 80% of Clayton – Cedar Creek 138kV line	9/37	Stable
P5.03	SLG @ 80% of Clayton – Jones – Cheswold 138kV line	9/37	Stable
P5.04	SLG @ 80% of Cheswold – Jones – Clayton 138kV line	9/37	Stable
P5.05	SLG @ 80% of Cheswold – Felton 138kV line	9/37	Stable
P5.06	SLG @ 80% of Felton – Cheswold 138kV line	9/37	Stable
P5.07	SLG @ Cedar Creek 138/230kV TF	/37	Stable
P5.08	SLG @ 80% of Cedar Creek – Red Lion 230kV line	7/25	Stable
P5.09	SLG @ 80% of Cedar Creek – Milford 230kV line	7/25	Stable

P7: Common Structure

Fault ID	Fault description	Clearing Time (Cycles)	Results
P7.01	CONTINGENCY 'DBL_4NC' /* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230 SLG @ Red Lion – Cedar Creek 230kV line, tower failure normal clear loss of Red Lion – Cartanza 230kV line	7	Stable
P7.02	CONTINGENCY 'DBL_4NC_2ND' /* RED LION-CEDAR CREEK 230;RED LION-REYBOLD 138 SLG @ Red Lion – Cedar Creek 230kV line, tower failure normal clear loss of Red Lion – Reybold 138kV line	9	Stable

Attachment 1. PSS/E Model One Line Diagram



Attachment 2. AC1-091/092/093/094/095 PSS/E Dynamic Model

```
/*****************************************************************************
/*** Project:              AC1-091
/*** POI:                  Cedar Creek 138 kV
/*** Inverter Model:           SMASC131
/*** Size:                 20.0 MW
/*** OBJ/DLL/LIB:              SMASC_C131_33_IVF111.dll
/*** OBJ/DLL/LIB:              SMAPPC_B18_33_IVF111.dll
/*** PSSE Version:             33
/*****************************************************************************

926132 'USRMDL' 1 'SMASC131' 1 1 0 76 15 193
               1.0 1.0 0.0 0.8 1.0 0.0 1.0 1.0 0.35
               1.0 0.0 5.0 0.5 2.0
               0.0 0.9 0.5 1.0 0.9 0.9
               0.0 0.2 0.05 0.4
               0.35 0.35 1.0 2.0 2.0 2.0 0.1 0.098 0.1 0.098 0.2 0.2
               0.01 1.0 20.0 0.5 0.61 0.62 0.0 0.125 0.1
               1.2 0.1 1.18 1.0 1.15 2.0 0.88 12.0 0.6 5.0 0.5 3.0
               65.0 0.1 64.0 1.0 61.5 3.0 59.3 5.0 57.0 3.0 50.0 0.1
               30.0 0.0 10.0 30.0 0.0 1.0 1.0/

926132 'USRMDL' 1 'SMAPPC18' 4 0 4 28 9 21 926130 232108 1 0
               3 0.5 0.25 0.04 0.0 0.1 1.0 0.04 0
               0 1 0 10 -0.001
               0.1 1.0 0.04 0 1 0.2 0.2
               0.8 0.91 0.915 1.060 1.055 0.3 1.0/

/*****************************************************************************
/*** Project:              AC1-092
/*** POI:                  Cedar Creek 138 kV
/*** Inverter Model:           SMASC131
/*** Size:                 20.0 MW
/*** OBJ/DLL/LIB:              SMASC_C131_33_IVF111.dll
/*** OBJ/DLL/LIB:              SMAPPC_B18_33_IVF111.dll
/*** PSSE Version:             33
/*****************************************************************************

926142 'USRMDL' 1 'SMASC131' 1 1 0 76 15 193
               1.0 1.0 0.0 0.8 1.0 0.0 1.0 1.0 0.35
               1.0 0.0 5.0 0.5 2.0
               0.0 0.9 0.5 1.0 0.9 0.9
               0.0 0.2 0.05 0.4
               0.35 0.35 1.0 2.0 2.0 2.0 0.1 0.098 0.1 0.098 0.2 0.2
               0.01 1.0 20.0 0.5 0.61 0.62 0.0 0.125 0.1
               1.2 0.1 1.18 1.0 1.15 2.0 0.88 12.0 0.6 5.0 0.5 3.0
               65.0 0.1 64.0 1.0 61.5 3.0 59.3 5.0 57.0 3.0 50.0 0.1
               30.0 0.0 10.0 30.0 0.0 1.0 1.0/
```

```
926142 'USRMDL' 1 'SMAPPC18' 4 0 4 28 9 21 926130 232108 1 0
        3 0.5 0.25 0.04 0.0 0.1 1.0 0.04 0
        0 1 0 10 -0.001
        0.1 1.0 0.04 0 1 0.2 0.2
        0.8 0.91 0.915 1.060 1.055 0.3 1.0/

/*****************************************************************************
/*** Project:              AC1-093
/*** POI:                  Cedar Creek 138 kV
/*** Inverter Model:       SMASC131
/*** Size:                 19.0 MW
/*** OBJ/DLL/LIB:          SMASC_C131_33_IVF111.dll
/*** OBJ/DLL/LIB:          SMAPPC_B18_33_IVF111.dll
/*** PSSE Version:         33
/*****************************************************************************


926152 'USRMDL' 1 'SMASC131' 1 1 0 76 15 193
        1.0 1.0 0.0 0.8 1.0 0.0 1.0 1.0 0.35
        1.0 0.0 5.0 0.5 2.0
        0.0 0.9 0.5 1.0 0.9 0.9
        0.0 0.2 0.05 0.4
        0.35 0.35 1.0 2.0 2.0 2.0 0.1 0.098 0.1 0.098 0.2 0.2
        0.01 1.0 20.0 0.5 0.61 0.62 0.0 0.125 0.1
        1.2 0.1 1.18 1.0 1.15 2.0 0.88 12.0 0.6 5.0 0.5 3.0
        65.0 0.1 64.0 1.0 61.5 3.0 59.3 5.0 57.0 3.0 50.0 0.1
        30.0 0.0 10.0 30.0 0.0 1.0 1.0/

926152 'USRMDL' 1 'SMAPPC18' 4 0 4 28 9 21 926130 232108 1 0
        3 0.5 0.25 0.04 0.0 0.1 1.0 0.04 0
        0 1 0 10 -0.001
        0.1 1.0 0.04 0 1 0.2 0.2
        0.8 0.91 0.915 1.060 1.055 0.3 1.0/

/*****************************************************************************
/*** Project:              AC1-094
/*** POI:                  Cedar Creek 138 kV
/*** Inverter Model:       SMASC131
/*** Size:                 16.0 MW
/*** OBJ/DLL/LIB:          SMASC_C131_33_IVF111.dll
/*** OBJ/DLL/LIB:          SMAPPC_B18_33_IVF111.dll
/*** PSSE Version:         33
/*****************************************************************************

926162 'USRMDL' 1 'SMASC131' 1 1 0 76 15 193
        1.0 1.0 0.0 0.8 1.0 0.0 1.0 1.0 0.35
        1.0 0.0 5.0 0.5 2.0
        0.0 0.9 0.5 1.0 0.9 0.9
        0.0 0.2 0.05 0.4
        0.35 0.35 1.0 2.0 2.0 2.0 0.1 0.098 0.1 0.098 0.2 0.2
        0.01 1.0 20.0 0.5 0.61 0.62 0.0 0.125 0.1
```

```
                1.2 0.1 1.18 1.0 1.15 2.0 0.88 12.0 0.6 5.0 0.5 3.0
                65.0 0.1 64.0 1.0 61.5 3.0 59.3 5.0 57.0 3.0 50.0 0.1
                30.0 0.0 10.0 30.0 0.0 1.0 1.0/

926162 'USRMDL' 1 'SMAPPC18' 4 0 4 28 9 21 926130 232108 1 0
                3 0.5 0.25 0.04 0.0 0.1 1.0 0.04 0
                0 1 0 10 -0.001
                0.1 1.0 0.04 0 1 0.2 0.2
                0.8 0.91 0.915 1.060 1.055 0.3 1.0/

/*****************************************************************************
/*** Project:              AC1-095
/*** POI:                  Cedar Creek 138 kV
/*** Inverter Model:       SMASC131
/*** Size:                 10.0 MW
/*** OBJ/DLL/LIB:          SMASC_C131_33_IVF111.dll
/*** OBJ/DLL/LIB:          SMAPPC_B18_33_IVF111.dll
/*** PSSE Version:         33
/*****************************************************************************

926172 'USRMDL' 1 'SMASC131' 1 1 0 76 15 193
                1.0 1.0 0.0 0.8 1.0 0.0 1.0 1.0 0.35
                1.0 0.0 5.0 0.5 2.0
                0.0 0.9 0.5 1.0 0.9 0.9
                0.0 0.2 0.05 0.4
                0.35 0.35 1.0 2.0 2.0 2.0 0.1 0.098 0.1 0.098 0.2 0.2
                0.01 1.0 20.0 0.5 0.61 0.62 0.0 0.125 0.1
                1.2 0.1 1.18 1.0 1.15 2.0 0.88 12.0 0.6 5.0 0.5 3.0
                65.0 0.1 64.0 1.0 61.5 3.0 59.3 5.0 57.0 3.0 50.0 0.1
                30.0 0.0 10.0 30.0 0.0 1.0 1.0/


926172 'USRMDL' 1 'SMAPPC18' 4 0 4 28 9 21 926171 232531 1 0
                3 0.5 0.25 0.04 0.0 0.1 1.0 0.04 0
                0 1 0 10 -0.001
                0.1 1.0 0.04 0 1 0.2 0.2
                0.8 0.91 0.915 1.060 1.055 0.3 1.0/
```

Attachment 3. AC1-091/092/093/094/095 PSS/E Case Dispatch

Bus Number	Bus Name	Id	In Service	PGen (MW)	PMax (MW)	PMin (MW)	QGen (Mvar)	QMax (Mvar)	QMin (Mvar)
200036	SALEM-G1 22.000	1	1	1253	1253	1018	300	535	100
200037	SALEM-G2 22.000	1	1	1245	1245	1008	300	542.9	100
200039	HOPE CG1 22.000	1	1	1320	1320	0	560	560	108
200052	ROCKSP 1 18.000	1	1	163.5	163.5	20	67.33	67.33	-50
200053	ROCKSP 2 18.000	1	1	163.5	163.5	20	67.33	67.33	-50
200054	ROCKSP 3 18.000	1	1	165	165	20	75	75	-50
200055	ROCKSP 4 18.000	1	1	165	165	20	75	75	-50
200062	SALEM G3 22.000	1	1	38.4	38.4	0	14	14	-14
230927	CDRCRK_REAC 230.00	1	1	0	0	0	-20	0	-20
231118	NEWCASTL 138.00	1	1	0	0	0	-60	0	-60
231131	BLOOM ENRGY 138.00	1	1	27	27	0	0	0	0
231505	HR4 18.000	4	1	185	185	0	23.33	23.33	-23.3
231900	EM5 23.000	5	1	450	450	0	0	0	0
231902	DC CT7 13.800	1	1	62.1	62.1	0	-3.07	65.06	-3.07
231903	GEN4 13.800	4	1	72	72	0	0	0	0
231904	DC1 NUG 13.800	1	0	0	0	0	0	0	0
231905	DC2 NUG 13.800	1	0	0	0	0	0	0	0
231907	DC10 13.800	1	1	17.8	17.8	0	12.1	12.1	-5
231911	HR5 13.800	5	1	125	125	0	10	10	-10
231912	HR6 13.800	6	1	125	125	0	10	10	-10
231913	HR7 13.800	7	1	125	125	0	10	10	-10
231914	HR8 18.000	8	1	190	190	0	18.61	18.61	-9.3
231915	DC CT6 13.800	1	1	55	55	0	-17	15	-17
232227	EASTN_69 69.000	1	1	0	0	0	-30	0	-30
232632	IR SVC 16.000	1	1	0	0	0	150	150	-150
232813	VAUGHN 69.000	1	1	3	3	0	0	0	0
232904	IR4 26.000	4	1	414.2	414.2	0	4.9	4.9	-2.93
232920	IR10 13.200	1	1	16.1	16.1	0	0	15	0
232925	NELSVC 16.000	1	1	0	0	0	-9.52	150	-150
901171	SMYRNA 2 13.800	1	1	53	53	30	-3.34	28	-18
901172	SMYRNA 1 13.800	1	1	48	48	30	1.658	25	0
903342	W3-032A-CTG118.000	1	1	211	211	0	28.27	100	-60
903343	W3-032A-STG113.800	1	1	127	127	0	28.27	50	-40
907291	X1-074 CT 20.000	1	1	200.5	200.5	92	52.12	120	-85
907292	X1-074 ST 13.800	1	1	99.5	99.5	92	34	34	-34
913400	Y3-102-STG 23.500	1	1	499	499	0	83.62	499	-183
913401	Y3-102-CTG1 21.000	1	1	290	290	100	83.62	290	-114
913402	Y3-102-CTG2 21.000	1	1	290	290	100	83.62	290	-114

919831	AA2-069 CT 18.000	CT	1	245	245	0	28.27	130	-90
919832	AA2-069 ST 18.000	ST	1	217	217	0	28.27	170	-120
924881	AB2-142 C 24.900	1	1	5.1	5.1	0	0	0	0
926132	AC1-091 GEN 0.5500	1	1	20	20	0	2.229	6.6	-6.6
926142	AC1-092 GEN 0.5500	1	1	20	20	0	2.229	6.6	-6.6
926152	AC1-093 GEN 0.5500	1	1	19	19	0	2.229	6.3	-6.3
926162	AC1-094 GEN 0.5500	1	1	16	16	0	2.229	5.3	-5.3
926172	AC1-095 GEN 0.5500	1	1	10	10	0	2.229	3.3	-3.3
927321	AC1-229 C 138.00	1	0	3.8	3.8	0	0.611	1.254	-1.25

Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the Appendices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the Appendices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators.

It should be noted the project/generator MW contributions presented in the body of the report and appendices sections are full contributions, whereas the loading percentages reported in the body of the report, take into consideration the commercial probability of each project as well as the ramping impact of "Adder" contributions.

Appendix 1

1. (DP&L - DP&L) The MILF_230-STEELE 230 kV line (from bus 232004 to bus 232000 ckt 1) loads from 98.23% to 100.39% (AC power flow) of its emergency rating (551 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 12.50 MW to the thermal violation.

```
CONTINGENCY 'DBL_4NC'                    /* RED LION-CEDAR CREEK 230;RED LION-CARTANZA 230
  OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
  OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
  END
```

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*5.47*
232616	*GEN FOOD*	*2.*
232904	*IR4*	*48.17*
232923	*MR1*	*12.53*
232924	*MR2*	*12.53*
232922	*MR3*	*13.44*
232901	*NORTHST*	*5.93*
901004	*W1-003 E*	*2.22*
901014	*W1-004 E*	*2.22*
901024	*W1-005 E*	*2.22*
901034	*W1-006 E*	*2.22*
901411	*W1-062*	*5.81*
903511	*W3-032A*	*40.7*
907052	*X1-032 E*	*1.89*
910572	*X3-008 E*	*3.32*
913412	*Y1-080 E*	*0.68*
915542	*Y3-058 E*	*4.1*
917082	*Z2-012 E*	*6.09*
920763	*Z2-076 E*	*1.22*
920773	*Z2-077 E*	*1.22*
921872	*AA2-069*	*332.32*
922752	*AB1-056 C OP*	*41.9*
922753	*AB1-056 E OP*	*119.31*
923282	*AB1-137 C*	*2.63*
923283	*AB1-137 E*	*1.13*
924361	*AB2-084 C*	*1.79*
924362	*AB2-084 E*	*2.93*
924681	*AB2-120 C OP*	*16.91*
924682	*AB2-120 E OP*	*27.59*
924781	*AB2-130 C OP*	*16.78*

924782	*AB2-130 E OP*	*27.38*
924832	*AB2-136 E*	*8.05*
925151	*AB2-172 C OP*	*5.08*
925152	*AB2-172 E OP*	*8.29*
925261	*AB2-180 C*	*6.18*
925262	*AB2-180 E*	*2.65*
926901	*AC1-091 C*	*4.99*
926902	*AC1-091 E*	*8.184*
926911	*AC1-092 C*	*4.99*
926912	*AC1-092 C*	*8.184*
926921	*AC1-093 C*	*4.72*
926922	*AC1-093 C*	*7.78*
926931	*AC1-094 C*	*3.99*
926932	*AC1-094 C*	*6.5*
926941	*AC1-095 C*	*2.53*
926942	*AC1-095 E*	*4.06*
927871	*AC1-177*	*1.85*
928001	*AC1-190 C*	*9.61*
928002	*AC1-190 E*	*4.12*
928241	*AC1-213 C*	*1.51*
928242	*AC1-213 E*	*0.99*

Appendix 2

1. (DP&L - DP&L) The AB2-135 TAP-CHURC_69 69 kV line (from bus 924820 to bus 232203 ckt 1) loads from 112.58% to 115.43% (AC power flow) of its emergency rating (93 MVA) for the tower line contingency outage of 'DBL_4NC'. This project contributes approximately 2.77 MW to the thermal violation.

```
CONTINGENCY 'DBL_4NC'                          /* RED LION-CEDAR CREEK
230;RED LION-CARTANZA 230
  OPEN LINE FROM BUS 231004 TO BUS 232002 CKT 1
  OPEN LINE FROM BUS 231004 TO BUS 232003 CKT 1
  END
```

Bus Number	*Bus Name*	*Full Contribution*
232900	*DEMECSMY*	*1.5*
232851	*DUP-SFR1*	*0.18*
232923	*MR1*	*1.32*
232924	*MR2*	*1.32*
232910	*NRG_G1*	*2.76*
232911	*NRG_G2*	*2.76*
232813	*VAUGHN*	*0.15*
901004	*W1-003 E*	*0.3*
901014	*W1-004 E*	*0.3*
901024	*W1-005 E*	*0.3*
901034	*W1-006 E*	*0.3*
901411	*W1-062*	*1.6*
907052	*X1-032 E*	*0.26*
915542	*Y3-058 E*	*0.6*
917082	*Z2-012 E*	*0.82*
920763	*Z2-076 E*	*0.15*
920773	*Z2-077 E*	*0.15*
921872	*AA2-069*	*35.03*
922752	*AB1-056 C OP*	*4.98*
922753	*AB1-056 E OP*	*14.19*
923282	*AB1-137 C*	*0.33*
923283	*AB1-137 E*	*0.14*
924361	*AB2-084 C*	*0.25*
924362	*AB2-084 E*	*0.4*
924681	*AB2-120 C OP*	*2.28*
924682	*AB2-120 E OP*	*3.71*
924781	*AB2-130 C OP*	*2.66*
924782	*AB2-130 E OP*	*4.34*
924821	*AB2-135 C*	*24.83*

924822	*AB2-135 E*	*28.32*
925261	*AB2-180 C*	*0.9*
925262	*AB2-180 E*	*0.38*
926901	*AC1-091 C*	*1.10*
926902	*AC1-091 E*	*1.81*
926911	*AC1-092 C*	*1.10*
926912	*AC1-092 C*	*1.81*
926921	*AC1-093 C*	*1.04*
926922	*AC1-093 C*	*1.72*
926931	*AC1-094 C*	*0.88*
926932	*AC1-094 C*	*1.46*
926941	*AC1-095 C*	*0.56*
926942	*AC1-095 E*	*0.9*
927871	*AC1-177*	*0.26*
928241	*AC1-213 C*	*0.21*
928242	*AC1-213 E*	*0.14*