Generation Interconnection
Feasibility Study Report
Queue Position AC1-081

The Interconnection Customer (IC) has proposed a 180 MW (180 MW Capacity) natural gas fueled combined cycle generating facility consisting of two (2) gas turbines and one (1) steam turbine/generator to be located in Hunlock Creek, Luzerne County, Pennsylvania. At the IC's request, PJM studied the AC1-081 project at both a Primary and Secondary Point of Interconnection. The study results are provided below. The planned in-service date, as requested by the IC during the project kick-off call, is September 28, 2020. This date may not be attainable due to additional required PJM studies and the Transmission Owner's construction schedule.

Point(s) of Interconnection

The Interconnection Customer requested a Primary and Secondary Point of Interconnection (POI) be evaluated for the AC1-081 project.

Primary Point of Interconnection

PJM studied the AC1-081 project as a 180 MW injection into the UGI Utilities Inc. system at a tap of the Mountain-Susquehanna T10 230 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2020. The AC1-081 project will connect with the UGI Utilities Inc. transmission system at a new 230 kV substation to be constructed adjacent to the Mountain (UGI)-Susquehanna (PPL EU) T10 230 kV circuit.

The interconnection requires construction of a new 230kV transmission line from the Hunlock Station and a new three (3) breaker 230kV ring bus. The radial transmission line would extend approximately 4 miles from the Hunlock Station to the location of the new switching station near the existing double circuit 230kV line in Newport Township, Luzerne County. The connection to the transmission system would be completed by looping the existing Mountain-Susquehanna T10 line into the new station.

Transmission Owner Scope of Attachment Facilities Work

Substation Estimate

Scope:

- Construct a new 230kV transmission line from the Hunlock Station to the new switching station site.
- Construct a three-breaker 230kV ring bus at a site in Newport Township adjacent to the 230kV double circuit lines.
- Loop the existing 230kV line into the new switching station.

Please note the following:

- The estimated time to engineer and construct this option is **30 months**. These time estimates do not include the time to purchase right of way or time to obtain necessary regulatory

approvals and permits and assumes that PJM will allow all transmission system outages when requested.

- UGI Utilities Inc. will compensate the generator interchange metering for line losses to the new switching station.
- UGI Utilities, Inc. does not own or control any of the right of way needed, therefore new right of way would have to be purchased for this option. The cost to purchase and prepare the right of way is not included in the cost estimate.
- Both projects are subject to Pennsylvania's transmission line siting regulations. UGI Utilities, Inc. has no reason to believe obtaining regulatory approval for siting either transmission line would be a major obstacle to it being built.
- The proposed transmission path crosses the Susquehanna River. UGI Utilities, Inc. has no reason to believe obtaining permits to cross the Susquehanna River will be a major obstacle.
- This estimate does not include OPGW fiber lines for the SCADA network.

Estimate: $17,000,000

Substation Direct Connection Work (UGI) ($300,000)

- Modification of existing line protection and control schemes at the remote terminal (Mountain CB 23010) to accommodate the new ring bus and generator interconnection.
- Install interchange metering equipment.

Estimate: $300,000

SCADA (UGI)

- Install UGI SCADA control and communications equipment at Hunlock & the new switching station.

Estimate: $250,000

Metering

The Interconnection Customer is 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.

Interconnection Customer Scope of Direct Connection 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.

Summer Peak Analysis - 2020

Transmission Network Impacts

Potential transmission 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)

None

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. (PL - PJM500) The LACKAW 500/230 kV transformer (from bus 208009 to bus 200074 ckt 3) loads from 115.63% to 116.72% (DC power flow) of its emergency rating (1165 MVA) for the line fault with failed breaker contingency outage of 'PL100873_A'. This project contributes approximately 28.15 MW to the thermal violation.

   CONTINGENCY 'PL100873_A'/* SUSQ-LACK 500KV - STUCK CB AT LACK500 1E
   DISCONNECT BRANCH FROM BUS 200022 TO BUS 917350 CKT 1
   DISCONNECT BRANCH FROM BUS 200074 TO BUS 208009 CKT 4
   END

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

2. (PL - PJM500) The LACKAW 500/230 kV transformer (from bus 208009 to bus 200074 ckt 4) loads from 115.63% to 116.72% (DC power flow) of its emergency rating (1165 MVA) for the line fault with failed breaker contingency outage of 'PL100872_A'. This project contributes approximately 28.15 MW to the thermal violation.

   CONTINGENCY 'PL100872_A'/* SUSQ-LACK 500KV - STUCK CB AT LACK500 1W
   DISCONNECT BRANCH FROM BUS 200022 TO BUS 917350 CKT 1
   DISCONNECT BRANCH FROM BUS 200074 TO BUS 208009 CKT 3
   END

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

3. (PL - PJM500) The LACKAW 500/230 kV transformer (from bus 208009 to bus 200074 ckt 4) loads from 113.7% to 114.76% (DC power flow) of its emergency rating (1165 MVA) for the line fault with failed breaker contingency outage of 'PL100858'. This project contributes approximately 27.41 MW to the thermal violation.

   CONTINGENCY 'PL100858'/* SUMT-LACK 230KV 1- STUCK CB AT LACK 3W
   DISCONNECT BRANCH FROM BUS 208009 TO BUS 211681 CKT 1/* LACK T1 230-69 KV
   DISCONNECT BRANCH FROM BUS 200074 TO BUS 208009 CKT 3/* LACK T3 500-230 KV
   DISCONNECT BRANCH FROM BUS 208009 TO BUS 208090 CKT 1/* SUMT-LACK 1
   END

4. (PL - PJM500) The LACKAW 500/230 kV transformer (from bus 208009 to bus 200074 ckt 4) loads from 113.7% to 114.76% (DC power flow) of its emergency rating (1165 MVA) for the line fault with failed breaker contingency outage of 'PL100855'. This project contributes approximately 27.41 MW to the thermal violation.

   CONTINGENCY 'PL100855'/* SUMT-LACK 230KV 2 - STUCK CB AT LACK 4W
   DISCONNECT BRANCH FROM BUS 208009 TO BUS 211681 CKT 1
   DISCONNECT BRANCH FROM BUS 200074 TO BUS 208009 CKT 3/* LACK T3
   DISCONNECT BRANCH FROM BUS 208009 TO BUS 208090 CKT 2/* SUMT-LACK 2
   END

5. (PL - PL) The MONT-MILT 230 kV line (from bus 208040 to bus 208034 ckt 1) loads from 100.22% to 101.11% (DC power flow) of its emergency rating (801 MVA) for the tower line contingency outage of 'PL101343'. This project contributes approximately 15.69 MW to the thermal violation.

   CONTINGENCY 'PL101343'/* CLINTON-SAEGERS & SAEGERS-ELIMSPORT 230 KV TOWER
   DISCONNECT BRANCH FROM BUS 212397 TO BUS 207968 CKT 1/* SAEG-ELIM
   DISCONNECT BRANCH FROM BUS 207937 TO BUS 212397 CKT 1/* SAEG-CLIN
   END

   Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

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)

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)

1,2,3,4. To mitigate the Lackawanna 500/230 kV transformer overloads will require replacement of the Lackawanna T3 and T4 transformers (250 MVA single phase units) with new 300 MVA single phase units which will increase the emergency rating from 1200 MVA to 1440 MVA. The estimated cost to perform this work is **$20,900,000** and will take **24 months** to complete.

5. To mitigate the MONT-MILT 230 kV line overload will require completion of the PPL EU Supplemental Project **S1106** which has an in-service date of December 31, 2020.

   This contingency is no longer valid once the topology in the model is updated to reflect the build of the new 500-230 kV substation and associated transmission work (tap Sunbury - Susquehanna 500 kV and Colombia - Frackville 230 kV and all contingencies are updated once S**1106** is in service.

Steady-State Voltage Requirements

To be performed during later study phases as required.

Short Circuit

No issues identified.

Stability and Reactive Power Requirement

To be performed during later study phases.

Light Load Analysis - 2020

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

Secondary Point of Interconnection

PJM studied the AC1-081 project as a 180 MW injection into the PPL EU system as a tap of the Susquehanna-Lackawanna 500 kV circuit in the vicinity of the under construction Shickshinny 500 kV Substation and evaluated it for compliance with reliability criteria for summer peak conditions in 2020.

Summer Peak Analysis - 2020

Transmission Network Impacts

Potential transmission 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)

None

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)

None

Appendices
(Primary Point of Interconnection)

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. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.
It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(PL - PJM500) The LACKAW 500/230 kV transformer (from bus 208009 to bus 200074 ckt 3) loads from 115.63% to 116.72% (DC power flow) of its emergency rating (1165 MVA) for the line fault with failed breaker contingency outage of 'PL100873_A'. This project contributes approximately 28.15 MW to the thermal violation.

CONTINGENCY 'PL100873_A' /* SUSQ-LACK 500KV - STUCK CB AT LACK500 1E
DISCONNECT BRANCH FROM BUS 200022 TO BUS 917350 CKT 1
DISCONNECT BRANCH FROM BUS 200074 TO BUS 208009 CKT 4
END

Bus Number	*Bus Name*	*Full Contribution*
200894	*26K02*	*7.33*
200823	*26MHP_X3-003*	*11.43*
209003	*KSTN IPP*	*0.29*
292590	*L-018 E*	*3.79*
294573	*P-028 E*	*23.12*
203999	*P-047 E*	*9.81*
209010	*PEIP 1*	*1.15*
209009	*PEIP 2*	*1.64*
297050	*V2-019 E*	*0.06*
901902	*W1-111 E*	*2.01*
209029	*WAYM IPP*	*0.52*
209031	*WAYMART E*	*18.82*
907462	*X1-109 E*	*13.95*
910522	*X3-003 E*	*3.85*
208055	*X4-048*	*58.4*
914041	*Y2-042*	*4.3*

914271	*Y2-089*	*113.99*
LTF	*Z1-019*	*63.92*
916051	*Z1-038*	*3.91*
916351	*Z1-091*	*3.23*
920832	*Z2-104*	*0.38*
920843	*Z2-107 E*	*3.08*
921212	*AA1-077 C*	*13.56*
921213	*AA1-077 E*	*21.26*
921283	*AA1-082 E*	*9.44*
921412	*AA1-106*	*2.68*
921612	*AA1-144 OP*	*26.41*
922062	*AA2-112*	*2.99*
922242	*AA2-132*	*2.94*
922252	*AA2-133*	*3.56*
922952	*AB1-084*	*6.13*
923102	*AB1-108 OP*	*149.42*
923673	*AB1-182 E*	*3.65*
923781	*AB2-012*	*2.79*
925951	*AC1-071 C*	*2.28*
925952	*AC1-071 E*	*15.17*
926031	*AC1-081 OP*	*28.15*
926681	*AC1-151 C*	*0.81*
926682	*AC1-151 E*	*1.32*

Appendix 2

(PL - PJM500) The LACKAW 500/230 kV transformer (from bus 208009 to bus 200074 ckt 4) loads from 115.63% to 116.72% (DC power flow) of its emergency rating (1165 MVA) for the line fault with failed breaker contingency outage of 'PL100872_A'. This project contributes approximately 28.15 MW to the thermal violation.

CONTINGENCY 'PL100872_A' /* SUSQ-LACK 500KV - STUCK CB AT LACK500 1W
DISCONNECT BRANCH FROM BUS 200022 TO BUS 917350 CKT 1
DISCONNECT BRANCH FROM BUS 200074 TO BUS 208009 CKT 3
END

Bus Number	*Bus Name*	*Full Contribution*
200894	*26K02*	*7.33*
200823	*26MHP_X3-003*	*11.43*
209003	*KSTN IPP*	*0.29*
292590	*L-018 E*	*3.79*
294573	*P-028 E*	*23.12*
203999	*P-047 E*	*9.81*
209010	*PEIP 1*	*1.15*

209009	*PEIP 2*	*1.64*
297050	*V2-019 E*	*0.06*
901902	*W1-111 E*	*2.01*
209029	*WAYM IPP*	*0.52*
209031	*WAYMART E*	*18.82*
907462	*X1-109 E*	*13.95*
910522	*X3-003 E*	*3.85*
208055	*X4-048*	*58.4*
914041	*Y2-042*	*4.3*
914271	*Y2-089*	*113.99*
LTF	*Z1-019*	*63.92*
916051	*Z1-038*	*3.91*
916351	*Z1-091*	*3.23*
920832	*Z2-104*	*0.38*
920843	*Z2-107 E*	*3.08*
921212	*AA1-077 C*	*13.56*
921213	*AA1-077 E*	*21.26*
921283	*AA1-082 E*	*9.44*
921412	*AA1-106*	*2.68*
921612	*AA1-144 OP*	*26.41*
922062	*AA2-112*	*2.99*
922242	*AA2-132*	*2.94*
922252	*AA2-133*	*3.56*
922952	*AB1-084*	*6.13*
923102	*AB1-108 OP*	*149.42*
923673	*AB1-182 E*	*3.65*
923781	*AB2-012*	*2.79*
925951	*AC1-071 C*	*2.28*
925952	*AC1-071 E*	*15.17*
926031	*AC1-081 OP*	*28.15*
926681	*AC1-151 C*	*0.81*
926682	*AC1-151 E*	*1.32*

Appendix 3

(PL - PL) The MONT-MILT 230 kV line (from bus 208040 to bus 208034 ckt 1) loads from 100.22% to 101.11% (DC power flow) of its emergency rating (801 MVA) for the tower line contingency outage of 'PL101343'. This project contributes approximately 15.69 MW to the thermal violation.

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CONTINGENCY 'PL101343'                          /* CLINTON-SAEGERS & SAEGERS-
ELIMSPORT 230 KV TOWER
  DISCONNECT BRANCH FROM BUS 212397 TO BUS 207968 CKT 1      /* SAEG-ELIM
  DISCONNECT BRANCH FROM BUS 207937 TO BUS 212397 CKT 1      /* SAEG-CLIN
  END
```

Bus Number	*Bus Name*	*Full Contribution*
292590	*L-018 E*	*1.44*
212265	*LOR1_N14_E*	*1.77*
209027	*LOR2_Q27_E*	*7.61*
208911	*MONT G1*	*46.41*
208912	*MONT G2*	*47.01*
212340	*PANDA*	*46.81*
212386	*R043_C*	*0.38*
212388	*R-043_E*	*1.52*
292934	*U2-015C OP1*	*0.98*
292935	*U2-015E OP1*	*6.56*
901902	*W1-111 E*	*1.66*
901932	*W1-114E*	*0.18*
901942	*W1-115E*	*0.18*
914031	*Y2-015 C*	*21.61*
914032	*Y2-015 E*	*0.45*
921653	*AA2-008 E*	*18.4*
921662	*AA2-017 C*	*0.64*
921663	*AA2-017 E*	*4.27*
922812	*AB1-068*	*1.28*
923673	*AB1-182 E*	*1.39*
926031	*AC1-081 OP*	*15.69*
926681	*AC1-151 C*	*0.7*
926682	*AC1-151 E*	*1.15*

Appendices
(Secondary Point of Interconnection)

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. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.
It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

None