

***Generation Interconnection
System Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC1-055***

Glen Falls 138 kV

November 2017

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 project developer 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

ESC Harrison County Power, LLC (“Interconnection Customer”) has proposed an **uprate** to prior queue request AA2-119 which is a natural gas combined cycle (1x1) generation facility. The site is located in the City of Clarksburg, Harrison County, West Virginia. The increased capability of 30 MW will be achieved by implementing new units configuration as 1 x 1 single shaft arrangement and by improved equipment efficiencies.

The AA2-119 project has completed a Facilities Study and PJM has determined that AA2-119 is responsible for the costs of upgrades associated with this AC1-055 queue request. If AA2-119 withdraws from PJM queue, AC1-055 will be automatically withdrawn. Please Note: both queue requests will receive one final Interconnection Service Agreement.

The following is a brief history of requested Megawatts:

- AA2-119 requested capability of 550 MW Energy (MFO) and 550 MW Capacity Interconnection Rights (CIR);
- AC1-055 requested generation increase in the amount of 30 MW Energy and 30 MW CIR;
- Both projects combined, AA2-119 and AC1-055 (or “AA2-119/AC1-055”), will have total capability of 580 MW Energy and 580 MW CIRs.

The proposed in-service date for the AC1-055 project is 6-1-2020 which is the same in-service date for prior queue request AA2-119. **This study does not imply a Monongahela Power Company (“Transmission Owner” or “Mon Power) to this in-service date.**

Point of Interconnection

AA2-119/AC1-055 will interconnect with the Mon Power transmission system by injecting power directly into Glen Falls substation 138 kV West Bus. Please refer to the single line diagram in Appendix 2 for more details.

Costs Summary and Transmission Owner Scope of Work

In addition to the construction work listed in the facilities study report of the prior queue request AA2-119, the following shows the Transmission Owner's facilities and network upgrades required to support AC1-055 uprate project.

(a) Attachment Facilities: \$0.00

(b) Direct Connection Network Upgrades:

Glen Falls 138 kV Substation: Adjust remote relay and metering settings at the Glen Falls 138 kV substation.

Estimated cost:\$ **6,200**

(c) Non-Direct Connection Network Upgrades:

Reconductor from Glen Falls Sub to structure #13, approx. 2.5 miles, replacing existing 336 ACSR with 954 ACSR. @ Glen Falls-Oak Mound 138kV Reconductor, 2.5 Miles. Please Note: this network upgrade is included in the AA2-119 facilities study report.

Network Upgrade Number N4855.

Estimated cost:\$ **2,665,000**

(d) Direct Connection Local Upgrades: \$0.00

(e) Non-Direct Connection Local Upgrades: \$0.00

(f) Option to Build Upgrades: \$0.00

Estimated Total Costs (a) to (f):\$ 2,671,200

NOTE: Above net amounts are in 2017 Dollars. Contribution in Aid of Construction (CIAC) Federal Income Tax Gross Up charge will be added to above amounts if this project does not meet the eligibility requirements of IRS Notice 88-129.

Interconnection Customer Requirements

In addition to the Mon Power facilities, Interconnection Customer will be responsible for meeting all criteria as specified in the applicable sections of the FirstEnergy “Requirements for Transmission Connected Facilities” document, effective 10-3-2016, which can be found under this link: <http://www.pjm.com/~media/planning/plan-standards/private-fe/fcr-facilities-connection-requirements.ashx>, including:

1. A compliance with the FirstEnergy and PJM generator power factor and voltage control requirements.
2. The execution of a back-up service agreement to serve the customer load supplied from AC1-055 generation project metering point when the units are out-of-service. This assumes the intent of Interconnection Customer is to net the generation with the load.

The above requirements are in addition to any metering, any requirements for the AA2-121 Generation Project, or any other requirements imposed by PJM.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for Interconnection Customers’s generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

FirstEnergy Requirements

The Interconnection Customer will be required to comply with all FirstEnergy Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the “FirstEnergy Requirements for Transmission Connected Facilities” document located at the following links:

<http://www.firstenergycorp.com/feconnect>

<http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx>

Network Impacts

The Queue Project AC1-055 was evaluated as a 30.0 MW (Capacity 30.0 MW) injection into the Glen Falls 138 kV (West) substation in the APS area. This POI is assumed to be on the West bus as is the AA2-119 project. Project AC1-055 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-055 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

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. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 129.81% to 136.72% (AC power flow) of its emergency rating (192 MVA) for the line fault with failed breaker contingency outage of 'C2-MP-138-024'. This project contributes approximately 13.32 MW to the thermal violation.

CONTINGENCY 'C2-MP-138-024'	/* GLEN FALLS-HARRISON
TAP STK BKR AT GLEN FALLS	
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235349 CKT 1	/* 01GLENFL
138 01HARR T 138	
DISCONNECT BRANCH FROM BUS 235347 TO BUS 235349 CKT 1	/* 01HARSNR
138 01HARR T 138	
DISCONNECT BRANCH FROM BUS 235349 TO BUS 235367 CKT 1	/* 01HARR T
138 01MARGAR 138	
DISCONNECT BRANCH FROM BUS 235347 TO BUS 235396 CKT 1	/* 01HARSNR
138 01ROBERT 138	
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235442 CKT 1	/* 01GLENFL
138 01MCALPN 138	
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235375 CKT 1	/* 01GLENFL
138 01NATLCN 138	
END	

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

2. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 129.79% to 136.69% (AC power flow) of its emergency rating (192 MVA) for the line fault with failed breaker contingency outage of 'C2-MP-138-023'. This project contributes approximately 13.32 MW to the thermal violation.

```
CONTINGENCY 'C2-MP-138-023'                                /* GLEN FALLS-MCALPIN STK
BKR AT GLEN FALLS
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235349 CKT 1    /* 01GLENFL
138 01HARR T 138
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235375 CKT 1    /* 01GLENFL
138 01NATLCN 138
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235442 CKT 1    /* 01GLENFL
138 01MCALPN 138
END
```

3. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 129.79% to 136.69% (AC power flow) of its emergency rating (192 MVA) for the bus fault outage of 'C1-MP-138-013'. This project contributes approximately 13.32 MW to the thermal violation.

```
CONTINGENCY 'C1-MP-138-013'                                /* GLEN-FALLS-138-EAST
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235375 CKT 1    /* 01GLENFL
138 01NATLCN 138
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235349 CKT 1    /* 01GLENFL
138 01HARR T 138
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235442 CKT 1    /* 01GLENFL
138 01MCALPN 138
END
```

4. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 129.76% to 136.67% (AC power flow) of its emergency rating (192 MVA) for the line fault with failed breaker contingency outage of 'C2-MP-138-025'. This project contributes approximately 13.32 MW to the thermal violation.

```
CONTINGENCY 'C2-MP-138-025'                                /* GLEN FALLS-NATIONAL
CARBON STK BKR AT GLEN FALLS
```

DISCONNECT BRANCH FROM BUS 235334 TO BUS 235349 CKT 1 /* 01GLENFL
138 01HARR T 138
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235442 CKT 1 /* 01GLENFL
138 01MCALPN 138
DISCONNECT BRANCH FROM BUS 235422 TO BUS 235375 CKT 1 /* 01W MILF
138 01NATLCN 138
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235375 CKT 1 /* 01GLENFL
138 01NATLCN 138
END

5. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 112.7% to 116.79% (AC power flow) of its emergency rating (192 MVA) for the tower line contingency outage of 'C5-MP-138-015'. This project contributes approximately 7.83 MW to the thermal violation.

CONTINGENCY 'C5-MP-138-015' /* GLF-WUN-GLF-MRG
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235349 CKT 1 /* 01GLENFL
138 01HARR T 138
DISCONNECT BRANCH FROM BUS 235347 TO BUS 235349 CKT 1 /* 01HARSNR
138 01HARR T 138
DISCONNECT BRANCH FROM BUS 235349 TO BUS 235367 CKT 1 /* 01HARR T
138 01MARGAR 138
DISCONNECT BRANCH FROM BUS 235417 TO BUS 235432 CKT 1 /* 01VARNER
138 01WALDORN 138
DISCONNECT BRANCH FROM BUS 235417 TO BUS 235812 CKT 1 /* 01VARNER
138 01CHIEFTON 138
DISCONNECT BRANCH FROM BUS 235347 TO BUS 235396 CKT 1 /* 01HARSNR
138 01ROBERT 138
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235812 CKT 1 /* 01GLENFL
138 01CHIEFTON 138
END

6. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 100.87% to 106.55% (AC power flow) of its emergency rating (192 MVA) for the tower line contingency outage of 'C5-MP-138-011'. This project contributes approximately 10.84 MW to the thermal violation.

CONTINGENCY 'C5-MP-138-011' /* GLF-BPH-GLF-BKH
DISCONNECT BRANCH FROM BUS 235306 TO BUS 235334 CKT 1 /* 01BRIDGP
138 01GLENFL 138

DISCONNECT BRANCH FROM BUS 235334 TO BUS 235375 CKT 1 /* 01GLENFL
138 01NATLCN 138
END

7. (AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 100.55% to 104.16% (AC power flow) of its emergency rating (192 MVA) for the single line contingency outage of 'B2-MP-138-023'. This project contributes approximately 6.88 MW to the thermal violation.

CONTINGENCY 'B2-MP-138-023' /* 235417 01VARNER 138
235432 01WALDORN 138 1
DISCONNECT BRANCH FROM BUS 235334 TO BUS 235812 CKT 1 /* 01GLENFL
138 01CHIEFTON 138
DISCONNECT BRANCH FROM BUS 235417 TO BUS 235812 CKT 1 /* 01VARNER
138 01CHIEFTON 138
DISCONNECT BRANCH FROM BUS 235417 TO BUS 235432 CKT 1 /* 01VARNER
138 01WALDORN 138
END

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

None

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.

Not Applicable

Light Load Analysis - 2020

Not Required

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)

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)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

1. To relieve the Glen Falls – Oak Mound 138 kV line overloads: Reconductor 2.5 miles of the Glen Falls – Oak Mound 138 kV line. New expected SE rating of Glen Falls – Oak Mound 138 kV line to be 316 MVA. Cost estimate is \$2,671,200. PJM Network Upgrade N4855. Overload is driven by AA2-119. Per PJM cost allocation rules, AC1-055 does not presently receive any cost allocation or responsibility for this upgrade.

Note 1: as changes occur in the interconnection process such as prior queued projects withdrawing from the queue or revised cost estimates, AC1-055 could have some cost responsibility.

Note 2: AC1-055 may need this upgrade in-service in order to be deliverable to the PJM transmission system. If AC1-055 comes into service prior to the upgrade being complete, an interim study may be required.

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

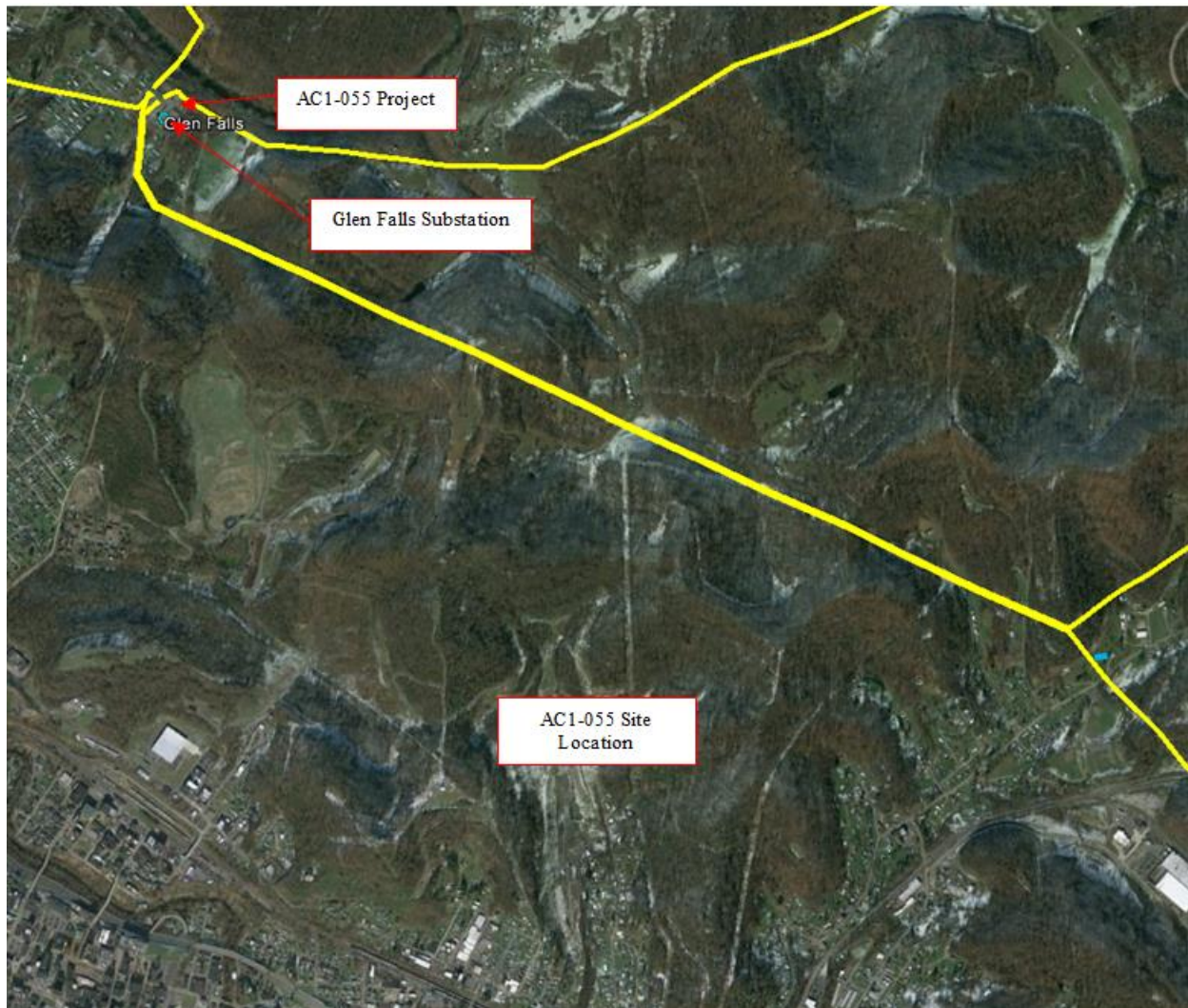
(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None

Appendix 1

Facility Location

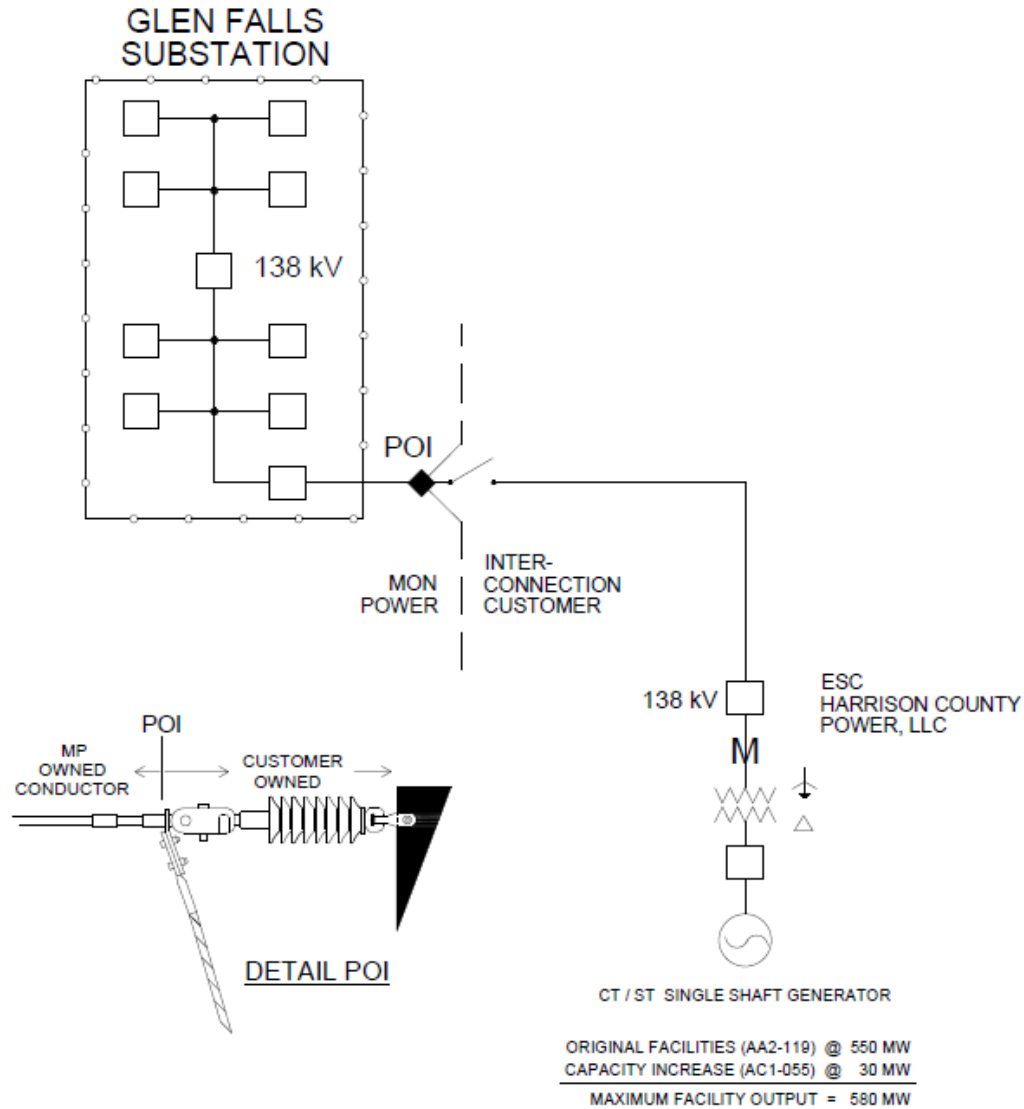
PJM Queue Position: AC1-055



Appendix 2

Interconnection One-Line Diagram

PJM Queue Position: AC1-055



◆ = POI (POINT OF INTERCONNECTION) LOCATED AT INTERCONNECTED CUSTOMER'S DEAD-END STRUCTURE WHERE MON POWER (MP) TRANSMISSION LINES TERMINATE

M = REVENUE METERING FOR INTERCONNECTION CUSTOMER IS OWNED, OPERATED, AND MAINTAINED BY THE INTERCONNECTION CUSTOMER

Appendix 3

Flowgate Information

PJM Queue Position: AC1-055

This appendix contains additional information about the flowgate presented in the body of the report. The intent of this 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.

(AP - AP) The 01GLENFL-01OAKMND 138 kV line (from bus 235334 to bus 235380 ckt 1) loads from 129.81% to 136.72% (AC power flow) of its emergency rating (192 MVA) for the line fault with failed breaker contingency outage of 'C2-MP-138-024'. This project contributes approximately 13.32 MW to the thermal violation.

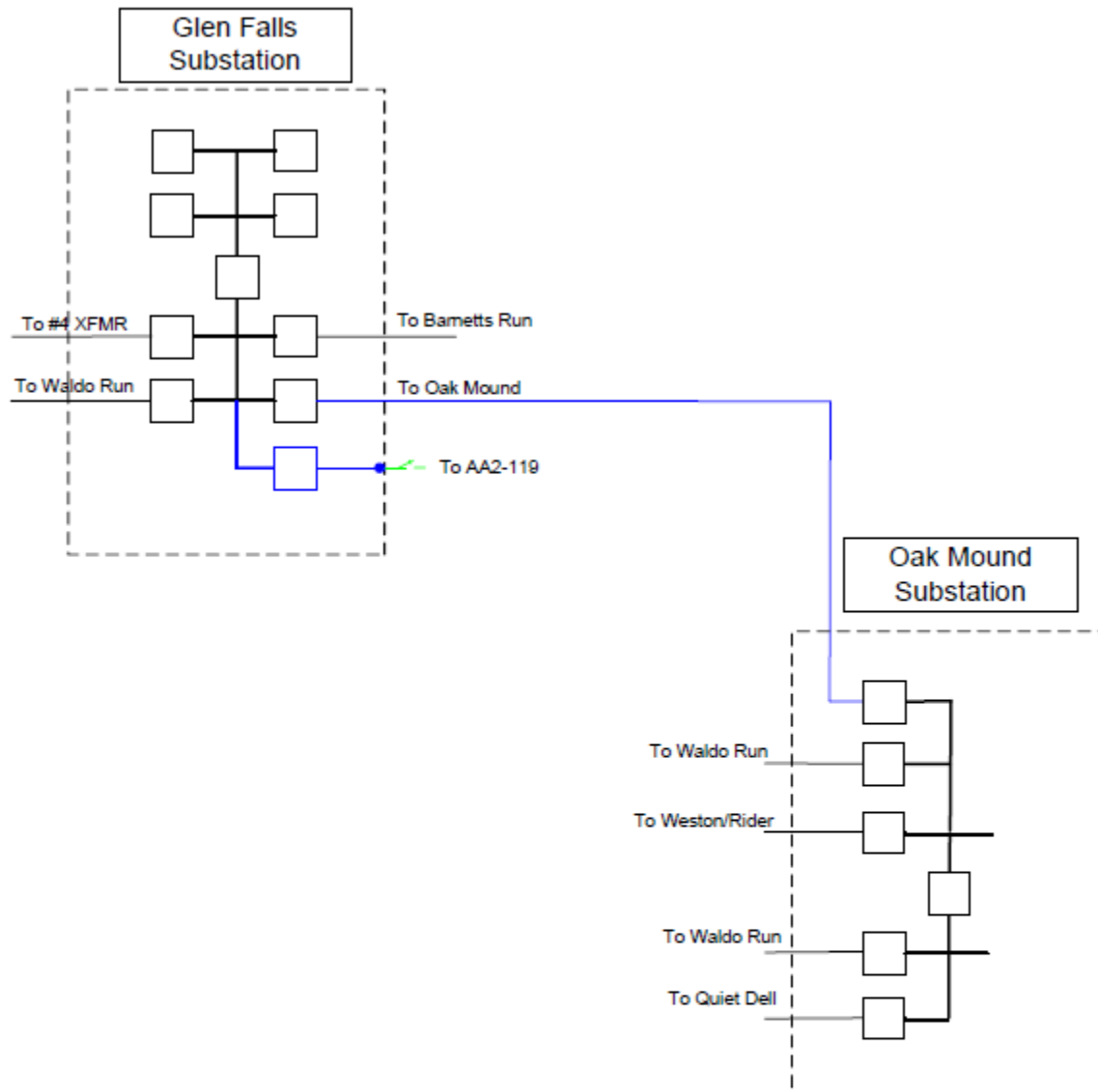
```
CONTINGENCY 'C2-MP-138-024'                                /* GLEN FALLS-HARRISON
TAP STK BKR AT GLEN FALLS
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235349 CKT 1    /* 01GLENFL
138 01HARR T 138
  DISCONNECT BRANCH FROM BUS 235347 TO BUS 235349 CKT 1    /* 01HARSNR
138 01HARR T 138
  DISCONNECT BRANCH FROM BUS 235349 TO BUS 235367 CKT 1    /* 01HARR T
138 01MARGAR 138
  DISCONNECT BRANCH FROM BUS 235347 TO BUS 235396 CKT 1    /* 01HARSNR
138 01ROBERT 138
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235442 CKT 1    /* 01GLENFL
138 01MCALPN 138
  DISCONNECT BRANCH FROM BUS 235334 TO BUS 235375 CKT 1    /* 01GLENFL
138 01NATLCN 138
END
```

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
922132	AA2-119	244.28
926541	AC1-055	13.32

Appendix 4

Network Facility Reinforcement

PJM Queue Position: AC1-055



Glen Falls-Oak Mound No. 4 Line- Facilities must exceed 316 MVA STE rating