Generation Interconnection

Feasibility Study Report

for

Queue Project AG1-463

MAYSVILLE 69 KV

20 MW Capacity / 50 MW Energy

January 2021

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1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is ATSI.

2 Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. 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 impact study is performed.

The Feasibility 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.

3 General

The Interconnection Customer (IC), has proposed a Storage generating facility located in Mercer County, Pennsylvania. The installed facilities will have a total capability of 50 MW with 20 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is May 21, 2024. This study does not imply a TO commitment to this in-service date.

Queue Number	AG1-463
Project Name	MAYSVILLE 69 KV
State	Pennsylvania
County	Mercer
Transmission Owner	ATSI
MFO	50
MWE	50
MWC	20
Fuel	Storage
Basecase Study Year	2024

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

4.1 Primary POI

The interconnection of the project at the Primary POI will be accomplished by extending the existing Maysville 69 kV bus, installing one (1) new 69 kV circuit breaker, and extending a new line exit to the Primary POI. The IC will be responsible for acquiring all easements, properties, and permits that may be required to expand the Maysville substation and associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary Direct Connection facilities for the AG1-463 generation project to connect to the FirstEnergy ("FE") Transmission System. The IC will be responsible for constructing the facilities on its side of the POI, including the Attachment Facilities which connect the generator to the FE Transmission System's Direct Connection facilities.

4.2 Secondary POI

The interconnection of the project at the Secondary POI will be accomplished by extending the existing Maysville 138 kV bus, installing one (1) new 138 kV circuit breaker, and extending a new line exit to the Primary POI. The IC will be responsible for acquiring all easements, properties, and permits that may be required to expand the Maysville substation and associated attachment facilities. A full scope of work or estimated cost is not provided for the proposed Secondary POI.

5 Cost Summary

The AG1-463 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$1,900,000
Total System Network Upgrade Costs (TO Identified)	$140,266,594[1]
Total System Network Upgrade Costs (PJM Identified) [2]	$0
Total Costs	**$142,166,594**

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 2016-36, 2016-25 I.R.B. (6/20/2016). If at a future

[1] This project currently causes and contributes to overloads of the TO system (see Transmission Owner Analysis section below) and therefore has potential to have cost allocation for the system reinforcements listed in the report. This will be re-evaluated in the System Impact phase. The results may vary with queue customers withdrawing from the queue and other generators deactivating over time. If a customer is the first to cause the need for a project (causes loading to exceed 100% of rating), then the customer is responsible. If a customer contributes to a facility that is already overloaded by a prior queue, then they may receive cost allocation.

[2] The conduct of light load analysis as required under the PJM planning process is not performed during the Generation Interconnection Feasibility Study phase of the PJM study process. Additional reinforcement requirements for this Interconnection Request may be defined during the conduct of the light load analysis which shall be performed following execution of the System Impact Study agreement.

date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

The interconnection of the project at the Primary POI will be accomplished by extending the existing Maysville 69 kV bus, installing one (1) new 69 kV circuit breaker, and extending a new line exit to the Primary POI. The IC will be responsible for acquiring all easements, properties, and permits that may be required to expand the Maysville substation and associated attachment facilities.

Attachment 1 shows a one-line diagram of the proposed primary Direct Connection facilities for the AG1-463 generation project to connect to the FirstEnergy ("FE") Transmission System. The IC will be responsible for constructing the facilities on its side of the POI, including the Attachment Facilities which connect the generator to the FE Transmission System's Direct Connection facilities.

The total physical interconnection costs is given in the table below:

Description	**Total Cost**
Install disconnect switch, dead-end structure, and associated facilities for generator lead line exit at interconnection substation.	$320,000
Install one 69 kV breaker and extend the Maysville 69 kV substation.	$1,580,000
Total Physical Interconnection Costs	**$1,900,000**

7 Schedule

Based on the scope of work for the Attachment Facilities and the Direct and/or Non-Direct Connection facilities, it is expected to take a minimum of **14 months** after the signing of an Interconnection Construction Service Agreement to complete the installation. This includes the requirement for the IC to make a preliminary payment that compensates FE for the first three months of the engineering design work that is related to the construction of the interconnection substation. This assumes that there will be no environmental issues with any of the new properties associated with this project, that there will be no delays in acquiring the necessary permits for implementing the defined Direct Connection and network upgrades, and that all transmission system outages will be allowed when requested.

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimated time to complete each of the required reinforcements is identified in the "System Reinforcements" section of the report.

8 Transmission Owner Analysis[3]

8.1 Transmission Owner Identified Network Impacts to Distribution Facilities

Potential TO identified network impacts to Transmission Owner distribution facilities were as follows:

None.

8.2 Transmission Owner Identified Network Impacts to Sub-Regional Facilities

Potential TO identified network impacts to Transmission Owner Sub-Regional facilities were as follows:

Idx	Overloaded Element	Contingency	Rating [MVA]	Loading Before %	Loading After %	Contribution [MW]
80	238949 02MAYSVL 69.0 239869 02GRNVLY80 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	77	95.10%	107.00%	9.17
33	238949 02MAYSVL 69.0 239893 02Y299+ 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	53	229.23%	267.65%	20.36
52	238949 02MAYSVL 69.0 239893 02Y299+ 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-B	53	106.34%	144.76%	20.36
47	238949 02MAYSVL 69.0 239893 02Y299+ 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-A	53	143.55%	175.98%	17.19
44	238949 02MAYSVL 69.0 239893 02Y299+ 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-B	53	152.40%	184.83%	17.19
51	238949 02MAYSVL 69.0 239893 02Y299+ 69.0 Ckt 1	ATSI-P1-2-OEE-69-027-A	53	132.52%	157.96%	13.48
39	238949 02MAYSVL 69.0 239893 02Y299+ 69.0 Ckt 1	Base Case	32	163.95%	201.19%	11.92
30	238949 02MAYSVL 69.0 938580 AE1-079 TAP 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	43	295.74%	343.36%	20.47
42	238949 02MAYSVL 69.0 938580 AE1-079 TAP 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-B	43	143.42%	191.04%	20.47
35	238949 02MAYSVL 69.0 938580 AE1-079 TAP 69.0 Ckt 1	ATSI-P1-2-OEE-69-024	43	193.04%	233.13%	17.24

[3] For TO Distribution Facilities that need upgrades, the TO has applied their cost allocation rules. For TO Sub-Regional Facilities in need of upgrades, PJM Cost Allocation Criteria has been applied.

Idx	Overloaded Element	Contingency	Rating [MVA]	Loading Before %	Loading After %	Contribution [MW]
36	238949 02MAYSVL 69.0 938580 AE1-079 TAP 69.0 Ckt 1	ATSI-P1-2-OEE-69-027-A	43	182.99%	214.53%	13.56
40	238949 02MAYSVL 69.0 938580 AE1-079 TAP 69.0 Ckt 1	ATSI-P1-2-OEE-69-027-B	43	163.02%	194.56%	13.56
32	238949 02MAYSVL 69.0 938580 AE1-079 TAP 69.0 Ckt 1	Base Case	27	227.83%	272.21%	11.98
85	239855 02MIDSEX J 69.0 239959 02HEASLEY 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	56	85.76%	102.47%	9.36
43	239861 02CP.REYN+ 69.0 239104 02SHARON 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	72	161.29%	189.73%	20.47
67	239861 02CP.REYN+ 69.0 239104 02SHARON 69.0 Ckt 1	ATSI-P1-2-OEE-69-024	72	97.76%	121.71%	17.24
78	239861 02CP.REYN+ 69.0 239104 02SHARON 69.0 Ckt 1	ATSI-P1-2-OEE-69-027-A	72	89.70%	108.53%	13.56
64	239869 02GRNVLY80 69.0 239870 02HEMPFIEL 69.0 Ckt 1	ATSI-P1-2-OEE-138-005-B-A	46	107.97%	119.76%	5.42
46	239869 02GRNVLY80 69.0 239870 02HEMPFIEL 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	46	159.05%	178.97%	9.17
66	239869 02GRNVLY80 69.0 239870 02HEMPFIEL 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-A	46	107.55%	122.79%	7.01
59	239869 02GRNVLY80 69.0 239870 02HEMPFIEL 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-B	46	114.24%	129.48%	7.01
62	239869 02GRNVLY80 69.0 239870 02HEMPFIEL 69.0 Ckt 1	ATSI-P1-2-OEE-69-024	46	110.59%	125.80%	7.00
58	239869 02GRNVLY80 69.0 239870 02HEMPFIEL 69.0 Ckt 1	Base Case	37	114.83%	129.75%	5.52
82	239870 02HEMPFIEL 69.0 239871 02HART.TAP 69.0 Ckt 1	ATSI-P1-2-OEE-138-005-B-A	46	89.44%	101.23%	5.42
50	239870 02HEMPFIEL 69.0 239871 02HART.TAP 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	46	140.52%	160.44%	9.17
84	239870 02HEMPFIEL 69.0 239871 02HART.TAP 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-A	46	89.02%	104.26%	7.01
75	239870 02HEMPFIEL 69.0 239871 02HART.TAP 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-B	46	95.71%	110.95%	7.01
79	239870 02HEMPFIEL 69.0 239871 02HART.TAP 69.0 Ckt 1	ATSI-P1-2-OEE-69-024	46	92.06%	107.27%	7.00
81	239870 02HEMPFIEL 69.0 239871 02HART.TAP 69.0 Ckt 1	Base Case	37	91.79%	106.71%	5.52
70	239875 02STONEBOR 69.0 939540 AE1-183 TAP 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	56	101.29%	117.66%	9.17
48	239893 02Y299+ 69.0 239104 02SHARON 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	76	146.46%	173.25%	20.36
76	239893 02Y299+ 69.0 239104 02SHARON 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-A	76	86.71%	109.32%	17.19
72	239893 02Y299+ 69.0 239104 02SHARON 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-B	76	92.88%	115.49%	17.19
41	239941 02HNDERSN 69.0 238955 02MCDOWL 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	48	175.19%	194.28%	9.17
57	239941 02HNDERSN 69.0 238955 02MCDOWL 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-B	48	114.11%	133.20%	9.17
56	239941 02HNDERSN 69.0 238955 02MCDOWL 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-A	48	123.15%	137.75%	7.01
53	239941 02HNDERSN 69.0 238955 02MCDOWL 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-B	48	129.56%	144.16%	7.01
54	239941 02HNDERSN 69.0 238955 02MCDOWL 69.0 Ckt 1	ATSI-P1-2-OEE-69-024	48	126.05%	140.63%	7.00
68	239941 02HNDERSN 69.0 238955 02MCDOWL 69.0 Ckt 1	Base Case	47	109.59%	121.33%	5.52
29	938580 AE1-079 TAP 69.0 239861 02CP.REYN+ 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	43	312.34%	359.96%	20.47
37	938580 AE1-079 TAP 69.0 239861 02CP.REYN+ 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-B	43	160.02%	207.64%	20.47
34	938580 AE1-079 TAP 69.0 239861 02CP.REYN+ 69.0 Ckt 1	ATSI-P1-2-OEE-69-024	43	205.98%	246.07%	17.24
45	938580 AE1-079 TAP 69.0 239861 02CP.REYN+ 69.0 Ckt 1	ATSI-P1-2-OEE-69-026	43	155.96%	183.83%	11.98

Idx	Overloaded Element	Contingency	Rating [MVA]	Loading Before %	Loading After %	Contribution [MW]
38	938580 AE1-079 TAP 69.0 239861 02CP.REYN+ 69.0 Ckt 1	ATSI-P1-2-OEE-69-027-B	43	172.48%	204.02%	13.56
31	938580 AE1-079 TAP 69.0 239861 02CP.REYN+ 69.0 Ckt 1	Base Case	27	240.33%	284.71%	11.98
49	939540 AE1-183 TAP 69.0 239941 02HNDERSN 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-A	56	155.20%	171.57%	9.17
69	939540 AE1-183 TAP 69.0 239941 02HNDERSN 69.0 Ckt 1	ATSI-P1-2-OEE-138-012-B	56	102.85%	119.22%	9.17
65	939540 AE1-183 TAP 69.0 239941 02HNDERSN 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-A	56	110.74%	123.26%	7.01
60	939540 AE1-183 TAP 69.0 239941 02HNDERSN 69.0 Ckt 1	ATSI-P1-2-OEE-69-022-B	56	116.24%	128.76%	7.01
63	939540 AE1-183 TAP 69.0 239941 02HNDERSN 69.0 Ckt 1	ATSI-P1-2-OEE-69-024	56	113.23%	125.73%	7.00
61	939540 AE1-183 TAP 69.0 239941 02HNDERSN 69.0 Ckt 1	Base Case	47	115.84%	127.58%	5.52

8.3 System Reinforcements on Distribution Facilities

None.

8.4 System Reinforcements on Sub-Regional Facilities

Idx	Facility	Upgrade ID	Upgrade Description	Cost
80	238949 02MAYSVL 69.0 239869 02GRNVLY80 69.0 Ckt 1	OEE-020A	**ATSI** **OEE-020A:** Reconductor the portion of the Maysville-Greenville Switching 69 kV Line segment. Time Estimate: 30 Cost: $6,939,538 Ratings: 80.0/96.0/96.0 MVA	$6,939,538
33,52,47, 44,51,39	238949 02MAYSVL 69.0 239893 02Y299+ 69.0 Ckt 1	OEE-014B	**ATSI** **OEE-014B:** Reconductor the Maysville-Sharon Tap 69 kV Line segment (9.4 miles). Upgrade remote ends so that the TL is the most limiting element of the circuit. Time Estimate: 48 Cost: $23,707,472 Ratings: 177.0/203.0/203.0 MVA	$23,707,472

30,42,35, 36,40,32	238949 02MAYSVL 69.0 938580 AE1-079 TAP 69.0 Ckt 1	OEE-012A, OEE-012B, OEE-012C	**ATSI** **OEE-012A:** Reconductor the portion of the Maysville-AE1-079 Tap 69 kV Line segment. The AE1-079 generator is roughly 1.25 miles from Maysville and 2.35 from Camp Raynolds (near structure 62 of the Maysville-Sharon Y-301 69 kV Line). Time Estimate: 30 Cost: $3,234,264 Ratings: 69.0/83.0/83.0 MVA **OEE-012B:** Reconductor the Maysville-AE1-079 Tap 69 kV Line segment (1.25 miles) . The AE1-079 generator is roughly 1.25 miles from Maysville and 2.35 from Camp Raynolds (near structure 62 of the Maysville-Sharon Y-301 69 kV Line). Time Estimate: 30 Cost: $3,140,063 Ratings: 111.0/134.0/134.0 MVA **OEE-012C:** Reconductor the Maysville-AE1-079 Tap 69 kV Line segment (1.25 miles). The AE1-079 generator is roughly 1.25 miles from Maysville and 2.35 from Camp Raynolds (near structure 62 of the Maysville-Sharon Y-301 69 kV Line) Time Estimate: 30 Cost: $3,140,063 Ratings: 177.0/203.0/203.0 MVA	$9,514,390
85	239855 02MIDSEX J 69.0 239959 02HEASLEY 69.0 Ckt 1	OEE-023A	**ATSI** **OEE-023A:** Reconductor the future Heasley-Middlesex Junction 69 kV Line segment. The Heasley project will be unbundling the 6-wire configuration and thus resulting in a line rating of 47 MVA SN and 56 MVA STE Time Estimate: 48 Cost: $20,096,400 Ratings: 80.0/96.0/96.0 MVA	$20,096,400
43,67,78	239861 02CP.REYN+ 69.0 239104 02SHARON 69.0 Ckt 1	OEE-013A, OEE-013C	**ATSI** **OEE-013A:** Upgrade the RT at Sharon so that the TL is limiting the circuit. Time Estimate: 12 Cost: $502,410 Ratings: 69.0/83.0/83.0 MVA **OEE-013C:** Reconductor the Camp Reynolds-Sharon 69 kV Line segment. Time Estimate: 54 Cost: $27,381,345 Ratings: 121.0/146.0/146.0 MVA	$27,883,755
64,46,66, 59,62,58	239869 02GRNVLY80 69.0 239870 02HEMPFIEL 69.0 Ckt 1	OEE-017A	**ATSI** **OEE-017A:** Reconductor the Greenville-Hempfield 69 kV Line segment (2.1 miles). Upgrade remote ends so that the TL is the most limiting element of the circuit. Time Estimate: 30 Cost: $5,997,519 Ratings: 80.0/96.0/96.0 MVA	$5,997,519
82,50,84, 75,79,81	239870 02HEMPFIEL 69.0 239871 02HART.TAP 69.0 Ckt			

70	239875 02STONEBOR 69.0 939540 AE1-183 TAP 69.0 Ckt 1	OEE-026A	**ATSI** **OEE-026A:** Reconductor the portion of the AE1-183 Tap-Stoneboro Tap 69 kV Line segment. The AE1-183 generator is roughly 8.1 miles from McDowell (near structure 108 of the Maysville-McDowell 69 kV Line) . Time Estimate: 36 Cost: $9,294,585 Ratings: 80.0/96.0/96.0 MVA	$9,294,585
48,76,72	239893 02Y299+ 69.0 239104 02SHARON 69.0 Ckt 1	OEE-015AA, OEE-015A	**ATSI** **OEE-015AA:** Upgrade RT at Sharon to exceed TL ratings Time Estimate: 12 Cost: $376,808 Ratings: 72.0/91.0/91.0 MVA **OEE-015A:** Reconductor the Sharon-Sharon Tap 69 kV Line segment (3.3 miles). Upgrade remote ends so that the TL is the most limiting element of the circuit. Time Estimate: 36 Cost: $9,074,781 Ratings: 111.0/134.0/134.0 MVA	$9,451,589
41,57,56, 53,54,68	239941 02HNDERSN 69.0 238955 02MCDOWL 69.0 Ckt 1	OEE-018A, OEE-018C	**ATSI** **OEE-018A:** Replace the metering ay McDowell so that the TL is the most limiting element Time Estimate: 12 Cost: $376,808 Ratings: 47.0/56.0/56.0 MVA **OEE-018C:** Reconductor the Henderson-McDowell 69 kV Line segment. Upgrade remote ends so that the TL is the most limiting element of the circuit. Time Estimate: 42 Cost: $16,077,120 Ratings: 80.0/96.0/96.0 MVA	$16,453,928
29,37,34, 45,38,31	938580 AE1-079 TAP 69.0 239861 02CP.REYN+ 69.0 Ckt 1	OEE-011C	**ATSI** **OEE-011C:** Reconductor the AE1-079 Tap-Camp Reynolds 69 kV Line segment (2.35 miles). The AE1-079 generator is roughly 1.25 miles from Maysville and 2.35 from Camp Raynolds (near structure 62 of the Maysville-Sharon Y-301 69 kV Line) Time Estimate: 30 Cost: $5,903,318 Ratings: 177.0/203.0/203.0 MVA	$5,903,318
49,65,60, 69,63,61	939540 AE1-183 TAP 69.0 239941 02HNDERSN 69.0 Ckt 1	OEE-016B	**ATSI** **OEE-016B:** Reconductor the AE1-183 Tap-Henderson Tap 69 kV Line segment. The AE1-183 generator is roughly 8.1 miles from McDowell (near structure 108 of the Maysville-McDowell 69 kV Line) . Time Estimate: 30 Cost: $5,024,100 Ratings: 111.0/134.0/134.0 MVA	$5,024,100
			TOTAL COST	**$140,266,594**

9 Interconnection Customer Requirements

9.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

The IC has requested a non-standard GSU transformer winding configuration. This transformer is in violation of section 14.2.6 of FE's "Requirements for Transmission Connected Facilities" document and will not be accepted. The GSU transformer must have a grounded wye connection on the high (utility) side and a delta connection on the low (generator) side. Inverter-based generation that is UL1741 certified for anti-islanding protection connected to the FE Transmission System at <100kV shall have a delta or ungrounded wye winding on the transmission side. The Customer one line diagram shows a transformer with a delta winding on the transmission side, but the Customer has not provided documentation of UL1741 certification.

9.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated 69 kV circuit breaker to protect the AG1-463 generator lead line. A single circuit breaker must be used to protect this line; if the project has several GSU transformers, the individual GSU transformer breakers cannot be used to protect this line.

2. The purchase and installation of the minimum required FE generation interconnection relaying and control facilities. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.

3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the FE Transmission System Control Center.

4. Compliance with the FE and PJM generator power factor and voltage control requirements.

5. The execution of a back-up service agreement to serve the customer load supplied from the AG1-463 generation project metering point when the units are out-of-service. This assumes the intent of the IC is to net the generation with the load.

The IC will also be required to meet all PJM, ReliabilityFirst, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and

under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and ReliabilityFirst audits. Failure to comply with these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the FE Transmission System.

9.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the FE Transmission System.

10 Revenue Metering and SCADA Requirements

10.1 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 IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

10.2 Interconnected Transmission Owner Requirements

The IC will be required to comply with all FE revenue metering requirements for generation interconnection customers which can be found in FE's "Requirements for Transmission Connected Facilities" document located at: http://www.pjm.com/planning/design-engineering/to-tech-standards/private-firstenergy.aspx

11 Summer Peak - Load Flow Analysis - Primary POI

The Queue Project AG1-463 was evaluated as a 50.0 MW (Capacity 20.0 MW) injection at the Maysville 69 kV substation in the ATSI area. Project AG1-463 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-463 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None.

11.2 Multiple Facility Contingency

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

None.

11.3 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.

11.4 Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168008153	238944	02MASURY	138.0	ATSI	239120	02SSPRNG	138.0	ATSI	1	ATSI-P1-2-OEE-345-874	operation	165.0	112.21	118.16	DC	9.81
168008098	238948	02MAYSVL	138.0	ATSI	958850	AF2-176 TAP	138.0	ATSI	1	ATSI-P1-2-OEE-69-022-B	operation	124.0	118.63	139.44	DC	25.8
168008100	238948	02MAYSVL	138.0	ATSI	958850	AF2-176 TAP	138.0	ATSI	1	Base Case	operation	124.0	97.72	114.32	DC	20.58
170047662	958850	AF2-176 TAP	138.0	ATSI	238944	02MASURY	138.0	ATSI	1	ATSI-P1-2-OEE-69-022-B	operation	124.0	157.38	178.19	DC	25.8
170047664	958850	AF2-176 TAP	138.0	ATSI	238944	02MASURY	138.0	ATSI	1	Base Case	operation	124.0	134.55	151.14	DC	20.58

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

None.

11.6 Flow Gate Details - Primary POI

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details 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 indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. 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 are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

None.

11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

None.

11.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
Base Case	
ATSI-P1-2-OEE-69-022-B	CONTINGENCY 'ATSI-P1-2-OEE-69-022-B' /* MAYSVILLE - SHARON 69 [Y-301] DISCONNECT BRANCH FROM BUS 938580 TO BUS 239861 CKT 1 /* AE1-079 TAP 69 02CP.REYN+ 69 DISCONNECT BRANCH FROM BUS 239104 TO BUS 239861 CKT 1 /* 02SHARON 69 02CP.REYN+ 69 DISCONNECT BUS 239894 /* 02CP.REYNL 69 DISCONNECT BUS 239890 /* 02GRNV MTL 69 END
ATSI-P1-2-OEE-345-874	CONTINGENCY 'ATSI-P1-2-OEE-345-874' /* LINE 02SHNAGO TO 02NILES 345 CK 1 DISCONNECT BRANCH FROM BUS 239106 TO BUS 239303 CKT 1 /* 02SHNAGO 345 02NILES 345 END

12 Short Circuit Analysis - Primary POI

The following Breakers are overdutied:

None.

12.1 System Reinforcements - Short Circuit

No short circuit impacts were identified for this project.

13 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AG1-463 was evaluated as a 50.1 MW (Capacity 20.0 MW) injection at the Maysville 138 kV substation in the ATSI area. Project AG1-463 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-463 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

13.1 Generation Deliverability

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
170047665	958850	AF2-176 TAP	138.0	ATSI	238944	02MASURY	138.0	ATSI	1	ATSI-P1-2-OEE-69-022-B	single	124.0	90.04	102.2	DC	15.08

13.2 Multiple Facility Contingency

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

None.

13.3 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.

13.4 Potential Congestion due to Local Energy Deliverability

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.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
168008153	238944	02MASURY	138.0	ATSI	239120	02SSPRNG	138.0	ATSI	1	ATSI-P1-2-OEE-345-874	operation	165.0	112.15	118.86	DC	11.07
168008098	238948	02MAYSVL	138.0	ATSI	958850	AF2-176 TAP	138.0	ATSI	1	ATSI-P1-2-OEE-69-022-B	operation	124.0	118.63	149.03	DC	37.7
168008100	238948	02MAYSVL	138.0	ATSI	958850	AF2-176 TAP	138.0	ATSI	1	Base Case	operation	124.0	97.72	126.01	DC	35.08

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONTNAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
17004766 2	958850	AF2-176 TAP	138.0	ATSI	238944	02MASURY	138.0	ATSI	1	ATSI-P1-2-OEE-69-022-B	operation	124.0	157.38	187.78	DC	37.7
17004766 4	958850	AF2-176 TAP	138.0	ATSI	238944	02MASURY	138.0	ATSI	1	Base Case	operation	124.0	134.55	162.84	DC	35.08

13.5 Flow Gate Details - Secondary POI

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details 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 indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. 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 are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

13.5.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
170047665	958850	AF2-176 TAP	ATSI	238944	02MASURY	ATSI	1	ATSI-P1-2-OEE-69-022-B	single	124.0	90.04	102.2	DC	15.08

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
938581	AE1-079 C O1	6.9671	80/20	6.9671
939541	AE1-183 C	2.0599	80/20	2.0599
939971	AE1-237 C	6.9671	80/20	6.9671
942691	AE2-285 C O1	15.4824	80/20	15.4824
943141	AE2-343 C	6.3478	80/20	6.3478
944251	AF1-093 C	2.0599	80/20	2.0599
945061	AF1-171 C (Withdrawn : 12/15/2020)	6.1930	80/20	6.1930
945851	AF1-250 C	5.5737	80/20	5.5737
958351	AF2-129 C	0.9361	80/20	0.9361
958851	AF2-176 C	28.8950	80/20	28.8950
960501	AF2-341 C O1	9.0473	80/20	9.0473
960511	AF2-342 C	9.0473	80/20	9.0473
960521	AF2-343 C	9.0473	80/20	9.0473
960531	AF2-344 C	9.0473	80/20	9.0473
960541	AF2-345 C	9.0473	80/20	9.0473
962071	AG1-051	10.3216	80/20	10.3216
963431	AG1-192 C	3.2112	80/20	3.2112
963971	AG1-251 C	0.1509	80/20	0.1509
963981	AG1-252 C	0.3383	80/20	0.3383
964321	AG1-293 C O2	2.5288	80/20	2.5288
964661	AG1-329 C	2.2708	80/20	2.2708
964681	AG1-331 C	2.2708	80/20	2.2708
964711	AG1-334 C	2.3224	80/20	2.3224
965941	AG1-463 C O2	15.0788	80/20	15.0788
G-007A	G-007A	0.1079	Confirmed LTF	0.1079
VFT	VFT	0.2902	Confirmed LTF	0.2902
CALDERWOOD	CALDERWOOD	0.0119	Confirmed LTF	0.0119
PRAIRIE	PRAIRIE	0.0801	Confirmed LTF	0.0801
CHEOAH	CHEOAH	0.0120	Confirmed LTF	0.0120
CBM-N	CBM-N	0.0552	Confirmed LTF	0.0552
COTTONWOOD	COTTONWOOD	0.0567	Confirmed LTF	0.0567
HAMLET	HAMLET	0.0081	Confirmed LTF	0.0081
GIBSON	GIBSON	0.0180	Confirmed LTF	0.0180
BLUEG	BLUEG	0.0573	Confirmed LTF	0.0573
TRIMBLE	TRIMBLE	0.0184	Confirmed LTF	0.0184
CATAWBA	CATAWBA	0.0059	Confirmed LTF	0.0059

13.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
Base Case	
ATSI-P1-2-OEE-345-874	CONTINGENCY 'ATSI-P1-2-OEE-345-874' / 597 OPEN BRANCH FROM BUS 239106 TO BUS 239303 CKT 1 / 239106 02SHNAGO 345 239303 02NILES 345 1 END
ATSI-P1-2-OEE-69-022-B	CONTINGENCY 'ATSI-P1-2-OEE-69-022-B' / 245 OPEN BRANCH FROM BUS 239861 TO BUS 938580 CKT 1 / 239861 02CP.REYN+ 69.0 938580 AE1-079 TAP 69.0 1 OPEN BRANCH FROM BUS 239104 TO BUS 239861 CKT 1 / 239104 02SHARON 69.0 239861 02CP.REYN+ 69.0 1 OPEN BRANCH FROM BUS 239861 TO BUS 239894 CKT 1 / 239861 02CP.REYN+ 69.0 239894 02CP.REYNL 69.0 1 OPEN BRANCH FROM BUS 239890 TO BUS 239894 CKT 1 / 239890 02GRNV MTL 69.0 239894 02CP.REYNL 69.0 1 END

14 Affected Systems

14.1 NYISO

NYISO Impacts to be determined during later study phases (as applicable).

14.2 MISO

MISO Impacts to be determined during later study phases (as applicable).

15 Attachment 1: One Line Diagram