



Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-369

KIRBY 138 KV

60 MW Capacity / 100 MW Energy

July 2020

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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 Interconnection Customer seeking to interconnect a wind or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

An Interconnection Customer with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

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 Solar generating facility located in Garrett County, Maryland. The installed facilities will have a total capability of 100 MW with 60 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is December 31, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-369
Project Name	KIRBY 138 KV
State	Maryland
County	Garrett
Transmission Owner	ATSI
MFO	100
MWE	100
MWC	60
Fuel	Solar
Basecase Study Year	2023

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

AF2-369 will interconnect with the ATSI transmission system by extending the Kirby 138 kV bus, installing one (1) 138 kV circuit breaker and extending a new line exit to the primary POI.

5 Cost Summary

The AF2-369 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$2,555,000
Total System Network Upgrade Costs	\$28,400,000 ¹
Total Costs	\$30,955,000

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 88-129. If at a future 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.

¹ This project currently causes and contributes to overloads of the Transmission System (see Summer Peak Load Flow 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's MW contribution to a facility that is already overloaded by a prior queue is less than 5 MW, then they will not receive cost allocation.

6 Transmission Owner Scope of Work

AF2-369 will interconnect with the ATSI transmission system by extending the Kirby 138 kV bus, installing one (1) 138 kV circuit breaker and extending a new line exit to the primary POI.

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	\$285,000
Add 138 kV breaker and new line exit at Kirby Substation	\$2,270,000
Total Physical Interconnection Costs	\$2,555,000

7 Schedule

Based on the scope of work for the interconnection facilities, it is expected to take a minimum of 12 months after the signing of an Interconnection Construction Service Agreement and construction kickoff call to complete the installation. 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 work 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 estimate elapsed time to complete each of the required reinforcements is identified in the “System Reinforcements” section of the report.

8 Transmission Owner Analysis

FE performed an analysis of its underlying transmission <100 kV system. The AF2-369 project did not contribute to any overloads on the FE transmission system.

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.

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 138 kV circuit breaker to protect the AF2-369 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 AF2-369 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 system.

9.3 Power Factor Requirements

The IC shall design its Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.90 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 Meteorological Data Reporting Requirements

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit)
- Irradiance (Watts/meter²)
- Ambient air temperature (Fahrenheit) – (Accepted, not required)
- Wind speed (meters/second) – (Accepted, not required)

Wind direction (decimal degrees from true north) – (Accepted, not required)

10.3 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

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

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 AF2-369 was evaluated as a 100.0 MW (Capacity 60.0 MW) injection at the Kirby 138 kV substation in the ATSI area. Project AF2-369 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-369 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)

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
100794342	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	Base Case	single	152.0	93.59	113.33	DC	30.01

11.2 Multiple Facility Contingency

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

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
100794153	238861	02KIRBY	138.0	ATSI	239218	02SSCIOT	138.0	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	89.03	116.77	DC	75.73
100794154	239218	02SSCIOT	138.0	ATSI	239134	02TANGY	138.0	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	87.56	115.3	DC	75.73

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)

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
100794339	238861	02KIRBY	138.0	ATSI	238640	02CRIS	138.0	ATSI	1	DAY-P1-2-OES-138-936T-A	single	179.0	109.66	128.67	DC	34.02
100794340	238861	02KIRBY	138.0	ATSI	238640	02CRIS	138.0	ATSI	1	253101 09BLUIK 138 938700 AE1-092 TAP 138 1	single	179.0	109.66	128.67	DC	34.02
100794341	238861	02KIRBY	138.0	ATSI	238640	02CRIS	138.0	ATSI	1	DAY_P1_OUTAGE_49A	single	179.0	107.32	126.32	DC	34.02

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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
100794334	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	DAY-P1-2-OES-138-936T-A	operation	179.0	173.87	205.54	DC	56.7
100794335	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	25310109BLUJK 138938700AE1-092 TAP 138 1	operation	179.0	173.87	205.54	DC	56.7
100794337	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	Base Case	operation	152.0	155.73	188.64	DC	50.02
95509553	239134	02TANGY	138.0	ATSI	243498	05DLAWAR	138.0	AEP	1	ATSI-P1-2-OES-138-937T	operation	273.0	94.58	103.33	DC	23.88

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
100794340,100794342,100794341,100794339	1	02KIRBY 138.0 kV - 02CRISS 138.0 kV Ckt 1	<p>ATSI OES-005A (807) : Reconductor approx. 11.3 mi from Kirby to Crissinger with 556.5 ACSR or better Project Type : FAC Cost : \$28,400,000 Time Estimate : 48.0 Months</p>	\$28,400,000
100794153	2	02KIRBY 138.0 kV - 02SSCIOT 138.0 kV Ckt 1	<p>s1983 (809) : Replace line relays at Kirby and Tangy for Kirby-Tangy 138 kV Line with standard relay panels; also replace ammeter at Tangy. (covered in the scope of RTEP s1983) Project Type : FAC Cost : \$0</p>	\$0
100794154	3	02SSCIOT 138.0 kV - 02TANGY 138.0 kV Ckt 1		
			TOTAL COST	\$28,400,000 ¹

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".

11.6.1 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
100794340	238861	02KIRBY	ATSI	238640	02CRISS	ATSI	1	253101 09BLUJK 138 938700 AE1-092 TAP 138 1	single	179.0	109.66	128.67	DC	34.02

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
938701	AE1-092 C	54.6617	80/20	54.6617
946051	AF1-270	28.3515	80/20	28.3515
959251	AF2-216 C O1	51.0327	80/20	51.0327
960781	AF2-369 C O1	34.0218	80/20	34.0218
WEC	WEC	0.0369	Confirmed LTF	0.0369
LGEE	LGEE	0.1466	Confirmed LTF	0.1466
CPLE	CPLE	0.0873	Confirmed LTF	0.0873
CBM-W2	CBM-W2	1.4496	Confirmed LTF	1.4496
NY	NY	0.0525	Confirmed LTF	0.0525
TVA	TVA	0.2632	Confirmed LTF	0.2632
CBM-S2	CBM-S2	0.8786	Confirmed LTF	0.8786
CBM-S1	CBM-S1	1.7125	Confirmed LTF	1.7125
MEC	MEC	0.2225	Confirmed LTF	0.2225

11.6.2 Index 2

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
100794153	238861	02KIRBY	ATSI	239218	02SSCIOT	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	89.03	116.77	DC	75.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
292544	T-154 (Deactivation : 07/01/2019 WD - 07/04/2019)	0.1210	50/50	0.1210
938701	AE1-092 C	57.7822	50/50	57.7822
938702	AE1-092 E	79.7801	50/50	79.7801
941941	AE2-206 C O1	1.9110	Adder	2.25
941942	AE2-206 E O1	2.6390	Adder	3.1
942841	AE2-303 C O1	7.0196	50/50	7.0196
942842	AE2-303 E O1	4.6797	50/50	4.6797
944101	AF1-078 C	0.8686	Adder	1.02
944102	AF1-078 E	1.1995	Adder	1.41
946051	AF1-270	29.9700	50/50	29.9700
946551	AF1-319 C O1	6.0572	50/50	6.0572
946552	AF1-319 E O1	3.0917	50/50	3.0917
957901	AF2-084 C O1	4.4325	50/50	4.4325
957902	AF2-084 E O1	2.1926	50/50	2.1926
959251	AF2-216 C O1	63.4509	50/50	63.4509
959252	AF2-216 E O1	42.3006	50/50	42.3006
960781	AF2-369 C O1	45.4386	50/50	45.4386
960782	AF2-369 E O1	30.2924	50/50	30.2924
WEC	WEC	0.0365	Confirmed LTF	0.0365
LGEE	LGEE	0.0987	Confirmed LTF	0.0987
CPL	CPL	0.0033	Confirmed LTF	0.0033
CBM-W2	CBM-W2	0.9091	Confirmed LTF	0.9091
NY	NY	0.0348	Confirmed LTF	0.0348
CBM-W1	CBM-W1	1.2385	Confirmed LTF	1.2385
TVA	TVA	0.1148	Confirmed LTF	0.1148
O-066	O-066	0.4099	Confirmed LTF	0.4099
CBM-S2	CBM-S2	0.1098	Confirmed LTF	0.1098
CBM-S1	CBM-S1	0.8435	Confirmed LTF	0.8435
G-007	G-007	0.0634	Confirmed LTF	0.0634
MEC	MEC	0.1796	Confirmed LTF	0.1796

11.6.3 Index 3

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
100794154	239218	02SSCIOT	ATSI	239134	02TANGY	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	87.56	115.3	DC	75.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
292544	T-154 (Deactivation : 07/01/2019 WD - 07/04/2019)	0.1210	50/50	0.1210
938701	AE1-092 C	57.7822	50/50	57.7822
938702	AE1-092 E	79.7801	50/50	79.7801
941941	AE2-206 C O1	1.9110	Adder	2.25
941942	AE2-206 E O1	2.6390	Adder	3.1
942841	AE2-303 C O1	7.0196	50/50	7.0196
942842	AE2-303 E O1	4.6797	50/50	4.6797
944101	AF1-078 C	0.8686	Adder	1.02
944102	AF1-078 E	1.1995	Adder	1.41
946051	AF1-270	29.9700	50/50	29.9700
946551	AF1-319 C O1	6.0572	50/50	6.0572
946552	AF1-319 E O1	3.0917	50/50	3.0917
957901	AF2-084 C O1	4.4325	50/50	4.4325
957902	AF2-084 E O1	2.1926	50/50	2.1926
959251	AF2-216 C O1	63.4509	50/50	63.4509
959252	AF2-216 E O1	42.3006	50/50	42.3006
960781	AF2-369 C O1	45.4386	50/50	45.4386
960782	AF2-369 E O1	30.2924	50/50	30.2924
WEC	WEC	0.0365	Confirmed LTF	0.0365
LGEE	LGEE	0.0987	Confirmed LTF	0.0987
CPL	CPL	0.0033	Confirmed LTF	0.0033
CBM-W2	CBM-W2	0.9091	Confirmed LTF	0.9091
NY	NY	0.0348	Confirmed LTF	0.0348
CBM-W1	CBM-W1	1.2385	Confirmed LTF	1.2385
TVA	TVA	0.1148	Confirmed LTF	0.1148
O-066	O-066	0.4099	Confirmed LTF	0.4099
CBM-S2	CBM-S2	0.1098	Confirmed LTF	0.1098
CBM-S1	CBM-S1	0.8435	Confirmed LTF	0.8435
G-007	G-007	0.0634	Confirmed LTF	0.0634
MEC	MEC	0.1796	Confirmed LTF	0.1796

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.

Queue Number	Project Name	Status
AE1-092	Blue Jacket-Kirby 138 kV	Active
AE2-206	East Sidney-Quincy 138 kV	Active
AE2-303	Honda Marysville Tap-Honda Marysville 69 kV	Active
AF1-078	East Sidney-Quincy 138 kV	Active
AF1-270	Blue Jacket-Kirby 138 kV	Active
AF1-319	Honda Marysville Tap 69 kV	Active
AF2-084	Honda-Marysville Tap 69 kV	Active
AF2-216	Blue Jacket-Kirby 138 kV	Active
AF2-369	Kirby 138 kV	Active

11.8 Contingency Descriptions - Primary POI

Contingency Name	Contingency Definition
253101 09BLUJK 138 938700 AE1-092 TAP 138 1	CONTINGENCY '253101 09BLUJK 138 938700 AE1-092 TAP 138 1' OPEN BRANCH FROM BUS 253101 TO BUS 938700 CKT 1 END
ATSI-P2-3-OES-138-036A	CONTINGENCY 'ATSI-P2-3-OES-138-036A' /* KIRBY B-24 FAILURE TO TRIP DISCONNECT BRANCH FROM BUS 238861 TO BUS 238640 CKT 1 /* 02KIRBY 138 02CRISS 138 DISCONNECT BRANCH FROM BUS 238861 TO BUS 240629 CKT 1 /* 02KIRBY 138 02KIRBY 69 DISCONNECT BRANCH FROM BUS 240629 TO BUS 240630 CKT 1 /* 02KIRBY 69 02KIRBY + 69 DISCONNECT BRANCH FROM BUS 240630 TO BUS 240605 CKT 1 /* 02KIRBY + 69 02RICHWOOD 69 DISCONNECT BRANCH FROM BUS 240630 TO BUS 240603 CKT 1 /* 02KIRBY + 69 02PROSPEC+ 69 DISCONNECT BRANCH FROM BUS 240603 TO BUS 240604 CKT 1 /* 02PROSPEC+ 69 02PRSPCTSR 69 DISCONNECT BRANCH FROM BUS 240603 TO BUS 240602 CKT 1 /* 02PROSPEC+ 69 02RADNOR 69 REMOVE LOAD O FROM BUS 240602 /* 02RADNOR 69 REMOVE LOAD M FROM BUS 240604 /* 02PRSPCTSR 69 REMOVE LOAD O FROM BUS 240605 /* 02RICHWOOD 69 DISCONNECT BUS 240629 /* 02KIRBY 69 DISCONNECT BUS 240630 /* 02KIRBY + 69 DISCONNECT BUS 240603 /* 02PROSPEC+ 69 DISCONNECT BUS 239592 /* 02PROSPECT 69 DISCONNECT BUS 240602 /* 02RADNOR 69 DISCONNECT BUS 240605 /* 02RICHWOOD 69 END
DAY_P1_OUTAGE_49A	CONTINGENCY 'DAY_P1_OUTAGE_49A' DISCONNECT BRANCH FROM BUS 253101 TO BUS 253009 CKT 1 DECREASE BUS 253009 SHUNT BY 100 PERCENT END
Base Case	
ATSI-P1-2-OES-138-937T	CONTINGENCY 'ATSI-P1-2-OES-138-937T' /* TANGY-DELAWARE 138KV LINE ENERGIZING CLOSE LINE FROM BUS 239134 TO BUS 243498 CKT 1 /* 02TANGY 138 05DLAWAR 138 END

Contingency Name	Contingency Definition
DAY-P1-2-OES-138-936T-A	CONTINGENCY 'DAY-P1-2-OES-138-936T-A' /* BLUE JACKET-KIRBY 138KV LINE OUTAGE DISCONNECT BRANCH FROM BUS 253101 TO BUS 938700 CKT 1 /* 09BLUJK 138 AE1- 092 TAP 138 DISCONNECT BUS 253101 /* 09BLUJK 138 END

12 Short Circuit Analysis - Primary POI

The Short Circuit Analysis will be performed during the System Impact Study phase.

13 Summer Peak - Load Flow Analysis - Secondary POI

The Queue Project AF2-369 was evaluated as a 100.0 MW (Capacity 60.0 MW) injection tapping the Kirby to Blue Jacket 138 kV line in the ATSI area. Project AF2-369 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-369 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
100794342	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	Base Case	single	152.0	95.63	113.66	DC	27.41

13.2 Multiple Facility Contingency

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

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
100794153	238861	02KIRBY	138.0	ATSI	239218	02SSCIOT	138.0	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	91.94	117.24	DC	69.07
100794154	239218	02SSCIOT	138.0	ATSI	239134	02TANGY	138.0	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	90.47	115.77	DC	69.07

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)

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
100794339	238861	02KIRBY	138.0	ATSI	238640	02CRIS	138.0	ATSI	1	DAY-P1-2-OES-138-936T-A	single	179.0	109.66	128.67	DC	34.02
100794340	238861	02KIRBY	138.0	ATSI	238640	02CRIS	138.0	ATSI	1	253101 09BLUJK 138 938700 AE1-092 TAP 138 1	single	179.0	109.66	128.67	DC	34.02
100794341	238861	02KIRBY	138.0	ATSI	238640	02CRIS	138.0	ATSI	1	DAY_P1_OUTAGE_4 9A	single	179.0	107.32	126.32	DC	34.02
98913027	938700	AE1-092 TAP	138.0	ATSI	253101	09BLUJK	138.0	DAY	1	ATSI-P2-3-OES-138-035A	breaker	269.0	121.95	147.98	DC	70.0

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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC D C	MW IMPAC T
100794334	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	DAY-P1-2-OES-138-936T-A	operation	179.0	173.87	205.54	DC	56.7
100794335	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	25310109BLUJK138938700AE1-092TAP1381	operation	179.0	173.87	205.54	DC	56.7
100794337	238861	02KIRBY	138.0	ATSI	238640	02CRISS	138.0	ATSI	1	Base Case	operation	152.0	159.13	189.19	DC	45.69
100794578	239073	02ROBERT	138.0	ATSI	239308	02MR-ETH	138.0	ATSI	1	ATSI-P1-2-OES-138-009_FSA_B	operation	194.0	101.67	113.02	DC	22.01
95509553	239134	02TANGY	138.0	ATSI	243498	05DLAWAR	138.0	AEP	1	ATSI-P1-2-OES-138-937T	operation	273.0	97.99	105.91	DC	21.61
111302157	239308	02MR-ETH	138.0	ATSI	238746	02GALION	138.0	ATSI	1	ATSI-P1-2-OES-138-009_FSA_B	operation	194.0	99.56	110.91	DC	22.01
151281973	938700	AE1-092TAP	138.0	ATSI	253101	09BLUJK	138.0	DAY	1	DAY-P1-2-OES-138-936T-B-A	operation	269.0	103.75	140.93	DC	100.0
151979949	958590	AF2-150TAP	138.0	ATSI	238746	02GALION	138.0	ATSI	1	Base Case	operation	196.0	108.58	116.31	DC	15.16
151979979	960780	AF2-369TAP	138.0	ATSI	238861	02KIRBY	138.0	ATSI	1	25310109BLUJK138938700AE1-092TAP1381	operation	269.0	103.75	140.93	DC	100.0
151979980	960780	AF2-369TAP	138.0	ATSI	238861	02KIRBY	138.0	ATSI	1	DAY-P1-2-OES-138-936T-A	operation	269.0	103.75	140.93	DC	100.0
151979982	960780	AF2-369TAP	138.0	ATSI	238861	02KIRBY	138.0	ATSI	1	Base Case	operation	218.0	83.28	120.13	DC	80.33

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
100794340	238861	02KIRBY	ATSI	238640	02CRISS	ATSI	1	253101 09BLUJK 138 938700 AE1-092 TAP 138 1	single	179.0	109.66	128.67	DC	34.02

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
938701	AE1-092 C	54.6617	80/20	54.6617
946051	AF1-270	28.3515	80/20	28.3515
959251	AF2-216 C O2	51.0327	80/20	51.0327
960781	AF2-369 C O2	34.0218	80/20	34.0218
WEC	WEC	0.0369	Confirmed LTF	0.0369
LGEE	LGEE	0.1466	Confirmed LTF	0.1466
CPLE	CPLE	0.0873	Confirmed LTF	0.0873
CBM-W2	CBM-W2	1.4496	Confirmed LTF	1.4496
NY	NY	0.0525	Confirmed LTF	0.0525
TVA	TVA	0.2632	Confirmed LTF	0.2632
CBM-S2	CBM-S2	0.8786	Confirmed LTF	0.8786
CBM-S1	CBM-S1	1.7125	Confirmed LTF	1.7125
MEC	MEC	0.2225	Confirmed LTF	0.2225

13.5.2 Index 2

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
100794153	238861	02KIRBY	ATSI	239218	02SSCIOT	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	91.94	117.24	DC	69.07

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
292544	T-154 (Deactivation : 07/01/2019 WD - 07/04/2019)	0.1210	50/50	0.1210
938701	AE1-092 C	57.7822	50/50	57.7822
938702	AE1-092 E	79.7801	50/50	79.7801
941941	AE2-206 C O1	1.9110	Adder	2.25
941942	AE2-206 E O1	2.6390	Adder	3.1
942841	AE2-303 C O1	7.0196	50/50	7.0196
942842	AE2-303 E O1	4.6797	50/50	4.6797
944101	AF1-078 C	0.8686	Adder	1.02
944102	AF1-078 E	1.1995	Adder	1.41
946051	AF1-270	29.9700	50/50	29.9700
946551	AF1-319 C O1	6.0572	50/50	6.0572
946552	AF1-319 E O1	3.0917	50/50	3.0917
957901	AF2-084 C O2	4.4968	50/50	4.4968
957902	AF2-084 E O2	2.2244	50/50	2.2244
959251	AF2-216 C O2	68.1579	50/50	68.1579
959252	AF2-216 E O2	45.4386	50/50	45.4386
960781	AF2-369 C O2	41.4390	50/50	41.4390
960782	AF2-369 E O2	27.6260	50/50	27.6260
WEC	WEC	0.0365	Confirmed LTF	0.0365
LGEE	LGEE	0.0987	Confirmed LTF	0.0987
CPL	CPL	0.0033	Confirmed LTF	0.0033
CBM-W2	CBM-W2	0.9091	Confirmed LTF	0.9091
NY	NY	0.0348	Confirmed LTF	0.0348
CBM-W1	CBM-W1	1.2385	Confirmed LTF	1.2385
TVA	TVA	0.1148	Confirmed LTF	0.1148
O-066	O-066	0.4099	Confirmed LTF	0.4099
CBM-S2	CBM-S2	0.1098	Confirmed LTF	0.1098
CBM-S1	CBM-S1	0.8435	Confirmed LTF	0.8435
G-007	G-007	0.0634	Confirmed LTF	0.0634
MEC	MEC	0.1796	Confirmed LTF	0.1796

13.5.3 Index 3

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
100794154	239218	02SSCIOT	ATSI	239134	02TANGY	ATSI	1	ATSI-P2-3-OES-138-036A	breaker	273.0	90.47	115.77	DC	69.07

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
292544	T-154 (Deactivation : 07/01/2019 WD - 07/04/2019)	0.1210	50/50	0.1210
938701	AE1-092 C	57.7822	50/50	57.7822
938702	AE1-092 E	79.7801	50/50	79.7801
941941	AE2-206 C O1	1.9110	Adder	2.25
941942	AE2-206 E O1	2.6390	Adder	3.1
942841	AE2-303 C O1	7.0196	50/50	7.0196
942842	AE2-303 E O1	4.6797	50/50	4.6797
944101	AF1-078 C	0.8686	Adder	1.02
944102	AF1-078 E	1.1995	Adder	1.41
946051	AF1-270	29.9700	50/50	29.9700
946551	AF1-319 C O1	6.0572	50/50	6.0572
946552	AF1-319 E O1	3.0917	50/50	3.0917
957901	AF2-084 C O2	4.4968	50/50	4.4968
957902	AF2-084 E O2	2.2244	50/50	2.2244
959251	AF2-216 C O2	68.1579	50/50	68.1579
959252	AF2-216 E O2	45.4386	50/50	45.4386
960781	AF2-369 C O2	41.4390	50/50	41.4390
960782	AF2-369 E O2	27.6260	50/50	27.6260
WEC	WEC	0.0365	Confirmed LTF	0.0365
LGEE	LGEE	0.0987	Confirmed LTF	0.0987
CPL	CPL	0.0033	Confirmed LTF	0.0033
CBM-W2	CBM-W2	0.9091	Confirmed LTF	0.9091
NY	NY	0.0348	Confirmed LTF	0.0348
CBM-W1	CBM-W1	1.2385	Confirmed LTF	1.2385
TVA	TVA	0.1148	Confirmed LTF	0.1148
O-066	O-066	0.4099	Confirmed LTF	0.4099
CBM-S2	CBM-S2	0.1098	Confirmed LTF	0.1098
CBM-S1	CBM-S1	0.8435	Confirmed LTF	0.8435
G-007	G-007	0.0634	Confirmed LTF	0.0634
MEC	MEC	0.1796	Confirmed LTF	0.1796

13.5.4 Index 4

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
98913027	938700	AE1-092 TAP	ATSI	253101	09BLUJK	DAY	1	ATSI-P2-3-OES-138-035A	breaker	269.0	121.95	147.98	DC	70.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
938701	AE1-092 C	71.3023	50/50	71.3023
938702	AE1-092 E	98.4474	50/50	98.4474
946051	AF1-270	36.9825	50/50	36.9825
959251	AF2-216 C O2	60.3990	50/50	60.3990
959252	AF2-216 E O2	40.2660	50/50	40.2660
960781	AF2-369 C O2	42.0018	50/50	42.0018
960782	AF2-369 E O2	28.0012	50/50	28.0012
NEWTON	NEWTON	0.0655	Confirmed LTF	0.0655
FARMERCITY	FARMERCITY	0.0029	Confirmed LTF	0.0029
G-007A	G-007A	0.0671	Confirmed LTF	0.0671
VFT	VFT	0.1806	Confirmed LTF	0.1806
CALDERWOOD	CALDERWOOD	0.0149	Confirmed LTF	0.0149
PRAIRIE	PRAIRIE	0.1395	Confirmed LTF	0.1395
CHEOAH	CHEOAH	0.0145	Confirmed LTF	0.0145
EDWARDS	EDWARDS	0.0189	Confirmed LTF	0.0189
TILTON	TILTON	0.0403	Confirmed LTF	0.0403
MADISON	MADISON	0.1875	Confirmed LTF	0.1875
GIBSON	GIBSON	0.0404	Confirmed LTF	0.0404
BLUEG	BLUEG	0.1389	Confirmed LTF	0.1389
TRIMBLE	TRIMBLE	0.0451	Confirmed LTF	0.0451
CATAWBA	CATAWBA	0.0042	Confirmed LTF	0.0042

13.6 Contingency Descriptions - Secondary POI

Contingency Name	Contingency Definition
DAY-P1-2-OES-138-936T-B-A	CONTINGENCY 'DAY-P1-2-OES-138-936T-B-A' /* BLUE JACKET-KIRBY 138KV LINE OUTAGE DISCONNECT BRANCH FROM BUS 960780 TO BUS 238861 CKT 1 /* AF2-369 TAP 138 02KIRBY 138 END
253101 09BLUJK 138 938700 AE1-092 TAP 138 1	CONTINGENCY '253101 09BLUJK 138 938700 AE1-092 TAP 138 1' OPEN BRANCH FROM BUS 253101 TO BUS 938700 CKT 1 END
ATSI-P2-3-OES-138-035A	CONTINGENCY 'ATSI-P2-3-OES-138-035A' /* KIRBY B-18 FAILURE TO TRIP DISCONNECT BRANCH FROM BUS 238861 TO BUS 239218 CKT 1 /* 02KIRBY 138 02SSCIOT 138 DISCONNECT BRANCH FROM BUS 239134 TO BUS 239218 CKT 1 /* 02TANGY 138 02SSCIOT 138 DISCONNECT BRANCH FROM BUS 238861 TO BUS 238640 CKT 1 /* 02KIRBY 138 02CRISS 138 END
ATSI-P2-3-OES-138-036A	CONTINGENCY 'ATSI-P2-3-OES-138-036A' /* KIRBY B-24 FAILURE TO TRIP DISCONNECT BRANCH FROM BUS 238861 TO BUS 238640 CKT 1 /* 02KIRBY 138 02CRISS 138 DISCONNECT BRANCH FROM BUS 238861 TO BUS 240629 CKT 1 /* 02KIRBY 138 02KIRBY 69 DISCONNECT BRANCH FROM BUS 240629 TO BUS 240630 CKT 1 /* 02KIRBY 69 02KIRBY + 69 DISCONNECT BRANCH FROM BUS 240630 TO BUS 240605 CKT 1 /* 02KIRBY + 69 02RICHWOOD 69 DISCONNECT BRANCH FROM BUS 240630 TO BUS 240603 CKT 1 /* 02KIRBY + 69 02PROSPEC+ 69 DISCONNECT BRANCH FROM BUS 240603 TO BUS 240604 CKT 1 /* 02PROSPEC+ 69 02PRSPCTSR 69 DISCONNECT BRANCH FROM BUS 240603 TO BUS 240602 CKT 1 /* 02PROSPEC+ 69 02RADNOR 69 REMOVE LOAD O FROM BUS 240602 /* 02RADNOR 69 REMOVE LOAD M FROM BUS 240604 /* 02PRSPCTSR 69 REMOVE LOAD O FROM BUS 240605 /* 02RICHWOOD 69 DISCONNECT BUS 240629 /* 02KIRBY 69 DISCONNECT BUS 240630 /* 02KIRBY + 69 DISCONNECT BUS 240603 /* 02PROSPEC+ 69 DISCONNECT BUS 239592 /* 02PROSPECT 69 DISCONNECT BUS 240602 /* 02RADNOR 69 DISCONNECT BUS 240605 /* 02RICHWOOD 69 END

Contingency Name	Contingency Definition
DAY_P1_OUTAGE_49A	CONTINGENCY 'DAY_P1_OUTAGE_49A' DISCONNECT BRANCH FROM BUS 253101 TO BUS 253009 CKT 1 DECREASE BUS 253009 SHUNT BY 100 PERCENT END
ATSI-P1-2-OES-138-009_FSA_B	CONTINGENCY 'ATSI-P1-2-OES-138-009_FSA_B' /* GALION - ROBERTS SOUTH 138KV LINE FAULT DISCONNECT BRANCH FROM BUS 238746 TO BUS 958590 CKT 1 /* 02GALION 138 02HAMIL+ 138 END
Base Case	
ATSI-P1-2-OES-138-937T	CONTINGENCY 'ATSI-P1-2-OES-138-937T' /* TANGY-DELAWARE 138KV LINE ENERGIZING CLOSE LINE FROM BUS 239134 TO BUS 243498 CKT 1 /* 02TANGY 138 05DLAWAR 138 END
DAY-P1-2-OES-138-936T-A	CONTINGENCY 'DAY-P1-2-OES-138-936T-A' /* BLUE JACKET-KIRBY 138KV LINE OUTAGE DISCONNECT BRANCH FROM BUS 253101 TO BUS 938700 CKT 1 /* 09BLUJK 138 AE1- 092 TAP 138 DISCONNECT BUS 253101 /* 09BLUJK 138 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