Generation Interconnection System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AE1-240

"Carll's Corner-Sherman Avenue 69 kV"

August 2019

Preface

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

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

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

General

Nabb Solar I, LLC, the Interconnection Customer (IC), has proposed a 49.7 MW Energy (29.0 MW Capacity) solar generating facility to be located at Latitude: 39.4341 Longitude: -75.1208 in Cumberland County, New Jersey. PJM studied the AE1-240 project as an injection into the Atlantic City Electric Company (ACE) transmission system as a tap of the Carll's Corner (PSSE bus #228252) to Sherman Avenue (PSSE bus #228226) 69 kV circuit and evaluated it for compliance with reliability criteria for summer peak conditions in 2022. The project was studied at a commercial probability of 100%. The planned in-service date, as requested by the IC, is September 30, 2021. This date may not be attainable due to required PJM studies (Facilities) and the Transmission Owner's construction schedule.

Point of Interconnection

The Interconnection Customer requested a transmission Point of Interconnection (POI) be evaluated for the AE1-240 project. The POI will be located at an IC owned breaker within 500 feet of the newly constructed substation which will connect to the existing ACE Carll's Corner – Sherman Ave 69 kV circuit (see Attachment 1).

Transmission Owner Scope of Attachment Facilities Work

Substation Interconnection Estimate

Scope: Build a new 69 kV substation with a 3-position ring bus. Two of the positions on the ring bus will be transmission line terminals for the tie-in of existing ACE Line 0739. The other position will be a terminal configured for the interconnection of the AE1-240 generation.

Estimate: $4,700,000
Construction Time: 32-48 months

Major Equipment Included in Estimate:

- Control Enclosure, 47' x 16' Qty. 1
- Power Circuit Breaker, 69 kV, 2000A, 40kA, 3 cycle Qty. 3
- Line Switch, 69 kV, 2000A, Manual, Arcing horns Qty. 2
- Disconnect Switch, 69 kV, 2000A, Manual Wormgear, Arcing Horns Qty. 6
- CT/VT Combination Units, 69 kV Qty. 3
- CVT, 69 kV Qty. 9
- Disconnect Switch Stand, High, 69 kV, Steel Qty. 8
- CT/VT Stand, Single Phase, High, 69 kV, Steel Qty. 3
- CVT Stand, Single Phase, High, 69 kV, Steel Qty. 9
- SSVT, 69 kV/240-120 V Qty. 1
- Relay Panel, Transmission Line, FL/BU (20") Qty. 2
- Relayed Bus Differential Panel Qty. 1
- Control Panel, 69 kV Circuit Breaker (10") Qty. 3
- Take-off structure, 69 kV Qty. 3
- Bus Support Structure, 3 phase, 69 kV, Steel Qty. 8
- 69 kV Al tub bus Lot

Estimate Assumptions:

- The required land is available for use.
- Developer responsible for land purchase for the substation, price is not included.
- Site clearing and grading performed by Developer.
- Cost to accelerate existing System Protection projects not included.

Required Relaying and Communications

New protection relays are required for the new terminals.

Front line and back-up line protection will be required. A relay panel for the generator bus will be required with front line and back-up protection.

New protection relays are required for the new line terminals. Frontline and Backup line protection will be required. A relay panel will be required for each transmission line (2 total).

A breaker control relay on a breaker control panel will be required for the control and operation of each new 69 kV circuit breaker (3 total).

The project will require re-wiring and adjustment of existing relay schemes at Carll's Corner and Sherman Ave to accommodate the new 69 kV substation.

Metering

A three phase 69 kV revenue metering point will need to be established within the IC facility at the POI.

The IC will purchase and install all metering instrument transformers, as well as construct a metering structure per ACE's specifications. The secondary wiring connections at the instrument transformers will be completed by the IC's contractors and inspected by ACE, while the secondary wiring work at the metering enclosure will be completed by ACE's meter technicians. The metering control cable and meter cabinets will be supplied by ACE and installed by the IC's contractors. ACE's meter technicians will program and install two solid state multi-function meters (Primary & Backup) for each new metering position. Each meter will be equipped with load profile, telemetry, and DNP outputs. The IC will be provided with one (1) meter DNP output.

The IC will be required to make provisions for a POTS (plain old telephone service) line within approximately three (3) feet of each ACE metering position to facilitate remote interrogation and data collection.

Interconnection Customer Scope of Direct Connection Work

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

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

Inverter Requirements

- The Interconnection Customer shall design is non-synchronous generation facility with the ability to maintain a power factor of at least 0.95 leading to 0.95 lagging measured at the Point of Interconnection.

Special Operating Requirements

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

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

Summer Peak Analysis - 2022

Transmission Network Impacts

Potential transmission network impacts are as follows:

Generator Deliverability

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

None

Multiple Facility Contingency

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

None

Contribution to Previously Identified Overloads

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

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
609899	227904	MILL #2	AE	227945	LEWIS #2	AE	1	AE_P4-2 AE33	breaker	282.0	121.65	123.37	AC	5.9
609653	227905	SCULL#1	AE	227903	MILL #1	AE	1	AE_P4-2 AE29	breaker	306.0	173.07	174.8	AC	6.45
610517	227905	SCULL#1	AE	227903	MILL #1	AE	1	AE_P1-2 BLE-SC-ML2	single	306.0	107.47	108.87	AC	4.39
609682	227906	SCULL#2	AE	227904	MILL #2	AE	1	AE_P4-2 AE28	breaker	307.0	162.46	164.49	AC	7.53
610510	227906	SCULL#2	AE	227904	MILL #2	AE	1	AE_P1-2 BLE-SC-ML1	single	307.0	108.3	109.69	AC	4.4
610511	227906	SCULL#2	AE	227904	MILL #2	AE	1	AE_P1-2 BLE-ML-LEW1	single	307.0	104.04	105.36	AC	4.18
609648	228110	BLE	AE	227905	SCULL#1	AE	1	AE_P4-2 AE29	breaker	307.0	179.44	181.16	AC	6.45
609672	228110	BLE	AE	227906	SCULL#2	AE	1	AE_P4-2 AE28	breaker	307.0	167.41	169.44	AC	7.53
610487	228110	BLE	AE	227905	SCULL#1	AE	1	AE_P1-2 BLE-SC-ML2	single	307.0	113.99	115.38	AC	4.39
610490	228110	BLE	AE	227905	SCULL#1	AE	1	AE_P1-2 BLE-ML-LEW2	single	307.0	100.8	102.06	AC	3.98

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
610495	228110	BLE	AE	227906	SCULL#2	AE	1	AE_P1-2 BLE-SC-ML1	single	307.0	113.23	114.62	AC	4.4
610496	228110	BLE	AE	227906	SCULL#2	AE	1	AE_P1-2 BLE-ML-LEW1	single	307.0	108.97	110.29	AC	4.18
611508	228130	TUCKAHOE	AE	227946	MILL#2	AE	1	AE_P7-1 AE7TOWER	tower	146.0	101.53	103.23	AC	3.11
611456	228217	DENNIS	AE	228130	TUCKAHOE	AE	1	AE_P7-1 AE7TOWER	tower	146.0	106.07	107.77	AC	3.11

Summer Peak Load Flow Analysis Reinforcements

System Reinforcements

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

ID	Index	Facility	Upgrade Description	Cost	Cost Allocated to AE1-240	NUN

<table>
<tr><th>ID</th><th>Index</th><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocated to AE1-240</th><th>NUN</th></tr>
<tr><td>610510,610511,609682</td><td>3</td><td>SCULL#2 138.0 kV - MILL #2 138.0 kV Ckt 1</td><td>
To mitigate the (ACE) Mill#2 Scull#2 138 kV line (from bus 228904 to bus 227906 ckt 1) overload, it will require increasing the emergency rating of the Mill#2 to Scull#2 138 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements are required at both Mill#2 to Scull#2.

Project Type : FAC

Cost : $12,800,000

Time Estimate : 36-60 Months

New Ratings:
Rate A: 478
Rate B: 559
Rate C: 559

The cost allocation table is below:
<table>
<tr><th>Queue</th><th>MW contribution</th><th>% of Cost</th><th>Cost ($12,800,000)</th></tr>
<tr><td>AE1-104</td><td>190.16</td><td>92.00</td><td>11,775,752</td></tr>
<tr><td>AE1-179</td><td>9.01</td><td>4.36</td><td>557,948</td></tr>
<tr><td>AE1-240</td><td>7.53</td><td>3.64</td><td>466,298</td></tr>
</table>
</td><td>$12,800,000</td><td>$466,298</td><td>n6189</td></tr>
</table>

<table>
<tr><th>ID</th><th>Index</th><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocated to AE1-240</th><th>NUN</th></tr>
<tr><td>609899</td><td>1</td><td>MILL #2 138.0 kV - LEWIS #2 138.0 kV Ckt 1</td><td>
To mitigate the (ACE) Mill#2 to Lewis#2 138 kV line (from bus 228904 to bus 227945 ckt 1) overload, it will require increasing the emergency rating of the Mill#2 to Lewis#2 138 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements are required at Lewis#2.

Project Type : FAC

Cost : $12,500,000

Time Estimate : 36-60 Months

New Ratings:
Rate A: 478
Rate B: 478

The cost allocation table is below:

<table>
<tr><th>Queue</th><th>MW contribution</th><th>% of Cost</th><th>Cost ($12,500,000)</th></tr>
<tr><td>AE1-104</td><td>54.23</td><td>80.71</td><td>10,088,926</td></tr>
<tr><td>AE1-179</td><td>7.06</td><td>10.51</td><td>1,313,439</td></tr>
<tr><td>AE1-240</td><td>5.90</td><td>8.78</td><td>1,097,633</td></tr>
</table>
</td><td>$12,500,000</td><td>$1,097,633</td><td>n6190</td></tr>
</table>

ID	Index	Facility	Upgrade Description	Cost	Cost Allocated to AE1-240	NUN
611456	7	**DENNIS 69.0 kV - TUCKAHOE 69.0 kV Ckt 1**	**To mitigate the (ACE) Dennis to Tuckahoe 69 kV line (from bus 228217 to bus 228130 ckt 1) overload, it will require increasing the emergency rating of the Dennis to Tuckahoe 69 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements are required at Tuckahoe.** **Project Type : FAC** **Cost : $7,000,000** **Time Estimate : 36-60 Months** **New Ratings:** **Rate A: 178** **Rate B: 178** **Rate C: 178** **Queue Project AE1-240 presently does not receive cost allocation for this upgrade.** **Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE1-240 could receive cost allocation.** **Note 2: Although Queue Project AE1-240 may not have cost responsibility for this upgrade, Queue Project AE1-240 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE1-240 comes into service prior to completion of the upgrade, Queue Project AE1-240 will need an interim study.**	$7,000,000	$0	n6193

ID	Index	Facility	Upgrade Description	Cost	Cost Allocated to AE1-240	NUN
611508	6	**TUCKAHOE 69.0 kV - MILL#2 69.0 kV Ckt 1**	**To mitigate the (ACE) Tuckahoe Mill#2 69 kV line (from bus 228130 to bus 227946 ckt 1) overload, it will require increasing the emergency rating of the Tuckahoe to Mill#2 69 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor.** **Project Type : FAC** **Cost : $20,000,000** **Time Estimate : 36-60 Months** **New Ratings:** **Rate A: 149** **Rate B: 166** **Queue Project AE1-240 presently does not receive cost allocation for this upgrade.** **Note 1: as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE1-240 could receive cost allocation.** **Note 2: Although Queue Project AE1-240 may not have cost responsibility for this upgrade, Queue Project AE1-240 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE1-240 comes into service prior to completion of the upgrade, Queue Project AE1-240 will need an interim study.**	$20,000,000	$0	n6197

<table>
<tr><th>ID</th><th>Index</th><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocated to AE1-240</th><th>NUN</th></tr>
<tr><td>609648,610490,610487</td><td>4</td><td>BLE 138.0 kV - SCULL#1 138.0 kV Ckt 1</td><td>To mitigate the (ACE) B.L. England Scull#1 138 kV line (from bus 228110 to bus 227905 ckt 1) overload, it will require increasing the emergency rating of the B.L. England to Scull#1 138 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements are required at both B.L. England and Scull#1

Project Type : FAC

Cost : $5,900,000

Time Estimate : 36-60 Months

New Ratings:
Rate A: 549
Rate B: 621
Rate C: 621

The cost allocation table is below:

<table><tr><th>Queue</th><th>MW contribution</th><th>% of Cost</th><th>Cost ($5,900,000)</th></tr><tr><td>AE1-104</td><td>231.27</td><td>94.23</td><td>5,559,375</td></tr><tr><td>AE1-179</td><td>7.72</td><td>3.15</td><td>185,576</td></tr><tr><td>AE1-240</td><td>6.45</td><td>2.63</td><td>155,048</td></tr></table></td><td>$5,900,000</td><td>$155,048</td><td>n6194</td></tr>
</table>

<table>
<tr><th>ID</th><th>Index</th><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocated to AE1-240</th><th>NUN</th></tr>
<tr><td>610517,609653</td><td>2</td><td>SCULL#1 138.0 kV - MILL #1 138.0 kV Ckt 1</td><td>
To mitigate the (ACE) Scull#1-Mill#1 - 138 kV line (from bus 227905 to bus 227903 ckt 1) overload, it will require increasing the emergency rating of the Scull#1 to Mill#1 138 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements at both, Mill#1 & Scull#1.

Project Type : FAC

Cost : $12,800,000

Time Estimate : 36-60 Months

New Ratings:
Rate A: 549
Rate B: 621
Rate C: 621

The cost allocation table is below:
<table>
<tr><th>Queue</th><th>MW contribution</th><th>% of Cost</th><th>Cost ($12,800,000)</th></tr>
<tr><td>AE1-104</td><td>224.77</td><td>94.07</td><td>12,040,914</td></tr>
<tr><td>AE1-179</td><td>7.72</td><td>3.23</td><td>413,559</td></tr>
<tr><td>AE1-240</td><td>6.45</td><td>2.70</td><td>345,526</td></tr>
</table>
</td><td>$12,800,000</td><td>$345,526</td><td>n6195</td></tr>
</table>

<table>
<tr><th>ID</th><th>Index</th><th>Facility</th><th>Upgrade Description</th><th>Cost</th><th>Cost Allocated to AE1-240</th><th>NUN</th></tr>
<tr><td>610496,609672,610495</td><td>5</td><td>BLE 138.0 kV - SCULL#2 138.0 kV Ckt 1</td><td>To mitigate the (ACE) B.L. England Scull#2 138 kV line (from bus 228110 to bus 227906 ckt 1) overload, it will require increasing the emergency rating of the B.L. England to Scull#2 138 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators, and conductor. In addition, various terminal reinforcements are required at both B.L. England and Scull#2

Project Type : FAC

Cost : $6,000,000

Time Estimate : 36-60 Months

New Ratings:
Rate A: 549
Rate B: 621
Rate C: 621

The cost allocation table is below:

<table>
<tr><th>Queue</th><th>MW contribution</th><th>% of Cost</th><th>Cost ($6,000,000)</th></tr>
<tr><td>AE1-104</td><td>205.79</td><td>92.56</td><td>5,553,636</td></tr>
<tr><td>AE1-179</td><td>9.01</td><td>4.05</td><td>243,152</td></tr>
<tr><td>AE1-240</td><td>7.53</td><td>3.39</td><td>203,211</td></tr>
</table>
</td><td>$6,000,000</td><td>$203,211</td><td>n6196</td></tr>
<tr><td></td><td></td><td></td><td>TOTAL COST</td><td>$77,000,000</td><td>$2,267,716</td><td></td></tr>
</table>

Short Circuit

No issues identified.

Stability Analysis

In progress. To be completed during the Facilities Study phase.

Light Load Analysis - 2022

Not required.

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.

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
610569	227903	MILL #1	AE	227902	LEWIS #1	AE	1	AE_P1-2 BLE-ML-LEW2	operation	306.0	141.53	143.36	AC	6.82
610770	227904	MILL #2	AE	227945	LEWIS #2	AE	1	AE_P1-2 BLE-ML-LEW1	operation	282.0	115.04	116.72	AC	5.75
610514	227905	SCULL#1	AE	227903	MILL #1	AE	1	AE_P1-2 BLE-SC-ML2	operation	306.0	160.34	162.37	AC	7.53
610516	227905	SCULL#1	AE	227903	MILL #1	AE	1	Base Case	operation	218.0	126.26	127.89	AC	4.32
610507	227906	SCULL#2	AE	227904	MILL #2	AE	1	AE_P1-2 BLE-SC-ML1	operation	307.0	161.0	163.02	AC	7.53
610509	227906	SCULL#2	AE	227904	MILL #2	AE	1	Base Case	operation	219.0	126.48	128.1	AC	4.32
610484	228110	BLE	AE	227905	SCULL#1	AE	1	AE_P1-2 BLE-SC-ML2	operation	307.0	166.73	168.76	AC	7.53
610486	228110	BLE	AE	227905	SCULL#1	AE	1	Base Case	operation	219.0	135.35	136.98	AC	4.32
610492	228110	BLE	AE	227906	SCULL#2	AE	1	AE_P1-2 BLE-SC-ML1	operation	307.0	165.94	167.96	AC	7.53
610494	228110	BLE	AE	227906	SCULL#2	AE	1	Base Case	operation	219.0	133.39	135.01	AC	4.32

Atlantic City Electric Costs

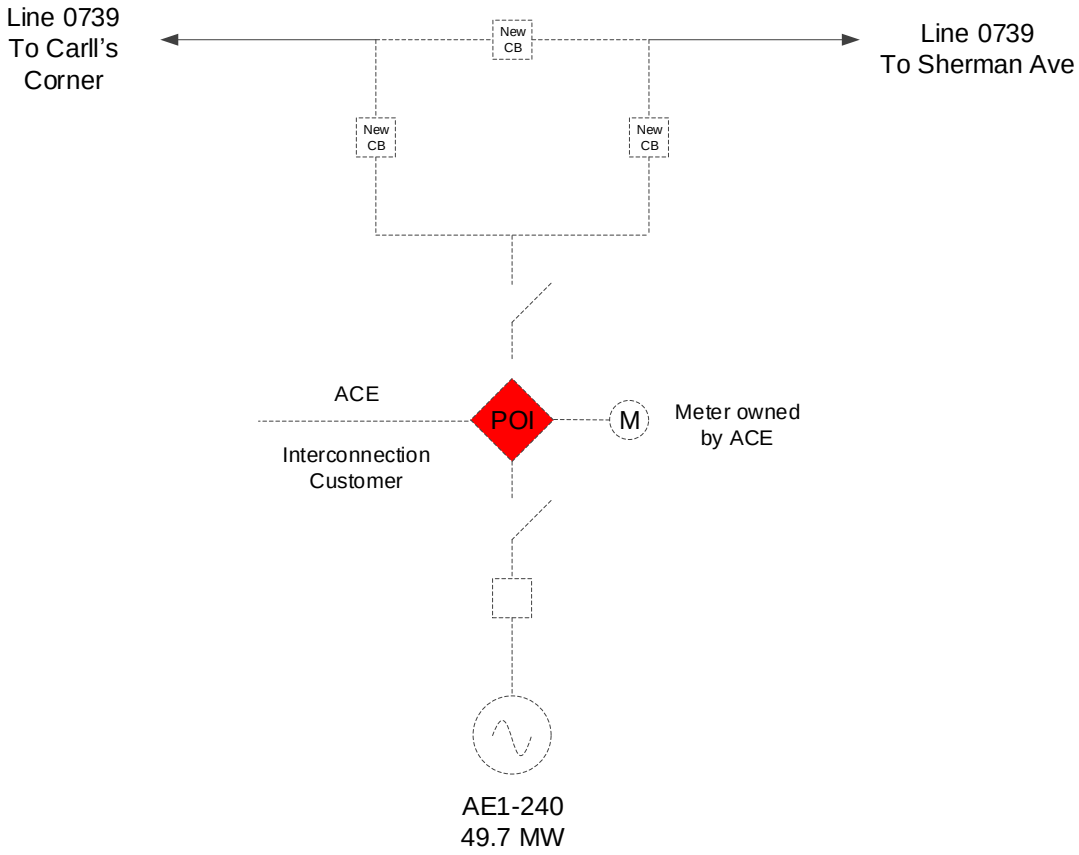
Cost estimates will further be refined as a part of the Facilities Study for this project. The Interconnection Customer will be responsible for all costs incurred by ACE in connection with the AE1-240 project.

Incremental Capacity Transfer Rights (ICTRs)

Will be determined at a later study phase.

Attachment 1

AE1-240
Carll's Corner – Sherman Ave 69 kV
New 69 kV Substation



An Interconnection Customer circuit breaker will be required no more than 500 feet from the ACE substation.

POI

Point of Interconnection

POI Flow Gate Details

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

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
609899	227904	MILL #2	AE	227945	LEWIS #2	AE	1	AE_P4-2 AE33	breaker	282.0	121.65	123.37	AC	5.9

Bus #	Bus	MW Impact
228202	CUMB CT	1.38
228203	P06	1.36
228206	SHRMN CT	1.23
228261	V4-054E	0.58
228711	V2-041C	0.04
228712	V2-041E	0.4
292062	V1-021 C	0.08
292063	V1-021 E	0.08
902432	W2-030 E	0.5
913341	Y1-077	24.77
924531	AB2-102 C	34.32
924532	AB2-102 E	0.76
938423	AE1-061 EBAT	1.01
938781	AE1-104 C O1	47.6
938782	AE1-104 E O1	121.79
939303	AE1-161 EBAT	2.67
939501	AE1-179 C O1	4.14
939502	AE1-179 E O1	2.92
940001	AE1-240 C O1	3.44
940002	AE1-240 E O1	2.46
BLUEG	BLUEG	0.65
CALDERWOOD	CALDERWOOD	0.07

Bus #	Bus	MW Impact
CANNELTON	CANNELTON	0.04
CARR	CARR	0.09
CATAWBA	CATAWBA	0.04
CHEOAH	CHEOAH	0.06
CHILHOWEE	CHILHOWEE	0.02
COFFEEN	COFFEEN	0.07
COTTONWOOD	COTTONWOOD	0.27
DUCKCREEK	DUCKCREEK	0.15
EDWARDS	EDWARDS	0.07
FARMERCITY	FARMERCITY	0.05
G-007	G-007	0.53
GIBSON	GIBSON	0.03
HAMLET	HAMLET	0.07
NEWTON	NEWTON	0.18
O-066	O-066	2.1
PRAIRIE	PRAIRIE	0.33
RENSSELAER	RENSSELAER	0.07
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.03
TATANKA	TATANKA	0.08
TILTON	TILTON	0.08
TRIMBLE	TRIMBLE	0.07
TVA	TVA	0.22
UNIONPOWER	UNIONPOWER	0.1

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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
609653	227905	SCULL#1	AE	227903	MILL #1	AE	1	AE_P4-2 AE29	breaker	306.0	173.07	174.8	AC	6.45

Bus #	Bus	MW Impact
228202	CUMB CT	1.5
228203	P06	1.46
228206	SHRMN CT	1.34
228261	V4-054E	0.63
228711	V2-041C	0.04

Bus #	Bus	MW Impact
228712	V2-041E	0.44
292062	V1-021 C	0.08
292063	V1-021 E	0.09
913341	Y1-077	37.68
924531	AB2-102 C	36.79
924532	AB2-102 E	0.82
938423	AE1-061 EBAT	0.52
938781	AE1-104 C O1	72.41
938782	AE1-104 E O1	185.26
939501	AE1-179 C O1	4.53
939502	AE1-179 E O1	3.19
940001	AE1-240 C O1	3.77
940002	AE1-240 E O1	2.69
BLUEG	BLUEG	0.91
CALDERWOOD	CALDERWOOD	0.1
CANNELTON	CANNELTON	0.06
CARR	CARR	0.12
CATAWBA	CATAWBA	0.06
CHEOAH	CHEOAH	0.09
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.1
COTTONWOOD	COTTONWOOD	0.38
DUCKCREEK	DUCKCREEK	0.21
EDWARDS	EDWARDS	0.1
FARMERCITY	FARMERCITY	0.06
G-007	G-007	0.7
GIBSON	GIBSON	0.04
HAMLET	HAMLET	0.1
NEWTON	NEWTON	0.25
O-066	O-066	2.76
PRAIRIE	PRAIRIE	0.47
RENSSELAER	RENSSELAER	0.1
SANTEETLA	SANTEETLA	0.03
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.11
TILTON	TILTON	0.11
TRIMBLE	TRIMBLE	0.1
TVA	TVA	0.32
UNIONPOWER	UNIONPOWER	0.14

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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
609682	227906	SCULL#2	AE	227904	MILL #2	AE	1	AE_P4-2 AE28	breaker	307.0	162.46	164.49	AC	7.53

Bus #	Bus	MW Impact
228202	CUMB CT	1.75
228203	P06	1.71
228206	SHRMN CT	1.56
228261	V4-054E	0.74
228711	V2-041C	0.04
228712	V2-041E	0.51
292062	V1-021 C	0.1
292063	V1-021 E	0.1
913341	Y1-077	33.53
924531	AB2-102 C	42.93
924532	AB2-102 E	0.95
938423	AE1-061 EBAT	0.6
938781	AE1-104 C O1	64.43
938782	AE1-104 E O1	164.85
939501	AE1-179 C O1	5.28
939502	AE1-179 E O1	3.73
940001	AE1-240 C O1	4.4
940002	AE1-240 E O1	3.14
BLUEG	BLUEG	0.86
CALDERWOOD	CALDERWOOD	0.09
CANNELTON	CANNELTON	0.05
CARR	CARR	0.13
CATAWBA	CATAWBA	0.06
CHEOAH	CHEOAH	0.08
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.09
COTTONWOOD	COTTONWOOD	0.36
DUCKCREEK	DUCKCREEK	0.2
EDWARDS	EDWARDS	0.09
FARMERCITY	FARMERCITY	0.06
G-007	G-007	0.77
GIBSON	GIBSON	0.04

Bus #	Bus	MW Impact
HAMLET	HAMLET	0.1
NEWTON	NEWTON	0.24
O-066	O-066	2.95
PRAIRIE	PRAIRIE	0.44
RENSSELAER	RENSSELAER	0.1
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.11
TILTON	TILTON	0.11
TRIMBLE	TRIMBLE	0.1
TVA	TVA	0.3
UNIONPOWER	UNIONPOWER	0.13

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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
609648	228110	BLE	AE	227905	SCULL#1	AE	1	AE_P4-2 AE29	breaker	307.0	179.44	181.16	AC	6.45

Bus #	Bus	MW Impact
228202	CUMB CT	1.5
228203	P06	1.46
228206	SHRMN CT	1.34
228261	V4-054E	0.63
228711	V2-041C	0.04
228712	V2-041E	0.44
292062	V1-021 C	0.08
292063	V1-021 E	0.09
913341	Y1-077	37.68
924531	AB2-102 C	36.79
924532	AB2-102 E	0.82
938423	AE1-061 EBAT	0.52
938781	AE1-104 C O1	72.41
938782	AE1-104 E O1	185.26
939501	AE1-179 C O1	4.53
939502	AE1-179 E O1	3.19
940001	AE1-240 C O1	3.77

Bus #	Bus	MW Impact
940002	AE1-240 E O1	2.69
BLUEG	BLUEG	0.91
CALDERWOOD	CALDERWOOD	0.1
CANNELTON	CANNELTON	0.06
CARR	CARR	0.12
CATAWBA	CATAWBA	0.06
CHEOAH	CHEOAH	0.09
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.1
COTTONWOOD	COTTONWOOD	0.38
DUCKCREEK	DUCKCREEK	0.21
EDWARDS	EDWARDS	0.1
FARMERCITY	FARMERCITY	0.06
G-007	G-007	0.7
GIBSON	GIBSON	0.04
HAMLET	HAMLET	0.1
NEWTON	NEWTON	0.25
O-066	O-066	2.76
PRAIRIE	PRAIRIE	0.47
RENSSELAER	RENSSELAER	0.1
SANTEETLA	SANTEETLA	0.03
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.11
TILTON	TILTON	0.11
TRIMBLE	TRIMBLE	0.1
TVA	TVA	0.32
UNIONPOWER	UNIONPOWER	0.14

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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
609672	228110	BLE	AE	227906	SCULL#2	AE	1	AE_P4-2 AE28	breaker	307.0	167.41	169.44	AC	7.53

Bus #	Bus	MW Impact
228202	CUMB CT	1.75
228203	P06	1.71

Bus #	Bus	MW Impact
228206	SHRMN CT	1.56
228261	V4-054E	0.74
228711	V2-041C	0.04
228712	V2-041E	0.51
292062	V1-021 C	0.1
292063	V1-021 E	0.1
913341	Y1-077	33.53
924531	AB2-102 C	42.93
924532	AB2-102 E	0.95
938423	AE1-061 EBAT	0.6
938781	AE1-104 C O1	64.43
938782	AE1-104 E O1	164.85
939501	AE1-179 C O1	5.28
939502	AE1-179 E O1	3.73
940001	AE1-240 C O1	4.4
940002	AE1-240 E O1	3.14
BLUEG	BLUEG	0.86
CALDERWOOD	CALDERWOOD	0.09
CANNELTON	CANNELTON	0.05
CARR	CARR	0.13
CATAWBA	CATAWBA	0.06
CHEOAH	CHEOAH	0.08
CHILHOWEE	CHILHOWEE	0.03
COFFEEN	COFFEEN	0.09
COTTONWOOD	COTTONWOOD	0.36
DUCKCREEK	DUCKCREEK	0.2
EDWARDS	EDWARDS	0.09
FARMERCITY	FARMERCITY	0.06
G-007	G-007	0.77
GIBSON	GIBSON	0.04
HAMLET	HAMLET	0.1
NEWTON	NEWTON	0.24
O-066	O-066	2.95
PRAIRIE	PRAIRIE	0.44
RENSSELAER	RENSSELAER	0.1
SANTEETLA	SANTEETLA	0.02
SMITHLAND	SMITHLAND	0.04
TATANKA	TATANKA	0.11
TILTON	TILTON	0.11
TRIMBLE	TRIMBLE	0.1

Bus #	Bus	MW Impact
TVA	TVA	0.3
UNIONPOWER	UNIONPOWER	0.13

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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
611508	228130	TUCKAHOE	AE	227946	MILL#2	AE	1	AE_P7-1 AE7TOWER	tower	146.0	101.53	103.23	AC	3.11

Bus #	Bus	MW Impact
228712	V2-041E	0.21
292062	V1-021 C	0.05
292063	V1-021 E	0.05
913341	Y1-077	8.62
924531	AB2-102 C	18.81
924532	AB2-102 E	0.42
938781	AE1-104 C O1	16.57
938782	AE1-104 E O1	42.38
939501	AE1-179 C O1	2.18
939502	AE1-179 E O1	1.54
940001	AE1-240 C O1	1.82
940002	AE1-240 E O1	1.3
BLUEG	BLUEG	0.26
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.02
CARR	CARR	0.05
CATAWBA	CATAWBA	0.02
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
COFFEEN	COFFEEN	0.03
COTTONWOOD	COTTONWOOD	0.1
DUCKCREEK	DUCKCREEK	0.06
EDWARDS	EDWARDS	0.03
FARMERCITY	FARMERCITY	0.02
G-007	G-007	0.32
GIBSON	GIBSON	0.01
HAMLET	HAMLET	0.03

Bus #	Bus	MW Impact
NEWTON	NEWTON	0.07
O-066	O-066	1.14
PRAIRIE	PRAIRIE	0.13
RENSSELAER	RENSSELAER	0.04
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.03
TILTON	TILTON	0.03
TRIMBLE	TRIMBLE	0.03
TVA	TVA	0.09
UNIONPOWER	UNIONPOWER	0.04

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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
611456	228217	DENNIS	AE	228130	TUCKAHOE	AE	1	AE_P7-1 AE7TOWER	tower	146.0	106.07	107.77	AC	3.11

Bus #	Bus	MW Impact
228712	V2-041E	0.21
292062	V1-021 C	0.05
292063	V1-021 E	0.05
913341	Y1-077	8.62
924531	AB2-102 C	18.81
924532	AB2-102 E	0.42
938781	AE1-104 C O1	16.57
938782	AE1-104 E O1	42.38
939501	AE1-179 C O1	2.18
939502	AE1-179 E O1	1.54
940001	AE1-240 C O1	1.82
940002	AE1-240 E O1	1.3
BLUEG	BLUEG	0.26
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.02
CARR	CARR	0.05
CATAWBA	CATAWBA	0.02
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01

Bus #	Bus	MW Impact
COFFEEN	COFFEEN	0.03
COTTONWOOD	COTTONWOOD	0.1
DUCKCREEK	DUCKCREEK	0.06
EDWARDS	EDWARDS	0.03
FARMERCITY	FARMERCITY	0.02
G-007	G-007	0.32
GIBSON	GIBSON	0.01
HAMLET	HAMLET	0.03
NEWTON	NEWTON	0.07
O-066	O-066	1.14
PRAIRIE	PRAIRIE	0.13
RENSSELAER	RENSSELAER	0.04
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.03
TILTON	TILTON	0.03
TRIMBLE	TRIMBLE	0.03
TVA	TVA	0.09
UNIONPOWER	UNIONPOWER	0.04

Contingency Name	Contingency Definition
AE_P1-2 BLE-ML-LEW1	CONTINGENCY 'AE_P1-2 BLE-ML-LEW1' DISCONNECT BUS 227903 / DISCONNECT BUS 227905 / DISCONNECT BUS 227929 / CLOSE LINE FROM BUS 227929 TO BUS 227930 CIRCUIT 1 / END
AE_P4-2 AE33	CONTINGENCY 'AE_P4-2 AE33' /*LEWIS TO CARDIFF BREAKER V DISCONNECT BRANCH FROM BUS 227902 TO BUS 227913 CKT 1 /*LEWIS CARDIFF 138 138 DISCONNECT BRANCH FROM BUS 227902 TO BUS 227903 CKT 1 /*LEWIS MILL #1 138 138 DISCONNECT BRANCH FROM BUS 227902 TO BUS 227918 CKT 1 /*LEWIS 138 69 T1 END
AE_P1-2 BLE-ML-LEW2	CONTINGENCY 'AE_P1-2 BLE-ML-LEW2' DISCONNECT BUS 227904 / DISCONNECT BUS 227906 / DISCONNECT BUS 227930 / 227930 CIRCUIT 1 / CLOSE LINE FROM BUS 227929 TO BUS 227930 CIRCUIT 1 / END

Contingency Name	Contingency Definition
AE_P4-2 AE28	CONTINGENCY 'AE_P4-2 AE28' /*ENGLAND TO OCEAN CITY BREAKER C DISCONNECT BRANCH FROM BUS 228110 TO BUS 228660 CKT 1 /*ENGLAND OCEAN CITY 138 138 DISCONNECT BRANCH FROM BUS 228110 TO BUS 227905 CKT 1 /*ENGLAND #1 SCULL 138 138 END
AE_P4-2 AE29	CONTINGENCY 'AE_P4-2 AE29' /*ENGLAND TO CORSON BREAKER D DISCONNECT BRANCH FROM BUS 228110 TO BUS 228111 CKT 1 /*ENGLAND MIDDLE TAP 138 138 DISCONNECT BRANCH FROM BUS 228110 TO BUS 227906 CKT 1 /*ENGLAND #2 SCULL 138 138 END
AE_P1-2 BLE-SC-ML1	CONTINGENCY 'AE_P1-2 BLE-SC-ML1' DISCONNECT BUS 227905 / DISCONNECT BUS 227929 / CLOSE LINE FROM BUS 227929 TO BUS 227930 CIRCUIT 1 / END
AE_P1-2 BLE-SC-ML2	CONTINGENCY 'AE_P1-2 BLE-SC-ML2' DISCONNECT BUS 227906 / DISCONNECT BUS 227930 / CLOSE LINE FROM BUS 227929 TO BUS 227930 CIRCUIT 1 / END
Base Case	
AE_P7-1 AE7TOWER	CONTINGENCY 'AE_P7-1 AE7TOWER' DISCONNECT BUS 227905 /* #1 BLE TO SCULL TO MILL 138 KV DISCONNECT BUS 227929 /* #1 SCULL 12 KV DISCONNECT BUS 227906 /* #2 BLE TO SCULL TO MILL 138 KV DISCONNECT BUS 227930 /* #2 SCULL 12 KV DISCONNECT BUS 227903 /* #1 MILL TO LEWIS 138 KV DISCONNECT BUS 227904 /* #2 MILL TO LEWIS 138 KV END