

Generation Interconnection Feasibility Study Report Queue Position AE1-145

The Interconnection Customer (IC) has proposed a 20 MW Energy (20 MW Capacity) hybrid solar/storage generating facility to be located at GPS coordinates Latitude: 37.8826450, Longitude: -75.5120060 in Accomack County, Virginia. PJM studied the AE1-145 project as a direct injection into the Old Dominion Electric Cooperative (ODEC) transmission system at the Wallops Island 69 kV Substation (PSSE bus # 232283) and evaluated it for compliance with reliability criteria for summer peak conditions in 2022. The project was studied at a commercial probability of 53%. The planned in-service date, as requested by the IC during the project kick-off call, is December 1, 2020. This date may not be attainable due to required PJM studies (System Impact and Facilities) and the Transmission Owner's construction schedule.

Point of Interconnection

The IC requested a transmission level interconnection. As a result, the AE1-145 project will connect with the ODEC transmission system at a new 3-breaker ring bus 69 kV substation to be constructed adjacent to the Wattsville - Wallops Island 69 kV circuit.

Transmission Owner Scope of Work

Direct Connect and Attachment Facilities Work Scope

The IC requested the POI for AE1-145 to be at the Wallops Island 69 kV substation. Given the local reliability issues associated with serving load at the Chincoteague 69 kV substation, the AE1-145 project will have to be interconnected on the Wattsville - Wallops Island Line using a 69 kV 3-breaker ring-bus substation. With no other interconnection customers in the immediate vicinity of AE1-145, the entire cost of the 69 kV 3-breaker ring-bus substation, a new 69 kV 5-breaker ring bus switching station at the Wallops Island tap and new equipment at Wattsville in this report will be allocated to the AE1-145 project.

Scope

- 1) Build a new 69 kV substation with a 3-breaker ring bus. One of the positions on the ring bus will be the Wallops Island terminal for the Wattsville - Wallops Island 69 kV line (Line 6748). Another position will be used for existing Transformer No. T1 at Wallops Island substation. A third position will be a terminal configured for the hybrid solar and battery storage facility with a disconnect switch. The POI will be at the terminal frame of the disconnect switch on the IC side.

Estimate: \$5,242,000

Construction Time: 24 months

Major Equipment Included in Estimate: The major equipment for the substation will include circuit breakers, disconnect switches, protective relays, foundations, a control building, control

wiring, security lighting and fence. GSU to be connected delta on the generator side and wye-grounded on the POI side and located in a separate substation owned by the IC.

- 2) Build a new 69 kV switching station with a 5-breaker ring bus to mitigate the Wattsville-Chincoteague 69 kV circuit overload. The ring-bus substation at the site of the Wallops Island tap of the 6748 Line will include line terminal positions for the 6745 Line from Wattsville, the 6746 Line from Wattsville, the former 6745 Line to Chincoteague, the former 6746 Line to Chincoteague and the 6748 Line to Wallops Island.

Estimate: \$5,500,000

Construction Time: 24 months

Major Equipment Included in Estimate: The major equipment for the substation will include circuit breakers, disconnect switches, protective relays, foundations, control building, control wiring, security lighting and fence. Note: This estimate does NOT include the costs of obtaining permits, additional rights-of-way, easements or property.

Anti-Islanding Detection and Fault Protection Requirements

In accordance with PJM requirements as specified in Manual 14A, unintentional islanding or anti-islanding requirements can be met with transfer trip. Given the configuration of the transmission system in the ODEC area, anti-islanding will be required for line terminals at Wattsville substation and all possible open points between Wattsville and the POI.

Scope

Replace the ground wire with OPGW over the 69kV transmission lines between Wattsville, the Wallops Island tap and Wallops Island substation (Line 6748). A detailed engineering study will be required during the facilities study phase to determine the number of transmission structures requiring replacement to carry the OPGW.

Estimate: \$2,149,000 (if 10% of the structures need replacement)
\$5,070,000 (if 80% of the structures need replacement)

Construction Time: 36 months

Major Equipment Included in Estimate: New communications equipment at Wattsville; Auxiliary Switches on all 69 kV switches; Relay, SCADA, and Communications Equipment; Replacement of ground wire with OPGW on Lines 6745 and 6748 between Wattsville, Wallops Island tap and Wallops Island substation.

ODEC - AE1-145 Total Costs	Cost (1)	Cost (2)
Attachment Facilities	\$ 10,742,000	\$ 10,742,000
Direct Connection Network Upgrades	\$ 2,149,000	\$ 5,070,000
Non Direct Connection Network Upgrades	\$ -	\$ -
Allocation for New System Upgrades	\$ -	\$ -
Contribution for Previously Identified Upgrades	\$ -	\$ -
Total Costs	\$ 12,891,000	\$ 15,812,000
(1) 10% structure replacement on Wattsville - Wallops Island Tap - Wallops Island 69 kV		
(2) 80% structure replacement on Wattsville - Wallops Island Tap - Wallops Island 69 kV		

The AE1-145 project will be responsible for 100% of the cost of the 69 kV 3-breaker ring-bus substation, the 69 kV 5-breaker switching station, and anti-islanding detection in this report.

Estimated Cost of Wattsville Substation Work: It is anticipated that Delmarva Power & Light will have work associated with the anti-islanding detection scope at their Wattsville Substation. That scope, schedule, and costs will be provided in the System Impact Study Report.

Estimated Schedule

The estimated time is 36 months from engineering start to construction finish, after the PJM three-party Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (ICSA) are signed.

Assumptions

ODEC will begin the project only after the PJM ISA and ICSA are fully executed and ODEC receives a written authorization by PJM to commence activities. The estimated time to complete the direct connection work is approximately 24 months after the execution of an ICSA. The schedule for the 69 kV transmission and substation work to accommodate the AE1-145 project would depend on the project start date. The work to accommodate the AE1-145 project will require transmission line outages. ODEC's outage windows for construction are typically in the spring and fall of the year; missing an outage window could result in project delays.

Excepting any operational, governmental and/or environmental regulatory delays, the use of additional resources, such as overtime, premiums for expedited material, and/or contractor labor, may enable ODEC to decrease this construction period. It is also assumed that all right-of-way and easements are secured without impact on anticipated construction start dates.

Metering

PJM Requirements

The IC 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 Sections 24.1 and 24.2. The IC is also required to provide revenue metering and real- time telemetry data to PJM in compliance with the requirements listed in PJM Manuals M-01 and M-14.

ODEC Requirements

ODEC will install revenue grade power quality metering to monitor compliance with industry standards for harmonics and other power quality requirements.

Interconnection Customer Scope of Direct Connection Work

The IC is responsible for all design and construction related to activities on its side of the POI as shown on Attachment 1. 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. The Direct-Connect 69 kV line from the IC's facilities to the interconnection substation must be built in accordance with Rural Utilities Service (RUS) standards or an acceptable national standard, effectively grounded, and appropriately shielded from lightning (refer to RUS Bulletins 1728f-810 and 1724E-200). The IC's transformer shall be connected wye-grounded on the 69 kV side and delta on the low-voltage side. 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.

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)

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
419096	232280	OAKHL_69	DP&L	232281	WATTSVILLE	DP&L	1	DPL_P1_2_CKT 13789	single	88.0	94.26	97.13	DC	2.52

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	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
418651	232241	VIENN_69	DP&L	232234	TODD	DP&L	1	DPL_P4-2_DP11	breaker	110.0	97.2	97.89	DC	1.7

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
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		BUS	BUS AREA			ARE A	ID			MVA	LOADIN G %	LOADIN G %		T
418344	232234	TODD	DP&L	232233	PRESTON	DP&L	1	DPL_P4-2_DP11	break er	93.0	133.17	134.24	DC	2.21
419836	923950	AB2-036 TAP	DP&L	232100	CHURCH	DP&L	1	DPL_P7_1_DBL_1NC B-A	tower	154.0	116.09	116.69	DC	2.09
418471	924820	AB2-135 TAP	DP&L	232203	CHURC_69	DP&L	1	DPL_P4-2_DP11	break er	93.0	120.88	121.42	DC	1.1

Transmission Owner Identified Overloads

This project is first to cause the following contingency overload:

6745 Line open between Watts ville substation and the Wallops Island tap.

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
N/A	232281	Wattsvil	ODEC (DPL)	232282	Chincotg	ODEC (DPL)	1	6745 line open between Watts ville and Wallops Island	Line	36	75	131	AC	20

Summer Peak Load Flow Analysis Reinforcements

New System Reinforcements

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

ID	Index	Facility	Upgrade Description	Cost
418651	2	VIENN_69 69.0 kV - TODD 69.0 kV Ckt 1	DP&L Description : No Violation. Facility loading does not exceed 100%.	\$0
419096	1	OAKHL_69 69.0 kV - WATTSVIL 69.0 kV Ckt 1	DP&L Description : No Violation. Facility loading does not exceed 100%.	\$0
418471	5	AB2-135 TAP 69.0 kV - CHURC_69 69.0 kV Ckt 1	DP&L Description : To mitigate (DP&L - DP&L) the AB2-135 TAP-CHURC_69 69 kV line (from bus 924820 to bus 232203 ckt 1) overloads, it will require reinforcements to increase the emergency rating of the AB2-135 tap to Church 69 kV line require the rebuild of the circuit, including the installation of new poles and a new disconnect switch. Time Estimate : 36-48 Months Cost : \$6,600,000	\$6,600,000
419836	4	AB2-036 TAP 138.0		\$0

		kV - CHURCH 138.0 kV Ckt 1	DP&L Description : No Violation. AB2-036 TAP to CHURCH 138 kV Line is the limiting equipment with an emergency rating of 348 MVA.	
418344	3	TODD 69.0 kV - PRESTON 69.0 kV Ckt 1	DP&L Description : To mitigate the (DP&L) TODD-PRESTON 69 kV line (from bus 232234 to bus 232233 ckt 1) overload will require substation reinforcements at Preston Substation and Todd Substation. Time Estimate : 12.0 Months Cost : \$67,000	\$67,000
N/A	N/A	WATTSVILLE 69 kV – CHINCOTEAGUE 69 kV Ckt 1	ODEC (DPL) See item 2 in Transmission Owner Work Scope - Direct Connect and Attachment Facilities Work Scope section above for mitigation. Time Estimate: 24 months Cost: \$5,500,000	\$5,500,000
			TOTAL COST	\$12,167,000

Steady-State Voltage Requirements

To be performed during later study phases as required.

Short Circuit

No issues identified.

Stability and Reactive Power Requirement

To be performed during later study phases as required.

Light Load Analysis - 2022

To be performed during later study phases (as required by PJM Manual 14B).

Voltage Drop

A voltage drop analysis will be performed as part of the System Impact Study. If the addition of the facility causes a violation, a STATCOM may be required at the interconnection substation.

System Impact Study Costs

Since the amount of generation on the ODEC system will exceed load present at various times during the year, and that operation of the ODEC system cannot be controlled separately from the rest of PJM, the following study tasks will need to be performed during the System Impact Study phase of the project in order to detect possible problems:

- Construction of a dynamic model of new generators;

- Harmonic Study;
- Steady State Analysis of Island Combinations;
- Temporary Overvoltage Analysis.

The estimated cost of these studies is **\$120,000** and will be added to the cost of the System Impact Study.

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	CK T ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADIN G %	POST PROJECT LOADIN G %	AC DC	MW IMPACT
419637	232128	PINEY138	DP&L	232127	LORETTO	DP&L	1	DPL_P1_2_CKT 23002	operation	158.0	75.65	81.26	DC	8.87
419095	232280	OAKHL_69	DP&L	232281	WATTSVILLE	DP&L	1	DPL_P1_2_CKT 13789	operation	88.0	114.76	121.93	DC	6.31
419455	232285	WALLOPS T	DP&L	232283	WALLOP S	DP&L	1	Base Case	operation	21.1	30.33	125.12	DC	20.0

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
419096	232280	OAKHL_69	DP&L	232281	WATTSVIL	DP&L	1	DPL_P1_2_CKT 13789	single	88.0	94.26	97.13	DC	2.52

Bus #	Bus	MW Impact
232905	BAYVIEW1	0.82
232912	OH NUG1	1.07
232913	OH NUG2	1.06
232914	OH NUG3	1.07
232915	OH NUG4	1.07
232916	OH NUG5	1.07
232917	OH NUG6	1.07
232918	OH NUG7	1.07
232921	TASLEY2G	1.41
232926	CRISFLD1	0.15
901003	W1-003 C	0.57
901013	W1-004 C	0.57
901023	W1-005 C	0.57
901033	W1-006 C	0.57
904210	V4-022 C	0.81
917081	Z2-012 C	0.5
918831	AA1-102	0.55
920321	AA2-130	0.03
924361	AB2-084 C	0.09
924681	AB2-120 C	6.67
926911	AC1-177	0.38
939154	AE1-145 CBAT	2.52

Bus #	Bus	MW Impact
939621	AE1-192 C O1	19.99
BAYOU	BAYOU	0.06
BIG_CAJUN1	BIG_CAJUN1	0.1
BIG_CAJUN2	BIG_CAJUN2	0.2
BLUEG	BLUEG	0.31
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.02
CARR	CARR	0.02
CATAWBA	CATAWBA	0.02
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
CHOCTAW	CHOCTAW	0.07
COFFEEN	COFFEEN	0.03
COTTONWOOD	COTTONWOOD	0.25
DEARBORN	DEARBORN	0.05
DUCKCREEK	DUCKCREEK	0.07
EDWARDS	EDWARDS	0.03
ELMERSMITH	ELMERSMITH	0.03
FARMERCITY	FARMERCITY	0.02
GIBSON	GIBSON	0.01
HAMLET	HAMLET	0.07
NEWTON	NEWTON	0.08
PRAIRIE	PRAIRIE	0.16
RENSSELAER	RENSSELAER	0.02
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.04
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.03
TVA	TVA	0.11
UNIONPOWER	UNIONPOWER	0.05

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
418651	232241	VIENN_69	DP&L	232234	TODD	DP&L	1	DPL_P4-2_DP11	breaker	110.0	97.2	97.89	DC	1.7

Bus #	Bus	MW Impact
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Bus #	Bus	MW Impact
232907	VN8	2.6
232919	VN10	0.25
901004	W1-003 E	0.38
901014	W1-004 E	0.38
901024	W1-005 E	0.38
901034	W1-006 E	0.38
904210	V4-022 C	0.16
904212	V4-022 E	0.26
907052	X1-032 E	0.35
915541	Y3-058 C	0.1
915542	Y3-058 E	1.06
917082	Z2-012 E	1.05
917432	Z2-076 E	0.14
917442	Z2-077 E	0.14
924362	AB2-084 E	0.54
924681	AB2-120 C	3.2
924682	AB2-120 E	5.21
924781	AB2-130 C O1	3.11
924782	AB2-130 E O1	5.08
925092	AB2-166 E	0.34
925261	AB2-180 C	1.6
925262	AB2-180 E	0.69
925731	AC1-049 C	0.1
925732	AC1-049 E	0.16
926911	AC1-177	0.36
927191	AC1-213 C	0.32
927192	AC1-213 E	0.21
927321	AC1-229 C	0.23
927322	AC1-229 E	0.37
930202	AB1-056 E O1	10.47
930881	AB1-137 C	0.26
930882	AB1-137 E	0.11
932161	AC2-023 C	3.31
932162	AC2-023 E	2.41
935121	AD1-145	0.81
936691	AD2-088 C O1	1.75
936692	AD2-088 E O1	1.16
938651	AE1-087 C	7.68
938652	AE1-087 E	1.92
938891	AE1-117 C O1	2.95

Bus #	Bus	MW Impact
938892	AE1-117 E O1	7.87
938901	AE1-118 C O1	2.96
938902	AE1-118 E O1	7.9
939151	AE1-145 C1	1.01
939152	AE1-145 C2	0.67
939153	AE1-145 E	0.02
939361	AE1-167 C O1	0.51
939362	AE1-167 E O1	0.42
939621	AE1-192 C O1	3.97
939622	AE1-192 E O1	1.94
BAYOU	BAYOU	0.06
BIG_CAJUN1	BIG_CAJUN1	0.09
BIG_CAJUN2	BIG_CAJUN2	0.18
BLUEG	BLUEG	0.28
CALDERWOOD	CALDERWOOD	0.03
CANNELTON	CANNELTON	0.02
CARR	CARR	0.01
CATAWBA	CATAWBA	0.02
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
CHOCTAW	CHOCTAW	0.06
COFFEEN	COFFEEN	0.03
COTTONWOOD	COTTONWOOD	0.23
DEARBORN	DEARBORN	0.05
DUCKCREEK	DUCKCREEK	0.06
EDWARDS	EDWARDS	0.03
ELMERSMITH	ELMERSMITH	0.03
FARMERCITY	FARMERCITY	0.02
G-007	G-007	0.03
GIBSON	GIBSON	0.01
HAMLET	HAMLET	0.06
NEWTON	NEWTON	0.08
O-066	O-066	0.12
PRAIRIE	PRAIRIE	0.14
RENSELAER	RENSELAER	0.01
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.03
TILTON	TILTON	0.03
TRIMBLE	TRIMBLE	0.03

Bus #	Bus	MW Impact
TVA	TVA	0.1
UNIONPOWER	UNIONPOWER	0.04

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
418344	232234	TODD	DP&L	232233	PRESTON	DP&L	1	DPL_P4-2_DP11	breaker	93.0	133.17	134.24	DC	2.21

Bus #	Bus	MW Impact
232905	BAYVIEW1	0.21
232907	VN8	3.37
232912	OH NUG1	0.53
232914	OH NUG3	0.53
232915	OH NUG4	0.53
232916	OH NUG5	0.53
232919	VN10	0.32
232921	TASLEY2G	0.36
232926	CRISFLD1	0.18
292089	T-011	0.07
293670	O-025 C	0.12
901003	W1-003 C	0.26
901004	W1-003 E	0.5
901013	W1-004 C	0.26
901014	W1-004 E	0.5
901023	W1-005 C	0.26
901024	W1-005 E	0.5
901033	W1-006 C	0.26
901034	W1-006 E	0.5
904210	V4-022 C	0.21
904212	V4-022 E	0.34
907052	X1-032 E	0.46
910571	X3-008 C	0.44
910572	X3-008 E	4.67
913411	Y1-080 C	0.05
913412	Y1-080 E	0.55
915541	Y3-058 C	0.13
915542	Y3-058 E	1.38
917081	Z2-012 C	0.13

Bus #	Bus	MW Impact
917082	Z2-012 E	1.36
917432	Z2-076 E	0.18
917442	Z2-077 E	0.18
918831	AA1-102	0.67
920321	AA2-130	0.04
924361	AB2-084 C	0.07
924362	AB2-084 E	0.71
924681	AB2-120 C	4.15
924682	AB2-120 E	6.77
924781	AB2-130 C O1	4.04
924782	AB2-130 E O1	6.59
924831	AB2-136 C	7.56
924832	AB2-136 E	8.02
925091	AB2-166 C	0.04
925092	AB2-166 E	0.45
925151	AB2-172 C	7.15
925152	AB2-172 E	11.67
925261	AB2-180 C	2.08
925262	AB2-180 E	0.89
925731	AC1-049 C	0.13
925732	AC1-049 E	0.21
926911	AC1-177	0.46
927031	AC1-190 C	12.58
927032	AC1-190 E	5.39
927191	AC1-213 C	0.41
927192	AC1-213 E	0.27
927321	AC1-229 C	0.3
927322	AC1-229 E	0.48
930202	AB1-056 E O1	13.59
930881	AB1-137 C	0.33
930882	AB1-137 E	0.14
932161	AC2-023 C	4.29
932162	AC2-023 E	3.13
935121	AD1-145	1.05
936691	AD2-088 C O1	2.27
936692	AD2-088 E O1	1.51
938651	AE1-087 C	6.02
938652	AE1-087 E	1.51
938891	AE1-117 C O1	3.83
938892	AE1-117 E O1	10.21

Bus #	Bus	MW Impact
938901	AE1-118 C O1	3.84
938902	AE1-118 E O1	10.25
939151	AE1-145 C1	1.31
939152	AE1-145 C2	0.88
939153	AE1-145 E	0.02
939361	AE1-167 C O1	0.66
939362	AE1-167 E O1	0.55
939621	AE1-192 C O1	5.15
939622	AE1-192 E O1	2.52
BAYOU	BAYOU	0.08
BIG_CAJUN1	BIG_CAJUN1	0.12
BIG_CAJUN2	BIG_CAJUN2	0.25
BLUEG	BLUEG	0.38
CALDERWOOD	CALDERWOOD	0.04
CANNELTON	CANNELTON	0.02
CARR	CARR	0.02
CATAWBA	CATAWBA	0.03
CHEOAH	CHEOAH	0.04
CHILHOWEE	CHILHOWEE	0.01
CHOCTAW	CHOCTAW	0.08
COFFEEN	COFFEEN	0.04
COTTONWOOD	COTTONWOOD	0.32
DEARBORN	DEARBORN	0.07
DUCKCREEK	DUCKCREEK	0.09
EDWARDS	EDWARDS	0.04
ELMERSMITH	ELMERSMITH	0.04
FARMERCITY	FARMERCITY	0.03
G-007	G-007	0.04
GIBSON	GIBSON	0.02
HAMLET	HAMLET	0.09
NEWTON	NEWTON	0.11
O-066	O-066	0.17
PRAIRIE	PRAIRIE	0.2
RENSSELAER	RENSSELAER	0.02
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.02
TATANKA	TATANKA	0.05
TILTON	TILTON	0.05
TRIMBLE	TRIMBLE	0.04
TVA	TVA	0.13

Bus #	Bus	MW Impact
UNIONPOWER	UNIONPOWER	0.06

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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
419836	923950	AB2-036 TAP	DP&L	232100	CHURCH	DP&L	1	DPL_P7_1_DBL_1NCB-A	tower	154.0	116.09	116.69	DC	2.09

Bus #	Bus	MW Impact
232902	EASTMUNI	1.25
232907	VN8	2.84
232914	OH NUG3	0.5
232915	OH NUG4	0.5
232916	OH NUG5	0.5
232919	VN10	0.17
232926	CRISFLD1	0.16
293670	O-025 C	0.1
901003	W1-003 C	0.25
901004	W1-003 E	0.47
901013	W1-004 C	0.25
901014	W1-004 E	0.47
901023	W1-005 C	0.25
901024	W1-005 E	0.47
901033	W1-006 C	0.25
901034	W1-006 E	0.47
904210	V4-022 C	0.2
904212	V4-022 E	0.32
907052	X1-032 E	0.42
910571	X3-008 C	0.13
910572	X3-008 E	1.41
913411	Y1-080 C	0.02
913412	Y1-080 E	0.24
915541	Y3-058 C	0.09
915542	Y3-058 E	0.98
917082	Z2-012 E	1.28
917432	Z2-076 E	0.19
917442	Z2-077 E	0.19
918831	AA1-102	0.61
919831	AA2-069	23.54

Bus #	Bus	MW Impact
920321	AA2-130	0.03
923951	AB2-036 C	13.22
923952	AB2-036 E	21.63
923961	AB2-037 C	11.92
923962	AB2-037 E	19.48
924361	AB2-084 C	0.06
924362	AB2-084 E	0.65
924681	AB2-120 C	3.92
924682	AB2-120 E	6.4
924781	AB2-130 C O1	3.08
924782	AB2-130 E O1	5.02
924831	AB2-136 C	2.79
924832	AB2-136 E	2.96
925092	AB2-166 E	0.36
925151	AB2-172 C	2.16
925152	AB2-172 E	3.52
925261	AB2-180 C	1.48
925262	AB2-180 E	0.63
925731	AC1-049 C	0.14
925732	AC1-049 E	0.23
926911	AC1-177	0.43
927031	AC1-190 C	3.97
927032	AC1-190 E	1.7
927191	AC1-213 C	0.33
927192	AC1-213 E	0.22
927321	AC1-229 C	0.35
927322	AC1-229 E	0.56
930202	AB1-056 E O1	16.72
930881	AB1-137 C	0.39
930882	AB1-137 E	0.17
932161	AC2-023 C	2.83
932162	AC2-023 E	2.06
935121	AD1-145	0.85
936691	AD2-088 C O1	1.72
936692	AD2-088 E O1	1.15
938251	AE1-038 C O1	0.44
938252	AE1-038 E O1	0.61
938651	AE1-087 C	1.82
938652	AE1-087 E	0.45
938891	AE1-117 C O1	4.41

Bus #	Bus	MW Impact
938892	AE1-117 E O1	11.76
938901	AE1-118 C O1	4.41
938902	AE1-118 E O1	11.77
939151	AE1-145 C1	1.24
939152	AE1-145 C2	0.83
939153	AE1-145 E	0.02
939361	AE1-167 C O1	0.62
939362	AE1-167 E O1	0.52
939621	AE1-192 C O1	4.86
939622	AE1-192 E O1	2.38
BAYOU	BAYOU	0.09
BIG_CAJUN1	BIG_CAJUN1	0.14
BIG_CAJUN2	BIG_CAJUN2	0.28
BLUEG	BLUEG	0.44
CALDERWOOD	CALDERWOOD	0.05
CANNELTON	CANNELTON	0.03
CARR	CARR	0.02
CATAWBA	CATAWBA	0.03
CHEOAH	CHEOAH	0.04
CHILHOWEE	CHILHOWEE	0.02
CHOCTAW	CHOCTAW	0.09
COFFEEN	COFFEEN	0.05
COTTONWOOD	COTTONWOOD	0.36
DEARBORN	DEARBORN	0.08
DUCKCREEK	DUCKCREEK	0.1
EDWARDS	EDWARDS	0.05
ELMERSMITH	ELMERSMITH	0.05
FARMERCITY	FARMERCITY	0.03
G-007	G-007	0.03
GIBSON	GIBSON	0.02
HAMLET	HAMLET	0.1
NEWTON	NEWTON	0.12
O-066	O-066	0.16
PRAIRIE	PRAIRIE	0.22
RENSELAER	RENSELAER	0.02
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.02
TATANKA	TATANKA	0.05
TILTON	TILTON	0.05
TRIMBLE	TRIMBLE	0.05

Bus #	Bus	MW Impact
TVA	TVA	0.15
UNIONPOWER	UNIONPOWER	0.07

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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
418471	924820	AB2-135 TAP	DP&L	232203	CHURC_69	DP&L	1	DPL_P4-2_DP11	breaker	93.0	120.88	121.42	DC	1.1

Bus #	Bus	MW Impact
232813	VAUGHN	0.11
232900	DEMECSMY	0.81
232910	NRG_G1	2.05
232911	NRG_G2	2.05
901004	W1-003 E	0.25
901014	W1-004 E	0.25
901024	W1-005 E	0.25
901034	W1-006 E	0.25
901411	W1-062	0.83
904210	V4-022 C	0.1
904212	V4-022 E	0.17
907052	X1-032 E	0.22
915542	Y3-058 E	0.48
917082	Z2-012 E	0.68
917432	Z2-076 E	0.12
917442	Z2-077 E	0.12
924362	AB2-084 E	0.34
924681	AB2-120 C	2.07
924682	AB2-120 E	3.39
924781	AB2-130 C O1	2.0
924782	AB2-130 E O1	3.27
924821	AB2-135 C	21.03
924822	AB2-135 E	23.99
925092	AB2-166 E	0.19
925261	AB2-180 C	0.73
925262	AB2-180 E	0.31
925731	AC1-049 C	0.09
925732	AC1-049 E	0.14
926131	AC1-091 C	0.52

Bus #	Bus	MW Impact
926132	AC1-091 E	0.86
926141	AC1-092 C	0.52
926142	AC1-092 E	0.86
926151	AC1-093 C	0.49
926152	AC1-093 E	0.81
926161	AC1-094 C	0.42
926162	AC1-094 E	0.69
926171	AC1-095 C	0.26
926172	AC1-095 E	0.42
926911	AC1-177	0.22
927191	AC1-213 C	0.17
927192	AC1-213 E	0.11
927321	AC1-229 C	0.22
927322	AC1-229 E	0.35
930202	AB1-056 E O1	10.42
930881	AB1-137 C	0.24
930882	AB1-137 E	0.1
932161	AC2-023 C	1.33
932162	AC2-023 E	0.97
933631	AC2-185 C	1.06
933632	AC2-185 E	1.73
933641	AC2-186 C	2.79
933642	AC2-186 E	4.56
935121	AD1-145	0.67
936691	AD2-088 C O1	1.11
936692	AD2-088 E O1	0.74
938891	AE1-117 C O1	2.79
938892	AE1-117 E O1	7.45
938901	AE1-118 C O1	2.79
938902	AE1-118 E O1	7.45
939151	AE1-145 C1	0.66
939152	AE1-145 C2	0.44
939153	AE1-145 E	0.01
939361	AE1-167 C O1	0.33
939362	AE1-167 E O1	0.27
939621	AE1-192 C O1	2.56
939622	AE1-192 E O1	1.26
BAYOU	BAYOU	0.07
BIG_CAJUN1	BIG_CAJUN1	0.11
BIG_CAJUN2	BIG_CAJUN2	0.22

Bus #	Bus	MW Impact
BLUEG	BLUEG	0.35
CALDERWOOD	CALDERWOOD	0.04
CANNELTON	CANNELTON	0.02
CARR	CARR	0.01
CATAWBA	CATAWBA	0.02
CHEOAH	CHEOAH	0.03
CHILHOWEE	CHILHOWEE	0.01
CHOCTAW	CHOCTAW	0.07
COFFEEN	COFFEEN	0.04
COTTONWOOD	COTTONWOOD	0.29
DEARBORN	DEARBORN	0.06
DUCKCREEK	DUCKCREEK	0.08
EDWARDS	EDWARDS	0.04
ELMERSMITH	ELMERSMITH	0.04
FARMERCITY	FARMERCITY	0.02
G-007	G-007	0.02
GIBSON	GIBSON	0.01
HAMLET	HAMLET	0.08
NEWTON	NEWTON	0.1
O-066	O-066	0.1
PRAIRIE	PRAIRIE	0.18
RENSSELAER	RENSSELAER	0.01
SANTEETLA	SANTEETLA	0.01
SMITHLAND	SMITHLAND	0.01
TATANKA	TATANKA	0.04
TILTON	TILTON	0.04
TRIMBLE	TRIMBLE	0.04
TVA	TVA	0.12
UNIONPOWER	UNIONPOWER	0.05

Contingency Name	Contingency Definition
Base Case	
DPL_P1_2_CKT 23002	CONTINGENCY 'DPL_P1_2_CKT 23002' DISCONNECT BUS 232007 XFMR END /INDIAN RIVER - PINEY GROVE 230 & PNY GRV AT-20
DPL_P1_2_CKT 13789	CONTINGENCY 'DPL_P1_2_CKT 13789'

	OPEN LINE FROM BUS 232132 TO BUS 232133 CIRCUIT 1 /OAK HALL - WATTSVILLE 138 END
DPL_P4-2_DP11	CONTINGENCY 'DPL_P4-2_DP11' /*STEELE BUS BREAKER TO MILFORD DISCONNECT BRANCH FROM BUS 232004 TO BUS 232000 CKT 1 /*MILFORD STEELE 230 230 DISCONNECT BRANCH FROM BUS 232000 TO BUS 232005 CKT 1 /*STEELE VIENNA 230 230 END
DPL_P7_1_DBL_1NCB-A	CONTINGENCY 'DPL_P7_1_DBL_1NCB-A' /* #1 & #2 KEENEY-STEELE 230 OPEN LINE FROM BUS 231003 TO BUS 232000 CKT 1 OPEN LINE FROM BUS 231003 TO BUS 923960 CKT 2 END