

Exhibit C
Generation Interconnection
System Impact Study Report
PJM
December 2020



**Generation Interconnection
System Impact Study Report
for**

Queue Project AE1-245

HAVILAND 138 KV

19.5 MW Capacity / 150 MW Energy

December 2020

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1 Introduction

This System Impact Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 205, as well as the System Impact Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is AEP.

2 Preface

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

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

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

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.

3 General

The Interconnection Customer (IC), has proposed a Wind generating facility located in Paulding County, Ohio. The installed facilities will have a total capability of 150 MW with 19.5 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is June 30, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AE1-245
Project Name	HAVILAND 138 KV
State	Ohio
County	Paulding
Transmission Owner	AEP
MFO	150
MWE	150
MWC	19.5
Fuel	Wind
Basecase Study Year	2022

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

AE1-245 will interconnect with the AEP transmission system at the Haviland 138 kV substation, Bus #1.

To accommodate the interconnection at the Haviland 138 kV substation, the substation will have to be expanded requiring the extension of the 138 kV bus #1, installation of one (1) 138 kV circuit breaker (see Attachment 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

Note: The Interconnection Customer may be required to go offline for routine circuit breaker maintenance.

5 Cost Summary

The AE1-245 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	\$2,076,000
Allocation towards System Network Upgrade Costs*	\$0
Total Costs	\$2,076,000

*As your project progresses through the study process and other projects modify their request or withdraw, then your cost allocation could change.

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.

Note 1: PJM Open Access Transmission Tariff (OATT) section 217.3A outline cost allocation rules. The rules are further clarified in PJM Manual 14A Attachment B. The allocation of costs for a network upgrade will start with the first Queue project to cause the need for the upgrade. Later queue projects will receive cost allocation contingent on their contribution to the violation and are allocated to the queues that have not closed less than 5 years following the execution of the first Interconnection Service Agreement which identifies the need for this upgrade.

Note 2: For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates \$0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently \$0, your project may need this system reinforcement

completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

6 Transmission Owner Scope of Work

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

Description	Total Cost
Extension of the 138 kV bus #1, installation of one (1) circuit breaker and associated protection and control equipment, 138 kV line risers, and SCADA equipment.	\$1,250,000
138kV Revenue Metering	\$376,000
Generator lead first span exiting the POI station, including the first structure outside the fence	\$400,000
Review and update protection and control settings on adjacent facilities	\$50,000
Total Physical Interconnection Costs	\$2,076,000

7 Incremental Capacity Transfer Rights (ICTRs)

None

8 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after Agreement execution.

9 Interconnection Customer Requirements

It is understood that the Interconnection Customer is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Interconnected Transmission Owner. The cost of the Interconnection Customer's generating plant and the costs for the line connecting the generating plant to the Interconnected Transmission Owner's Transmission circuit are not included in this report; these are assumed to be the Interconnection Customer's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for the Interconnected Transmission Owner to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 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.
2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

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/>

11 Summer Peak Analysis

The Queue Project AE1-245 was evaluated as a 150.0 MW (Capacity 19.5 MW) injection into the Haviland #1 138 kV substation (bus #243017) in the AEP area. Project AE1-245 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-245 was studied with a commercial probability of 100.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

None

11.2 Multiple Facility Contingency

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

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 PROJE CT LOADIN G %	POST PROJE CT LOADIN G %	AC D C	MW IMPAC T
61726 4	24305 1	05NDELP H	138. 0	AEP	24299 1	05E SID E	138. 0	AEP	1	AEP_P4_#10140_05ALL EN 138_H	breaker	167.0	99.34	106.47	AC	13.66
61859 1	24305 1	05NDELP H	138. 0	AEP	24299 1	05E SID E	138. 0	AEP	1	AEP_P7-1_#11065	tower	167.0	99.33	106.46	AC	13.66
61859 2	24305 1	05NDELP H	138. 0	AEP	24299 1	05E SID E	138. 0	AEP	1	AEP_P7-1_#10895	tower	167.0	99.25	106.39	AC	13.66

11.3 Contribution to Previously Identified Overloads

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

None

11.4 Steady-State Voltage Requirements

None

11.5 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection

Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC DC	MW IMPACT
617845	243017	05HAVILN	138.0	AEP	242989	05E LIMA	138.0	AEP	1	AEP_P1- 2_#7501	operation	220.0	63.92	103.83	AC	91.74

11.6 System Reinforcements

ID	Idx	Facility	Upgrade Description	Cost	Cost Allocated to AE1-245	Upgrade Number
617264,618592,618591	1	05NDELPH 138.0 kV - 05E SIDE 138.0 kV Ckt 1	<p>PJM Supplemental Project S1563.2: North Delphos-Rockhill 138 kV: Rebuild 15.4 miles of double circuit 138 kV line utilizing 1033 ACSR conductor. SE Rating after S1563.2 is complete: S/E:251 MVA</p> <p>Projected IS Date is Dec 2024.</p> <p>An interim study will be required for AE1-245 if they want to come into service prior to completion of S1563.2.</p> <p>Note: if the supplemental project is cancelled, AE1-245 may become responsible for upgrading this line.</p>	\$24.5 M	\$0	S1563.2

Note : For customers with System Reinforcements listed: If your present cost allocation to a System Reinforcement indicates \$0, then please be aware that as changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, the cost responsibilities can change and a cost allocation may be assigned to your project. In addition, although your present cost allocation to a System Reinforcement is presently \$0, your project may need this system reinforcement completed to be deliverable to the PJM system. If your project comes into service prior to completion of the system reinforcement, an interim deliverability study for your project will be required.

11.7 Flow Gate Details

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".

11.7.1 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
618592	243051	05NDELPH	AEP	242991	05E SIDE	AEP	1	AEP_P7-1_#10895	tower	167.0	99.25	106.39	AC	13.66

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247521	T-131 C	3.7259	50/50	3.7259
247911	05TIMB G E	9.3521	Adder	11.0
247925	T-131 E	88.0920	50/50	88.0920
247959	V1-011 E	6.7354	Adder	7.92
926811	AC1-167 C O1	2.7449	Adder	3.23
926812	AC1-167 E O1	1.3316	Adder	1.57
926861	AC1-173 C	7.2676	50/50	7.2676
926862	AC1-173 E	48.4506	50/50	48.4506
934741	AD1-101 C O1	4.1414	50/50	4.1414
934742	AD1-101 E O1	6.7582	50/50	6.7582
934901	AD1-119 C O1	2.0378	50/50	2.0378
934902	AD1-119 E O1	3.3254	50/50	3.3254
940031	AE1-245 C	1.5093	Adder	1.78
940032	AE1-245 E	10.1008	Adder	11.88
CIN	CIN	0.0735	Confirmed LTF	0.0735
IPL	IPL	0.0410	Confirmed LTF	0.0410
CHILHOWEE	CHILHOWEE	0.0034	Confirmed LTF	0.0034
CBM-W2	CBM-W2	0.4952	Confirmed LTF	0.4952
CBM-W1	CBM-W1	0.5037	Confirmed LTF	0.5037
MECS	MECS	0.4515	Confirmed LTF	0.4515
TVA	TVA	0.0087	Confirmed LTF	0.0087
WEC	WEC	0.0552	Confirmed LTF	0.0552
O-066	O-066	0.2423	Confirmed LTF	0.2423
CARR	CARR	0.0125	Confirmed LTF	0.0125
CHEOAH	CHEOAH	0.0095	Confirmed LTF	0.0095
SANTEETLA	SANTEETLA	0.0029	Confirmed LTF	0.0029
G-007	G-007	0.0378	Confirmed LTF	0.0378
HAMLET	HAMLET	0.0173	Confirmed LTF	0.0173
BLUEG	BLUEG	0.0802	Confirmed LTF	0.0802
MEC	MEC	0.2680	Confirmed LTF	0.2680
CALDERWOOD	CALDERWOOD	0.0104	Confirmed LTF	0.0104
TRIMBLE	TRIMBLE	0.0095	Confirmed LTF	0.0095
RENSSELAER	RENSSELAER	0.0099	Confirmed LTF	0.0099
CATAWBA	CATAWBA	0.0101	Confirmed LTF	0.0101

11.8 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
AC1-167	Mark Center 69kV	Active
AC1-173	Logtown 138kV	In Service
AD1-101	Continental 69 kV	Active
AD1-119	Payne 69 kV	Active
AE1-245	Haviland 138 kV	Active
V1-011	Haviland 138kV	In Service

11.9 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#7501	CONTINGENCY 'AEP_P1-2_#7501' OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 247877 CKT 1 / 246264 05ST R14 8 34.5 247877 05ST.RD14 SS34.5 1 END
AEP_P7-1_#11065	CONTINGENCY 'AEP_P7-1_#11065' OPEN BRANCH FROM BUS 243242 TO BUS 247864 CKT 1 / 243242 05ALLEN 138 247864 05LOGTOWN 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 END
AEP_P4_#10140_05ALLEN 138_H	CONTINGENCY 'AEP_P4_#10140_05ALLEN 138_H' OPEN BRANCH FROM BUS 243242 TO BUS 247864 CKT 1 / 243242 05ALLEN 138 247864 05LOGTOWN 138 1 OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1 OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1 OPEN BRANCH FROM BUS 246264 TO BUS 247877 CKT 1 / 246264 05ST R14 8 34.5 247877 05ST.RD14 SS34.5 1 END

Contingency Name	Contingency Definition
AEP_P7-1_#10895	<p>CONTINGENCY 'AEP_P7-1_#10895'</p> <p>OPEN BRANCH FROM BUS 243242 TO BUS 243877 CKT 1 / 243242 05ALLEN 138 243877 05DAWKNS 138 1</p> <p>OPEN BRANCH FROM BUS 243242 TO BUS 243330 CKT 1 / 243242 05ALLEN 138 243330 05LINCOL 138 1</p> <p>OPEN BRANCH FROM BUS 243242 TO BUS 247864 CKT 1 / 243242 05ALLEN 138 247864 05LOGTOWN 138 1</p> <p>OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1</p> <p>OPEN BRANCH FROM BUS 243877 TO BUS 243342 CKT 1 / 243877 05DAWKNS 138 243342 05MILAN 138 1</p> <p>OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1</p> <p>OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1</p> <p>END</p>

12 Light Load Analysis

13 Network Impacts

The Queue Project AE1-245 was evaluated as a 150.0 MW (Capacity 19.5 MW) injection at the Haviland 138kV substation in the AEP area. Project AE1-245 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE1-245 was studied with a commercial probability of 1.0. Potential network impacts were as follows:

14 Generation Deliverability

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

None

15 Multiple Facility Contingency

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

None

16 Contribution to Previously Identified Overloads

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

None

17 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.

None

17.1 System Reinforcements – Light Load

None

18 Short Circuit Analysis

The following Breakers are overdutied

None

19 Stability and Reactive Power Assessment

(Summary of the VAR requirements based upon the results of the dynamic studies)

To be determined in the Facilities Study Phase

20 Affected Systems

20.1 TVA

None

20.2 Duke Energy Progress

None

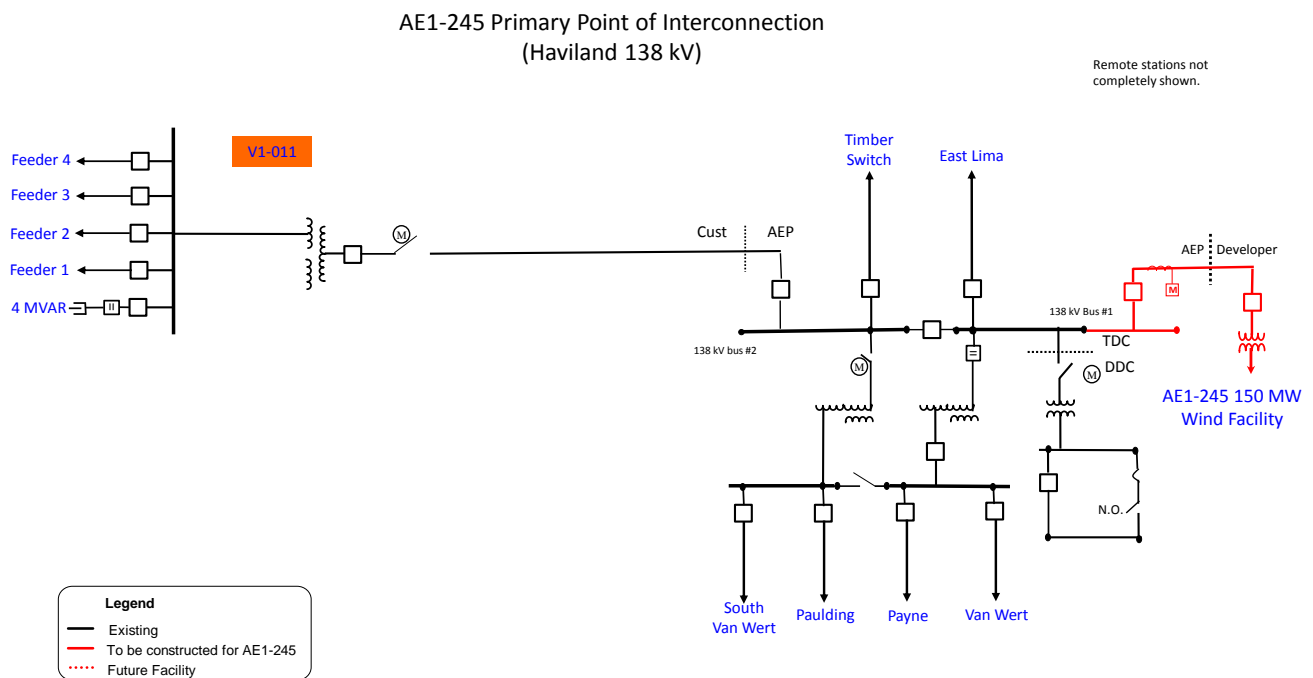
20.3 MISO

None

20.4 LG&E

None

21 Attachment 1: One Line Diagram and Project Location





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Summary: Application - 7 of 40 (Exhibit C - Generation Interconnection System Impact Study Report) electronically filed by Christine M.T. Pirik on behalf of Grover Hill Wind, LLC