Generation Interconnection

Impact Study Report

for

Queue Project AE2-090

RANDOLPH-HODGIN 138 KV

86.4 MW Capacity / 144 MW Energy

May, 2020

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1 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.

2 General

Invenergy Solar Project Development LLC has proposed a Solar generating facility located in Randolph County, Indiana. The installed facilities will have a total capability of 144 MW with 86.4 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is 12/31/2022. This study does not imply a TO commitment to this in-service date.

The objective of this System Impact Study is to determine budgetary cost estimates and approximate construction timelines for identified transmission facilities required to connect the proposed generating facilities to the AEP transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required for maintaining the reliability of the AEP transmission system.

Queue Number	**AE2-090**
Project Name	RANDOLPH-HODGIN 138 KV
Interconnection Customer	Invenergy Solar Project Development LLC
State	Indiana
County	Randolph
Transmission Owner	AEP
MFO	144
MWE	144
MWC	86.4
Fuel	Solar
Basecase Study Year	2022

2.1 Point of Interconnection

AE2-090 will interconnect with the AEP transmission system via a new station cut into the Randolph to Hodgin 138kV section of the Randolph – College Corner 138kV Circuit.

To accommodate the interconnection on the Randolph to Hodgin 138kV section of Randolph – College Corner 138kV Circuit, a new three (3) circuit breaker 138kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus will be constructed (see Figure 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.

2.2 Cost Summary

The AE2-090 project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	$ 250,000
Direct Connection Network Upgrade	$ 6,000,000
Non Direct Connection Network Upgrades	$1, 500,000
Allocation for New System Upgrades	$ 300,000
Contribution for Previously Identified Upgrades	$ 24,164,000
Total Costs	$ 32,214,000

3 Transmission Owner Scope of Work

4 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
138kV Revenue Metering	$ 250,000
Total Attachment Facility Costs	$250,000

5 Direct Connection Cost Estimate

The total preliminary cost estimate for the Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Construct a new three (3) circuit breaker 138 kV switching station physically configured in a breaker and half bus arrangement but operated as a ring-bus (See Figure 1). Installation of associated protection and control equipment, 138 kV line risers and SCADA will also be required.	$6,000,000
Total Direct Connection Facility Costs	$6,000,000

6 Non-Direct Connection Cost Estimate

The total preliminary cost estimate for the Non-Direct Connection work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Randolph – Hodgin 138kV T-Line Cut In	$ 1,000,000
Upgrade line protections & Controls at the Randolph 138kV Substation	$ 250,000
Upgrade line protections & Controls at the College Corner 138kV Substation	$ 250,000
Total Non-Direct Connection Facility Costs	$1,500,000

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 Invenergy Solar Project Development LLC is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of Invenergy Solar Project Development LLC's generating plant and the costs for the line connecting the generating plant to the Randolph – Hodgin section of the Randolph – College Corner 138kV Circuit are not included in this report; these are assumed to be Invenergy Solar Development North America's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power 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 AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

http://www.pjm.com/~/media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx

11 Network Impacts

The Queue Project AE2-090 was evaluated as a 144.0 MW (Capacity 86.4 MW) injection into the Randolph – Hodgin 138 kV line in the AEP area. Project AE2-090 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AE2-090 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Summer Peak Load Flow

12 Generation Deliverability

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

None

13 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
1423542	243262	05COLLCO	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	AEP_P4_#10527_05BLUFFP 138_E2	breaker	167.0	86.31	102.34	AC	30.24
1425035	940980	AE2-089 TAP	138.0	AEP	243237	05ADAM	138.0	AEP	1	AEP_P7-1_#11019	tower	205.0	96.26	100.9	AC	11.23

14 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
1424866	243262	05COLLCO	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS	tower	167.0	102.41	113.2	AC	18.44
2172635	248001	06DEARB1	345.0	OVEC	248013	06PIERCE	345.0	OVEC	1	.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS	tower	972.0	108.89	110.04	AC	12.93

15 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
1424360	243262	05COLLCO	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	AEP_P1-2_#6372A	operation	167.0	96.11	108.2	AC	21.01
1424361	243262	05COLLCO	138.0	AEP	250001	08COLINV	138.0	DEO&K	1	.138.DEO&K-AEP-DAY.B2 TODHUNTER JCT 138	operation	167.0	96.11	108.2	AC	21.01

16 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost	Cost Allocated to AE2-090	Upgrade Number
1425035	2	AE2-089 TAP 138.0 kV - 05ADAM 138.0 kV Ckt 1	Replace Adam Substation conductor 500 MCM CU 37 Str. Cost estimate $300K. Time estimate 12-18 months. New SE rating 255 MVA.	$300 K	$300 K	N6593
1424866,1423542	1	05COLLCO 138.0 kV - 08COLINV 138.0 kV Ckt 1	AEP end SE rating is 167 MVA. Limiting element is ACSR ~ 397.5 ~ 30/7 ~ LARK - Conductor section 1. A Sag Study will be required on the 0.15 mile section of line to mitigate the overload. Depending on the sag study results, cost for this upgrade is expected to be between $20,000 (no remediation required just sag study) and $0.3 million (complete line reconductor/rebuild required). New AEP SE rating to be 245 MVA. PJM Network Upgrade N6123. Sag Study: 6 to 12 months. Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement. This overload is presently driven by a prior queue cycle and therefore AE2-090 presently does not receive a cost allocation to this upgrade. Note 1: Queue Project AE2-090 presently does not receive cost allocation for this upgrade. As changes to the interconnection process occur, such as prior queued projects withdrawing from the queue, reducing in size, etc, Queue Project AE2-090 could receive cost allocation. Note 2: Although Queue Project AE2-090 may not have cost responsibility for this upgrade, Queue Project AE2-090 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE2-090 come into service prior to completion of the upgrade, Queue Project AE2-090 will need an interim study. DEOK-end SE rating is 178 MVA. Rebuild 11.87 miles of the DEOK portion of line. $24.164 M. 36 months from ISA. New DEOK SE rating to be 239 MVA. PJM Network Upgrade N6284. AE2-090 is the driver for this upgrade.	$20 K + $24.164 M	$24.164 M	N6123 N6284

ID	Index	Facility	Upgrade Description	Cost	Cost Allocated to AE2-090	Upgrade Number
2172635	3	06DEARB1 345.0 kV - 06PIERCE 345.0 kV Ckt 1	Perform a sag study. OVEC's cost estimate for performing the sag study is $125K. New SE rating to be 1204 MVA. This constraint is driven by a prior queue. Per PJM cost allocation rules, Queue Project AE2-090 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 AE2-090 could receive cost allocation. Note 2: Although Queue Project AE2-090 may not have cost responsibility for this upgrade, Queue Project AE2-090 may need this upgrade in-service to be deliverable to the PJM system. If Queue Project AE2-090 comes into service prior to completion of the upgrade, Queue Project AE2-090 will need an interim study.	$125 K	$0	TBD
			TOTAL COST:		$24.464M	

17 Flow Gate Details

The following indices 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. 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 and indices sections are full contributions, whereas the loading percentages reported in the body of the report, take into consideration the commercial probability of each project as well as the ramping impact of "Adder" contributions.

17.1 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
1424866	243262	05COLLCO	AEP	250001	08COLINV	DEO&K	1	.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS	tower	167.0	102.41	113.2	AC	18.44

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243415	05WWVSTA	2.0676	50/50	2.0676
247288	05RICHG1	0.6868	50/50	0.6868
247289	05RICHG2	0.6868	50/50	0.6868
247929	S-071 E	5.9250	Adder	6.97
932841	AC2-111 C O1	7.0625	50/50	7.0625
932842	AC2-111 E O1	11.5231	50/50	11.5231
934961	AD1-128 C O1	5.8904	50/50	5.8904
934962	AD1-128 E O1	9.6106	50/50	9.6106
940991	AE2-090 C	11.0670	50/50	11.0670
940992	AE2-090 E	7.3780	50/50	7.3780
942071	AE2-219 C	3.3387	Adder	3.93
942072	AE2-219 E	4.6105	Adder	5.42
WEC	WEC	0.4515	Confirmed LTF	0.4515
LGEE	LGEE	0.0070	Confirmed LTF	0.0070
CIN	CIN	2.0384	Confirmed LTF	2.0384
CBM-W2	CBM-W2	10.8704	Confirmed LTF	10.8704
CARR	CARR	0.0338	Confirmed LTF	0.0338
CBM-W1	CBM-W1	3.2134	Confirmed LTF	3.2134
MECS	MECS	1.5610	Confirmed LTF	1.5610
O-066	O-066	0.6461	Confirmed LTF	0.6461
CBM-S1	CBM-S1	0.4250	Confirmed LTF	0.4250
G-007	G-007	0.1008	Confirmed LTF	0.1008
HAMLET	HAMLET	0.0247	Confirmed LTF	0.0247
MEC	MEC	2.6935	Confirmed LTF	2.6935
RENSSELAER	RENSSELAER	0.0270	Confirmed LTF	0.0270
CATAWBA	CATAWBA	0.0122	Confirmed LTF	0.0122
IPL	IPL	1.7530	Confirmed LTF	1.7530

17.2 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
1425035	940980	AE2-089 TAP	AEP	243237	05ADAM	AEP	1	AEP_P7-1_#11019	tower	205.0	96.26	100.9	AC	11.23

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
247536	S-071 C	0.3550	50/50	0.3550
247929	S-071 E	10.7654	50/50	10.7654
933591	AC2-176 C O1	2.6454	50/50	2.6454
933592	AC2-176 E O1	17.7035	50/50	17.7035
940981	AE2-089 C O1	37.9133	50/50	37.9133
940982	AE2-089 E O1	25.2755	50/50	25.2755
940991	AE2-090 C	5.7261	Adder	6.74
940992	AE2-090 E	3.8174	Adder	4.49
942071	AE2-219 C	3.5072	Adder	4.13
942072	AE2-219 E	4.8432	Adder	5.7
DUCKCREEK	DUCKCREEK	0.1935	Confirmed LTF	0.1935
LGEE	LGEE	0.5493	Confirmed LTF	0.5493
CIN	CIN	2.1193	Confirmed LTF	2.1193
CPLE	CPLE	0.1078	Confirmed LTF	0.1078
FARMERCITY	FARMERCITY	0.0025	Confirmed LTF	0.0025
CBM-W2	CBM-W2	8.6067	Confirmed LTF	8.6067
CARR	CARR	0.0062	Confirmed LTF	0.0062
O-066	O-066	0.0135	Confirmed LTF	0.0135
EDWARDS	EDWARDS	0.1176	Confirmed LTF	0.1176
CBM-S2	CBM-S2	0.3182	Confirmed LTF	0.3182
CBM-S1	CBM-S1	1.3170	Confirmed LTF	1.3170
G-007	G-007	0.0010	Confirmed LTF	0.0010
RENSSELAER	RENSSELAER	0.0049	Confirmed LTF	0.0049
IPL	IPL	1.8900	Confirmed LTF	1.8900

17.3 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
2172635	248001	06DEARB1	OVEC	248013	06PIERCE	OVEC	1	.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS	tower	972.0	108.89	110.04	AC	12.93

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243795	05HDWTR1G C	0.5280	50/50	0.5280
247264	05LAWG1A	6.5680	50/50	6.5680
247265	05LAWG1B	6.5680	50/50	6.5680
247266	05LAWG1S	10.4880	50/50	10.4880
247267	05LAWG2A	6.5680	50/50	6.5680
247268	05LAWG2B	6.5680	50/50	6.5680
247269	05LAWG2S	10.4880	50/50	10.4880
247543	V3-007 C	4.0030	50/50	4.0030
247914	05WLD G1 E	6.7830	Adder	7.98
247929	S-071 E	7.2534	Adder	8.53
247935	V3-007 E	26.7890	50/50	26.7890
247958	05WLD G2 E	7.1166	Adder	8.37
247963	05HDWTR1G E	9.6441	50/50	9.6441
247968	Z2-115 E	0.1388	Adder	0.16
913222	Y1-054 E	-1.2825	Adder	-1.51
915662	Y3-099 E	0.2005	50/50	0.2005
915672	Y3-100 E	0.2005	50/50	0.2005
916182	Z1-065 E	0.3823	Merchant Transmission	0.3823
920501	AA2-148 C O1	3.5308	50/50	3.5308
920502	AA2-148 E O1	23.6292	50/50	23.6292
923881	AB2-028 C	2.9006	50/50	2.9006
923882	AB2-028 E	19.4114	50/50	19.4114
925242	**AB2-178 E (Withdrawn : 12/10/2019)**	**1.9853**	**50/50**	**1.9853**
926691	AC1-152	2.0660	50/50	2.0660
926851	AC1-172	2.0660	50/50	2.0660
926881	AC1-175 C	11.7010	50/50	11.7010
926882	AC1-175 E	19.0910	50/50	19.0910
926951	AC1-182	-1.0853	Adder	-1.28
930061	AB1-014 C	-2.5234	Adder	-2.97
932461	AC2-066 C	-1.5141	Adder	-1.78
932681	AC2-090 C	5.8505	50/50	5.8505
932682	AC2-090 E	9.5455	50/50	9.5455
932841	AC2-111 C O1	2.3455	Adder	2.76
932842	AC2-111 E O1	3.8269	Adder	4.5
933591	AC2-176 C O1	1.2844	Adder	1.51
933592	AC2-176 E O1	8.5954	Adder	10.11
933601	AC2-177 C O1	4.0030	50/50	4.0030
933602	AC2-177 E O1	26.7890	50/50	26.7890
934161	AD1-043 C O1	3.7853	Adder	4.45
934162	AD1-043 E O1	6.1760	Adder	7.27

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
934961	AD1-128 C O1	4.7641	Adder	5.6
934962	AD1-128 E O1	7.7730	Adder	9.14
936561	AD2-071 C	5.0310	Adder	5.92
936562	AD2-071 E	2.4779	Adder	2.92
939761	AE1-207 C	5.0460	Adder	5.94
939762	AE1-207 E	6.9683	Adder	8.2
939771	AE1-208 C	4.4398	Adder	5.22
939772	AE1-208 E	6.0543	Adder	7.12
939781	AE1-209 C O1	1.6045	50/50	1.6045
939782	AE1-209 E O1	10.7375	50/50	10.7375
939791	AE1-210 C O1	1.6045	50/50	1.6045
939792	AE1-210 E O1	10.7375	50/50	10.7375
940981	AE2-089 C O1	6.1359	Adder	7.22
940982	AE2-089 E O1	4.0906	Adder	4.81
940991	AE2-090 C	6.5920	Adder	7.76
940992	AE2-090 E	4.3946	Adder	5.17
941691	AE2-169	2.6639	Adder	3.13
941711	AE2-171	2.4903	Adder	2.93
941721	AE2-172	3.0036	Adder	3.53
942071	AE2-219 C	3.1909	Adder	3.75
942072	AE2-219 E	4.4064	Adder	5.18
942081	AE2-220 C	8.0829	50/50	8.0829
942082	AE2-220 E	11.1621	50/50	11.1621
942221	AE2-234 C O1	1.5245	Adder	1.79
942222	AE2-234 E O1	0.6895	Adder	0.81
942791	AE2-297 C O1	13.8732	50/50	13.8732
942792	AE2-297 E O1	9.2488	50/50	9.2488
950161	J401	1.3116	PJM External (MISO)	1.3116
966531	J1152	12.1540	PJM External (MISO)	12.1540
WEC	WEC	2.4073	Confirmed LTF	2.4073
LGEE	LGEE	1.0628	Confirmed LTF	1.0628
CIN	CIN	13.5852	Confirmed LTF	13.5852
CBM-W2	CBM-W2	71.3295	Confirmed LTF	71.3295
CARR	CARR	0.3319	Confirmed LTF	0.3319
CBM-W1	CBM-W1	16.8663	Confirmed LTF	16.8663
MECS	MECS	7.1365	Confirmed LTF	7.1365
O-066	O-066	6.1916	Confirmed LTF	6.1916
CBM-S1	CBM-S1	4.2053	Confirmed LTF	4.2053
G-007	G-007	0.9660	Confirmed LTF	0.9660
HAMLET	HAMLET	0.2076	Confirmed LTF	0.2076
MEC	MEC	15.2506	Confirmed LTF	15.2506
CHOCTAW /* 35% REVERSE 4566958 4511400	CHOCTAW /* 35% REVERSE 4566958 4511400	0.0000	LTF	0.0000
RENSSELAER	RENSSELAER	0.2623	Confirmed LTF	0.2623
CATAWBA	CATAWBA	0.0952	Confirmed LTF	0.0952
IPL	IPL	12.5055	Confirmed LTF	12.5055

Affected Systems

18 Affected Systems

18.1 TVA

None

18.2 Duke Energy Progress

None

18.3 MISO

MISO Impacts to be determined during later study phases.

18.4 LG&E

None

19 Contingency Descriptions:

Contingency Name	Contingency Definition
AEP_P1-2_#6372A	CONTINGENCY 'AEP_P1-2_#6372A' OPEN BRANCH FROM BUS 243262 TO BUS 250106 CKT 1 / 243262 05COLLCO 138 250106 08TODHJT 138 1 END
AEP_P4_#10527_05BLUFFP 138_E2	CONTINGENCY 'AEP_P4_#10527_05BLUFFP 138_E2' OPEN BRANCH FROM BUS 243253 TO BUS 243319 CKT 1 / 243253 05BLUFFP 138 243319 05JAY 138 1 OPEN BRANCH FROM BUS 243253 TO BUS 246014 CKT 1 / 243253 05BLUFFP 138 246014 05BLUFFPNT 69.0 1 END
.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS	CONTINGENCY '.345.DEO&K-AEP.C5 4504MFTANNERS4512EBTANNERS' OPEN BRANCH FROM BUS 243233 TO BUS 249567 CKT 1 OPEN BRANCH FROM BUS 243233 TO BUS 249565 CKT 1 END
AEP_P1-2_#4817	CONTINGENCY 'AEP_P1-2_#4817' OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1 END
.138.DEO&K-AEP-DAY.B2 TODHUNTER JCT 138	CONTINGENCY '.138.DEO&K-AEP-DAY.B2 TODHUNTER JCT 138' OPEN BUS 250106 END
AEP_P7-1_#11019	CONTINGENCY 'AEP_P7-1_#11019' OPEN BRANCH FROM BUS 243218 TO BUS 243232 CKT 2 / 243218 05DESOTO 345 243232 05SORENS 345 2 OPEN BRANCH FROM BUS 243225 TO BUS 243232 CKT 1 / 243225 05KEYSTN 345 243232 05SORENS 345 1 END

20 Short Circuit

The following Breakers are overduty: None

Figure 1: AE2-090 Randolph – Hodgin 138kV One Line Diagram

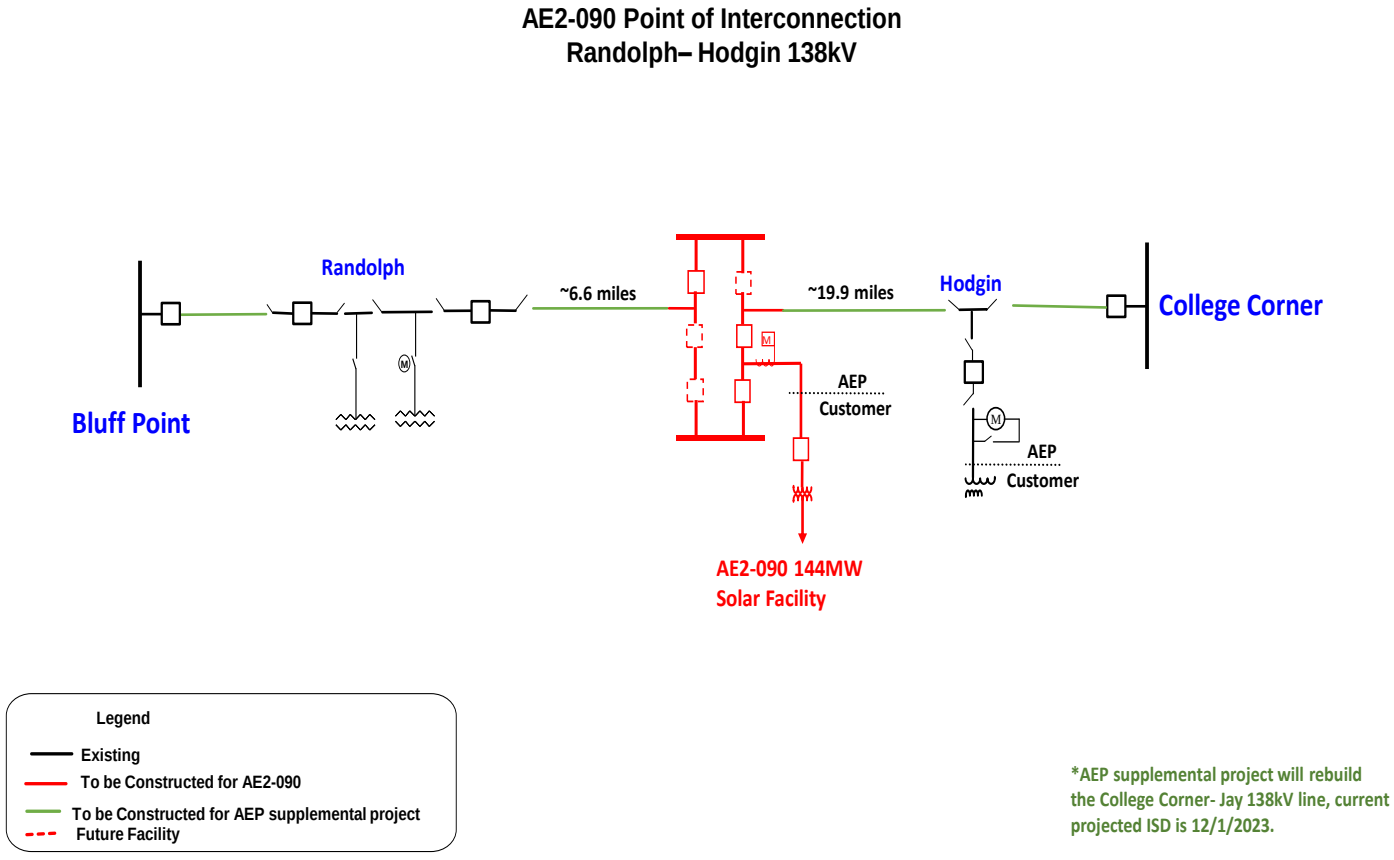

Figure 2: AE2-090 Point of Interconnection (Randolph – Hodgin 138kV)