Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position AC2-106

Biers Run 138 kV

September 2017

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

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

General

The Interconnection Customer (IC) proposes to install PJM Project #AC2-106, a 100.0 MW (68.4 MW Capacity) solar generating facility in Ross County, Ohio (see Figure 2). The primary point of interconnection is a direct connection to AEP's Biers Run 138 kV substation (see Figure 1). The secondary point of interconnection is a direct connection to AEP's Biers Run 69 kV substation (see Figure 3).

The requested in service date is October 1, 2019.

Attachment Facilities

Primary Point of Interconnection (Biers Run 138 kV substation)

To accommodate the interconnection at the Biers Run 138 kV substation, the substation will have to be expanded requiring the installation of one (1) new 138 kV circuit breaker (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required.

Direct Connection at the Biers Run 138 kV Substation Work and Cost:

- Expand the substation requiring the installation of one (1) new 138 kV circuit breaker (see Figure 1). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required.
- **Estimated Station Cost: $1,000,000**

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for Non-Direct Connection work is given in the following table below:

For AEP building Non-Direct Connection cost estimates:

Description	Estimated Cost
138 kV Revenue Metering	**$250,000**
Upgrade line protection and controls at the Biers Run 138 kV substation.	**$250,000**
Total	**$500,000**

Table 1

Secondary Point of Interconnection (Biers Run 69 kV)

To accommodate the interconnection at the Biers Run 69 kV substation, the substation will have to be expanded requiring the installation of two (2) new 69 kV circuit breakers (see Figure 3). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required.

Interconnection Customer Requirements

It is understood that The Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Biers Run 138 kV substation are not included in this report; these are assumed to be the IC'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.

Revenue Metering and SCADA Requirements

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 Sections 24.1 and 24.2.

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

Option 1

Network Impacts

The Queue Project AC2-106 was evaluated as a 100.0 MW (Capacity 68.4 MW) injection at the Biers Run 138 kV substation in the AEP area. Project AC2-106 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-106 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	**Description**
6783	CONTINGENCY '6783' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1 END
5808_B2_TOR1983B_MOAB	CONTINGENCY '5808_B2_TOR1983B_MOAB' OPEN BRANCH FROM BUS 243522 TO BUS 243593 CKT 1 / 243522 05HARRIS 138 243593 05ZUBER 138 1 END
8126_A	CONTINGENCY '8126_A' OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN 138 1 END
8126_B	CONTINGENCY '8126_B' OPEN BRANCH FROM BUS 931410 TO BUS 243483 CKT 1 / 931410 AC2-059 TAP 138 243483 05CRCLVS 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN 138 1 END
8094_C2_05BIXBY 345-303C	CONTINGENCY '8094_C2_05BIXBY 345-303C' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1

Option 1	
Contingency Name	**Description**
	OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1 END

Table 2

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)

AC2-106 Contribution to Previously Identified Overloads - Option 1															
		Contingency	Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	LFFB	8094_C2_05BIXBY 345-303C	AEP - AEP	05HARRIS-05OBETZ 138 kV line	243522	243550	1	DC	106.66	108.71	ER	179	8.18	1
2	DCTL	6783	AEP - AEP	05HARRIS-05OBETZ 138 kV line	243522	243550	1	DC	106.66	108.71	ER	179	8.18	
3	DCTL	8126_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	139.7	145.59	ER	50	6.53	
4	DCTL	8126_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	132.22	138.11	ER	50	6.53	

Table 3

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

Affected System Analysis & Mitigation

LGEE Impacts:

LGEE Impacts to be determined during later study phases (as applicable).

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

OVEC Impacts to be determined during later study phases (as applicable).

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.

AC2-106 Delivery of Energy Portion of Interconnection Request - Option 1														
	Contingency		Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
3	N-1	5808_B2_TOR1983B_ MOAB	AEP - AEP	05HARRIS-05OBETZ 138 kV line	243522	243550	1	DC	97.41	103.43	ER	179	10.77	

Table 4

New System Reinforcements

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

None

Previous System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05HARRIS-05OBETZ 138 kV line	Upgrade Harrison 138 kV substation bus work from CB Switches to Wavetrap.	An approximate construction time would be 12 to 24 months after signing an interconnection agreement.	$200,000
			Total Previous Network Upgrades	**$200,000**

Table 5

The System Reinforcement listed below is not part of the Bulk Electric System (BES), but was identified by AEP and will be required for the interconnection of AC2-106.

#	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05BIERSRUN-05SLATE 69 kV line	Rebuild/reconductor 5.0 miles of the ACSR 211.6 6/1 Penguin (4/0) conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	$6,000,000
			Total Network Upgrades	**$6,000,000**

Table 6

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 be between 24 to 36 months after signing an interconnection agreement.

Note: The time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed In-Service Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the construction of the 100.0 MW (68.4 MW Capacity) solar generating facility of The Interconnection Customer (IC) (PJM Project #AC2-106) will require the following additional interconnection charges. This plan of service will interconnect the proposed generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the The Interconnection Customer (IC) generating facility.

Cost Breakdown for the Primary Point of Interconnection (Biers Run 138 kV)		
Attachment Cost	Expand Biers Run 138 kV Substation	**$1,000,000**
Non-Direct Connection Cost Estimate	138 kV Revenue Metering	**$250,000**
	Upgrade line protection and controls at the Biers Run 138 kV substation.	**$250,000**
	Previous System Reinforcements *(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)*	**$200,000**
	Previous System Reinforcements-Not part of BES *(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)*	**$6,000,000**
	Total Estimated Cost for Project AC2-106	**$7,700,000**

Table 7

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

Option 2

Network Impacts

The Queue Project AC2-106 was evaluated as a 100.0 MW (Capacity 68.4 MW) injection at the Biers Run 69 kV substation in the AEP area. Project AC2-106 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-106 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	**Description**
6783	CONTINGENCY '6783' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1 END
6786_B2_B	CONTINGENCY '6786_B2_B' OPEN BRANCH FROM BUS 931410 TO BUS 246890 CKT 1 / 931410 AC2-059 TAP 138 246890 05HOPETN 138 1 END
6786_B2_A	CONTINGENCY '6786_B2_A' OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 END
8124_C2_05BIERSR 138-F_A	CONTINGENCY '8124_C2_05BIERSR 138-F_A' OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246893 CKT 1 / 246889 05BIERSR 138 246893 05BIERSRUN 69.0 1 END
2085_C2_05BEATTY 345-304C	CONTINGENCY '2085_C2_05BEATTY 345-304C' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 END
DAY_L34552-2	CONTINGENCY 'DAY_L34552-2' OPEN LINE FROM BUS 253077 TO BUS 253100 CKT 1 /* 09STUART 345 - 09ATLNTA 345 REMOVE UNIT 2 FROM BUS 253077 /* 09STUART 345 END

Option 1	
Contingency Name	**Description**
8126_A	CONTINGENCY '8126_A' OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN 138 1 END
8126_B	CONTINGENCY '8126_B' OPEN BRANCH FROM BUS 931410 TO BUS 243483 CKT 1 / 931410 AC2-059 TAP 138 243483 05CRCLVS 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN 138 1 END
8094_C2_05BIXBY 345-303C	CONTINGENCY '8094_C2_05BIXBY 345-303C' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1 END

Table 8

Generator Deliverability

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

AC2-106 Generator Deliverability - Option 2														
		Contingency	Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	DCTL	8126_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	98.73	128.39	ER	50	14.83	
2	DCTL	8126_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	98.73	128.39	ER	50	14.83	

Table 9

Multiple Facility Contingency

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

AC2-106 Multiple Facility Contingency - Option 2														
		Contingency	Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	LFFB	8094_C2_05BIXBY 345-303C	AEP - AEP	05HARRIS-05OBETZ 138 kV line	243522	243550	1	DC	99.39	101.31	ER	179	7.63	1
2	DCTL	6783	AEP - AEP	05HARRIS-05OBETZ 138 kV line	243522	243550	1	DC	99.39	101.31	ER	179	7.63	
3	DCTL	8124_C2_05BIERSR 138-F_A	AEP - AEP	05SLATE-05ADENA 69 kV line	243617	243839	1	DC	66.82	111.08	ER	100	66.28	
4	DCTL	8124_C2_05BIERSR	AEP - AEP	05ADENA-05ROSS 69	243839	243615	1	DC	91.45	133.81	ER	73	66.28	

AC2-106 Multiple Facility Contingency - Option 2														
	Contingency		Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
		138-F_A		kV line										

Table 10

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)

AC2-106 Contribution to Previously Identified Overloads - Option 2														
	Contingency		Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	DCTL	2085_C2_05BEATTY 345-304C	AEP - AEP	05BCKSKI-05PETERSB8 69 kV line	243598	243612	1	DC	178.3	183.29	ER	50	5.54	
2	DCTL	DAY_L34552-2	AEP - AEP	05BCKSKI-AC2-087 Tap 69 kV line	243598	931650	1	DC	107.03	110.68	ER	72	5.84	
3	DCTL	2085_C2_05BEATTY 345-304C	AEP - AEP	05PETERSB8-HIGHLA 69 kV line	243612	243606	1	DC	155.21	159.49	ER	50	5.54	
4	DCTL	8124_C2_05BIERSR 138-F_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	133.74	240.36	ER	50	66.28	
5	DCTL	8126_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	140.11	185.63	ER	50	22.76	
6	DCTL	8126_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	132.63	178.15	ER	50	22.76	
7	DCTL	DAY_L34552-2	AEP - AEP	09GRNFLD-09WASHCH 69 kV line	253030	253091	1	DC	100.26	102.94	ER	98	5.84	
6	DCTL	DAY_L34552-2	AEP - AEP	09GRNFLD-AC2-087 Tap 69 kV line	931650	253030	1	DC	147.58	151.23	ER	72	5.84	

Table 11

Steady-State Voltage Requirements

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

Affected System Analysis & Mitigation

LGEE Impacts:

LGEE Impacts to be determined during later study phases (as applicable).

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

OVEC Impacts to be determined during later study phases (as applicable).

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.

AC2-106 Delivery of Energy Portion of Interconnection Request - Option 2															
		Contingency	Affected		Bus				Loading		Rating		MW	FG
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	DCTL	762_B2_TOR8072	AEP - AEP	05BCKSKI-05PETERSB8 69 kV line	243598	243612	1	DC	177.91	182.9	ER	50	5.54	
2	DCTL	889_B2	AEP - AEP	05BCKSKI-AC2-087 Tap 69 kV line	243598	931650	1	DC	106.75	110.4	ER	72	5.84	
3	DCTL	762_B2_TOR8072	AEP - AEP	05PETERSB8-HIGHLA 69 kV line	243612	243606	1	DC	154.85	159.1	ER	50	5.53	
4	DCTL	6786_B2_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	97.41	140.77	ER	50	21.68	
5	DCTL	889_B2	AEP - AEP	09GRNFLD-09WASHCH 69 kV line	253030	253091	1	DC	111.02	114.32	NR	80	5.88	
6	DCTL	889_B2	AEP - AEP	09GRNFLD-09WASHCH 69 kV line	253030	253091	1	DC	100.06	102.74	ER	98	5.84	
7	DCTL	889_B2	AEP - AEP	09GRNFLD-AC2-087 Tap 69 kV line	931650	253030	1	DC	147.3	150.95	ER	72	5.84	

Table 12

Figure 1: Primary Point of Interconnection (Biers Run 138 kV Substation)

Single Line Diagram

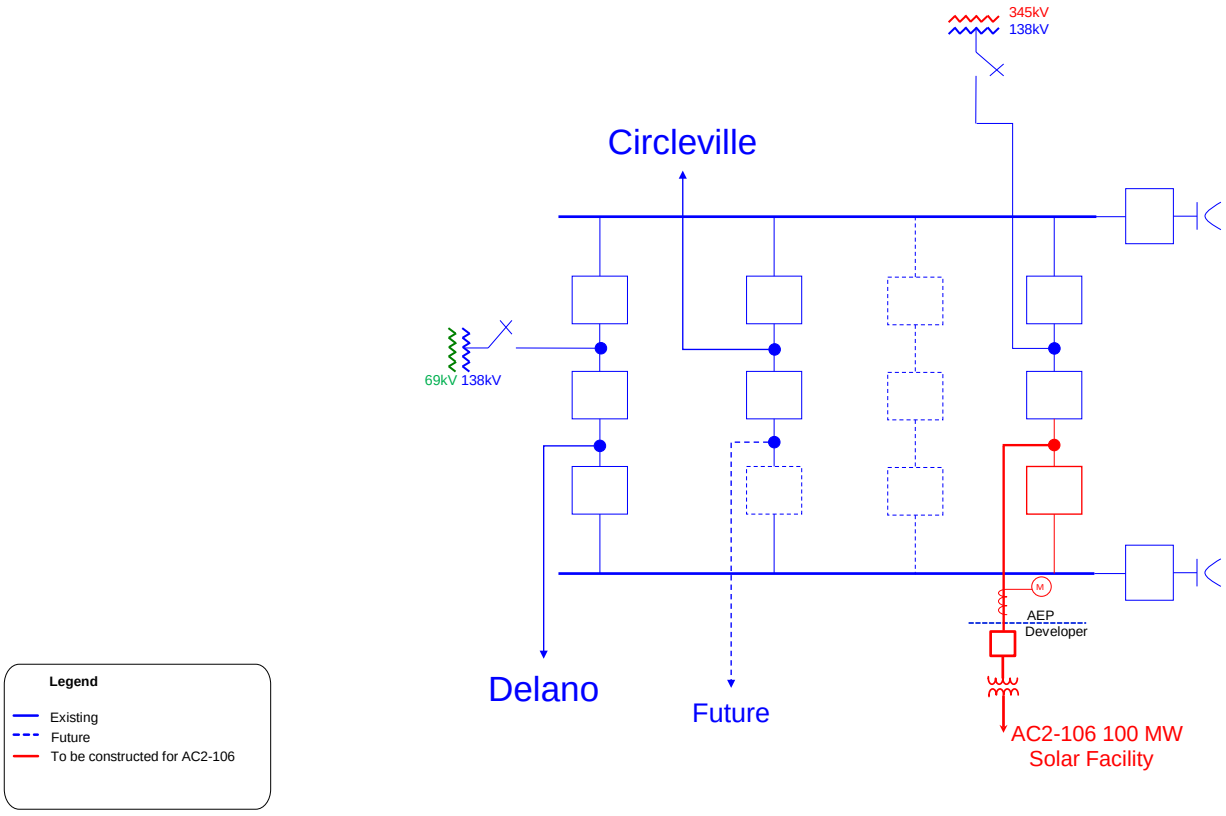


Figure 2: Primary Point of Interconnection (Biers Run 138 kV Substation)

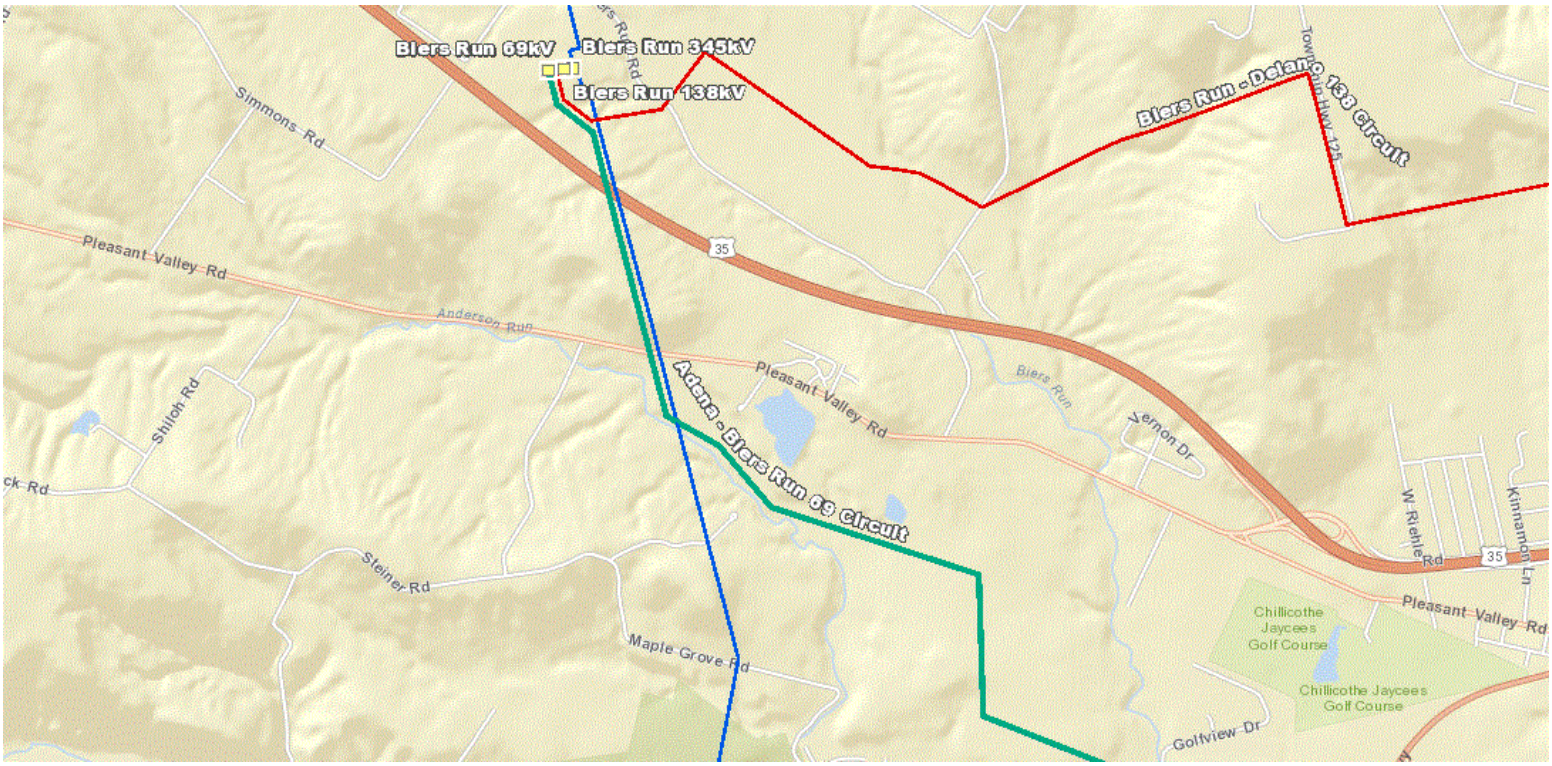
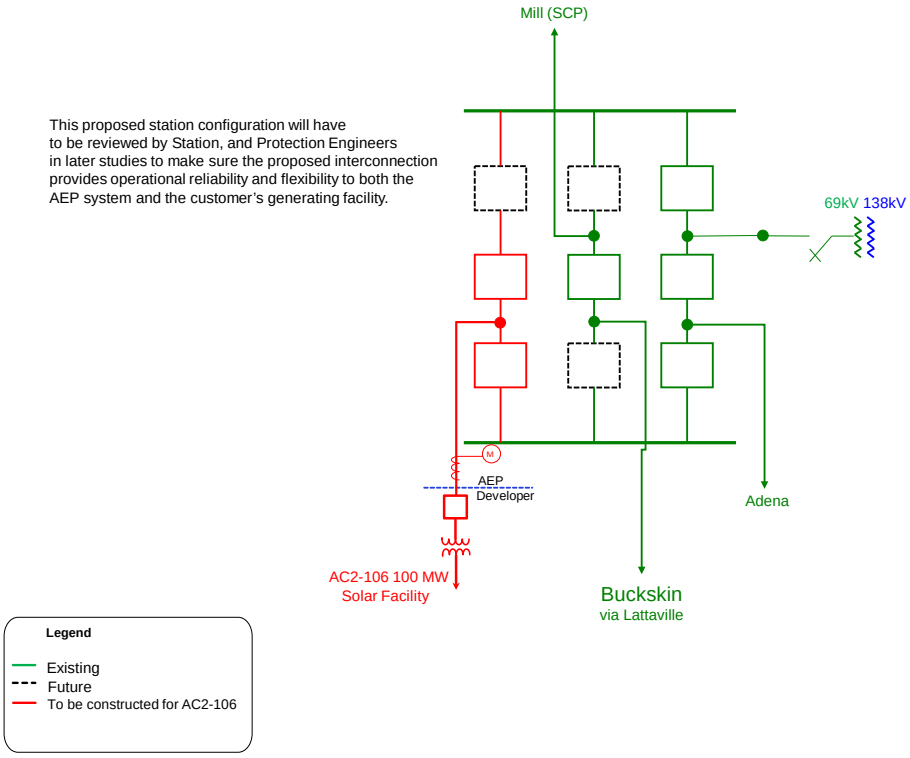


Figure 3: Secondary Point of Interconnection (Biers Run 69 kV Substation)

Single Line Diagram



Appendices for Primary POI

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.

Appendix 1

(AEP - AEP) The 05HARRIS-05OBETZ 138 kV line (from bus 243522 to bus 243550 ckt 1) loads from 106.66% to 108.71% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of '8094_C2_05BIXBY 345-303C'. This project contributes approximately 8.18 MW to the thermal violation.

CONTINGENCY '8094_C2_05BIXBY 345-303C'
OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1
OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1
END

Bus Number	*Bus Name*	*Full Contribution*
931201	*AC2-029 C*	*5.37*
931202	*AC2-029 E*	*8.76*
931411	*AC2-059 C*	*8.86*
931412	*AC2-059 E*	*9.14*
931811	*AC2-106 C OP*	*5.59*
931812	*AC2-106 E OP*	*2.58*
924351	*AB2-083 C OP*	*2.83*
924352	*AB2-083 E OP*	*1.33*
925341	*AC1-001 C*	*5.65*
925342	*AC1-001 E*	*2.66*
927161	*AC1-210 C OP*	*8.9*
927162	*AC1-210 E OP*	*4.02*

Appendices for Secondary POI

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.

Appendix 1

(AEP - AEP) The 05HARRIS-05OBETZ 138 kV line (from bus 243522 to bus 243550 ckt 1) loads from 99.39% to 101.31% (**DC power flow**) of its emergency rating (179 MVA) for the line fault with failed breaker contingency outage of '8094_C2_05BIXBY 345-303C'. This project contributes approximately 7.63 MW to the thermal violation.

CONTINGENCY '8094_C2_05BIXBY 345-303C'
OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1
OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1
END

Bus Number	*Bus Name*	*Full Contribution*
931201	*AC2-029 C*	*5.37*
931202	*AC2-029 E*	*8.76*
931411	*AC2-059 C OP*	*5.46*
931412	*AC2-059 E OP*	*5.63*
931811	*AC2-106 C OP*	*5.22*
931812	*AC2-106 E OP*	*2.41*
924351	*AB2-083 C OP*	*2.83*
924352	*AB2-083 E OP*	*1.33*
925341	*AC1-001 C*	*5.65*
925342	*AC1-001 E*	*2.66*
927161	*AC1-210 C OP*	*8.9*
927162	*AC1-210 E OP*	*4.02*