

***Generation Interconnection  
Feasibility Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AD2-106***

***Bulan 69 kV***

**December 2018**

## 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.

For Local and Network Upgrades which are required due to overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost less than \$5,000,000, the cost of the Local and Network Upgrades will be shared by all proposed projects which have been assigned a Queue Position in the New Services Queue in which the need for the Local and Network Upgrades was identified. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects.

For Local and Network Upgrades which are required due to the overloads associated with the System Impact Studies of an individual New Services Queue, and have a cost of \$5,000,000 or greater, the cost of the Local and Network Upgrades will be allocated according to the order of the New Service Requests in the New Services Queue and the MW contribution of each individual Interconnection Request for those projects which cause or contribute to the need for the Local or Network Upgrades. The Load Flow Cost Allocation methods discussed in this manual, including cutoffs, still apply to the individual projects.

Cost allocation rules can be found in PJM Manual 14A, Attachment B. 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.

PJM utilizes manufacturer models to ensure the performance of turbines is properly captured during the simulations performed for stability verification. Turbine manufacturers provide such models to their customers. The list of manufacturer models PJM has already validated is contained in Attachment G-2 of Manual 14A. Manufacturer models may be updated from time to time, for various reasons such as to reflect changes to the control systems or to more accurately represent the capabilities turbines and controls which are currently available in the field. Additionally, as new turbine models are developed, turbine manufacturers provide such new models which must be used in the conduct of these studies. PJM needs adequate time to evaluate the new models in order to reduce delays to the System Impact Study process timeline for the Interconnection Customer as well as other Interconnection Customers in the study group. Therefore, PJM will require that any Interconnection Customer with a new manufacturer model must supply that model to PJM, along with a \$10,000 fully refundable deposit, no later than three (3) months prior to the starting date of the System Impact Study (See Section 2.2.2. of Manual

14A for starting dates) for the Interconnection Request which shall specify the use of the new model. The Interconnection Customer will be required to submit a completed dynamic model study request form (Attachment G-1 of Manual 14A) in order to document the request for the study.

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 #AD2-106, an 80.0 MW (33.6 MW Capacity) solar facility in Perry County, Kentucky (see Figure 2). The primary point of interconnection will be a direct connection to AEP's Bulan 69 kV substation (see Figure 1). The secondary point of interconnection will be to AEP's Shamrock – Bulan 69 kV section of the Bonnyman – Hazard 69 kV circuit (see Figure 3).

The requested in service date is December 31, 2021.

## Attachment Facilities

### Primary Point of Interconnection (Bulan 69 kV Substation)

To accommodate the interconnection at the Bulan 69 kV Substation, a new Four (4) circuit breaker 69 kV 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, 69 kV line risers, SCADA, and 69 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.

#### New Switching Station Work and Cost:

- Construct a new Four (4) circuit breaker 69 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, 69 kV line risers and SCADA will also be required.
- **Estimated Station Cost: \$5,000,000**

## Direct Connection Cost Estimate

The total preliminary cost estimate for Direct Connection work is given in the following tables below.

For AEP building Direct Connection cost estimates:

Description	Total Cost
Bulan - Shamrock 69 kV T-Line Cut In	\$700,000
<b>Total</b>	<b>\$700,000</b>

**Table 1**

## 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	Total Cost
69 kV Revenue Metering	\$250,000
Upgrade line protection and controls at the Bonnyman 69 kV substation	\$250,000
Upgrade line protection and controls at Hazard 69 kV substation	\$250,000
<b>Total</b>	<b>\$750,000</b>

**Table 2**

## Interconnection Customer Requirements

It is understood that The Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to AEP. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Bulan 69 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>

## Network Impacts – Option 1

The Queue Project AD2-106 was evaluated as an 80.0 MW (Capacity 33.6 MW) injection at the Bulan 69 kV substation in the AEP area. Project AD2-106 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-106 was studied with a commercial probability of 53%. Potential network impacts were as follows:

### Base Case Used

Summer Peak Analysis – 2021 Case

### Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	Description
'AEP_P1-2_#363'	OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 END
'AEP_P1-3_#8818'	OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNNU 765 242934 05CORNNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 END
'325_B3_05HAZRD1 138-1_WOMOAB'  <b>Note:</b> This contingency is invalid.	OPEN BRANCH FROM BUS 243671 TO BUS 243703 CKT 1 / 243671 05BEAVR1 138 243703 05TOPMOS 138 1 OPEN BRANCH FROM BUS 243672 TO BUS 243703 CKT 1 / 243672 05BECKHA 138 243703 05TOPMOS 138 1 OPEN BRANCH FROM BUS 243672 TO BUS 243704 CKT 1 / 243672 05BECKHA 138 243704 05VICCO 138 1 OPEN BRANCH FROM BUS 243692 TO BUS 243693 CKT Z1 / 243692 05HAZRD1 138 243693 05HAZRD2 138 Z1 OPEN BRANCH FROM BUS 243692 TO BUS 243704 CKT 1 / 243692 05HAZRD1 138 243704 05VICCO 138 1 OPEN BRANCH FROM BUS 243692 TO BUS 243729 CKT 1 / 243692 05HAZRD1 138 243729 05HAZARD1- 69.0 1 OPEN BRANCH FROM BUS 243672 TO BUS 244643 CKT 1 / 243672 05BECKHA 138 244643 05BECKHM L 34.5 1 OPEN BRANCH FROM BUS 243704 TO BUS 244650 CKT 1 / 243704 05VICCO 138 244650 05VICC L 34.5 1 OPEN BRANCH FROM BUS 243711 TO BUS 243729 CKT 1 / 243711 05BULAN 69.0 243729 05HAZARD1- 69.0 1 OPEN BRANCH FROM BUS 243729 TO BUS 243738 CKT 1 / 243729 05HAZARD1- 69.0 243738 05LESLIE 69.0 1 END

**Table 3**

## **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)*

AD2-106 Contribution to Previously Identified Overloads														
#	Type	Contingency	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.	FG App.
		Name			From	To			Initial	Final	Type	MVA		
1	N-1	'AEP_P1-2_#363'	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV	324114	248000	1	DC	192.26	192.41	ER	1370	1.99	
2	-	None	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV	324114	248000	1	DC	137.83	138.0	NR	1134	1.92	
3	N-1	'AEP_P1-3_#8818'	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV	324114	248000	1	DC	115.44	115.58	ER	1370	1.92	

**Table 4**

## **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.

AD2-106 Delivery of Energy Portion of Interconnection Request														
#	Type	Contingency	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating Type	MVA	MW Con.	FG App.
		Name			From	To			Initial	Final				
1	N-1	'325_B3_05HAZRD1 138-1_WOMOAB' <b>Note:</b> This contingency is invalid.	AEP-AEP	05BULAN- 05SHAMROCK 69 kV	243711	243745	1	DC	5.73	100.93	ER	75	80	
2	N-1	'AEP_P1-2_#363	LGEE – OVEC	7TRIMBLE- 06CLIFTY 345 kV	324114	248000	1	DC	182.86	183.02	ER	1370	4.75	
3	-	None	LGEE - OVEC	7TRIMBLE- 06CLIFTY 345 kV	324114	248000	1	DC	140.19	140.37	NR	1134	4.57	

**Table 5**

### **New System Reinforcements**

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

None

### **Contribution to Previously Identified System Reinforcements**

*(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)*

*(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)*

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
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Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1-3	7TRIMBLE-06CLIFTY 345 kV	Pending Upgrade: Reconductor the line with a high temperature conductor and upgrade necessary terminal equipment. Cost estimate is \$17.4M with a time estimate of 18 months. PJM Network Upgrade N5469.	An approximate construction time would be 18 months after signing an interconnection agreement.	\$17.4 Million
<b>Total Network Upgrades</b>				<b>\$17.4 Million</b>

**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.

## **Conclusion**

Based upon the results of this Feasibility Study, the construction of the IC's 80 MW (33.6 MW Capacity) solar generating facility (PJM Project #AD2-106) will require the following additional interconnection charges. This plan of service will interconnect the proposed solar generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the IC's generating facility.

<b>Cost Breakdown for Primary Point of Interconnection (Bulan 69kV Substation)</b>		
<b>Attachment Cost</b>	New 69 kV Switching Station and installation of associated protection and controls equipment.	\$5,000,000
<b>Direct Connection Cost Estimate</b>	Bulan - Shamrock 69 kV T-Line Cut In	\$700,000
<b>Non-Direct Connection Cost Estimate</b>	69kV Revenue Metering	\$250,000
	Upgrade line protection and controls at the Hazard 69 kV substation to coordinate with the new 69 kV switching station.	\$250,000
	Upgrade line protection and controls at the Bonnyman 69 kV substation to coordinate with the new 69 kV switching station.	\$250,000
	<b><u>Contribution to Previously Identified System Reinforcements</u></b> <i>(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)</i> <i>(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)</i>	\$17,400,000
<b>Total Estimated Cost for Project AD2-106</b>		<b>\$23,850,000</b>

### **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.

## **Network Impacts – Option 2**

The Queue Project AD2-106 was evaluated as an 80.0 MW (Capacity 33.6 MW) injection tapping the Bulan to Shamrock 69kV line in the AEP area. Project AD2-106 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-106 was studied with a commercial probability of 53%. Potential network impacts were as follows:

### **Base Case Used**

Summer Peak Analysis – 2021 Case

### **Contingency Descriptions**

The following contingencies resulted in overloads:

Option 2	
Contingency Name	Description
'AEP_P1-2_#363'	OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 END
'AEP_P1-3_#8818'	OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNNU 765 242924 05HANG R 765 1 OPEN BRANCH FROM BUS 242921 TO BUS 242934 CKT 1 / 242921 05CORNNU 765 242934 05CORNNU 345 1 REMOVE UNIT 1A FROM BUS 247245 / 247245 05HRKG1A 18.0 REMOVE UNIT 1B FROM BUS 247246 / 247246 05HRKG1B 18.0 REMOVE UNIT 1S FROM BUS 247247 / 247247 05HRKG1S 18.0 REMOVE UNIT 2A FROM BUS 247248 / 247248 05HRKG2A 18.0 REMOVE UNIT 2B FROM BUS 247249 / 247249 05HRKG2B 18.0 REMOVE UNIT 2S FROM BUS 247250 / 247250 05HRKG2S 18.0 END

**Table 8**

### **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)*

AD2-106 Contribution to Previously Identified Overloads Option 2									
Contingency	Affected	Facility	Bus	Cir.	PF	Loading	Rating	MW	FG

#	Type	Name	Area	Description	From	To			Initial	Final	Type	MVA		
1	N-1	'AEP_P1-2_#363'	LGEE - OVEC	7TRIMBLE-06CLIFTY 345 kV	324114	248000	1	DC	192.25	192.4	ER	1370	1.96	
2	-	None	LGEE – OVEC	7TRIMBLE-06CLIFTY 345 kV	324114	248000	1	DC	137.81	137.98	NR	1134	1.89	
3	N-1	'AEP_P1-3_#8818'	LGEE – OVEC	7TRIMBLE-06CLIFTY 345 kV	324114	248000	1	DC	115.43	115.57	ER	1370	1.88	

**Table 9**

## **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.

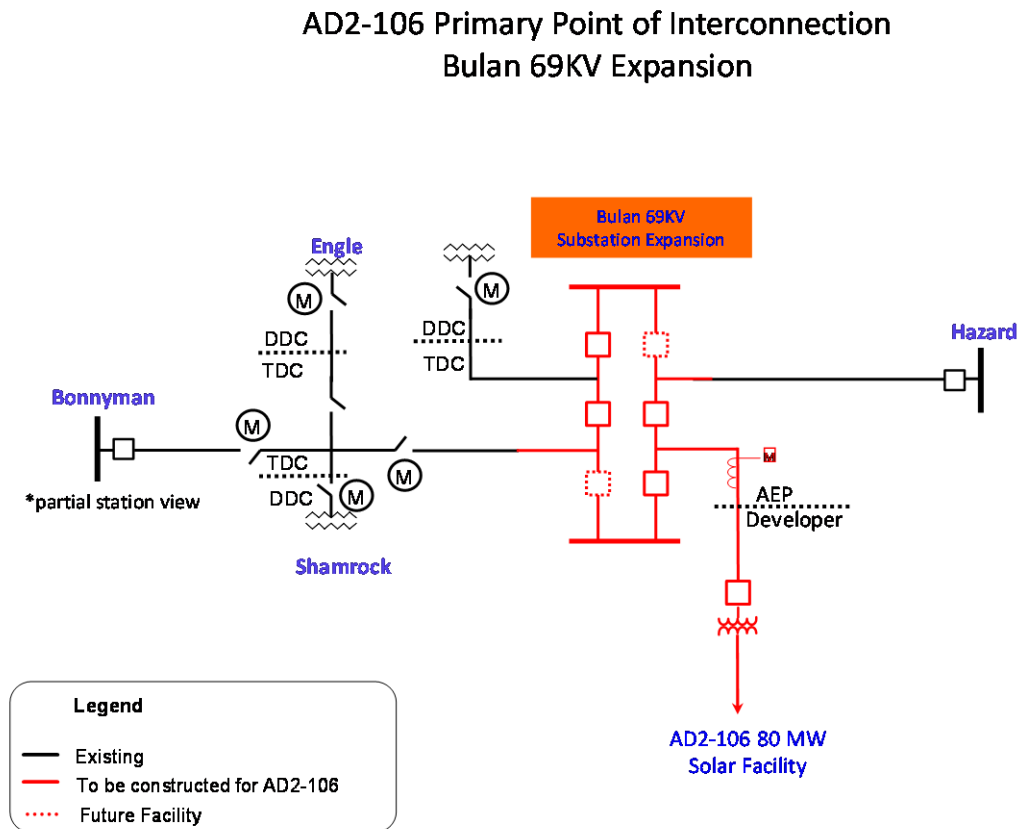
Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission

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

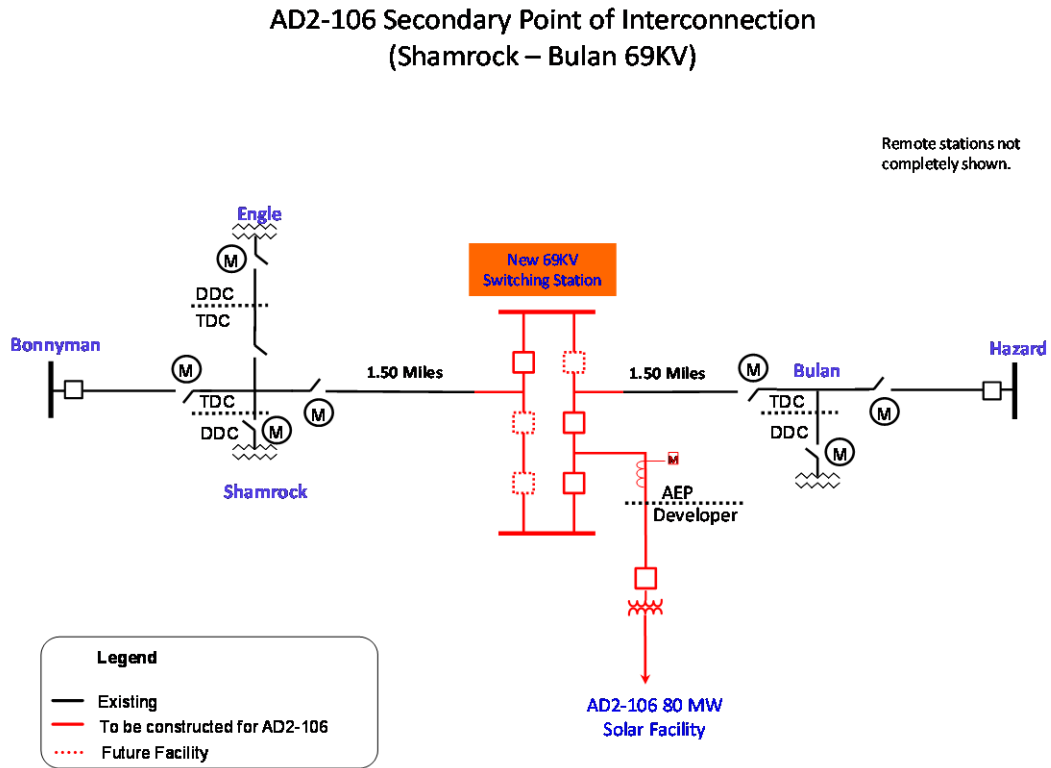
AD2-106 Delivery of Energy Portion of Interconnection Request Option 2														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.	FG App.
					From	To			Initial	Final	Type	MVA		
1	N-1	'AEP_P1-2_#363	LGEE – OVEC	7TRIMBLE- 06CLIFTY 345 kV	324114	248000	1	DC	182.84	183.0	ER	1370	4.66	
2	-	None	LGEE - OVEC	7TRIMBLE- 06CLIFTY 345 kV	324114	248000	1	DC	140.17	140.35	NR	1134	4.49	

**Table 10**

**Figure 1: Primary Point of Interconnection (Bulan 69kV Substation)**  
**Single-Line Diagram**



**Figure 3: Secondary Point of Interconnection (Shamrock - Bulan 69kV)**  
**Single-Line Diagram**





## **Appendices - 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. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the Appendices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the Appendices. 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 appendices 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.

## Appendix 1

(LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 192.26% to 192.41% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP\_P1-2\_#363'. This project contributes approximately 1.99 MW to the thermal violation.

CONTINGENCY 'AEP\_P1-2\_#363'

OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1

/ 243208 05JEFRSO

765 243209 05ROCKPT 765 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
247287	05AND G3	0.76
243442	05RKG1	37.19
243443	05RKG2	36.63
342900	1COOPER1 G	2.98
342903	1COOPER2 G	5.78
342918	1JKCT 1G	2.34
342921	1JKCT 2G	2.34
342924	1JKCT 3G	2.34
342927	1JKCT 4G	1.55
342930	1JKCT 5G	1.54
342933	1JKCT 6G	1.55
342936	1JKCT 7G	1.55
342939	1JKCT 9G	1.59
342942	1JKCT 10G	1.59
342945	1LAUREL 1G	1.68
932551	AC2-075 C	1.08
933441	AC2-157 C	8.16
LTF	AD1-092	3.63
LTF	AD1-093	6.12
LTF	AD1-094	1.1
935011	AD1-134	8.34
935141	AD1-148	2.47
936281	AD2-036 C	3.24
936381	AD2-048 C	3.93
936571	AD2-072 C O1	12.29
936771	AD2-100 C	6.97
936821	AD2-105 C O1	3.75
936831	AD2-106 C O1	1.99
936841	AD2-107 C O1	1.29
LTF	CARR	0.33
LTF	CBM-S1	40.52
LTF	CBM-S2	6.89

<i>LTF</i>	<i>CBM-W1</i>	<i>21.42</i>
<i>LTF</i>	<i>CBM-W2</i>	<i>141.33</i>
<i>LTF</i>	<i>CIN</i>	<i>25.73</i>
<i>LTF</i>	<i>CLIFTY</i>	<i>95.03</i>
<i>LTF</i>	<i>CPL</i>	<i>1.18</i>
<i>LTF</i>	<i>DEARBORN</i>	<i>0.51</i>
<i>LTF</i>	<i>IPL</i>	<i>15.7</i>
<i>981181</i>	<i>J708</i>	<i>40.82</i>
<i>981521</i>	<i>J759</i>	<i>9.35</i>
<i>981531</i>	<i>J762</i>	<i>29.43</i>
<i>981571</i>	<i>J783</i>	<i>9.25</i>
<i>938311</i>	<i>J795</i>	<i>3.66</i>
<i>938731</i>	<i>J800</i>	<i>15.73</i>
<i>938861</i>	<i>J829</i>	<i>12.54</i>
<i>938921</i>	<i>J842 C</i>	<i>3.98</i>
<i>938931</i>	<i>J843 C</i>	<i>4.32</i>
<i>939021</i>	<i>J856</i>	<i>9.32</i>
<i>274650</i>	<i>KINCAID ;1U</i>	<i>5.91</i>
<i>274651</i>	<i>KINCAID ;2U</i>	<i>5.89</i>
<i>LTF</i>	<i>LGEE</i>	<i>19.02</i>
<i>LTF</i>	<i>MEC</i>	<i>21.85</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.26</i>
<i>LTF</i>	<i>ROSETON</i>	<i>1.87</i>
<i>LTF</i>	<i>WEC</i>	<i>1.74</i>
<i>900404</i>	<i>X3-028 C</i>	<i>161.12</i>
<i>LTF</i>	<i>Z1-043</i>	<i>8.38</i>
<i>930461</i>	<i>AB1-087</i>	<i>59.08</i>
<i>930471</i>	<i>AB1-088</i>	<i>59.08</i>
<i>LTF</i>	<i>AB2-013</i>	<i>5.1</i>
<i>927331</i>	<i>AC1-040 C</i>	<i>9.43</i>
<i>925981</i>	<i>AC1-074 C</i>	<i>4.53</i>

## **Appendices – 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. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the Appendices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the Appendices. 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 appendices 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.

## Appendix 1

(LGEE - OVEC) The 7TRIMBLE-06CLIFTY 345 kV line (from bus 324114 to bus 248000 ckt 1) loads from 192.25% to 192.4% (**DC power flow**) of its emergency rating (1370 MVA) for the single line contingency outage of 'AEP\_P1-2\_#363'. This project contributes approximately 1.96 MW to the thermal violation.

CONTINGENCY 'AEP\_P1-2\_#363'

OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1

/ 243208 05JEFRSO

765 243209 05ROCKPT 765 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
247287	05AND G3	0.76
243442	05RKG1	37.19
243443	05RKG2	36.63
342900	1COOPER1 G	2.98
342903	1COOPER2 G	5.78
342918	1JKCT 1G	2.34
342921	1JKCT 2G	2.34
342924	1JKCT 3G	2.34
342927	1JKCT 4G	1.55
342930	1JKCT 5G	1.54
342933	1JKCT 6G	1.55
342936	1JKCT 7G	1.55
342939	1JKCT 9G	1.59
342942	1JKCT 10G	1.59
342945	1LAUREL 1G	1.68
932551	AC2-075 C	1.08
933441	AC2-157 C	8.16
LTF	AD1-092	3.63
LTF	AD1-093	6.12
LTF	AD1-094	1.1
935011	AD1-134	8.34
935141	AD1-148	2.47
936281	AD2-036 C	3.24
936381	AD2-048 C	3.93
936571	AD2-072 C O2	12.19
936771	AD2-100 C	6.97
936821	AD2-105 C O2	3.71
936831	AD2-106 C O2	1.96
936841	AD2-107 C O2	1.3
LTF	CARR	0.33
LTF	CBM-S1	40.52
LTF	CBM-S2	6.89

<i>LTF</i>	<i>CBM-W1</i>	<i>21.42</i>
<i>LTF</i>	<i>CBM-W2</i>	<i>141.33</i>
<i>LTF</i>	<i>CIN</i>	<i>25.73</i>
<i>LTF</i>	<i>CLIFTY</i>	<i>95.03</i>
<i>LTF</i>	<i>CPL</i>	<i>1.18</i>
<i>LTF</i>	<i>DEARBORN</i>	<i>0.51</i>
<i>LTF</i>	<i>IPL</i>	<i>15.7</i>
<i>981181</i>	<i>J708</i>	<i>40.82</i>
<i>981521</i>	<i>J759</i>	<i>9.35</i>
<i>981531</i>	<i>J762</i>	<i>29.43</i>
<i>981571</i>	<i>J783</i>	<i>9.25</i>
<i>938311</i>	<i>J795</i>	<i>3.66</i>
<i>938731</i>	<i>J800</i>	<i>15.73</i>
<i>938861</i>	<i>J829</i>	<i>12.54</i>
<i>938921</i>	<i>J842 C</i>	<i>3.98</i>
<i>938931</i>	<i>J843 C</i>	<i>4.32</i>
<i>939021</i>	<i>J856</i>	<i>9.32</i>
<i>274650</i>	<i>KINCAID ;1U</i>	<i>5.91</i>
<i>274651</i>	<i>KINCAID ;2U</i>	<i>5.89</i>
<i>LTF</i>	<i>LGEE</i>	<i>19.02</i>
<i>LTF</i>	<i>MEC</i>	<i>21.85</i>
<i>LTF</i>	<i>RENSSELAER</i>	<i>0.26</i>
<i>LTF</i>	<i>ROSETON</i>	<i>1.87</i>
<i>LTF</i>	<i>WEC</i>	<i>1.74</i>
<i>900404</i>	<i>X3-028 C</i>	<i>161.12</i>
<i>LTF</i>	<i>Z1-043</i>	<i>8.38</i>
<i>930461</i>	<i>AB1-087</i>	<i>59.08</i>
<i>930471</i>	<i>AB1-088</i>	<i>59.08</i>
<i>LTF</i>	<i>AB2-013</i>	<i>5.1</i>
<i>927331</i>	<i>AC1-040 C</i>	<i>9.43</i>
<i>925981</i>	<i>AC1-074 C</i>	<i>4.53</i>