

***Generation Interconnection  
Feasibility Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position AD2-147***

***“South Charleston 345kV”***

***42 MW Capacity / 100 MW Energy***

**July 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 users, 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), has proposed a solar generating facility located at latitude 39.5845910 and longitude -85.2268770, in Fayette County, Indiana. The installed facilities will have a total capability of 100 MW with 42 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is **December 31, 2020**. **This study does not imply a Dayton Power & Light Company commitment to this in-service date.**

### Primary Point of Interconnection

**AD2-147 “South Charleston 345 kV”** will interconnect with the Dayton Power & Light Company transmission system via a new 345kV breaker position at South Charleston Substation. South Charleston Substation is a future 345-69 kV ring bus substation that taps the existing Greene-Beatty 345 kV line<sup>1</sup>. The Point of Interconnection (POI) will be where the attachment hardware interconnects with the last dead-end structure leaving the South Charleston 345kV Substation. This is the primary Point of Interconnection (POI) chosen by the IC.

---

<sup>1</sup> The scope of work in this Feasibility Study assumes that the South Charleston 345-69 kV Substation (Supplemental project s0322 with an expected in-service date of 6/1/2021) has been built by Dayton. Dayton is not required to build the South Charleston 345-69 kV substation for the RTEP per the PJM Tariff since it is a Supplemental upgrade. If Dayton decides to not move forward with this substation, then the scope of this AD2-147 Feasibility Study will need to change to include the construction of a new 345 kV interconnection switchyard. If Dayton decides to delay the in-service date of this new substation, the IC could work with Dayton on a side agreement to advance the construction if feasible.

The interconnection scope of work and costs in this report are based off of the Primary Point of Interconnection (Option 1).

See **Attachment 1** for a one line of the physical interconnection point for Option 1.

**Secondary Point of Interconnection**

The IC requested that a secondary POI be reviewed for network impacts (Option 2). The secondary interconnection chosen was a direct line into Hutchings 138 kV Substation.

This report does not provide costs for the physical interconnection of Option 2. It was just analyzed for network impacts to the system. Results are shown in the “Network Impacts – Option 2” section of this report.

**Cost Summary: South Charleston 345 kV Line Tap<sup>1</sup>**

The **AD2-147** project will be responsible for the following costs:

<b>Description</b>	<b>Total Cost</b>
Attachment Facilities	\$ 0
Direct Connection Network Upgrades	\$ 1,250,000
Non Direct Connection Network Upgrades	\$ 50,000
<b>Total Costs</b>	<b>\$ 1,300,000</b>

In addition to the costs for the physical interconnection point above, the **AD2-147** project may be responsible for a contribution to the following costs:

<b>Description</b>	<b>Total Cost</b>
New System Upgrades	\$ 0
Previously Identified Upgrades	\$ 0
<b>Total Costs</b>	<b>\$ 0</b>

## **South Charleston 345 kV Physical Interconnection**

### **Attachment Facilities**

The Interconnection Customer will construct the attachment generator lead line into the proposed Point of Interconnection as depicted on the one-line diagram in Attachment 1.

### **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.

<b>Description</b>	<b>Total Cost</b>
Install a new 345kV breaker to expand the South Charleston 345kV ring bus to interconnect the AD2-147 project. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment, and associated facilities.	\$ 1,250,000
<b>Total Direct Connection Facility Costs</b>	<b>\$ 1,250,000</b>

The substation direct connection cost estimate for the AD2-147 project is approximately **\$1,250,000**. The substation direct connection work for this project includes the addition of a fourth 345 kV breaker to the 345 kV three breaker ring bus at the South Charleston substation which will be tapped off the Greene-Beatty 345kV line. The 345 kV generator lead line will be constructed by the developer and will be terminated onto the last dead-end substation structure leaving the substation. The new 345kV breaker will be equipped with the necessary communication systems to facilitate remote supervisory control of the breaker and status monitoring. Dayton will install the line relaying, communications, and interconnection metering to accommodate the interconnection of the AD2-147 generator.

### **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.

<b>Description</b>	<b>Total Cost</b>
Protection System changes at South Charleston Substation	\$ 25,000
Protection System changes at Greene Substation	\$ 25,000
<b>Total Non-Direct Connection Facility Costs</b>	<b>\$ 50,000</b>

The substation non-direct connection cost estimate for the AD2-147 project is approximately **\$50,000**. Remote end relaying will need to be evaluated for settings changes at Greene and South Charleston Substations to facilitate the interconnection of the new generation.

## **Interconnection Customer Requirements**

### **Requirement from the PJM Open Access Transmission Tariff:**

1. An /Interconnection Customer entering the New Service 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.

### **Dayton Interconnection Requirements**

The Dayton Power and Light Company (DP&L) has prepared this Facilities Connection Requirements document to ensure compliance with North American Electric Reliability Council (NERC) Reliability Standards and applicable Regional Reliability Organization, sub regional, Power Pool, and individual Transmission Owner planning criteria and facility connection requirements in compliance to NERC Standard FAC-001-2. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the DP&L transmission system. Detailed information outlining DP&L interconnection requirements can be reviewed utilizing the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

## **Schedule**

Based on the extent of the Dayton primary Direct Connection and Non-Direct Connection upgrades required to support the AD2-147 generation project, it is expected to take a minimum of **12 months**<sup>1</sup> from the date of a fully executed Interconnection Construction Service Agreement to complete the installation subject to market conditions and vendor lead times. This includes the requirement for the Interconnection Customer to make a preliminary payment to Dayton which funds the Non-Direct Connection work and the first three months of engineering design that is related to the construction of the Direct Connection facilities. It assumes that there will be no environmental or permitting issues to implement the Direct and Non-Direct Connection upgrades for this project and that all system outages will be allowed when requested.

## **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.

### **Dayton Metering Requirements**

The Interconnection Customer will be required to comply with all Dayton Revenue Metering Requirements for Generation Interconnection Customers as outlined in the link below. The Revenue Metering Requirements may be found within the Dayton Power & Light Co. "Requirements for the Connection of Facilities to the Dayton Power & Light Co. Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

<http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx>

## **Network Impacts**

### **Option 1**

The Queue Project AD2-147 was evaluated as a 100.0 MW (Capacity 42.0 MW) injection at the **South Charleston 345 kV** substation in the Dayton area. Project AD2-147 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-147 was studied with a commercial probability of 53%. Potential network impacts were as follows:

### **Summer Peak Analysis - 2020**

#### **Generator Deliverability**

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

None.

#### **Multiple Facility Contingency**

*(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)*

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)*

None.

#### **Steady-State Voltage Requirements**

*(Summary of the VAR requirements based upon the results of the steady-state voltage studies)*

To be determined in the Impact Study Phase.

## **Short Circuit**

*(Summary of impacted circuit breakers)*

None.

## **Affected System Analysis & Mitigation**

*(Summary of impacts on systems external to PJM)*

### **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).

### **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.*

*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

## **Light Load Analysis - 2021**

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

Not required for this fuel type.

## **System Reinforcements**

### **Short Circuit**

*(Summary form of Cost allocation for breakers will be inserted here if any)*

None

### **Stability and Reactive Power Requirement**

*(Results of the dynamic studies should be inserted here)*

To be determined in System Impact Study Phase

## **Summer Peak Load Flow Analysis Reinforcements**

### **New System Reinforcements**

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

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)*

None

## **Light Load Load Flow Analysis Reinforcements**

### **New System Reinforcements**

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

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)*

None

## **Network Impacts**

### **Option 2**

The Queue Project AD2-147 was evaluated as a 100.0 MW (Capacity 42.0 MW) injection at the **Hutchings 138 kV** substation in the Dayton area. Project AD2-147 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-147 was studied with a commercial probability of 53%. Potential network impacts were as follows:

### **Summer Peak Analysis - 2020**

#### **Generator Deliverability**

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

None.

#### **Multiple Facility Contingency**

*(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)*

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)*

None.

#### **Steady-State Voltage Requirements**

*(Summary of the VAR requirements based upon the results of the steady-state voltage studies)*

To be determined in the Impact Study Phase.

## **Short Circuit**

*(Summary of impacted circuit breakers)*

None.

## **Affected System Analysis & Mitigation**

*(Summary of impacts on systems external to PJM)*

### **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).

### **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.*

*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

## **Light Load Analysis - 2021**

Light Load Studies to be conducted during later study phases (as required by PJM Manual 14B).

Not required for this fuel type.

## **System Reinforcements**

### **Short Circuit**

*(Summary form of Cost allocation for breakers will be inserted here if any)*

None

**Stability and Reactive Power Requirement**

*(Results of the dynamic studies should be inserted here)*

To be determined in System Impact Study Phase

**Summer Peak Load Flow Analysis Reinforcements**

**New System Reinforcements**

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

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)*

None

**Light Load Load Flow Analysis Reinforcements**

**New System Reinforcements**

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

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)*

None

**Attachment 1. AD2-147 ‘South Charleston 345 kV’  
One Line Diagram**