*Feasibility Study Report*

*For*

# *PJM Generation Interconnection Request Queue Position AD2-214*

# *Rock Falls – Garden Plains*

**May 2019**

## 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.

The Interconnection Customer seeking to interconnect a wind generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per item 5.iv. of Schedule H to the Interconnection Service Agreement.

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.

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") for Queue AD2-214 Rock Falls – Garden Plains project has proposed a 68 MW Energy (40.8 MW Capacity*)* solar PV ground mounted tracking facility to be located in Whiteside County, IL. They will be calling the facility Round Grove Solar. It is proposed in the Interconnection Request (Attachment N) that the point of interconnection to be studied is a 138kV line between Rock Falls and Garden Plains (between PSSe bus nos. 272512 and 271543). The IC has proposed a service date for this project of May 3, 2021. They have requested a backfeed in April 2021.

Impacts on the MISO member transmission systems are not included in this analysis, but will be included in the System Impact Study Phase. Winter peak analysis will be performed in the System Impact Study phase.

This Generation Interconnection Feasibility Study provides analysis results to aid the IC in assessing the practicality and cost of incorporating the facility into the PJM system. This study was limited to load flow analyses of probable contingencies. If the IC elects to pursue a System Impact Study, a more comprehensive analysis will be performed.

## Point of Interconnection

The Interconnection Customer (IC) AD2-214, a 68MW solar facility, proposes to interconnect with the ComEd transmission system by tying into the Garden Plain-Rock Falls 138kV Line 15518.

## Attachment Facilities

The IC AD2-214 generator lead would interconnect to a new 138kV Interconnection Substation. This interconnection would require one 138kV line MOD, a dead-end structure and revenue metering as shown in the one line diagram.

The cost for the attachment facilities is estimated at $1M.

| Scope of Work | Cost Estimate |
|---|---|
| Installation of one 138kV line MOD, one dead-end structure and one set of revenue metering (see notes below on cost estimate) | $1,000,000 |

## Direct Connection Network Upgrades

In order to accommodate interconnection of AD2-214, a new 138kV Interconnection Substation would need to be built close to the Garden Plain-Rock Falls 138kV Line 15518 approximately 15.13 miles from the Garden Plain TSS 132.

The scope of work includes the installation of three 138kV circuit breakers in a "breaker-and-a-half" bus configuration and cutting in the Interconnection Substation to Garden Plain-Rock Falls 138kV Line 15518, as shown in the one-line diagram below.

The IC is responsible for constructing all of the facilities on the IC side of the point of interconnection outside of the substation. It is assumed for the purposes of this report that the IC

will obtain the site for the Interconnection Substation and right-of-way between the Interconnection Substation and the 138kV transmission line.

In the event that the IC exercises the option to build the interconnecting substation, the IC will be required to construct all interconnection facilities that will be turned over to ComEd in accordance with ComEd published standards and the PJM Tariff.

ComEd would design, engineer and construct the tie in of the Interconnection Substation to the Garden Plain-Rock Falls 138kV Line 15518.

The preliminary cost estimate for Direct Connection Network Upgrade is given in the following tables.

For Option to Build Direct Connection cost estimates:

| Scope of Work | Cost Estimate |
|---|---|
| Installation of a new 138kV substation as described above | N/A |
| Transmission line tie in work (foundations, structures, conductors) | $ 2,000,000 |
| ComEd oversight and testing | $ 1,000,000 |
| Total Cost Estimate (see notes below on cost estimate) | $ 3,000,000 |

For ComEd building the interconnecting substation cost estimates:

| Scope of Work | Cost Estimate |
|---|---|
| Installation of a new 138kV substation as described above | $15,000,000 |
| Transmission line tie in work (foundations, structures, conductors) | $ 2,000,000 |
| Total Cost Estimate (see notes below on cost estimate) | $ 17,000,000 |

ComEd would take approximately 24-months to construct the substation and transmission line work after the ISA / ICSA are signed.

## Non-Direct Connection Network Upgrades

The 138kV line 15518 connects to four different substations. Accordingly, integration of the new 138kV Interconnection Substation would require relay/communications/SCADA upgrades at the Garden Plain TSS 132, Nelson TSS 155 and Sterling Steel ESS H71 and Rock Falls TSS 133 substations. The ComEd cost is given below:

| Scope of Work | Cost Estimate |
|---|---|
| Relay/communications/SCADA upgrades at Garden Plain TSS 132 | $ 750,000 |
| Relay/communications/SCADA upgrades at Nelson TSS 155 substation | $ 750,000 |
| Relay/communications/SCADA upgrades at ESS H71 substation | $ 750,000 |
| Relay/communications/SCADA upgrades at Rock Falls TSS 133 substation | $ 750,000 |
| Total Cost Estimate (see notes below on cost estimate) | $ 3,000,000 |

**Notes on Cost Estimate:**

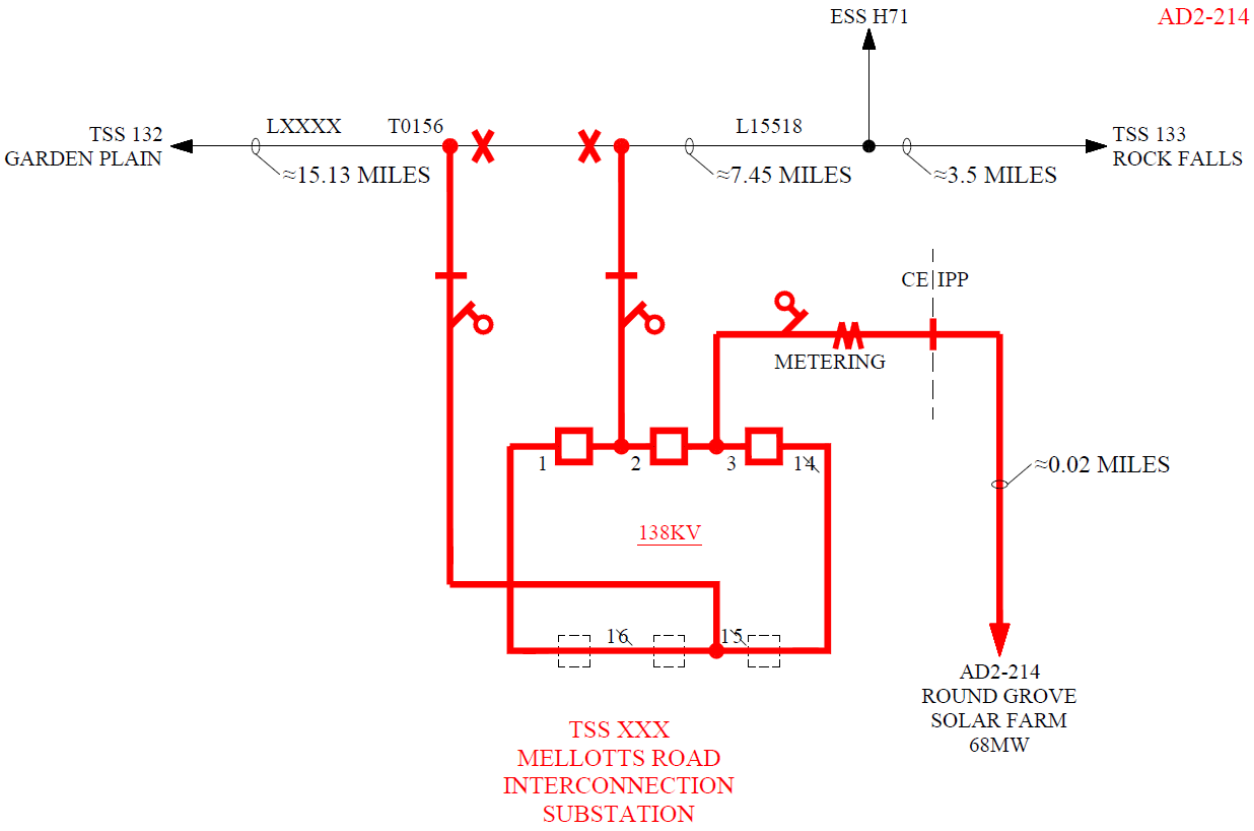
1) These estimates are Order-of-Magnitude estimates of the costs that ComEd would bill to the customer for this interconnection. These estimates are based on a one-line electrical diagram of the project and the information provided by the IC.

2) There were no site visits performed for these estimates. There may be costs related to specific site related issues that are not identified in these estimates. The site reviews will be performed during the Facilities Study or during detailed engineering.

3) These estimates are not a guarantee of the maximum amount payable by the IC and the actual costs of ComEd's work may differ significantly from these estimates. Per the PJM Tariff, IC will be responsible for paying all actual costs of ComEd's work.

4) The IC is responsible for all engineering, procurement, testing and construction of all equipment on the IC’s side of the Point of Interconnection (POI).

5) These cost estimates do not include cost of acquiring right-of-way for the transmission line and purchasing any additional land, if needed, for the line terminations. The need and cost of acquiring property and associated legal costs will be investigated during Facilities Study for this project.



**Network Impacts**

The Queue Project AD2-214 was evaluated as a 60.0 MW (Capacity 40.8 MW) injection tapping the Rock Falls to Garden Plains 138kV line in the ComEd area. Project AD2-214 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AD2-214 was studied with a commercial probability of 53%. Potential network impacts were as follows:

# Summer Peak Analysis - 2021

**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)*

None

**Steady-State Voltage Requirements**
*(Results of the steady-state voltage studies should be inserted here)*

To be determined

**Short Circuit**
*(Summary of impacted circuit breakers)*

None

# Affected System Analysis & Mitigation

**MISO Impacts:**

MISO 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.

1. (CE - CE) The LEE CO EC;BP-BYRON ; B 345 kV line (from bus 274768 to bus 270678 ckt 1) loads from 100.63% to 103.24% (**DC power flow**) of its emergency rating (1726 MVA) for the single line contingency outage of 'COMED_P1-2_345-L18402_B-R'. This project contributes approximately 18.16 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L18402_B-R'
 TRIP BRANCH FROM BUS 270932 TO BUS 270730 CKT 1              / WALTO; B 345 ELECT; B 345
 END
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2. (CE - CE) The AD1-064 TAP-WAYNE ; B 345 kV line (from bus 934400 to bus 270916 ckt 1) loads from 99.87% to 100.08% (**DC power flow**) of its emergency rating (2058 MVA) for the single line contingency outage of 'COMED_P1-2_345-L18402_B-R'. This project contributes approximately 8.7 MW to the thermal violation.

```
CONTINGENCY 'COMED_P1-2_345-L18402_B-R'
 TRIP BRANCH FROM BUS 270932 TO BUS 270730 CKT 1              / WALTO; B 345 ELECT; B 345
 END
```

# Light Load Analysis - 2021

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

# System Reinforcements

**Short Circuit**

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

None identified

**Stability and Reactive Power Requirement**

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

To be determined in later phases

## 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