System Impact Study Report

For

PJM Generation Interconnection Request Queue Position AC1-113

Rockford 138kV

February 2020

Preface

The intent of the System Impact 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.

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.

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.

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.

General

The Queue AC1-113 project is a Rockford Power, LLC ("Interconnection Customer" or "IC"), an LS Power owned facility, proposal to uprate the existing Rockford Generating Station, located located in Winnebago County, IL.

The AC1-113 project proposes a 20 MW increase (total) in Energy and Capacity for Units 1 and 2 (10 MW each).

Unit	PSSE Bus No.	Existing CIRs	CIRs after AC1 Queue
11	274822	149.1	149.1+10=159.1
12	274824	147.8	147.8+10=157.8

These projects are all uprates of existing facilities and no electrical changes to the generators, transformers, etc. are proposed.

The IC has indicated the increased capability is available now. A backfeed date for this facility is not applicable.

This Generation Interconnection System Impact Study provides analysis results to aid the IC in assessing the practicality and cost of incorporating the facility into the PJM system.

Point of Interconnection

This is an existing facility and there will be no changes to the POI

Attachment Facilities

No new attachment Facilities

Direct Connection Network Upgrades

No new direct connection network upgrades are necessary

Network Impacts

The Queue Project AC1-113 was evaluated as a 20.0 MW (Capacity 20.0 MW) injection into the Rockford; BP 138 kV substation in the ComEd area. Project AC1-113 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC1-113 was studied with a commercial probability of 100%. 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, 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)

None

Short Circuit
(Summary of impacted circuit breakers)

Not required

Affected System Analysis & Mitigation

MISO Impacts:

None

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.

Not Applicable

Light Load Analysis - 2020

Not required

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)

This study is focused on AC2-115 and AC2-116, along with the rest of the PJM system, maintaining synchronism and having all states return to an acceptable new condition following the disturbance. The recovery criteria applicable to this study are as per PJM's Regional Transmission Planning Process:

a) The system with AC2-115 and AC2-116 included should be transiently stable with post-contingency oscillations positively damped with a margin of at least 3%.

b) The AC2-115 and AC2-116 generator is able to ride through the faults (except for faults where protective action trips the generator(s)).

c) Following fault clearing, all bus voltages recover to a minimum of 0.7 per unit after 2.5 seconds (except where protective action isolates that bus).

d) No transmission element trips, other than those either directly connected or designed to trip as a consequence of the fault.

Plots from the dynamic simulations are provided in Attachment 6 with results summarized in Table 5 to Table 10.

Loss of synchronism for AC2-116 unit 21 was originally observed for contingencies P4.01~03 while using the Qmin values of -58 MVAr for AC2-115 CT11 and CT12, and -62 MVAr for AC2-116 CT21. ComEd advised to use Qmin value of -15 MVAr for all units. No tripping was observed for the mentioned contingencies after using -15 MVAr as the Qmin.

Loss of synchronism for AC2-115 unit 11 and 12 were originally observed for contingencies P4.09~11 while using the Qmin values of -58 MVAr for AC2-115 CT11 and CT12, and -62 MVAr for AC2-116 CT21 and using the delayed clearing time of 15 cycles. The critical delayed clearing time of 14 cycles was obtained and used with the Qmin of -15 MVAr and no tripping was observed.

Loss of synchronism for AC2-116 unit 21 for contingency P5.01, and Loss of synchronism for AC2-115 unit 11 and 12 for contingency P5.04 were originally observed, however ComEd confirmed that the lines 95201 and 98221 have redundant high-speed protection, and so a failure of primary protection will not result in any delay in clearing of these faults. Therefore these contingencies were not simulated.

Minimum reactive limitation was designated to maintain stability based on the original stability study for the Rockford Energy Center I and II, and that the AC2-115 / AC2-116 analysis found that it was still necessary to maintain this limitation for stability.

Note: The AC2-115 stability analysis includes Queue Project AC1-113.

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

Figure 1: Point of Interconnection Single Line Diagram