Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-032

“KINCAID”

July 2020

1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is ComEd.

2 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. Cost allocation rules for network upgrades 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 or solar generation facility shall maintain meteorological data facilities as well as provide that meteorological data which is required per Schedule H to the Interconnection Service Agreement and Section 8 of Manual 14D.

An Interconnection Customer 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 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.

3 General

The Interconnection Customer (IC) has proposed a solar generating facility located in Christian County, Illinois. The AF2-032 queue position is a 20 MW Energy (13.6 MW Capacity) project. The proposed in-service date for this uprate project is June 01, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-032
Project Name	KINCAID
State	Illinois
County	Christian
Transmission Owner	ComEd
MFO	20
MWE	20
MWC	13.6
Fuel	Solar
Basecase Study Year	2023

A new service customer with a generating facility that could be commercially operable prior to June 1st of the basecase study year is required to request an interim deliverability analysis from PJM.

4 Point of Interconnection

AF2-032 will interconnect with the ComEd transmission system at the existing 345 kV bus at the Sta. 21 Kincaid Substation.

5 Cost Summary

The AF2-032 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$5,000,000
Total System Network Upgrade Costs	$45,000,000
Total Costs	$50,000,000

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

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. The IC will be responsible for paying actual costs of ComEd's work in accordance with Sections 212.1 and 217 of the PJM Open Access Transmission Tariff.

4) The IC is responsible for all engineering, procurement, testing and construction of all equipment on the IC's side of the 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.

6 Transmission Owner Scope of Work

Attachment Facilities

The AF2-032 generator lead would interconnect to the 345kV bus at the Sta. 21 Kincaid Substation. The required Attachment Facilities are one 345kV line MOD, a dead-end structure and revenue metering as shown in the one-line diagram.

Network Upgrades

To accommodate interconnection of AF2-032, a new bus position would need to be created on the 345kV ring bus switchgear at the Sta. 21 Kincaid substation for the IC's generator lead.

The scope of work includes the installation of one 345 kV circuit breaker at Sta. 21 Kincaid to create a line position for the IC's generator lead, as shown in the one-line diagram below.

The total physical interconnection costs are given in the table below:

Description	Total Cost
Installation of one 345kV line MOD, one dead-end structure and one set of revenue metering (see notes below on cost estimate)	$1,000,000
Installation of one 345kV circuit breaker at Sta. 21 Kincaid and relay/protection work	$4,000,000
Total Physical Interconnection Costs	$5,000,000

7 Schedule

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

8 Transmission Owner Analysis

See Section 6.

9 Interconnection Customer Requirements

The Interconnection Customer is responsible for all design and construction related activities on the Interconnection Customer's side of the Point of Interconnection.

10 Revenue Metering and SCADA Requirements

10.1 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 Section 8 of Attachment O.

10.2 Interconnected Transmission Owner Requirements

The IC will be required to comply with all Interconnected Transmission Owner's revenue metering requirements for generation interconnection customers located at the following link:

ComEd interconnection requirements can be found at https://www.pjm.com/planning/design-engineering/to-tech-standards/private-comed.aspx

To the extent that these Applicable Technical Requirements and Standards may conflict with the terms and conditions of the Tariff, the Tariff shall control.

11 Summer Peak - Load Flow Analysis

The Queue Project AF2-032 was evaluated as a 20.0 MW (Capacity 13.6 MW) injection as an uprate to the existing Kincaid Generation at the Kincaid 345 kV substation in the ComEd area. Project AF2-032 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-032 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

11.1 Generation Deliverability

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

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
96069329	939400	AE1-172 TAP	345.0	CE	934720	AD1-100 TAP	345.0	CE	1	AEP_P1-2_#10136	single	1528.0	99.97	100.1	DC	2.04

11.2 Multiple Facility Contingency

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

None

11.3 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

11.4 Potential Congestion due to Local Energy Deliverability

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.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
96069423	270796	KINCAID ; B	345.0	CE	347955	7AUSTIN	345.0	AMIL	1	COMED_P1-2_345-L2105___-S-D	operation	956.0	152.23	153.29	DC	10.13

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost

ID	Idx	Facility	Upgrade Description	Cost
96069329	1	AE1-172 TAP 345.0 kV - AD1-100 TAP 345.0 kV Ckt 1	**CE_NUN_Sta. 12 Dresden (7) : ComEd 345kV L11212 SSTE rating is 1846 MVA. The upgrade will be to install a new 345kV bus tie circuit breaker at Station 12 Dresden. The new 345kV breaker will be installed as BT CB 12-13. Initial review of this proposal is that the existing contingency will be reduced and potentially reducing the post contingency flow. PJM to confirm this proposal in study. Assuming this proposal is acceptable in solution, a preliminary estimate is $4M with a 24 month estimated construction contingent upon outage scheduling with Station 12 Dresden. The ratings for L11212 will not change rather the contingency as stated above will be revised.** **Project Type : CON** **Cost : $4,000,000** **Time Estimate : 24.0 Months** **CE_NUN_L11212_2 (29) : ComEd 345kV L11212 SSTE rating is 1846 MVA. The upgrade will be to replace-2-345kV circuit breakers, upgrade a line relay scheme, station conductor upgrades at both terminals and recconductor the line. A preliminary estimate for the upgrades is $41M with an estimated construction timeline of 24-30 months. Upon completion the ratings will be 1754/2246/2297/2488 MVA (SN/SLTE/SSTE/SLD).** **Project Type : FAC** **Cost : $41,000,000** **Time Estimate : 24-30 Months**	$45,000,000
			Total System Network Upgrade Costs	**$45,000,000**

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

11.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details 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 indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. 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 are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

11.6.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
96069329	939400	AE1-172 TAP	CE	934720	AD1-100 TAP	CE	1	AEP_P1-2_#10136	single	1528.0	99.97	100.1	DC	2.04

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
243442	05RKG1	12.7963	80/20	12.7963
274650	KINCAID ;1U	14.4032	80/20	14.4032
274651	KINCAID ;2U	14.3994	80/20	14.3994
274853	TWINGROVE;U1	1.8305	80/20	1.8305
274854	TWINGROVE;U2	1.8305	80/20	1.8305
274863	CAYUGA RI;1U	2.5658	80/20	2.5658
274864	CAYUGA RI;2U	2.5658	80/20	2.5658
274880	GENERATOR;	1.6928	80/20	1.6928
917501	Z2-087 C	1.5169	80/20	1.5169
924041	AB2-047 C O1	10.9922	80/20	10.9922
924261	AB2-070 C O1	5.3511	80/20	5.3511
925771	AC1-053 C	5.2598	80/20	5.2598
926841	AC1-171 C O1	0.6107	80/20	0.6107
930461	AB1-087	30.9320	80/20	30.9320
930471	AB1-088	30.9320	80/20	30.9320
933441	AC2-157 C	4.2742	80/20	4.2742
935001	AD1-133 C O1	31.4172	80/20	31.4172
935141	AD1-148	9.5467	80/20	9.5467
936771	AD2-100 C	18.1453	80/20	18.1453
936971	AD2-131 C	1.1953	80/20	1.1953
937211	AD2-159 C	7.1019	80/20	7.1019
939401	AE1-172 C O1	26.1417	80/20	26.1417
939741	AE1-205 C O1	28.4105	80/20	28.4105
940101	AE1-252 C O1	52.5168	80/20	52.5168
941341	AE2-130 C	26.9760	80/20	26.9760
941731	AE2-173 O1	16.9110	80/20	16.9110
942111	AE2-223 C	6.5953	80/20	6.5953
942481	AE2-261 C	26.6445	80/20	26.6445
942601	AE2-276	2.8120	80/20	2.8120
944201	AF1-088 FTIR	56.2400	80/20	56.2400
944221	AF1-090 C O1	4.6035	80/20	4.6035
945391	AF1-204 C O1	3.4329	80/20	3.4329
945871	AF1-252 O1	8.1607	80/20	8.1607
945881	AF1-253 O1	5.6497	80/20	5.6497
951741	J474 C	3.6340	PJM External (MISO)	3.6340
952251	J641	10.1542	PJM External (MISO)	10.1542
952271	J644	9.8934	PJM External (MISO)	9.8934
952651	J756 C	3.2891	PJM External (MISO)	3.2891
952871	J757 C	4.2355	PJM External (MISO)	4.2355
953401	J811	7.6230	PJM External (MISO)	7.6230
953651	J815	26.4700	PJM External (MISO)	26.4700
953741	J826 C	2.1406	PJM External (MISO)	2.1406

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
953851	J845 C	2.0661	PJM External (MISO)	2.0661
953881	J848 C	4.0490	PJM External (MISO)	4.0490
954411	J912	9.9960	PJM External (MISO)	9.9960
954721	J750 C	2.6250	PJM External (MISO)	2.6250
954821	J955	125.6112	PJM External (MISO)	125.6112
955031	J979 C	3.2392	PJM External (MISO)	3.2392
955401	J1022 C	3.2109	PJM External (MISO)	3.2109
955711	J1055 C	1.6769	PJM External (MISO)	1.6769
956151	J1102	8.1613	PJM External (MISO)	8.1613
956281	J1115 C	5.3308	PJM External (MISO)	5.3308
956451	J1139	12.1665	PJM External (MISO)	12.1665
957141	AF2-008 FTIR	28.1200	80/20	28.1200
957381	AF2-032 C	2.0424	80/20	2.0424
959341	AF2-225 C	21.3079	80/20	21.3079
959611	AF2-252 C	5.3596	80/20	5.3596
960141	AF2-305	1.8935	80/20	1.8935
960261	AF2-317	3.0549	80/20	3.0549
960611	AF2-352 C	5.3596	80/20	5.3596
960621	AF2-353 C	31.4720	80/20	31.4720
LGEE	LGEE	1.0149	Confirmed LTF	1.0149
CPLE	CPLE	0.7998	Confirmed LTF	0.7998
G-007A	G-007A	0.9134	Confirmed LTF	0.9134
VFT	VFT	2.4510	Confirmed LTF	2.4510
CBM-W2	CBM-W2	37.5675	Confirmed LTF	37.5675
CBM-W1	CBM-W1	0.7631	Confirmed LTF	0.7631
TVA	TVA	4.1538	Confirmed LTF	4.1538
CBM-S2	CBM-S2	8.4041	Confirmed LTF	8.4041
CBM-S1	CBM-S1	23.3959	Confirmed LTF	23.3959
MADISON	MADISON	4.7799	Confirmed LTF	4.7799
MEC	MEC	4.5175	Confirmed LTF	4.5175

11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AB1-087	Sullivan 345kV #1	Active
AB1-088	Sullivan 345kV #2	Active
AB2-047	Brokaw-Pontiac Midpoint	Engineering and Procurement
AB2-070	Brokaw-Lanesville	Active
AC1-053	Lanesville-Brokaw	Active
AC1-171	Powerton	Active
AC2-157	Sullivan 345 kV	Active
AD1-133	Pontiac MidPoint-Dresden	Active
AD1-148	Brokaw-Lanesville	Active
AD2-100	Kincaid-Pana	Active
AD2-131	Latham Kincaid	Active
AD2-159	Chestnut 345kV	Active
AE1-172	Loretto-Wilton Center	Active
AE1-205	McLean 345 kV	Active
AE1-252	Loretto-Wilton Center	Active
AE2-130	Rockport 765 kV	Active
AE2-173	McLean 345 kV	Active
AE2-223	McLean 345 kV	Active
AE2-261	Kincaid-Pana	Active
AE2-276	Sullivan 345kV	Active
AF1-088	Sullivan 345 kV	Active
AF1-090	Kincaid-Pana	Active
AF1-204	Eugene 345 kV	Active
AF1-252	Kincaid-Pana	Active
AF1-253	Kincaid-Pana	Active
AF2-008	Sullivan 345 kV	Active
AF2-032	Kincaid	Active
AF2-225	McLean 345 kV	Active
AF2-252	Blue Mound 345 kV	Active
AF2-305	Brokaw-Lanesville 345 kV	Active
AF2-317	Hill Topper 345 kV	Active
AF2-352	Blue Mound 34.5 kV	Active
AF2-353	Rockport 765 kV	Active
Z2-087	Pontiac MidPoint-Brokaw 345kV	In Service
J1022	MISO	MISO
J1055	MISO	MISO
J1102	MISO	MISO
J1115	MISO	MISO
J1139	MISO	MISO

Queue Number	Project Name	Status
J474	MISO	MISO
J641	MISO	MISO
J644	MISO	MISO
J750	MISO	MISO
J756	MISO	MISO
J757	MISO	MISO
J811	MISO	MISO
J815	MISO	MISO
J826	MISO	MISO
J845	MISO	MISO
J848	MISO	MISO
J912	MISO	MISO
J955	MISO	MISO
J979	MISO	MISO

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#10136	CONTINGENCY 'AEP_P1-2_#10136' OPEN BRANCH FROM BUS 243208 TO BUS 243209 CKT 1 / 243208 05JEFRSO 765 243209 05ROCKPT 765 1 OPEN BRANCH FROM BUS 243209 TO BUS 243443 CKT 2 / 243209 05ROCKPT 765 243443 05RKG2 26.0 2 REMOVE UNIT 2H FROM BUS 243443 / 243443 05RKG2 26.0 REMOVE UNIT 2L FROM BUS 243443 / 243443 05RKG2 26.0 END
COMED_P1-2_345-L2105___-S-D	CONTINGENCY 'COMED_P1-2_345-L2105___-S-D' TRIP BRANCH FROM BUS 944220 TO BUS 347945 CKT 1 / AF1-090 TAP 345 7PANA 345 END

12 Short Circuit Analysis

The following breakers are overdutied:

None

12.1 System Reinforcements - Short Circuit

None

13 Affected Systems

13.1 MISO

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