Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-069

“CRESCENT RIDGE 138 KV”

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.

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.

The conduct of light load analysis as required under the PJM planning process is not performed during the Generation Interconnection Feasibility Study phase of the PJM study process. Additional reinforcement requirements for this Interconnection Request may be defined during the conduct of the light load analysis which shall be performed following execution of the System Impact Study agreement.

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned/existing wind generating facility located in Bureau County, Illinois. This project is an increase to the Interconnection Customer's AC1-214 project, which will share the same point of interconnection. The AF2-069 queue position is a 9.3 MW Energy (2.2 MW Capacity) uprate to the previous project. The total installed facilities will have a capability of 88.7 MWs with 21.2 MWs of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is October 04, 2021. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-069
Project Name	CRESCENT RIDGE 138 KV
State	Illinois
County	Bureau
Transmission Owner	ComEd
MFO (combined)	88.7
MWE	9.3
MWC	2.2
Fuel	Wind
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

AF2-069 will interconnect with the ComEd transmission system as an uprate to AC1-214 at the Crescent Ridge 138 kV substation. The proposed addition is behind the POI between ComEd and Lone Tree Wind Farm.

5 Cost Summary

The AF2-069 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$200,000
Total System Network Upgrade Costs	$7,200,000
Total Costs	$7,400,000

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.

6 Transmission Owner Scope of Work

Attachment Facilities

To accommodate interconnection of AF2-069; the relaying, SCADA, Communication and metering between Lone Tree Wind Farm and TSS 981 Crescent Ridge would be reviewed and upgraded if needed.

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

Description	Total Cost
Relaying, SCADA, communication, and metering between Lone Tree Wind Farm and TSS 981 Crescent Ridge will be reviewed and upgraded if needed.	$200,000
Total Physical Interconnection Costs	$200,000

7 Schedule

ComEd would take approximately 18-months to review and possibly upgrade the relaying, SCADA, Communication and metering 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 AF2-069 was evaluated as a 9.3 MW (Capacity 2.2 MW) injection as an uprate to AC1-214 at the Crescent Ridge 138 kV substation in the ComEd area. Project AF2-069 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-069 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)

None

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)

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
96131796	958340	AF2-128 TAP	138.0	CE	348935	4CORBIN	138.0	AMIL	1	COMED_P2-2_074_KE-138___1	bus	179.0	258.07	263.26	DC	9.3
96133457	958340	AF2-128 TAP	138.0	CE	348935	4CORBIN	138.0	AMIL	1	COMED_P7_138-L6101___-S_+_138-L7413__R-S-A	tower	179.0	258.07	263.26	DC	9.3
96133458	958340	AF2-128 TAP	138.0	CE	348935	4CORBIN	138.0	AMIL	1	COMED_P7_138-L6101___-S_+_138-L7413__R-S-B	tower	179.0	258.07	263.26	DC	9.3

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
96132442	271241	CRESCENT ; R	138.0	CE	271836	KEWANEE ;11	138.0	CE	1	COMED_P2-1_981-L98105___B	operation	214.0	215.86	220.21	DC	9.3
96132470	271836	KEWANEE ;11	138.0	CE	271837	KEWANEE ;12	138.0	CE	1	COMED_P2-1_981-L98105___B	operation	246.0	188.09	191.32	DC	7.94
96132700	271837	KEWANEE ;12	138.0	CE	271838	KEWANEE ;13	138.0	CE	1	COMED_P2-1_981-L98105___B	operation	449.0	104.74	106.28	DC	6.91
96132436	946540	AF1-318 TAP	138.0	CE	958340	AF2-128 TAP	138.0	CE	1	COMED_P1-2_138-L7413__R-S	operation	179.0	258.12	263.32	DC	9.3
96132441	946540	AF1-318 TAP	138.0	CE	958340	AF2-128 TAP	138.0	CE	1	Base Case	operation	179.0	195.96	197.72	DC	3.15
96132447	958340	AF2-128 TAP	138.0	CE	348935	4CORBIN	138.0	AMIL	1	271835	operation	179.0	209.85	211.72	DC	3.35
96132452	958340	AF2-128 TAP	138.0	CE	348935	4CORBIN	138.0	AMIL	1	Base Case	operation	179.0	195.91	197.67	DC	3.15

11.5 System Reinforcements - Summer Peak Load Flow

ID	Idx	Facility	Upgrade Description	Cost
96131796,96133458,96133457	1	**AF2-128 TAP 138.0 kV - 4OGLESBY MN 138.0 kV Ckt 1**	**CE_NUN_L7713_2 (751) : Re-conductor a portion of the line. A preliminary estimate for this upgrade is $7.2M with an estimated construction timeline of 30 months. Upon completion of the upgrade the new ratings will be 351/449/459/498/688 MVA (SN/SLTE/SSTE/SLD/ALDR).** **Project Type : FAC** **Cost : $7,200,000** **Time Estimate : 30.0 Months** **NonPJMArea: The external (i.e. Non-PJM) Transmission Owner, AMIL, will not evaluate this violation until the impact study phase.**	$7,200,000
			Total System Network Upgrade Costs	**$7,200,000**

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
96133458	958340	AF2-128 TAP	CE	348935	4CORBIN	AMIL	1	COMED_P7_138-L6101___-S_+_138-L7413__R-S-B	tower	179.0	258.07	263.26	DC	9.3

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
274849	CRESCENT ;1U	1.6730	50/50	1.6730
274851	PROVIDENC;RU	2.5526	50/50	2.5526
293771	O-035 E	59.1923	50/50	59.1923
927201	AC1-214 C O1	18.9975	50/50	18.9975
927202	AC1-214 E O1	60.3921	50/50	60.3921
946541	AF1-318 C O1	52.7831	50/50	52.7831
946542	AF1-318 E O1	247.1479	50/50	247.1479
957751	AF2-069 C	2.1997	50/50	2.1997
957752	AF2-069 E	7.0991	50/50	7.0991
957761	AF2-070 C	3.0996	50/50	3.0996
957762	AF2-070 E	15.0480	50/50	15.0480
958341	AF2-128 C O1	13.9902	50/50	13.9902
958342	AF2-128 E O1	65.4995	50/50	65.4995
NEWTON	NEWTON	0.0140	Confirmed LTF	0.0140
FARMERCITY	FARMERCITY	0.0007	Confirmed LTF	0.0007
CALDERWOOD	CALDERWOOD	0.0065	Confirmed LTF	0.0065
NY	NY	0.0072	Confirmed LTF	0.0072
PRAIRIE	PRAIRIE	0.0336	Confirmed LTF	0.0336
O-066	O-066	0.0874	Confirmed LTF	0.0874
CHEOAH	CHEOAH	0.0065	Confirmed LTF	0.0065
EDWARDS	EDWARDS	0.0046	Confirmed LTF	0.0046
TILTON	TILTON	0.0082	Confirmed LTF	0.0082
G-007	G-007	0.0135	Confirmed LTF	0.0135
GIBSON	GIBSON	0.0071	Confirmed LTF	0.0071
BLUEG	BLUEG	0.0226	Confirmed LTF	0.0226
TRIMBLE	TRIMBLE	0.0072	Confirmed LTF	0.0072
CATAWBA	CATAWBA	0.0046	Confirmed LTF	0.0046

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
AC1-214	Crescent Ridge	Engineering and Procurement
AF1-318	Crescent Ridge-Corbin	Active
AF2-069	Crescent Ridge 138 kV	Active
AF2-070	Crescent Ridge 138 kV	Active
AF2-128	Crescent Ridge-Corbin 138 kV	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
COMED_P1-2_138-L7413__R-S	CONTINGENCY 'COMED_P1-2_138-L7413__R-S' TRIP BRANCH FROM BUS 271836 TO BUS 271241 CKT 1 / KEWAN; 1 138 CRESC; R 138 END
271835	CONTINGENCY '271835' OPEN BRANCH FROM BUS 271835 TO BUS 271839 CKT 1 END
COMED_P2-2_074_KE-138___1	CONTINGENCY 'COMED_P2-2_074_KE-138___1' DISCONNECT BUS 271836 / KEWAN; 1 138 DISCONNECT BUS 271837 / KEWAN; 5 138 DISCONNECT BUS 271838 / KEWAN; 4 138 END
Base Case	
COMED_P2-1_981-L98105___B	CONTINGENCY 'COMED_P2-1_981-L98105___B' TRIP BRANCH FROM BUS 958340 TO BUS 348935 CKT 1 / AF1-318 TAP 138 4CORBIN 138 END
COMED_P7_138-L6101___-S_+_138-L7413__R-S-A	CONTINGENCY 'COMED_P7_138-L6101___-S_+_138-L7413__R-S-A' TRIP BRANCH FROM BUS 272521 TO BUS 926820 CKT 1 / STREATOR ; 138 AC1-168 TAP 138 TRIP BRANCH FROM BUS 271836 TO BUS 271241 CKT 1 / KEWANEE ;11 138 CRESCENT ; R 138 END
COMED_P7_138-L6101___-S_+_138-L7413__R-S-B	CONTINGENCY 'COMED_P7_138-L6101___-S_+_138-L7413__R-S-B' TRIP BRANCH FROM BUS 271655 TO BUS 271835 CKT 1 / HENNEEPIN; T 138 KEWANEE ;23 138 TRIP BRANCH FROM BUS 271655 TO BUS 348918 CKT 1 / HENNEEPIN; T 138 4HENNEPIN S 138 TRIP BRANCH FROM BUS 926820 TO BUS 271655 CKT 1 / AC1-168 TAP ; 138 HENNEEPIN; T 138 TRIP BRANCH FROM BUS 271836 TO BUS 271241 CKT 1 / KEWANEE ;11 138 CRESCENT ; R 138 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).