Generation Interconnection

Feasibility Study Report

for

Queue Project AF1-253

KINCAID-PANA

43.2 MW Capacity / 43.2 MW Energy

January, 2020

1 General

The Interconnection Customer (IC) has proposed a storage generating facility located in Christian County, Illinois. The installed facilities will have a capability of 43.2 MW with 43.2 of new request MW of this output being recognized by PJM as capacity. Note that this project is an increase to the Interconnection Customer's prior queue project, which will share the same property and connection point. 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. The IC requested a both a Primary and Secondary Point of Interconnection be evaluated for the AF1-253 project.

Queue Number	AF1-253
Project Name	KINCAID-PANA
State	Illinois
County	Christian
Transmission Owner	ComEd
MFO	305.6
MWE	43.2
MWC	43.2
Fuel	Storage
Basecase Study Year	2023

1.1 Point of Interconnection

Queue Position AF1-253, a 43.2 MW storage facility, proposes to interconnect with the ComEd transmission system by utilizing the same attachment facilities and Point of Interconnection as AF1-090, which is a tap of the Kincaid to Pana 345 kV line (20.80 miles from Kincaid).as AF1-090.

1.2 Cost Summary

AF1-253 will be responsible for the following costs associated with the physical interconnection of the project:

Description	Total Cost
Attachment Facilities	$200,000
Direct Connection Network Upgrade	$0
Non Direct Connection Network Upgrades	$0
Total Costs	**$200,000**

In addition, the AF1-253 project may be responsible for a contribution to the following costs associated with network upgrades (See Section 16):

Description	Total Cost

Description	Total Cost
System Upgrades	**$1,640,000**

Cost allocations for these upgrades will be provided in the System Impact Study Report.

2 Transmission Owner Scope of Work

Attachment Facilities

Addition of a 43.2 MW storage facility will require review and possible upgrade of SCADA, Communication, relays and metering.

Direct Connection Network Upgrades

None.

Non-Direct Connection Network Upgrades

None

3 Attachment Facilities

The total preliminary cost estimate for the Attachment work is given in the table below. These costs do not include CIAC Tax Gross-up.

Description	Total Cost
Addition of a 43.2 MW storage facility will require review and possible upgrade of SCADA, Communication, relays and metering.	$200,000
Total Attachment Facility Costs	**$200,000**

4 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.

Description	Total Cost
Total Direct Connection Facility Costs	**$0**

5 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.

Description	Total Cost
Total Non-Direct Connection Facility Costs	**$0**

6 Schedule

ComEd would take approximately 18-months to review and possibly upgrade SCADA, Communication, relays and metering after the ISA / ICSA are signed.

7 Transmission Owner Analysis

See Section 3

8 Interconnection Customer Requirements

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.

ComEd distribution line drops to move customer cranes and heavy equipment is not part of PJM process. The customer should directly contact ComEd New Business Group to arrange for line drops, if needed.

9 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 Section 8 of Attachment O.

10 Network Impacts

The Queue Project AF1-253 was evaluated as a 43.2 MW (Capacity 43.2 MW) injection tapping the Kincaid to Pana 345 kV line (20.8 miles from Kincaid) in the ComEd area. Project AF1-253 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF1-253 was studied with a commercial probability of 0.53. Potential network impacts were as follows:

Summer Peak Load Flow

11 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
4357019 8	95682 0	J1180 TAP	345. 0	AMIL	24771 2	05SULLIVA N	345. 0	AEP	1	COMED_P1 -2_345- L11212_B- S-B	singl e	1466. 0	99.65	100.13	DC	7.35

12 Multiple Facility Contingency

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

None

13 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

14 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
4442291 0	27079 6	KINCAI D ; B	345. 0	CE	34795 5	7AUSTI N	345. 0	AMIL	1	COMED_P1- 2_SPS- 2105&U1___ D	operatio n	956.0	143.62	145.8	DC	20.83

15 System Reinforcements

ID	Index	Facility	Upgrade Description	Cost
43570198	1	J1180 TAP 345.0 kV - 05SULLIVAN 345.0 kV Ckt 1	AEP AEPI0010a (223) : Reconductor/rebuild 0.82 miles of ACAR ~ 1024.5 ~ 30/7 ~ RAIL1 conductor section 5 Project Type : FAC Cost : $1,640,000 Time Estimate : 24 - 36 Months NonPJMArea (484) : The external (i.e. Non-PJM) Transmission Owner, MISO, will not evaluate this violation until the impact study phase. Project Type : FAC Cost : $0 Time Estimate : 0.0 Months	$1,640,000
			TOTAL COST	$1,640,000

16 Flow Gate Details

The following indices contain additional information about each flowgate presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact. It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

16.1 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
43570198	956820	J1180 TAP	AMIL	247712	05SULLIVAN	AEP	1	COMED_P1-2_345-L11212_B-S-B	single	1466.0	99.65	100.13	DC	7.35

Bus #	Bus	MW Impact
274650	KINCAID ;1U	11.5140
274651	KINCAID ;2U	11.5093
274662	QUAD CITI;1U	9.1065
274663	QUAD CITI;2U	9.0946
274677	POWERTON ;5U	7.0361
274678	POWERTON ;6U	7.0490

Bus #	Bus	MW Impact
274699	CORDOVA ;1C	1.5955
274700	CORDOVA ;2C	1.5955
274701	CORDOVA ;1S	1.7949
274715	NELSON EC;1C	1.4727
274716	NELSON EC;1S	1.0746
274717	NELSON EC;2C	1.4841
274718	NELSON EC;2S	1.0842
274764	LEE CO EC;5U	0.6588
274765	LEE CO EC;6U	0.6588
274830	U3-021 1	2.2277
274831	U3-021 2	2.2277
274848	CAMPGROVE;RU	0.3155
274849	CRESCENT ;1U	0.0975
274851	PROVIDENC;RU	0.1487
274853	TWINGROVE;U1	0.6385
274854	TWINGROVE;U2	0.6385
274863	CAYUGA RI;1U	0.4196
274864	CAYUGA RI;2U	0.4196
274877	BISHOP HL;1U	0.2033
274878	BISHOP HL;2U	0.2033
274880	GENERATOR;	0.8051
276156	O-029 C	0.1008
276157	O-029 C	0.1090
276158	O-029 C	0.1989
276160	W4-084	0.2254
293513	O-009 C1	0.1862
293514	O-009 C2	0.0945
293515	O-009 C3	0.1045
917501	Z2-087 C	0.3639
919221	AA1-146	1.3738
919581	AA2-030	9.8423
919621	AA2-039 C	1.4200
924041	AB2-047 C O1	3.2588
924261	AB2-070 C O1	3.2118
924471	AB2-096	15.4700
925161	**AB2-173 (Withdrawn : 12/24/2019)**	**1.7553**
925581	AC1-033 C	0.9539
925771	AC1-053 C	3.2482
926431	AC1-114	0.9228
926821	AC1-168 C O1	0.6769
926841	AC1-171 C O1	0.8733
927201	AC1-214 C O1	1.3680
927511	AC1-113 1	0.4613
927521	AC1-113 2	0.4613
930481	AB1-089	25.0907
930741	AB1-122 1O1	25.8695
932881	AC2-115 1	0.9226
932891	AC2-115 2	0.9226
932921	AC2-116	0.3230
933341	AC2-147 C	0.3844
933911	AD1-013 C	0.6853
933931	AD1-016 C	0.3271

Bus #	Bus	MW Impact
934051	AD1-031 C O1	1.9370
934101	AD1-039 1	2.5352
934431	AD1-067 C	0.0496
934651	AD1-096 C	0.3645
934701	AD1-098 C O1	2.6270
934871	AD1-116 C	0.3246
934971	AD1-129 C	0.3349
935001	AD1-133 C O1	13.4424
935141	AD1-148	6.2676
936291	AD2-038 C O1	0.9607
936511	AD2-066 C O1	3.3011
936771	AD2-100 C	19.5678
936791	AD2-102 C	5.6437
936971	AD2-131 C	1.2890
937001	AD2-134 C	1.0322
937211	AD2-159 C	4.1742
937311	AD2-172 C	1.0078
937531	AD2-214 C	2.7454
938851	AE1-113 C	3.1814
938861	AE1-114 C O1	1.6889
939051	AE1-134 1	0.7648
939061	AE1-134 2	0.7648
939321	AE1-163 C O1	2.4140
939401	AE1-172 C O1	4.4876
939741	AE1-205 C O1	8.4227
940101	AE1-252 C O1	9.0153
940501	AE2-035 C	0.5341
941131	AE2-107 C	1.3693
941731	AE2-173 O1	5.0135
942111	AE2-223 C	1.9553
942421	AE2-255 C O1	1.2051
942481	AE2-261 C	26.9513
942651	AE2-281 C O1	0.3449
942991	AE2-321 C	2.8948
943381	AF1-009 C	0.1204
943391	AF1-010 C	1.1714
943401	AF1-011 C	0.7289
943411	AF1-012 C	6.3031
943801	AF1-048 C	0.7172
943921	AF1-060	0.3052
944221	AF1-090 C O1	5.9900
945871	AF1-252 O1	10.6186
945881	AF1-253 O1	7.3513
946151	AF1-280 C O1	8.2995
946161	AF1-281 C	0.1817
946321	AF1-296 C O1	2.6146
946501	AF1-314 C	1.0047
946531	AF1-317 C O1	1.2006
946541	AF1-318 C O1	3.7418
946661	AF1-330 C	0.3741
946671	AF1-331	0.4717
946681	AF1-332 C	1.2006

Bus #	Bus	MW Impact
951741	J474 C	1.4943
952251	J641	8.7682
952271	J644	8.1103
952651	J756 C	1.8310
952871	J757 C	3.4475
953371	J808	8.5130
953401	J811	16.7944
953431	J853	10.6148
953641	J813	38.1500
953651	J815	28.2050
953671	J817	9.8607
953741	J826 C	0.8822
953881	J848 C	4.6059
953951	J859	8.2377
954181	J884	5.5240
954411	J912	12.7020
954681	J949 C	27.4737
954721	J750 C	1.7559
954761	J468 C	3.3881
954821	J955	94.1512
954831	J956	12.1680
955001	J976	21.6510
955031	J979 C	3.6847
955041	J980 C	3.6847
955101	J987	6.7330
955131	J991	39.9180
955161	J994	6.1420
955171	J995	7.3730
955391	J1021 C	1.9781
955401	J1022 C	1.3233
955441	J1026 C	3.5412
955551	J1039	3.6085
956071	J1094	13.0605
956091	J1096	10.8885
956151	J1102	4.3365
956241	J1111	10.4745
956281	J1115 C	2.1628
956341	J1123 C	1.4237
956451	J1139	9.7815
956501	J1145	15.2575
956821	J1180	37.6605
CPLE	CPLE	0.5861
WEC	WEC	1.6758
CBM-W2	CBM-W2	62.5225
NY	NY	0.3528
CBM-W1	CBM-W1	53.7179
TVA	TVA	7.1008
CBM-S2	CBM-S2	8.1729
CBM-S1	CBM-S1	33.3643
MADISON	MADISON	22.3534
MEC	MEC	13.8052
GIBSON	GIBSON	0.3713

Bus #	Bus	MW Impact
BLUEG	BLUEG	2.7724
TRIMBLE	TRIMBLE	0.9972

Affected Systems

17 Affected Systems

17.1 LG&E

LG&E Impacts to be determined during later study phases (as applicable).

17.2 MISO

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

17.3 TVA

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

17.4 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

17.5 NYISO

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

Contingency Name	Contingency Definition
COMED_P1-2_345-L11212_B-S-B	CONTINGENCY 'COMED_P1-2_345-L11212_B-S-B' TRIP BRANCH FROM BUS 934720 TO BUS 939400 CKT 1 / AD1-100 TAP 345 AE1-172 TAP 345 END
COMED_P1-2_SPS-2105&U1___D	CONTINGENCY 'COMED_P1-2_SPS-2105&U1___D' TRIP BRANCH FROM BUS 944220 TO BUS 347945 CKT 1 / AF1-090 TAP 345 7PANA 345 TRIP BRANCH FROM BUS 347945 TO BUS 346895 CKT 1 / 7PANA 345 7COFFEEN 345 END

Short Circuit

18 Short Circuit

The following Breakers are overdutied:

None

19 Secondary Point of Interconnection

20 Network Impacts

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Summer Peak Load Flow

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23 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)

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24 Potential Congestion due to Local Energy Deliverability

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with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

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4442291 0	27079 6	KINCAI D ; B	345. 0	CE	34795 5	7AUSTI N	345. 0	AMIL	1	COMED_P1-2_SPS-2105&U1___ D	operatio n	956.0	143.62	145.8	DC	20.83