

FILE

PUCO EXHIBIT FILING

Date of Hearing: 2/8/2019

Case No. 18-501-EL-FOR, 18-1392-EL-RDR, 18-1393-EL-ATA

PUCO Case Caption: 2018 Long-Term Forecast Report of Ohio Power

Company and Related Matters, Application of Ohio Power

Company for Approval to Enter Into Renewable Energy

Purchase Agreements for Inclusion in the Renewable

Generator Roster and Application of Ohio Power Company for
Approval to Amend its Tariffs.

List of exhibits being filed: Volume XII

IEU 14 and 15

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Reporter's Signature: Karen Sue Gibson

Date Submitted: 2/8/2019

BEFORE THE PUBLIC UTILITIES COMMISSION OF OHIO

- - -

In the Matter of the 2018 :
Long-Term Forecast Report : Case No. 18-501-EL-FOR
of Ohio Power Company and :
Related Matters. :

In the Matter of the :
Application of Ohio Power :
Company for Approval to :
Enter Into Renewable : Case No. 18-1392-EL-RDR
Energy Purchase :
Agreements for Inclusion :
in the Renewable :
Generation Rider. :

In the Matter of the :
Application of Ohio Power : Case No. 18-1393-EL-ATA
Company for Approval to :
Amend its Tariffs. :

- - -

PROCEEDINGS

before Ms. Sarah Parrot and Ms. Greta See, Attorney
Examiners, at the Public Utilities Commission of
Ohio, 180 East Broad Street, Room 11-A, Columbus,
Ohio, called at 9:00 a.m. on Friday, February 8,
2019.

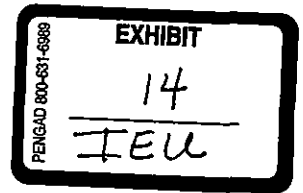
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VOLUME XII - REBUTTAL TESTIMONY

- - -

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- - -



***Revised
Generation Interconnection
System Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC1-085***

***“Stuart-Clinton 345 kV”
400 MW Energy, 152 MW Capacity***

October 2018

Revision 3

Preface

The intent of the System Impact Study is to determine a plan, with approximate cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. 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 System Impact Study is performed.

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.

October 3, 2018 Revised System Impact Study Report Changes¹:

The AC1-085 System Impact Study was revised again on October 3, 2018 to incorporate the following changes:

1. Network upgrade n5136 for Replacing the Beatty Line Riser Section on the Adkins-Beatty 345 kV line to achieve SN/SE ratings of 1414/1414 MVA was removed as it is no longer needed. With the retirement of Stuart Unit 1, the overload of the emergency rating of the Adkins-Beatty 345 kV line is eliminated.
2. Cost allocation for a sag study of the Adkins-Beatty 345 kV line (under n5457) has been removed. With the retirement of Stuart Unit 1, the overload of the emergency rating of the Adkins-Beatty 345 kV line is eliminated.

September 18, 2018 Revised System Impact Study Report Changes:

The AC1-085 System Impact Study has been revised to incorporate the following changes:

1. AEP's Planning Criteria has been revised. Emergency ratings are now used evaluating single contingencies to 345 kV and above facilities. Retools of the AC1 System Impact Studies were required to determine how this would affect cost responsibility for queue projects.

¹ Stuart Unit 1 deactivated on 9/30/2017 and their Capacity Interconnection Rights terminated as of 9/30/2018. With their rights terminated, a retool of the analysis identified that Network Upgrades n5136 and n5457 were no longer required.

2. System Impact Study results have changed as the AB1-169 project is no longer the first to cause the need for the Beatty Road Line Riser section upgrade (Network Upgrade n5136). The cost responsibility has moved to the AC1 queue and this project now has cost allocation for n5136.²
3. System Impact Study results have changed and this project now has a cost allocation towards a sag study for the Adkins-Beatty 345 kV line (Network Upgrade n5457).
4. Attachment Facilities and Direct/Non-Direct Connection costs updated as Facilities Study estimates have been received.

November 2017 Revised System Impact Study Report Changes:

The AC1-085 System Impact Study has been revised to incorporate the following changes:

1. Load flow analysis was retooled considering the removal of the output from queue positions Z1-097 and Z2-029 (uprates to Adkins and Stuart units). The additional MW from Z1-097 and Z2-029 projects were already captured in the existing units in the case and thus were double modeled.
2. Results were updated considering a load flow software error which missed a “Basecase/N-0” overload on the Adkins-Beatty 345 kV line which requires an upgrade to the Dayton end normal rating of this line.

General

Hecate Energy Highland, LLC, the Interconnection Customer (IC), has proposed a solar generating facility located in Hillsboro, Ohio. The installed facilities will have a total capability of **400 MW** with **152 MW** of this output being recognized by PJM as Capacity. The proposed in-service date for this project is **December 31, 2021**. **This study does not imply a Dayton Power & Light (DP&L) commitment to this in-service date.**

Point of Interconnection

AC1-085 “Stuart-Clinton 345 kV” will interconnect with the Dayton Power & Light Company transmission system via a new 345 kV three breaker ring bus switchyard that will tap the Stuart-Clinton 345kV line. The Point of Interconnection (POI) will be the first dead-end structure on the AC1-085 345 kV generator lead line outside the new three breaker ring bus switchyard fence (refer to one line diagram in **Attachment 1**).

Cost Summary

The AC1-085 “Stuart-Clinton 345 kV” project will be responsible for the following costs:

Description	Total Cost
Attachment Facilities	\$ 0
Direct Connection Network Upgrades (Dayton)	\$ 6,331,205
Non Direct Connection Network Upgrades (Dayton)	\$ 110,000
Allocation for New System Upgrades	\$ 0
Contribution for Previously Identified Upgrades ¹ (AEP)	\$ 66,055
Total Costs	\$ 6,507,260

Attachment Facilities

The Interconnection Customer will construct the attachment generator lead line into the proposed Point of Interconnection as depicted on the one-line diagram in Attachment 1.

Direct Connection Cost Estimate

The substation direct connection work for this project includes the construction of a 345 kV three breaker ring bus substation which will be tapped off the Stuart-Clinton 345kV line. Dayton will install a single 345kV line from the new 345kV ring bus substation to a developer owned dead-end structure immediately outside of the substation fence (POI). The 345 kV generator lead line constructed by the developer will be terminated onto this POI deadened structure immediately outside of the new three breaker ring bus substation fence. DP&L will install the associated disconnect switches at the new substation, line relaying, communications, and interconnection metering to accommodate the interconnection of the AC1-085 generator.

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.

¹ Note: Stuart Unit 1 deactivated on 9/30/2017 and the remaining Stuart and Killen generating units deactivated on 6/1/2018. These units are contributing to the flows on the Adkins – Beatty 345 kV line in this AC1analysis per the PJM Tariff to retain their capacity rights on the system. The rights for Stuart Unit 1 were terminated as of 9/30/2018. If no other queue positions claim the rights of the remaining Stuart and Killen generating units by 6/1/2019, the rights for these plants will also expire. If this occurs, no constraints, based on the generation dispatch in this study, will exist on the Adkins – Beatty 345 kV line and no upgrades will be required to be built on the Adkins – Beatty 345 kV line. The status of whether anyone claims the rights of the old Stuart and Killen generating units will be monitored and tracked to determine if construction of the network upgrades identified in this Facilities Study are still needed.

Description	Total Cost
AC1-085 Interconnection Switchyard: Install a new 3 breaker ring interconnection switchyard along the Stuart-Clinton 345 kV line.	\$ 5,037,026
Transmission Line Tie-In work to accommodate new AC1-085 Interconnection Switchyard.	\$ 1,294,179
Total Direct Facilities Cost Estimate	\$ 6,331,205

The PJM Network Upgrade Number for this Direct Connection work is **n5896**.

Non-Direct Connection Cost Estimate

Upgrade remote end relaying at Stuart and Clinton substations to accommodate AC1-085 interconnection through the new three breaker interconnection switchyard ring bus design.

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
Clinton Substation: Upgrade Stuart 345 kV line relaying. PJM Network Upgrade Number n5897	\$ 100,000
Stuart Substation: Upgrade Clinton 345 kV line relaying. PJM Network Upgrade Number n5898	\$ 10,000
Total Non-Direct Facilities Cost Estimate	\$ 110,000

Schedule

Overall elapsed time to complete both the required Direct/Non-Direct Connection work (Dayton) is approximately **24 months**.

Based on the extent of the Dayton primary Direct and Non-Direct Connection upgrades required to support the AC1-085 generation project, it is expected to take a minimum of **24 months** from the date of a fully executed Interconnection Construction Service Agreement to complete the installation subject to market conditions, vendor lead times, and any power siting requirements. This work can be done concurrently with the Network Upgrades required. This includes the requirement for the Interconnection Customer to make a preliminary payment to Dayton which funds construction of the Non-Direct Connection facilities and Network Upgrades as well as the first three months of construction work in earnest related installation of the Direct Connection facilities. It assumes that there will be no environmental or permitting issues to implement the Direct Connection, Non-Direct Connection, and Network Upgrades for this project and that all system outages will be allowed when requested.

AEP anticipates completing the Network Upgrade work in parallel with the Direct/Non-Direct Connection schedule. However, timing of this work is subject to approval of facility outage requests by AEP, Dayton and PJM Transmission Operations, and that system conditions allow outages to occur as scheduled.

Interconnection Customer Requirements

Requirement from the PJM Open Access Transmission Tariff:

1. 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.
2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

Dayton Interconnection Requirements

The Dayton Power and Light Company (DP&L) has prepared this Facilities Connection Requirements document to ensure compliance with North American Electric Reliability Council (NERC) Reliability Standards and applicable Regional Reliability Organization, sub regional, Power Pool, and individual Transmission Owner planning criteria and facility connection requirements in compliance to NERC Standard FAC-001-2. These connection requirements apply to all generation facilities, transmission facilities, and end-users connecting to the DP&L transmission system. Detailed information outlining DP&L interconnection requirements can be reviewed utilizing the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

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 Sections 24.1 and 24.2.

Dayton Requirements

The Interconnection Customer will be required to comply with all Dayton Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the Dayton Power & Light Co. "Requirements for the Connection of Facilities to the Dayton Power & Light Co. Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-dayton/dayton-facilities-connection-requirements.ashx>

The metering point for this interconnection will be located at the new 345 kV ring bus switchyard that will be constructed along the Stuart-Clinton 345kV line as shown in **Attachment 1**.

Reliability Councils, and Transmission Owners). Project AC1-083 was studied with a commercial probability of 100%. Potential network impacts were as follows:

Base Case Used

Summer Peak Analysis – 2020 Case

Contingency Descriptions

The following contingencies resulted in overloads:

Contingency Name	Description
349_B2_TOR21	CONTINGENCY '349_B2_TOR21' OPEN BRANCH FROM BUS 242528 TO BUS 248005 CKT 1 / 242528 05SPORN 345 248005 06KYGER 345 1 END
8468_B2	CONTINGENCY '8468_B2' OPEN BRANCH FROM BUS 242528 TO BUS 248005 CKT 2 / 242528 05SPORN 345 248005 06KYGER 345 2 END

livability

ntingencies for the Capacity portion only of the interconnection)

Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Circuit	Power Flow	Loading % Initial	Loading % Final	Rating Type	MVA	Contribution
Non	DAY - AEP	09ADKINS-05BEATTY 345 kV line	253110	243453	1	AC	97.15	98.34	NR	1233	14.1

Attachment 2 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper Appendix in the Attachment. y, there will be only one Flowgate Appendix for the contingency that results in the highest facility loading.

analysis

r solar projects.

ity Contingency

ower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

ected circuit breakers)

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)

Note: Please see Attachment 2 for projects providing impacts to flowgate violations. The values in the Reference column correspond to the proper Appendix in the Attachment. For each overloaded facility, there will be only one Flowgate Appendix for the contingency that results in the highest facility loading.

None.

Steady-State Voltage Requirements

None.

Stability and Reactive Power Requirement for Low Voltage Ride Through

(Summary of the VAR requirements based upon the results of the dynamic studies)

Find the finalized AC1-085 Stability study report in **Attachment 3. No mitigations are required.**

Real-time system operating conditions outside of the stability testing criteria included in this report could occur in this region causing curtailments to maintain stability of the BES system.

Affected System Analysis & Mitigation

LGEE Impacts:

None

MISO Impacts:

None

OVEC Impacts:

None

Energy Portion of Interconnection Request

the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request. 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 request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

Contingency Name	Affected Area	Facility Description	Bus		Circuit	Power Flow	Loading %		Rating		MW Contribution
			From	To			Initial	Final	Type	MVA	
8468_B2	OVEC - AEP	06KYGER-05SPORN 345 kV line	248005	242528	1	AC	126.2	129.5	NR	1017	40.
349_B2_TOR21	OVEC - AEP	06KYGER-05SPORN 345 kV line	248005	242528	2	AC	132.1	135.7	NR	971	40.

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)

1. Adkins Beatty 345 kV Line Overload:

To relieve the Adkins – Beatty 345 kV line overloads:

AEP:

- SE rating is 1523 MVA and is sufficient for the single contingencies.
- SN rating is 1233 MVA and is not sufficient for the non-contingency condition.

The upgrade is to replace a full tension takeoff structure and upgrade the conductor on the Beatty line leaving Adkins sub. The cost for this reinforcement is \$400K and it will take approximately nine (9) months to complete. The new line rating will be 1339/1556 MVA SN/SE after this reinforcement. PJM Network Upgrade n5933.

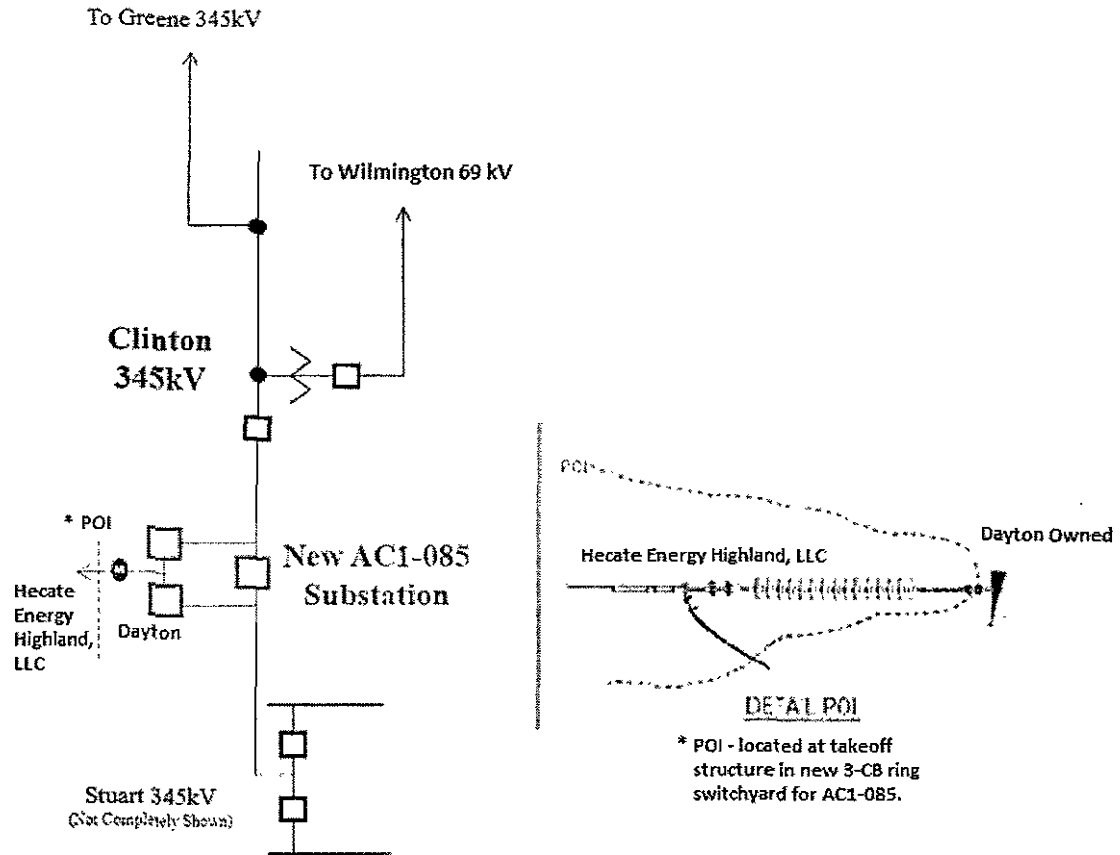
Per PJM cost allocation rules, since the upgrade cost is less than \$5M, the cost responsibility remains within the AC1 queue and the AC1-085 project will have cost allocation as it contributes to the loading on the Adkins-Beatty 345 kV line. See cost allocation below:

Facility	Upgrade Description	Network Upgrade Number	Total Upgrade Cost	ACI-068 Allocation	ACI-069 Allocation	ACI-085 Allocation	ACI-165 Allocation
Beatty 345	(AEP): Replace a full takeoff structure and upgrade the conductor leaving Adkins substation. SN/SE ratings of Adkins-Beatty 345 kV line after reinforcement are 1339 MVA/1556 MVA, respectively. Estimated time to Complete: Nine (9) months	n5933	\$400,000	\$83,945	\$83,945	\$66,055	\$83,028
		Total Network Upgrades		\$83,945	\$83,945	\$66,055	\$83,028

rt Unit 1 deactivated on 9/30/2017 and the remaining Stuart and Killen generating units deactivated on 6/1/2018. The rights for Stuart Unit 1 are set to expire on 9/30/2018. The remaining Stuart and Killen units are contributing to the flows on the Adkins – Beatty 345 kV line in this ACI analysis. The rights for these units do not expire until 1 year after the deactivation date. If no other queue positions claim the rights of the remaining Stuart Unit 1 by 6/1/2019, the rights for these plants will also expire. If this occurs, no constraints, based on the generation dispatch in this study, will be in place for the 345 kV line and no upgrades will be required to be built on the Adkins – Beatty 345 kV line. The status of whether anyone claims the rights for the Killen generating units will be monitored and tracked to determine if construction of the network upgrade (n5933) identified in this Facility is needed.

Attachment 1

AC1-085 One Line



Attachment 2

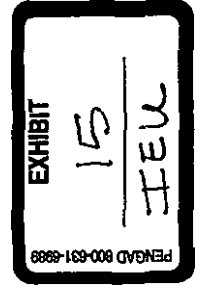
Appendices

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, 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.

Name
COMPETITIVELY-SENSITIVE CONFIDENTIAL_AEP_PJM_Hub_LMPs_2017_All.xlsx
COMPETITIVELY-SENSITIVE CONFIDENTIAL_AEP_PJM_Hub_LMPs_2021_All.xlsx
COMPETITIVELY-SENSITIVE CONFIDENTIAL_AEP_PJM_Hub_LMPs_2024_All.xlsx
COMPETITIVELY-SENSITIVE CONFIDENTIAL_AEP_PJM_Hub_LMPs_2027_All.xlsx

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313 778	289 268	2019-01-31 11:05	
314 765	289 326	2019-01-31 11:05	
313 782	286 467	2019-01-31 11:06	





Electric Power Transmission System in Ohio

State of Ohio
Public Utilities Commission

<http://www.PUCO.ohio.gov>

- 138 kilovolt line
- 345 kilovolt line
- 765 kilovolt line
- Interstate Highway
- Generating Station
- Substation

Company Codes

CGE - Cincinnati Gas & Electric
CSP - Columbus Southern Power
DPL - Dayton Power & Light
MPC - Monongahela Power
OEP - Ohio Edison
OPC - Ohio Power
OVE - Ohio Valley Electric
TEC - Toledo Edison
CCD - CGE, CSP, and DPL joint

