# Generation Interconnection

# Feasibility Study Report

# for

# Queue Project AG1-369

# LOGTOWN 138 KV

# 29.94 MW Capacity / 49.9 MW Energy

January 2021

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## 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 AEP.

## 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.

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## 3 General

The Interconnection Customer (IC), has proposed a Solar generating facility located in Paulding County, Ohio. The installed facilities will have a total capability of 49.9 MW with 29.94 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this project is October 31, 2023. This study does not imply a TO commitment to this in-service date.

| Queue Number | AG1-369 |
|---|---|
| Project Name | LOGTOWN 138 KV |
| State | Ohio |
| County | Paulding |
| Transmission Owner | AEP |
| MFO | 49.9 |
| MWE | 49.9 |
| MWC | 29.94 |
| Fuel | Solar |
| Basecase Study Year | 2024 |

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

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## 4 Point of Interconnection

AG1-369 will interconnect with the AEP transmission system via a direct connection to the Logtown 138 kV switching station as an uprate to the PJM project AF2-377.

Note: It is assumed that the existing 138 kV revenue metering system, generation lead and Protection & Control Equipment that will be installed for AF2-377 will be adequate for the increased generation of AG1-369. Depending on the timing of the completion of the AF2-377 interconnection construction relative to the AG1-369 completion, there may (or many not) be a need to review and revise the relay settings for the increased generation of AG1-369.

## 5 Cost Summary

The AG1-369 project will be responsible for the following costs:

| Description | Total Cost |
|---|---|
| **Total Physical Interconnection Costs** | $45,000 |
| **Total System Network Upgrade Costs** | $20,000 |
| **Total Costs** | $65,000 |

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 2016-36, 2016-25 I.R.B. (6/20/2016). 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.

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

The estimates provided in this report are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements. In addition, Stability analysis will be completed during the Facilities Study stage. It is possible that a need for additional upgrades could be identified by these studies.

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## 6 Transmission Owner Scope of Work

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

| Description | Total Cost |
|---|---|
| Review line protection and control settings at the Logtown 138 kV switching station | $45,000 |
| **Total Physical Interconnection Costs** | **$45,000** |

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# 7 Schedule

It is anticipated that the time between receipt of executed Agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would generally be between 24 to 36 months after signing Agreement execution.

# 8 Interconnection Customer Requirements

It is understood that the Interconnection Customer (IC) is responsible for all costs associated with this interconnection. The costs above are reimbursable to the Transmission Owner. The cost of the IC's generating plant and the costs for the line connecting the generating plant to the Point of Interconnection are not included in this report; these are assumed to be the IC's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for the Transmission Owner to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

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.

# 9 Revenue Metering and SCADA Requirements

## 9.1 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.

## 9.2 Meteorological Data Reporting Requirements

The solar generation facility shall provide the Transmission Provider with site-specific meteorological data including:

- Back Panel temperature (Fahrenheit) - (Required for plants with Maximum Facility Output of 3 MW or higher)

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- Irradiance (Watts/meter2) - (Required for plants with Maximum Facility Output of 3 MW or higher)
- Ambient air temperature (Fahrenheit) - (Accepted, not required)
- Wind speed (meters/second) - (Accepted, not required)
- Wind direction (decimal degrees from true north) - (Accepted, not required)

### 9.3 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:

http://www.pjm.com/planning/design-engineering/to-tech-standards/

## 10 Summer Peak - Load Flow Analysis

The Queue Project AG1-369 was evaluated as a 49.9 MW (Capacity 29.94 MW) injection at the Logtown 138 kV substation in the AEP area. Project AG1-369 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AG1-369 was studied with a commercial probability of 53.0 %. Potential network impacts were as follows:

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## 10.1 Generation Deliverability

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

None

## 10.2 Multiple Facility Contingency

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

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **161759463** | 243051 | 05NDELPH | 138.0 | AEP | 242991 | 05E SIDE | 138.0 | AEP | 1 | AEP_P7-1_#11065 | tower | 251.0 | 89.35 | 103.27 | DC | 34.94 |

## 10.3 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

## 10.4 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **168210022** | 247864 | 05LOGTOWN | 138.0 | AEP | 243242 | 05ALLEN | 138.0 | AEP | 1 | AEP_P1-2_#10155 | operation | 281.0 | 97.91 | 115.66 | DC | 49.89 |

## 10.5 System Reinforcements - Summer Peak Load Flow

| ID | Idx | Facility | Upgrade Description | Cost |
|---|---|---|---|---|
| **161759463** | 1 | **05NDELPH 138.0 kV - 05E SIDE 138.0 kV Ckt 1** | **AEP**<br>**AEPO0050a (429) : A Sag Study will be required on the 0.33 miles of ACSR ~ 795 ~ 45/7 ~ TERN- Conductor to mitigate the overload. Depending on the sag study results, the cost for this upgrade is expected to be between $20,000 (no remediations required, just sag study) and 0.5 million (complete line reconductor/rebuild). New rating after sag study: S/N: 251 S/E: 335. Time Estimate: a) Sag Study: 6-12 months b) Rebuild: The standard time required for construction differs from state to state. An approximate construction time would be 24 to 36 months after signing an interconnection agreement.**<br>**Project Type : FAC**<br>**Cost : $20,000**<br>**Time Estimate : 6-12 Months** | $20,000 |
| | | | **TOTAL COST** | **$20,000** |

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## 10.6 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".

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### 10.6.1 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **161759463** | 243051 | 05NDELPH | AEP | 242991 | 05E SIDE | AEP | 1 | AEP_P7-1_#11065 | tower | 251.0 | 89.35 | 103.27 | DC | 34.94 |

| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **247521** | T131 | 3.3141 | 50/50 | 3.3141 |
| **247911** | 05TIMB G E | 8.3397 | Adder | 9.81 |
| **247959** | V1-011 E | 6.0062 | Adder | 7.07 |
| **270164** | T-131 E | 84.0228 | 50/50 | 84.0228 |
| **926811** | AC1-167 C O1 | 2.2805 | Adder | 2.68 |
| **926812** | AC1-167 E O1 | 1.1063 | Adder | 1.3 |
| **926865** | AC1-173 C | 1.0936 | 50/50 | 1.0936 |
| **926866** | AC1-173 E | 46.2125 | 50/50 | 46.2125 |
| **934741** | AD1-101 C O1 | 3.6289 | 50/50 | 3.6289 |
| **934742** | AD1-101 E O1 | 5.9219 | 50/50 | 5.9219 |
| **934901** | AD1-119 C O1 | 1.5734 | Adder | 1.85 |
| **934902** | AD1-119 E O1 | 2.5676 | Adder | 3.02 |
| **940031** | AE1-245 C | 1.3459 | Adder | 1.58 |
| **940032** | AE1-245 E | 9.0071 | Adder | 10.6 |
| **942801** | AE2-298 C | 3.2154 | 50/50 | 3.2154 |
| **942802** | AE2-298 E | 2.1436 | 50/50 | 2.1436 |
| **943181** | AE2-322 C | 2.7353 | Adder | 3.22 |
| **943182** | AE2-322 E | 1.3371 | Adder | 1.57 |
| **943581** | AF1-029 C O1 | 1.6077 | 50/50 | 1.6077 |
| **943582** | AF1-029 E O1 | 1.0718 | 50/50 | 1.0718 |
| **943791** | AF1-047 C | 1.4172 | Adder | 1.67 |
| **943792** | AF1-047 E | 0.9448 | Adder | 1.11 |
| **958091** | AF2-103 C | 0.0911 | Adder | 0.11 |
| **958092** | AF2-103 E | 0.1263 | Adder | 0.15 |
| **958951** | AF2-186 C O1 | 1.3517 | Adder | 1.59 |
| **958952** | AF2-186 E O1 | 1.8666 | Adder | 2.2 |
| **960851** | AF2-376 C | 1.3807 | Adder | 1.62 |
| **960852** | AF2-376 E | 2.0711 | Adder | 2.44 |
| **960861** | AF2-377 C | 14.0038 | 50/50 | 14.0038 |
| **960862** | AF2-377 E | 21.0057 | 50/50 | 21.0057 |
| **965051** | AG1-369 C | 20.9637 | 50/50 | 20.9637 |
| **965052** | AG1-369 E | 13.9758 | 50/50 | 13.9758 |
| **WEC** | WEC | 0.0230 | Confirmed LTF | 0.0230 |
| **CALDERWOOD** | CALDERWOOD | 0.0075 | Confirmed LTF | 0.0075 |
| **CBM-W2** | CBM-W2 | 0.1792 | Confirmed LTF | 0.1792 |
| **NY** | NY | 0.0216 | Confirmed LTF | 0.0216 |
| **O-066** | O-066 | 0.2692 | Confirmed LTF | 0.2692 |
| **SIGE** | SIGE | 0.0060 | Confirmed LTF | 0.0060 |
| **CHEOAH** | CHEOAH | 0.0075 | Confirmed LTF | 0.0075 |
| **G-007** | G-007 | 0.0420 | Confirmed LTF | 0.0420 |
| **HAMLET** | HAMLET | 0.0162 | Confirmed LTF | 0.0162 |
| **MEC** | MEC | 0.0858 | Confirmed LTF | 0.0858 |

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| Bus # | Bus | Gendeliv MW Impact | Type | Full MW Impact |
|---|---|---|---|---|
| **BLUEG** | BLUEG | 0.0087 | Confirmed LTF | 0.0087 |
| **TRIMBLE** | TRIMBLE | 0.0033 | Confirmed LTF | 0.0033 |
| **LAGN** | LAGN | 0.0175 | Confirmed LTF | 0.0175 |
| **CATAWBA** | CATAWBA | 0.0091 | Confirmed LTF | 0.0091 |
| **CBM-W1** | CBM-W1 | 0.9954 | Confirmed LTF | 0.9954 |

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## 10.7 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 |
|---|---|---|
| **AC1-167** | Mark Center 69kV | Active |
| **AC1-173** | Logtown 138kV | In Service |
| **AD1-101** | Continental 69 kV | Active |
| **AD1-119** | Payne 69 kV | Active |
| **AE1-245** | Haviland 138 kV | Active |
| **AE2-298** | Haviland-Cavett Switch 69 kV | Active |
| **AE2-322** | Mark Center 69 kV | Active |
| **AF1-029** | Haviland-Cavett Switch 69 kV | Active |
| **AF1-047** | Mark Center 69 kV | Active |
| **AF2-103** | Haviland 138 kV | Active |
| **AF2-186** | South Cecil 69 kV | Active |
| **AF2-376** | Timber Switch 138 kV | Active |
| **AF2-377** | Logtown 138 kV | Active |
| **AG1-369** | Logtown 138 kV | Active |
| **V1-011** | Haviland 138kV | In Service |

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## 10.8 Contingency Descriptions

| Contingency Name | Contingency Definition |
|---|---|
| **AEP_P1-2_#10155** | CONTINGENCY 'AEP_P1-2_#10155'<br>OPEN BRANCH FROM BUS 243051 TO BUS 247864 CKT 1 / 243051 05NDELPH 138 247864 05LOGTOWN 138 1<br>END |
| **AEP_P7-1_#11065** | CONTINGENCY 'AEP_P7-1_#11065'<br>OPEN BRANCH FROM BUS 243242 TO BUS 247864 CKT 1 / 243242 05ALLEN 138 247864 05LOGTOWN 138 1<br>OPEN BRANCH FROM BUS 243242 TO BUS 243383 CKT 1 / 243242 05ALLEN 138 243383 05TILLMA 138 1<br>OPEN BRANCH FROM BUS 243383 TO BUS 246950 CKT 1 / 243383 05TILLMA 138 246950 05TIMBSS 138 1<br>OPEN BRANCH FROM BUS 243383 TO BUS 246265 CKT 1 / 243383 05TILLMA 138 246265 05TILLMAN 34.5 1<br>END |

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## 11 Short Circuit Analysis

The following Breakers are overdutied

None

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# 12 Affected Systems

## 12.1 TVA

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

## 12.2 Duke Energy Progress

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

## 12.3 MISO

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

## 12.4 LG&E

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

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