PJM Generator Interconnection Request
Queue #AC1-103/AD2-005
Nottingham 138 kV
Facilities Study

December 2020

AC1-103 and AD2-005 Nottingham 138 kV

Facilities Study Report

A. Facilities Study Summary

1. Project Description

Harrison Power, LLC (Harrison) proposes to install PJM Project #AC1-103/AD2-005, a 1085.0 MW (1061.0 MW Capacity) natural gas-fueled generating facility in Cadiz, OH (see Figures 2 and 3). The plant will consist of two (2) 1x1 combined cycle units. The point of interconnection will be two new 138kV circuits connecting AC1-103/AD2-005 to AEP's existing Nottingham 138 kV station (see Figure 1). Harrison Power will construct and own the entirety of the two new transmission circuits, except for the last entrance span into Nottingham station. AEP will construct and own this span for the two circuits. Note that FirstEnergy/ATSI is an affected Transmission Owner for this IPP project; only the impact on AEP is discussed in this report. The FE/ATSI Facilities Study Report is included as an attachment to this Facilities Study. Please see Attachment 1 for details regarding the FE/ATSI scope work required to connect the AC1-103/AD2-005 project.

The requested backfeed date is June 15, 2022.

The requested in-service date is January 1, 2023.

2. Amendments/Changes to the Impact Study Report

In the AC1-103 System Impact Study, the following AEP remote-end protection upgrades were specified: Freebyrd (n5543), Yager (n5544) and Holloway (n5545). However, during the Facilities Study an engineering review was completed and it was determined these system upgrades are not required, as it will only be changes to relay-settings at these three remote-end stations.

In addition, the previously-separate protection & controls updates at Nottingham (n5542) have been factored into the main Nottingham station expansion (n5540). N5542 should be cancelled, and the scope of n5540 increased accordingly.

Harrison Power's request for an increase in Energy and Capacity of 35 MW has been included in this Facilties Study Report. The System Impact Study for AD2-005 was completed and there were no Load Flow, Short Circuit, or Stability concerns for the requested increase of 35 MW.

The new MFO was increased to 1085.0 MW and the Capacity to 1061.0 MW as noted in section 1 above.

3. Interconnection Customer Schedule

PJM and AEP understand that Harrison has requested the following schedule dates:

Receive back feed power from AEP: 6/15/2022
Commercial Operation Date: 1/1/2023

These dates are per the email sent by Jim Palumbo on May 6, 2020.

4. AEP's Scope of Work to Facilitate Interconnection

AEP's scope of work would be as follows:

- To accommodate the interconnection at AEP's existing Nottingham 138 kV station, the Nottingham 138 kV substation will have to be expanded by adding three (3) 138kV circuit breakers, extending the 138kV bus #7 and 138kV bus #8, and adding a new circuit breaker string (see Figure 1; Nottingham is configured in a breaker-and-a-half layout). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required. Note that since there will be two generation-leads to Harrison, two sets of metering, SCADA and related equipment will be necessary.

- AEP will extend one span of 138kV transmission line for each of the two generation-leads going to the AC1-103/AD2-005 site. Harrison will build and own the first transmission line structure outside of Nottingham station, to which AEP's transmission line conductor will attach.

- Protective-relay settings for the remainder of the Nottingham 138kV substation will have to be reviewed and updated to account for the addition of the AC1-103/AD2-005 generation source, as well as the adjacent FirstEnergy Nottingham-Yager 138kV transmission line rebuild.

- Protective-relay settings at AEP's Holloway, Yager and Freebyrd 138 kV remote-end substations will need to be reviewed and updated to coordinate with the Nottingham station, due to the new generation source being added nearby.

- Harrison will be responsible for all of the connection costs associated with interconnecting the PJM project AC1-103/AD2-005 to the AEP transmission system. The cost of Harrison's generating plant and the costs for the 138kV double-circuit line connecting the generating plant to the Harrison-AEP Point-of-Interconnection are not included in this report; these are Harrison's cost responsibility. In addition, Harrison will be responsible for constructing a fiber-optic connection from their telecom equipment to AEP's telecom network.

- The Interconnection Service Agreement does not in or by itself establish a requirement for American Electric Power 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. This could be for construction power purposes, station service power when the generation is off-line, etc.

5. Description of Transmission Owner Facilities Included in the Facilities Study

Direct Connection Work

AEP will need to expand the existing Nottingham station to facilitate the connection of the two generation-leads going to Harrison Power. To accomplish this, Nottingham 138kV bus #7 and bus #8 will be extended to the east. Three additional circuit breakers will be installed (P8, R, R8). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required (see Figure 1).

AEP will extend one span of 138kV transmission line for each of the two generation-leads going to the AC1-103/AD2-005 site. Harrison will build and own the first transmission line structure outside of Nottingham station, to which AEP's transmission line conductor will attach. AEP will be required to own and operate the facilities entering Nottingham station.

AEP will need to update the telecom equipment at Nottingham, for SCADA/EMS functionality. Fiber-optic cable will be extended to the AEP/Harrison point-of-interconnection.

Network Upgrade Work

A. The Transmission Protection system in the surrounding area will need to be reviewed to accommodate the addition of the new generating station:

Protective-relay settings at AEP's Holloway, Yager and Freebyrd 138 kV remote-end substations will need to be reviewed and updated to coordinate with the Nottingham station, due to the new generation source being added nearby.

B. Due to system overloads found during the PJM Study, the following Network reinforcements are required:

No AEP facility upgrades will be needed. FirstEnergy/ATSI upgrades will be addressed separately by FE/ATSI.

6. Total Cost of Transmission Owner Facilities Included in the Facilities Study:

Direct Connection facilities	$4,353,693
Network Upgrade facilities	$0 *(no specific cost for remote relay settings)*
Total Cost	$4,353,693

The estimates do not include the impact that delays in obtaining ROW, permits or other approvals may have.

7. Summary of Schedule Milestones for Completion of Transmission Owner Work Included in Facilities Study:

Task	Dates
AEP Engineering Start	11/01/2020
All Material Ordered	6/1/2021
Construction Start (Grading & Below Grade)	10/15/2021
Construction Start (Above Grade)	02/12/2022
Outage requests made by	04/15/2021
Outage (IPP Structure Foundations, Line Crossings, Safety Clearances)	1st Qtr 2022-2nd Qtr 2022
Outage (Cut-In & Testing)	2nd Qtr 2022
Ready for back feed	06/15/2022
In-Service Date (Backfeed)	06/15/2022

Assumptions

- ISA and ICSA executed by October 1, 2020
- Harrison's 138kV transmission line route and clearances have been approved by AEP Transmission, for potential conflict with AEP's area transmission facilities
- System conditions allow scheduled outages to occur.
- Harrison will have their construction and required checkout completed prior to the start of the AEP cut-in & testing outage.

Transmission Outage Plan

In order to connect AC1-103/AD2-005 and associated construction, the tentative system outage plan is as follows:

Equipment Out	Reason	Duration	Comments
Freebyrd-South Cadiz 138kV circuit, between Freebyrd and Stone Plant Switch tap	Permit IPP Customer to construct 138kV gen-lead transmission lines	3 days	Subject to Customer's construction timeline
Isolate Nottingham 138kV breaker 'P' and open bus-tie switches BTS3 & BTS4	Safety clearance for installing new 138kV breakers in P & R strings	8 weeks	Subject to PJM approvals
Nottingham 138kV bus 8	Construct AEP 138kV T-Line exits span(s)	8 hours	Coordinate with Customer's schedule, for POI on T-Line
Separate outages to Nottingham 138kV bus 7 and 8 to tie-in new bus extension & breakers	Energize the expanded section of Nottingham station	8 hours	Should not need outage to Freebyrd or Knox 138kV circuits

Note that all 138kV outages are subject to PJM and AEP Operations BES outage-scheduling requirements.

B. Transmission Owner Facilities Study Results

1. Transmission Lines – New

AEP will extend one span of 138kV transmission line for each of the two generation-leads going to the AC1-103/AD2-005 site. Harrison will build and own the first transmission line structure outside of Nottingham station, to which AEP's transmission line conductor will attach.

2. Transmission Lines – Upgrades

No upgrades on existing AEP transmission lines are anticipated at this time. When Harrison Power is constructing the approximately 4.5-mile double-circuit generation-lead between Nottingham and the AC1-103/AD2-005 site, any transmission line crossings with AEP facilities will have to be coordinated properly, to ensure that NESC clearances and AEP standards are adhered to. At the time of the completion of the PJM Facilities Study, the details of these potential line crossings are not known. Any costs for AEP to modify its transmission facilities must be paid for by Harrison Power, such as raising, lowering, or redesigning the 138kV line(s). Potential transmission facilities of concern in the local area are AEP's Nottingham-Freebyrd 138kV and Freebyrd-South Cadiz 138kV circuits (refer to Figure 3).

Any needed changes to AEP Ohio distribution lines in the area must be addressed with AEP Ohio personnel.

3. Substation Facilities – New

None

4. Substation Facilities – Upgrades

A. As mentioned previously, the existing Nottingham station will need to be expanded to connect the two 138kV connections to the IPP:

AEP will need to expand the existing Nottingham station to facilitate the connection of the two generation-leads going to Harrison Power. To accomplish this, Nottingham 138kV bus #7 and bus #8 will be extended to the east. Three additional circuit breakers will be installed (P8, R, R8). Installation of associated protection and control equipment, 138 kV line risers, SCADA, and 138 kV revenue metering will also be required (see Figure 1).

AEP will need to update the telecom equipment at Nottingham, for SCADA/EMS functionality. Fiber-optic cable will be extended to the AEP/Harrison point-of-interconnection.

B. The Transmission Protection system in the surrounding area will need to be upgraded to accommodate the addition of the new generating station:

Protective-relay settings at AEP's Holloway, Yager and Freebyrd 138 kV remote-end substations will need to be reviewed and updated to coordinate with the Nottingham station, due to the new generation source being added nearby.

Protective-relay settings for the remainder of the Nottingham 138kV substation will have to be reviewed and updated to account for the addition of the AC1-103/AD2-005 generation source, as well as the adjacent FirstEnergy Nottingham-Yager 138kV transmission line rebuild

C. Due to system overloads found during the PJM Study, the following Network reinforcements are required:

No reinforcements on the AEP transmission system.

5. Metering & Communications

Standard 138 kV metering will be installed at the new switching station. A standard station communication scheme will be used. All metering equipment to be installed at the AEP Interconnect Station and the Harrison generation station shall meet the requirements as specified by AEP in the "AEP Metering and Telemetering Requirements for AEP Transmission Customers" document (SS-490011). Communication requirements are published in the "AEP SCADA RTU Requirements at Transmission Interconnection Facilities" (document SS-500000).

6. A. Environmental, Real Estate, Siting and Permitting Issues

Harrison will need to construct and own the 4.5-mile double-circuit 138 kV transmission line between their generation plant and the POI one span outside Nottingham station (see Figure 3). As such, Harrison is responsible for any environmental permitting, Ohio Power Siting Board approval, right-of-way acquisitions, etc., in order to properly construct these transmission facilities.

AEP is expected to be required to file a Construction Notice with the Ohio Power Siting Board for the transmission line exit span leaving Nottingham, for the two circuits leaving Nottingham station and going to Harrison.

Since Harrison will be constructing up to the POI with AEP, one span outside the Nottingham fenced area, but on AEP-owned land, it is expected that Harrison will need to be granted transmission line easement(s) from AEP for facilities within AEP's Nottingham station property. This will be granted, assuming that the transmission line facilities are in a location acceptable to AEP, factoring in such design details as orientation, structure height, and distance from the Nottingham station fence, among others. In addition, the tensions and locations of the connecting conductors will require coordination with AEP.

- **B. System Modeling & Operating Requirements**

  In addition to the IPP modeling requirements imposed by PJM as part of the Generation Interconnection process, the following system modeling parameters will need to be supplied by Harrison to AEP:

  - 138 kV transmission line impedances, including positive and zero sequence, up to the agreed-upon Point-of-Interconnection
  - Physical arrangement of transmission line phases for the 138 kV double-circuit, in relationship to AEP's 138 kV facilities. This is critical in order to calculate the mutual coupling effects between Harrison's gen-leads and AEP's Nottingham-Freebyrd 138 kV circuit and/or Freebyrd-South Cadiz 138 kV circuit. Due to the exceptionally high flows on Harrison's 138 kV gen-leads, this could have a significant impact on AEP's protection settings.
  - Coordination of protection equipment and settings at the AC1-103/AD2-005 site, to properly coordinate with Nottingham station relays & communication equipment.

  Each generation unit and transmission line will be operated independently, which will be radial from Nottingham station. At no point shall the two generation-leads be tied together at the AC1-103/AD2-005 site. This could adversely impact the transmission protection scheme or overload AEP's or Harrison's 138kV transmission facilities.

7. Summary of Results of Study

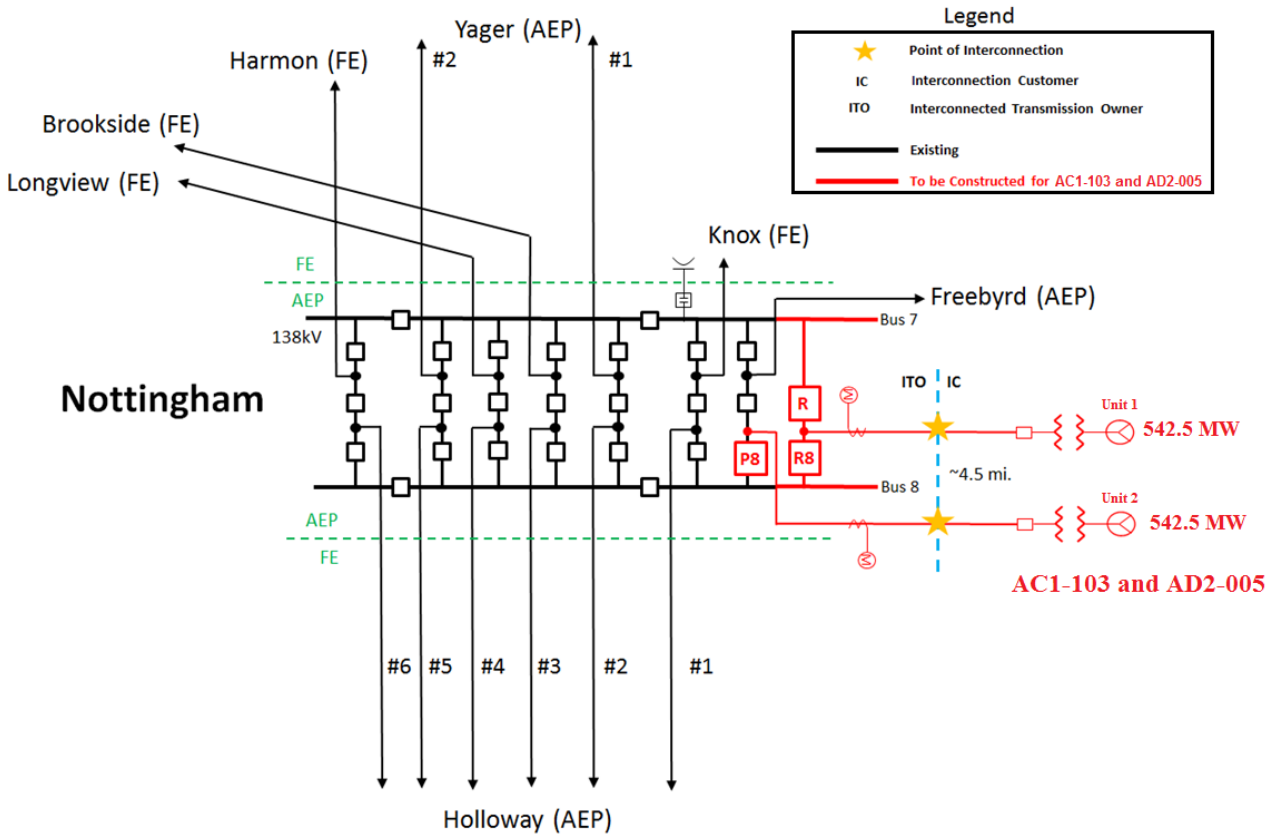
Cost Estimates for AEP

Task	Network Upgrade Number	Engineering	Material	Construction	Other	Total
Expansion of Nottingham 138kV station, notably the addition of 3-138kV breakers, new protection & communications equipment, relay-settings adjustments, & fiber-optic cable.	**n5540**	$601,890	$1,034,311	$1,355,915	$519,058	**$3,511,175**
Metering at Nottingham station (for two generation connections)	**n5541**	$86,495	$230,269	$190,524	$131,804	**$639,091**
Extension of two 138kV transmission line spans from Nottingham station to the POI with Harrison Power	**n6066**	$65,620	$32,784	$62,991	$42,033	**$203,427**
Total		**$754,005**	**$1,297,364**	**$1,609,430**	**$692,895**	**$4,353,693**

8. Information Required for Interconnection Service Agreement

	Direct Interconnection Costs	Network Upgrades	Total
Direct Material	$1,297,364	$0	$1,297,364
Direct Labor	$2,363,434	$0	$2,363,434
Indirect Material	$246,333	$0	$246,333
Indirect Labor	$446,562	$0	$446,562
Total	**$4,353,693**	**$0**	**$4,353,693**

Figure 1: Point of Interconnection (Nottingham 138 kV)
Single Line Diagram

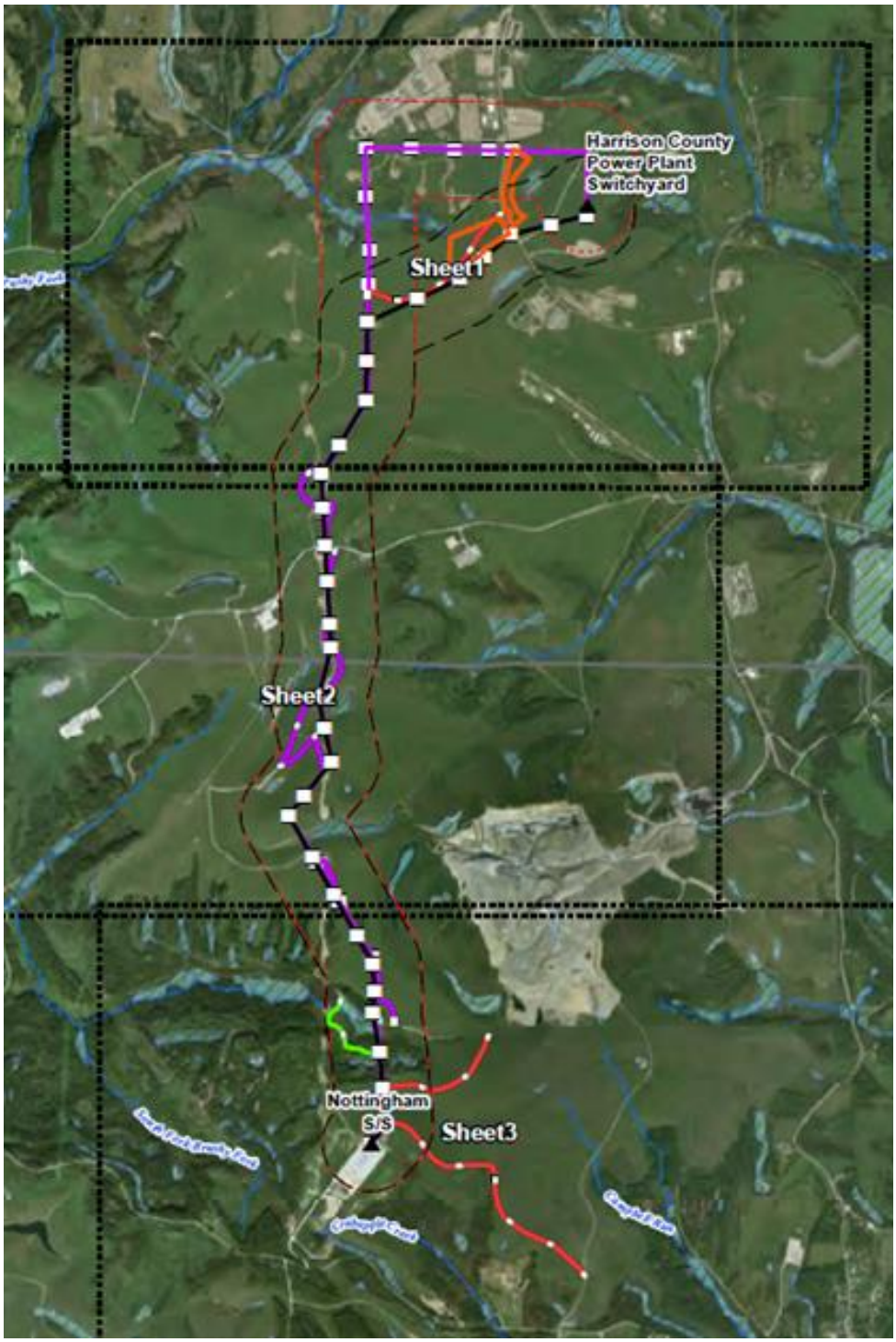


<u>GPS Coordinates of Nottingham station site:</u>
40.19618, -81.03200

*The Point of Interconnection (for each generator lead) is at the first structure outside of the Nottingham 138 kV switching station with the Interconnected Transmission Owner owning the first span of conductors out of its switching station and the Interconnection Customer owning the first structure and remaining structures and conductors back to its generation plant.

Figure 2: Local Transmission Map (Nottingham 138 kV)

Figure 3: Proposed plan for Harrison Power's 138kV transmission lines (For reference only)



Attachment 1

PJM Generator Interconnection Request
Queue #AC1-103/AD2-005
Nottingham 138 kV
Facilities Study (First Energy/ATSI)

Nottingham 138 kV

Affected Utility - Study Report

Description of the Project

Harrison Power, LLC (hereinafter referred to as "Developer") has proposed the addition of a 1,085.0 MW (1061 MW capacity) natural gas generating facility in Cadiz, OH. The plant will consist of two (2) 1x1 combined cycle units. The point of interconnection will be a direct connection to AEP's Nottingham substation.

The requested in-service date is January 1, 2023. The requested back-feed date is 6/15/2020.

The generation facility will interconnect with **American Electric Power (AEP)**, at their Nottingham 138 kV Substation.

Developer's Submitted Milestone Schedule

Developer's requested Commercial Operation Date (COD) for the generation facility is **January 1, 2023**. FirstEnergy Corp.'s (Transmission Owner) proposed schedule does match the Developer's requested Milestone Schedule. A Project Kickoff meeting must occur by September 1, 2019 to meet Transmission Owner's Assumed Milestone Schedule listed below.

Developer's Requested Milestone Schedule:

06/15/2022 Initial Back-feed through Project Substation Date
01/01/2023 Project Commercial Operation Date

Transmission Owner's Assumed Milestone Schedule (for relocation of substation and associated transmission lines):

06/15/2022 Initial Back-feed through Project Substation Date
01/01/2023 Project Commercial Operation Date

Direct Connection and Non-Direct Connection Schedule: In order to meet the Transmission Owners Date for energization of AC1-103/AD2-005, a proposed twenty-seven (27) month schedule is estimated, from the date of a fully executed Construction Service Agreement and Construction Kick-Off Meeting, to complete the engineering, construction and associated activities, as detailed in the following sections below.

Transmission Owner assumes 14 months to complete physical construction and rebuild of the Nottingham-Yager #1 138 kV transmission line portion of the project

Estimated 27-month Schedule
(assumes a 9/1/2019 Kick-Off Meeting)

Activity	Estimated Start Month	Estimated End Month
Rebuild and Reconductor of Nottingham-Yager #1 138 kV		
Preliminary Engineering	1	3
Detailed Engineering	4	12
Right of Way Engineering	1	12
Siting, Permits and Real Estate	1	9
Material Delivery	12	13
Line Construction *	13	27

*This assumes the Nottingham-Yager #1 138 kV line can be taken out of service during summer period (June-September) for construction.

Scope of Work

Project Scope

The Transmission Owner is responsible for the design, procurement, and construction of the new 138 kV transmission line rebuild and reconductor from Nottingham (AEP) Substation to Yager (AEP) Substation. The Transmission Owner will also be responsible for relay settings changes at Knox Substation, Brookside Substation, Longview Substation and Harmon Substation. The remaining remote terminal from Nottingham (AEP) substation are terminals owned and maintained by AEP and will be the responsibility of AEP for any required upgrades.

Description of Facilities Work:

Facilities Work to be constructed by Transmission Owner:

General Description of Work

The following transmission lines will be rebuilt and reconductored.

1. **Nottingham-Yager #1 138 kV**
   [PJM Network Upgrade n5473]
   - **Scope:** The scope of the project is to rebuild and reconductor approximately 18.5 miles of the Nottingham-Yager #1 138kV circuit (from structure #15730 to structure #15923) from 477 ACSR to 795 ACSR. The remaining 0.7 miles already has 795 ACSR and will not require any modifications. Structure loading calculations were performed, taking into account the condition of the existing facilities, and it was determined that a complete rebuild of the transmission line will be required.

2. **Knox Substation** – Remote Terminal work

[PJM Network Upgrade n5546]

- **Scope:** Upgrade line protection and control settings at the Knox (FE) 138 kV substation to coordinate with the expanded Nottingham 138 kV substation.

3. **Brookside Substation** – Remote Terminal work
   [PJM Network Upgrade n5547]
   - **Scope:** Upgrade line protection and control settings at the Brookside (FE) 138 kV substation to coordinate with the expanded Nottingham 138 kV substation.

4. **Longview Substation** – Remote Terminal work
   [PJM Network Upgrade n5548]
   - **Scope:** Upgrade line protection and control settings at the Longview FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation.

5. **Harmon Substation** – Remote Terminal work
   [PJM Network Upgrade n5549]
   - **Scope:** Upgrade line protection and control settings at the Harmon FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation.

General Assumptions

1. The schedule can also be affected by any siting/permitting and/or transmission outage related issues.
2. It is assumed that a LON will be required to be submitted to the OPSB.
3. Crossing permits may be required for US Route 22, US Route 250, State Route 151, and the railroad just south of State Route 151.
4. Access will be challenging due to the terrain. Access roads assumed to be equal to the line length. Due to the challenging terrain, access road costs have been adjusted to reflect costs provided for similar terrain on project in a similar situated area.

Engineering Assumptions

1. The approximately 14.9 mile portion of the line to the north of this area from structure #3292 to Structure #15730 will be direct embedded steel poles. Existing wood H-Frame construction will be replaced with steel monopoles. It is anticipated that the new design will require 79 tangent, 4 angle, and 7 deadend structures. Tangent structures will utilize engineered direct embed foundations. Angle and deadend structures will be self-supporting steel utilizing drilled shaft foundations. Steel pole material cost are based on conceptual design weights and current contract steel pole pricing.
2. The approximately 3.6 mile portion of the line from Structure #15923 to Structure #3292 will be constructed using steel monopole construction. New transmission line structures shall include steel structures design with associated 138 kV line hardware and concrete foundations for steel structure transmission line construction. This type of construction is estimated for the approximately 3.6 mile portion of the line from Structure #15923 to Structure #3292. This portion of the engineering and construction work will be coordinated with the rebuild and reconductor of the portion of the Holloway-Knox 138 kV project (which shares the same transmission line corridor).
3. The 0.1 mile from structure #15730 to the Yager substation and the 0.5 mile section from Structure 15923 to Nottingham Sub already has 795 ACSR installed and will not require any modifications.

4. Foundation values assumed 'normal' soil plus rock. It was assumed that rock would be encountered at 6 ft. below the ground surface. Note that the depth to rock and quality of rock can greatly impact the foundation costs associated with the steel pole structures. While a 10% estimate was requested, without soil borings, it will be difficult to say with certainty that this estimate will be within 10% of the actual installed costs.
5. Construction and cost estimates include removal of transmission structures, but actual removal will be dependent upon the final design and location of new transmission structures.
6. Construction access to all transmission structures will be provided and permitted by the Transmission Owner as part of the overall site plan development.
7. All forestry or vegetation clearing work to accommodate transmission line rebuild and reconductor shall be provided by the Transmission Owner per the standards, oversight and specifications for final centerline design.
8. Line phasing will be coordinated with the substation phasing such that horizontal construction can be utilized (no vertical construction allowing change of phase capability will be provided with proposed line construction).
9. Cost estimates assume no significant geo-tech matting required for access to the transmission loop structures during construction.
10. Since voltage is the same and structures will be similar type of construction, existing right-of-way will be adequate for the rebuild.

Siting Assumptions

1. Schedule assumes transmission line siting requirements are included as part of the overall site development and municipal planning approval process.
2. Assume no significant social or ecological impacts in the area of the project. Transmission Owner is assuming that it will have no significant field or office ecological work or review.
3. Schedule assumes no property owner, governmental, or municipal opposition to the overall AC1-103 project.

Right-of-Way Assumptions

1. Transmission Owner will provide or acquire all necessary right-of-way for the 138-kV line rebuild. It is assumed that the rebuild and reconductor will take place within the existing right-of-way.
2. Depending on access plans, some off-ROW access may be required.

Forestry/Vegetation Management Assumptions

1. Transmission Owner to provide all vegetation clearing for new transmission corridors as part of the site development plans. Any additional clearing required may be performed by Transmission Owner (paid for by Developer) as part of clearing and land development required for the project to meet Transmission Owner standards.
2. No special conditions for vegetation clearing. Vegetation removal may be constrained due to seasonal restrictions due to T&E's (10/1 - 3/31) for native bat habitat.
3. E&S measures, road grading, post construction rehabilitation to be performed by Transmission Owner.

Total Estimated Costs of TO Facilities for Direct and Non-Direct Connection:

The following table summarizes the total estimated costs. The estimated costs are in 2019 dollars. The taxes are a CIAC (Contribution in Aid of Construction) Federal Income Tax Gross Up charge. This tax may or may not be charged based on whether or not this project meets the eligibility requirements of IRS Notice 88-129.

Description	Total Cost (w/o Tax)	Tax (if applicable)	Total Cost (w/o Tax)
Nottingham-Yager #1 138 kV line - FE / ATSI owns and operates the transmission lines between the AEP owned and operated substations (Nottingham and Yager). To mitigate this overload, the Nottingham-Yager #1 138 kV Line (18.5 miles) would need to be rebuilt and reconductored, replacing the existing 477 ACSR conductor with 795 ACSR. This work is to rebuild and reconductor the 14.9 miles portion of the line. [PJM n5473]	$38,672,300	$4,961,700	$43,634,000
Nottingham-Yager #1 138 kV line - FE / ATSI owns and operates the transmission lines between the AEP owned and operated substations (Nottingham and Yager). To mitigate this overload, the Nottingham-Yager #1 138 kV Line (18.5 miles) would need to be rebuilt and reconductored, replacing the existing 477 ACSR conductor with 795 ACSR. This work is for the installation of steel arms, 795 ACSR conductor, static conductor and associated hardware on the approximately 3.6 miles portion of the 138 kV line that shares the same structures as the Holloway-Knox 138 kV line. [PJM #n5473]	$2,560,400	$328,500	$2,888,900
Project management, construction management, forestry, and right-of-way.	$1,460,100	$187,400	$1,647,500
Nottingham Remote Terminal Upgrades			
Knox Substation - Upgrade line protection and control settings at the Knox FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation. [PJM n5546]	$ 9,400	$ 1,300	$10,700
Brookside Substation - Upgrade line protection and control settings at the Brookside FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation. [PJM n5547]	$ 9,400	$ 1,300	$10,700
Longview Substation - Upgrade line protection and control settings at the Longview FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation. [PJM n5548]	$ 9,400	$ 1,300	$10,700

Harmon Substation - Upgrade line protection and control settings at the Harmon FE 138 kV substations to coordinate with the expanded Nottingham 138 kV substation. [PJM n5549]	$ 9,400	$ 1,300	$10,700
Total Costs	**$42,730,400**	**$5,482,800**	**$ 48,213,200**

Information needed for ISA

Direct Labor	$29,263,950
Direct Material	$2,915,800
Indirect Labor	$7,480,850
Indirect Materials	$3,069,800
Total	**$42,730,400**

Schedule:

A proposed **twenty-seven (27) month** schedule is estimated to complete the engineering, construction and the associated activities, from the date of a fully executed Construction Service Agreement and Construction Kick-Off Meeting. This schedule assumes that all issues covered by the "Environmental, Real Estate and Permitting Issues" section of this document are resolved, and outages will occur as planned. Construction cannot begin until after all applicable permits and/or easements have been obtained.

Transmission Owner assumes 14 months to complete physical construction and rebuild of the Nottingham-Yager #1 138 kV Transmission line portion of the project.

Activity	Estimated Start Month	Estimated End Month
Estimated Construction Schedule for Rebuild and Reconductor of Nottingham-Yager #1 138 kV		
Preliminary Engineering	1	3
Detailed Engineering	4	12
Right of Way Engineering	1	12
Siting, Permits and Real Estate	1	9
Material Delivery	12	13
Line Construction *	13	27

*This assumes the Nottingham-Yager #1 138 kV line can be taken out of service during summer period (June-September) for construction.

Transmission Connection Requirements

The proposed interconnection facilities must be designed in accordance with the Transmission Owner's *Requirements for Transmission Connected Facilities* documents located at either of the following links:

www.firstenergycorp.com/feconnect

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

Environmental, Real Estate and Permitting Issues

The following are possible environmental, real estate and permitting issues:

- Environmental permitting, municipal permits, OPSB and Ohio PUC notification durations vary, some up to twelve (12) months after preliminary engineering is completed to secure the required approvals.
- Developer will provide all access rights, easements, ROW and permits necessary to complete the project that the Transmission Owner does not already possess. It is assumed that the project will be constructed within the existing right-of-way at or near where the existing facilities are currently located within the transmission line corridor. Environmental permitting shall encompass all federal, state and local requirements, consultations and agency coordination.
- Developer is responsible for all property acquisition (including any additional easements/rights-of-way (ROW)) for transmission and communication facilities needed for the generator interconnection.
- Transmission Owner will require Developer to obtain the necessary right-of-way and priority tree rights, via easements, and/or fee ownership of land needed for any relocation of a transmission lines across adjoining properties that are impacted to meet Transmission Owner requirements.

General Assumptions/Qualifiers

The accomplishment of the work on the Transmission Owner system to support the estimated costs and proposed schedule is dependent on the following:

- All work occurs within an existing transmission line right-of-way or on AEP's property with access to all existing structures possible via that property and the right-of-way following established access routes that do not cross wetlands or streams.
- Obtaining the necessary line outages. Transmission line outages are typically not granted from June to September and are discouraged during extreme winter conditions.
- No equipment delivery, environmental, permitting, regulatory or real estate delays.
- Estimates assume no significant rock encountered during construction.
- No extreme weather.
- No force majeure.

ATTACHMENTS

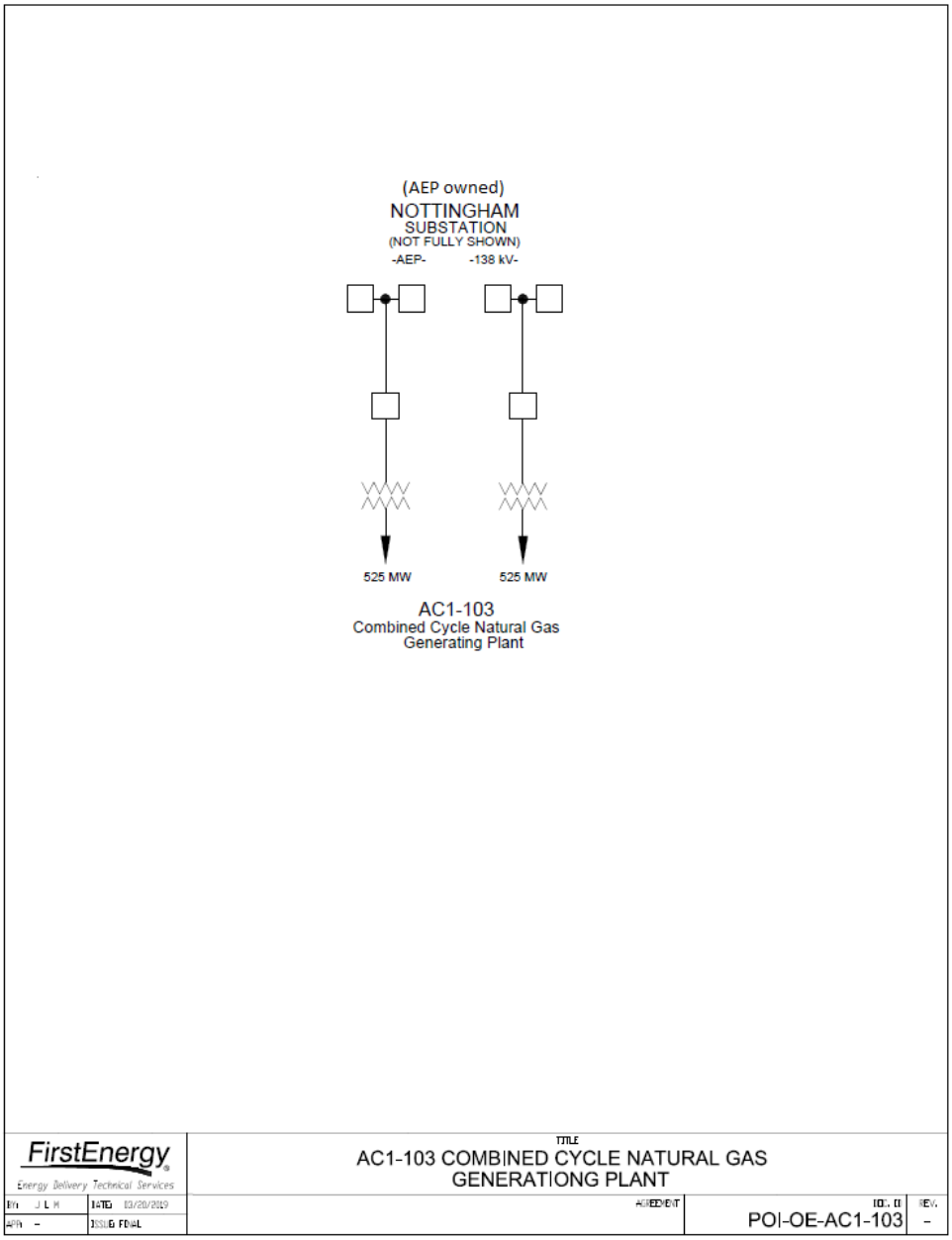
ATTACHMENT A
Queue # AC1-103/AD2-005
Detailed Protection Requirements

(NOT to be used for Construction)

PROTECTION AND MEASUREMENTS EQUIPMENT SPECIFICATIONS

None. Relaying and control settings will need to be reviewed and revised, if necessary.

FIGURE 2
AC1-103/AD2-005 Nottingham 138 kV
Proposed Project Single Line Diagram



Geographical Map
Nottingham-Yager #1 138 kV line