

Attachment J
LGE-GIS-2019-029 Provisional
Facilities Study Report



PPL companies

FS-LGE-GIS-2019-029 Provisional Request

Provisional Facilities Study Report

December 10, 2020

Study & Preliminary Report Completed By:
LG&E/KU Transmission

Report Prepared By:
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1. Executive Summary

A Provisional Facilities Study was performed by LG&E/KU for the following request:

**Table 1
 Provisional Request Details**

Queue Position	Queue Date	County	State	Max Output (MW) S/W	Point of Inter-connection	In-Service Date	Inter-connection Service Type	Generator Type
LGE-GIS-2019-029	11/08/2019	Hardin County	KY	100	Black Branch-Hardinsburg 138kV	6/30/2022*	NRIS/ERIS	Solar

*In the Facilities Study agreement the customer updated the in-service date from 12/31/2021 to 04/01/2022 for generator testing and to 06/30/2022 for commercial operation

TranServ as Independent Transmission Organization (ITO) completed a Provisional Generator Interconnection (GI) System Impact Study (SIS). The Provisional GI SIS analyzed the impact of this Generator Interconnection, located near Louisville, Kentucky, in accordance with the LG&E and KU Large GI Study Criteria document as posted on the LG&E and KU Open Access Same-Time Information System (OASIS). Customer executed a Provisional Facility Study Agreement with the ITO and LG&E and KU to complete a Provisional Facilities Study. LG&E and KU Services Company (LG&E-KU) contracted Black & Veatch (BV) to complete a +/-20% cost estimate study for the Provisional Generation Interconnect Request GI-2019-029 facility study. The request requires a new interconnection substation that will tap the existing 138 kV Black Branch to Hardinsburg segment of the Hardinsburg to Central Hardin EKPC 138kV line in Hardin County, Kentucky.

The LG&E/KU Open Access Transmission Tariff (OATT) states that the Provisional Facilities Study will include a good faith estimate of (i) the cost of Direct Assignment Facilities to be charged to the Eligible Customer, (ii) the Eligible Customer’s appropriate share of the cost of any Network Upgrades, and (iii) the time required to complete such construction and initiate the requested service.

TranServ has reviewed the Provisional Facilities Study results from LG&E and KU and prepared this report in accordance with the LG&E and KU OATT.

2. Constraint Identified in the SIS

Since this is a provisional request, this study was a near term only study with a restudy requirement. This SIS covered the present time frame as provided below.

Present Time Frame: □

- The in-service date of the GI-2019-029 request is 12/31/2021.
- The timeframe of this Provisional SIS covered from the period from 12/31/2021 to 12/31/2022.

If any study assumptions change a restudy may be required. Subsequent studies will be performed on a regular basis. The first such study will cover 12/31/2022 to 12/31/2023. Ultimately a SIS will be performed which is not provisional.

2.1 Steady State Constraints

No constraints were found in the SIS report.

2.2 Contingent Facility Analysis Results

There are no GI-2019-029 contingent facilities identified in the SIS report.

2.3 Short Circuit Analysis Results

The Short Circuit Analysis results from the SIS indicate that the transmission system has adequate interrupting capabilities to accommodate the addition of the new solar generator.

2.4 Stability Analysis Results from SIS

In the sensitivity analysis (without the Hardin county Projects) criteria violations were found for one P6 condition as shown in Table E-1.

**Table E-1
 2020S Max Sensitivity Analysis Criteria Violations**

Pre GI-2019-029 Model				Post GI-2019-029 Model			
Bus Number	Bus Name	Voltage (p.u.)	Seconds	Bus Number	Bus Name	Voltage (p.u.)	Seconds
324303	[4ROGERSVILLE138.00]	0.6954	13.6998	324303	[4ROGERSVILLE138.00]	0.6896	5.1
342568	[4CENT HARDIN138.00]	0.7081	13.6998	342568	[4CENT HARDIN138.00]	0.7036	5.1
324261	[4HARDIN CO 138.00]	0.7088	13.6998	324261	[4HARDIN CO 138.00]	0.7037	5.1
324244	[4ETOWN 138.00]	0.7117	13.6998	324244	[4ETOWN 138.00]	0.7065	5.1
324288	[4NELSON CO 138.00]	0.7675	13.6998	324288	[4NELSON CO 138.00]	0.763	5.1
				999133	[GI-2019-029P138.00]	0.7045	5.1
				999132	[GI-2019-029M138.00]	0.7051	5.1
				999131	[GI-2019-029C34.500]	0.7151	5.1
				999130	[GI-2019-029G34.500]	0.7151	5.1
				999129	[GI-2019-029S0.5500]	0.6794	5.1

LG&E and KU criteria allows 6 BES substations to drop below 0.8 pu. Thus no criteria violations were identified in the Pre GI-2019-029 sensitivity analysis. However additional substations were found to drop below 0.8 pu in the Post GI-2019-029 sensitivity analysis resulting in a criteria violation. An operating guide will be needed to ameliorate these criteria violations prior to the addition of the Hardin County Projects currently expected to be in-service by June 2022. All other tested disturbances passed the stability criterion in the sensitivity analysis and all tested disturbances passed the stability criterion in the analysis which included the addition of the Hardin County Projects.

2.5 Stiffness Verification due to Inverter Based Resource Interconnection

The GIS-2019-029 Short circuit ratio (SCR) was found to exceed the minimum requirement of 2.0. Due to the location of the GIS-2019-029 POI, the Weighted SCR (WSCR) did not apply. There are no Grid Stiffness constraints to granting the GIS-2019-029 GI request.

3. Affected System Impacts from SIS

Tables E-2 from the SIS report documented the Ad Hoc Study Group Comments which relate to independent testing performed by the Ad Hoc Study Group members consistent with the allowance for such testing in the LG&E and KU GI Criteria document.

**Table E-2
 Ad Hoc Study Group Independent Study Comments**

Ad Hoc Group Member	Date Received	Ad Hoc Group Member Comment provided within the June 13, 2020 Deadline
PJM	05/28/2020	PJM plans to also study this project when the traditional SIS study commences.
EKPC	05/28/2020	EKPC does not see the need to perform an affected system study at this point. EKPC will wait to see if the project moves forward to a “traditional” SIS.
MISO	06/09/2020	MISO performed a Screening Analysis for LGE-2019-029 and found that this project meets MISO’s Screening Criteria. MISO identifies itself as an affected party with LGE for this project and will perform a MISO AFS; however, MISO is not planning to perform an AFS as part of this Provisional Interconnection request. MISO will perform a study for this project when the regular System Impact Study is performed.
BREC	05/28/2020	BREC will not be performing an affected system study for the provisional request. MISO will be providing their feedback by June 12th. As in the past, we will likely follow their suggestion.
No other Ad Hoc Member chose to provide independent testing results for this request by the 06/13/2020 deadline.		

Regarding GI-2019-029, MISO has performed a preliminary screening and found that this project meets MISO’s Screening Criteria requiring a study. However, as this is a provisional interconnection service request they have declined to perform an affected systems study at this time and indicated that MISO will perform an affected system study during the regular SIS. PJM has also declined to perform an affected systems study at this time without indicating whether the project would otherwise trigger screening criteria if the interconnection service request was not provisional. PJM has indicated that they will decide whether or not a study is required during the regular SIS.

Customer is solely responsible for any projects that may be identified in future affected systems studies during the SIS for GI-2019-029.

In addition to Table E-2, the GI-2019-029 POI is within 2 buses of some third party buses and the entities do not see a need for an Affected System Study for the provisional request, as shown in

Table E-3. No entity indicated a need to perform an Affected System Study as indicated in Tables E-2 and E-3.

Table E-3
First ITO Determined path to Affected System Study Results (POI)

Neighboring System Buses within Two Buses of the POI			Bus Owner Response
Bus Owner	Bus Name	Bus Number	
BREC (MISO member)	4N.HARD	340615	BREC will not be performing an affected system study for the provisional request. MISO will be providing their feedback by June 12th. As in the past, we will likely follow their suggestion.
EKPC (PJM member)	4CENT HARDIN	324568	EKPC does not see the need to perform an affected system study at this point. EKPC will wait to see if the project moves forward to a “traditional” SIS.

4. Facilities Study Results from LG&E and KU

4.1 Methodology

The following terms are defined in this facilities study report:

- **New Network Facilities (NNF)** - additions, modifications, and upgrades to the Transmission Owner’s system required at or beyond the Point of Interconnection (POI) to accommodate the interconnection of the Generating Facility to the Transmission System. It is possible for system network power to flow through NNF equipment, along with generation facility power.
- **Transmission Interconnection Facilities (TIF)** - all facilities and equipment owned by the Transmission Owner from the Point of Interconnection (POI) to the Point of Change of Ownership (PCO); including any modifications, additions, or upgrades to such facilities and equipment. Transmission Interconnection Facilities are sole use facilities and shall not include Distribution Upgrades, Generator Upgrades, Stand Alone Network Upgrades, or Network Upgrades. Only generation facility power can flow through TIF equipment.
- **Generation Owner Facilities** – all facilities and equipment owned by the Interconnection Customer starting at the Point of Change of Ownership (PCO).
- **Point of Interconnection (POI)** – the point where the transmission interconnection facilities connect to the new network upgrades.
- **Point of Change of Ownership (PCO)** – the point where the Interconnection Customer’s facilities connect to the transmission interconnection facilities.

- **Distribution Upgrades (Distribution Facilities)**
- **Interconnection Customer (IC) - The Generator Owner.**

Article 11 of the LGIA specifies which party (Transmission or Generator Owner) has a construction obligation and who bears the expense of that obligation. Based on the requirements within the LGIA:

- **Generator Owner Facilities:** The Generator Owner is responsible for building, owning, and maintaining the assets. The Generator Owner bears the expense for these assets.
- **Transmission Interconnection Facilities (TIF):** LG&E and KU Transmission is responsible for building, owning, and maintaining the assets. The Generator Owner bears the non-refundable expense for these assets (Generation contribution to Transmission).
- **Network Facilities (NF) (include NNF):** LG&E and KU Transmission is responsible for building, owning, and maintaining the assets. However, the Generator Owner funds the initial expense for the Network Facilities unless LG&E and KU Transmission chooses to fund them. Any funds received from the Generator will be refunded to the Generator, plus interest, as the Generator takes transmission service, or repayment can be set up over a defined period. The Terms of payment for the Network Facilities will be determined in the negotiation period (identified in the LG&E and KU OATT: Attachment M Section 11) of the LGIA.
- **Distribution Facilities:** LG&E and KU Transmission does not own any Distribution Assets. So, Distribution Asset Costs identified would be reviewed and determined with the local distribution utility.

The LGE-GIS-2019-029 Solar Transmission Estimate was created following the below steps:

- Engineering and Project Management costs were estimated. LG&E and KU project Management & Engineering labor were estimated at 20% of the contracted project Management & Engineering labor cost.
- Construction Management labor costs were estimated. LG&E and KU Construction Management were estimated at 50% of the contracted Construction Management labor costs.
- The Generator Owner facilities are not included in the estimates.
- The Transmission Owner's Telecommunications Department provided an estimate for telecom facilities.
- Cost estimates were broken down between Company labor, contracted labor, materials, and contingency.

- Pricing provided by the vendor was combined with Transmission Owner's burdens and contingency cost
- Pricing provided by the Transmission Owner's Telecommunications Department was aggregated in the cost summary table.
- The responsibility for costs was determined per the Transmission Owner's Allocation of Costs for Generator Interconnections document, effective 01/01/2018, for a new three breaker ring bus configuration. As such, costs associated with this estimate are categorized as Transmission Interconnect Facilities (TIF) and New Network Facilities (NNF). All costs associated with Transmission Interconnect Facilities (TIF) will be the sole responsibility of the Interconnection Customer. Transmission Interconnect Facilities (TIF) cost estimate and summary are shown on section 4.5.2. New Network Facilities (NNF) cost estimate and summary are shown on section 4.5.4.

4.2 Major Project Assumptions, Constraints, and Risks

4.2.1 Assumptions and Clarifications

The cost estimates prepared for this interconnect request are based on the following assumptions.

- The IC's interconnection circuit construction and the IC's generation facilities are not included in this study.
- This report does not consider any issues related to the proposed routing of the generator lead-line to connect to the Transmission Owners Transmission System. If it is later determined that there are line clearance issues related to the generator's proposed lead-line, the customer must provide an alternate route that avoids such issues. In the event an alternate route is not available, the Transmission Owner may need to modify its transmission facilities to maintain adequate clearances. The Customer will be responsible for the costs and any schedule delay as a result.
- Estimate accuracy is +/- 20%.
- Internal LG&E-KU costs for Project Management & Engineering labor were estimated at 20% of the contracted Project Management & Engineering labor costs.
- Internal LG&E-KU costs for Construction Management were estimated at 50% of the contracted Construction Management labor costs.
- Telecom labor and material costs were provided by LG&E-KU and are assumed to be 100% LG&E-KU costs.
- LG&E-KU burdens and contingency were estimated internally by LG&E-KU.

- All contracted costs presented within this report include 6% escalation on cost, contractor burdens, and markups.
- Union Labor rates were utilized for construction labor.
- Materials are assumed to be tax exempt. No sales taxes are included in the estimate.
- Insurance is included for contracted costs.
- Substation Engineering, Project and Construction Management, and Construction Mobilization/Demobilization costs were allocated between Network Facility (67%) and Transmission Interconnection Facility (33%) costs.

4.2.1.1 Construction

- Temporary construction power is assumed to be provided by LG&E-KU.
- Adequate site access will be provided by the IC.
- Costs for subcontracted site security are included for non-work hours, holidays, and weekends for the duration of construction.
- Costs are included for a part-time onsite Construction Safety manger.
- Temporary laydown, matting, or other improvements are not included.

4.2.1.2 Civil-Site Development

- Site development for the access road, substation pad, and transmission cut-in will be by the IC and is not included in the cost of this estimate. It is assumed that all property purchase, site clearing/grubbing, grading, landscaping, drainage, storm water, and/or erosion control design, permitting, and construction will be provided by the IC. The IC will provide a rough graded and fenced pad with a 20' swing gate per LG&E-KU standards.
- Boundary, topographic, and/or environmental surveys are not included and are assumed to be by the IC.
- Site Planning, Zoning, Easement and/or Real Estate negotiations or approvals are not included and are assumed to be by the IC.
- All environmental and other necessary permits to complete the site development construction will be secured and paid for by the IC.
- Final surfacing stone for the station is included.

4.2.1.3 Civil-Structural

- A-frame and lightning mast structures will be comprised of bent plate and will be detail-designed by a steel fabricator, with loads provided by the substation engineer.
- All remaining steel will consist of standard AISC shapes to be detail-designed by the substation engineer.
- Geotechnical soil information was not available at the time of the estimate completion. Black & Veatch completed a geotechnical desktop review of the site location to generate foundation design assumptions for the estimate. Costs for procurement of soil borings and completion of a geotechnical report are included in the estimate.
- Based on the proposed location of the site, it is expected that the site will fall under Seismic Design Category C. Liquefaction was not considered for foundation design estimates.
- Based on Hazard Maps and historical prevalence of sinkholes in the area, there is a very high risk of Karst. A ground penetrating radar (GPR) study using Stepped Frequency Continuous Wave (SFCW) radar methods is recommended to map potential voids from Karst within the limestone rock layers. Costs are included for this effort.
- The soil conditions are assumed to be conducive for the installation of drilled pier foundations. However, the extension of drilled piers beyond voids and the use of permanent steel casing may be required where voids are present.
- Based on the geotechnical desktop review, it was assumed that the site would consist of clay soil over shallow limestone rock. Drilled pier foundations are assumed to have a rock socket of five (5) feet.
- The control house is assumed to be constructed at approximately grade elevation. It will not be elevated for flood considerations. No stairs are assumed to be required.

4.2.1.4 Relaying & Communications

- The IC will supply the fiber communication (OPGW) channel between the IC collector substation and the LG&E-KU station.
- The estimate includes costs for the fiber connection from the new LG&E-KU Control House to the dead end structure.
- The IC will supply a line protection relay panel in the IC-owned collector substation to interface with the LG&E-KU-owned line protection relay panel in the interconnection station for coordinated protection of the IC line segment.

- The estimate includes installation of a new 421/411L relay panel at Hardinsburg.

4.2.2 Project Risks and Constraints

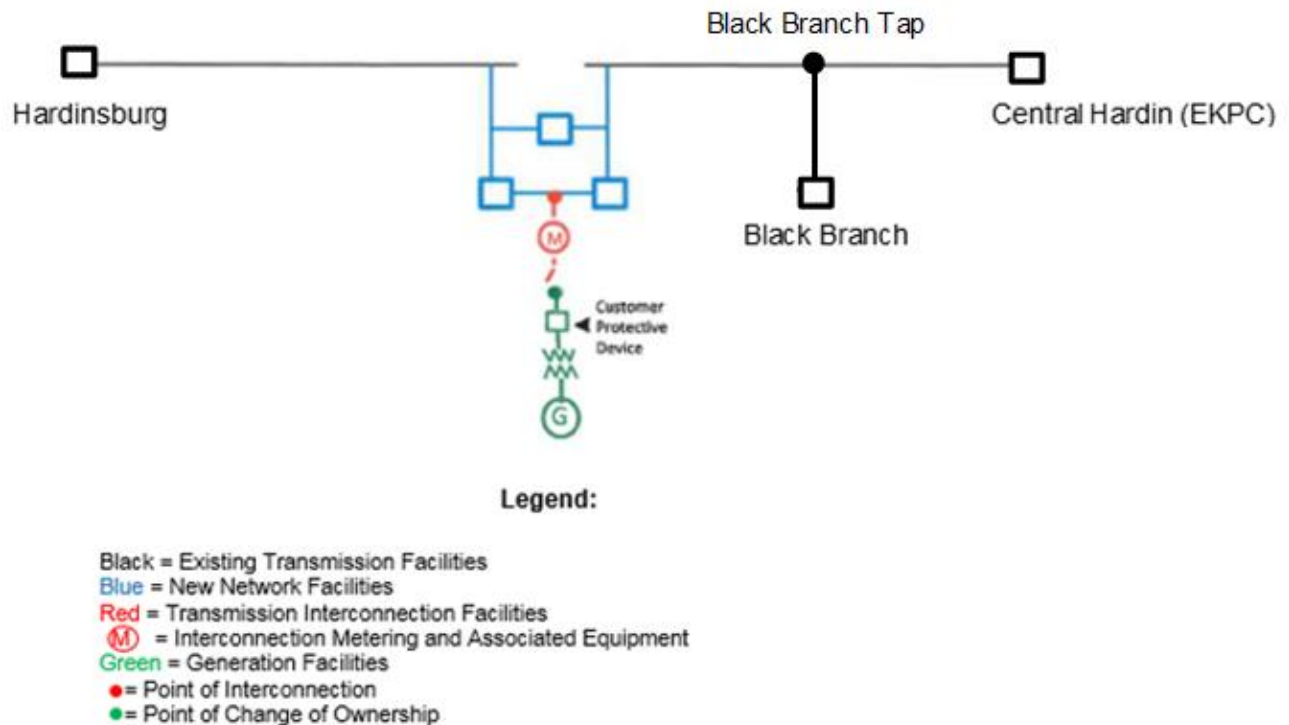
- Geotechnical soil information was not available at the time of the estimate completion. The vendor completed a geotechnical desktop review of the site location to generate foundation design assumptions for the estimate. The site is anticipated to have clay soil over shallow limestone rock and require site grading to balance the station pad elevation. Costs for procurement of soil borings and completion of a geotechnical report are included in the estimate. Site soil conditions that differ from anticipated conditions could have significant impact on foundation design and below grade construction.
- No property survey information was available at the time of the conceptual substation design and cost estimate. The location of the network and interconnection facilities were identified based on aerial imagery and partial property parcel information. Changes to the physical location of the facilities could impact costs.
- Material and labor availability at the time of project execution could have significant cost impacts.

4.3 Interconnection Facilities Needs

Figure 1 shows the division of responsibility for a new three breaker ring bus configuration, per the Transmission Owner's *Allocation of Costs for Generator Interconnections* document, effective 01/01/2018.

The IC will be responsible for the design, construction, and permitting of the 138kV transmission line from their facilities to the Point of Change of Ownership (PCO) at the LGE-GIS-2019-029.

Figure 1: Point of Interconnection



Details of the Transmission Interconnection Facilities and New Network Facilities required for the generation interconnection are provided in Section 4.5.

4.4 Description of Upgrades

This section describes facilities identified to be installed, replaced, and/or upgraded by LG&E-KU to accommodate the project. During detailed design other components may be identified for installation or replacement due to this interconnection.

The conceptual station arrangement developed for this estimate is included as Appendix A. The proposed station arrangement and location relative to the transmission corridor and the IC facilities is shown below in Figure 2. The approximate latitude and longitude of the POI is 37.677633,°N, 85.995672°W.

Figure 2. Project Location Map



The locations of the interconnection facilities were selected based on the following criteria:

- The anticipated size of the new 138kV station, and
- The proximity and orientation of the station to the existing 138kV transmission corridor

4.5 Total Conceptual Cost Estimate: (Total Estimated Cost \$8,377,002 USD)

The cost estimates are based on a ring bus interconnection configuration as shown in Figure 1 in section 4.3 and the assumptions provided in the section 4.2. The estimated total project cost is estimated with +/- 20% accuracy.

4.5.1 Generator Owner Facilities

The generator owner is responsible for the installation and costs for the generator, step up transformer and customer protective devices up to the Transmission Owner (TO) metering equipment. The customer is responsible for determining the generator owner costs for the facilities owned and operated by the customer.

4.5.2 Transmission Interconnection Facilities: (Total Estimated Cost \$1,767,230)

The transmission interconnection facilities will include all equipment and materials at the interconnection facility between the Point of Ownership Change and the Point of Interconnection.

Costs associated with the new control building enclosure, station service transformers, and associated foundations are assumed to be split between Network and Interconnect Facilities based on the ratio of zones of protection for the ultimate configuration. For this estimate, these costs were split 67% Network, 33% Interconnection.

The required equipment and materials are identified below, and a summary of the interconnection facilities costs are provided in Table 4-1.

4.5.2.1 Station

The transmission interconnection facilities will include the following:

4.5.2.1.1 High Voltage

- One (1) 138kV Motor-Operated Disconnect Switch
- Three (3) 138kV Surge Arresters
- Three (3) 138kV Metering CCVTs
- Three (3) 138kV Metering CTs
- Two (2) 138kV SSVTs (Split Cost between Network and Transmission Interconnect as described above)

4.5.2.1.2 Civil/Structural

- One (1) Steel A-Frame structure
- Six (6) 1-Phase CCVT/ Metering CT Supports
- Two (2) SSVT Supports (Split Cost)
- One (1) slab foundation for new control enclosure and associated entrance mats (Split Cost)

4.5.2.1.3 Protection & Control

- One (1) New Control House Space Allocation (split cost) consisting of below relay panels:
 - (1) line protection panel for GI Interconnect
 - (1) metering panel for GI
 - (1) RTU panel
 - AC/DC systems (Split Cost)

4.5.3 Transmission Lines

Not applicable.

4.5.3.1 Telecommunication Facilities

- Not applicable.

Table 4-1
Transmission Interconnection Facility Cost Estimate

Description	Cost
Company Labor	\$207,681
Contract Labor	\$716,387
Materials	\$682,505
Contingency	\$160,657
Total	\$1,767,230

4.5.4 Network Facilities: (Total Estimated Cost \$6,609,772 USD)

4.5.4.1 Network Interconnection Facilities: (Total Estimated Cost \$6,609,772)

The network facilities include a new 138kV interconnection station, a 138kV tap to the existing Black Branch-Hardinsburg segment of the Hardinsburg-Central Hardin (EKPC) transmission line, and associated Telecom facilities.

Costs associated with the new control building enclosure, station service transformers, and associated foundations are assumed to be split between Network and Interconnect Facilities based on the ratio of zones of protection for the ultimate configuration. For this estimate, these costs were split 67% Network, 33% Interconnection.

LG&E/KU and the vendor combined cost estimate for network interconnection facilities is shown in Table 4-2 and includes the following:

4.5.4.1.1 Station

- The new network interconnection facility will be a three (3) breaker ring bus arrangement with three (3) 138kV lines (Hardinsburg, Central Hardin, & GI Interconnect) and the following equipment:

4.5.4.1.2 High Voltage

- Three (3) 138kV Circuit Breakers
- Six (6) 138kV Manually Operated Disconnect Switches
- Six (6) 138kV Surge Arresters
- Six (6) 138kV CCVTs
- Two (2) 138kV SSVTs (Split Cost between Network and Transmission Interconnect as described above)

4.5.4.1.3 Civil/Structural

- Two (2) Steel A-Frame structures
- Two (2) 3-Phase Low Bus Supports
- Fifteen (15) 1-Phase Low Bus Supports
- Four (4) 1-Phase High Bus Supports
- Two (2) Low Disconnect Switch Support Stands
- Four (4) High Disconnect Switch Support Stands
- Six (6) 1-Phase CCVT Supports
- Two (2) SSVT Supports (Split Cost)
- One (1) slab foundation for new control enclosure and associated entrance mats (Split Cost)
- One (1) Lightning Mast

4.5.4.1.4 Protection & Control

- One (1) Small (14' x 42') control house (split cost) consisting of the following:
 - (2) line protection panels for Hardinsburg & Central Hardin (EKPC)
 - (2) Digital communications paths, (1) associated with the Hardinsburg line and (1) associated with the Central Hardin (EKPC) line
 - (1) RTU panel
 - (1) DFR panel
 - AC/DC systems (Split Cost)
- One (1) new Line relay panel at Hardinsburg

4.5.4.2 Transmission Lines

- Two (2) 138kV three (3) pole, caisson supported, steel deadened structures and foundations
- Hardware and Conductor for taps from existing 138kV line to the station structure
- Two (2) OPGW splice boxes

4.5.4.3 Telecommunication Facilities

- Di-electric Fiber Cable (24-SM) for End Section
- Fiber Termination Panel
- AFL Fiber Splice Enclosure, Trays & Bushings
- Slack Drum
- ICON Multiplexer e/w required access modules
- 48VDC Power Plant
- 125/48 VDC-DC Converter (1:4 system)
- 90H" x 19W" Hybrid Relay Rack

Table 4-2
Network Interconnection Facility Cost Estimate

Description	Cost
Company Labor	\$688,415
Contract Labor	\$2,543,781
Contracted Materials	\$2,776,688
Contingency	\$600,888
Total	\$6,609,772

4.5.5 Distribution Facilities: (Total Estimated Cost \$0 USD)

No distribution facility upgrades have been identified.

5. Conclusion and Project Completion Timeframes

The engineering, design, and construction of the interconnection facilities and network upgrades is estimated to take twenty-four (24) months from receipt of the Interconnection Customer's execution of the LGIA, or notice to proceed in the event of a suspension. This estimated timeline assumes the Interconnection Customer will provide a build-ready site within twelve (12) months of the execution of the LGIA, or notice to proceed in the event of a suspension. Additionally, this estimate assumes that the project schedule would not be impacted by storm damage and restoration, time of year limitations, permitting issues, outage scheduling, system emergencies, and contractor and equipment availability, or other unforeseen circumstances.

This report does not consider any issues related to the proposed routing of the generator leadline to connect to the Transmission Owners Transmission System. If it is later determined that there are line clearance issues related to the generator's proposed lead-line, the customer must provide an alternate route that avoids such issues. In the event an alternate route is not available, the Transmission Owner may need to modify its transmission facilities to maintain adequate clearances. The Customer will be responsible for the costs and any schedule delay as a result.

An operating guide will be needed to ameliorate stability criteria violations identified in section 2.4 of this report prior to the addition of the Hardin County Projects currently expected to be in-service by June 2022.

Since this is a provisional request, this study covers only the year 2022. If any study assumptions change a restudy may be required. Subsequent studies will be performed on a regular basis. The first such study will cover 12/31/2022 to 12/31/2023. Ultimately a SIS will be performed which is not provisional.

No LG&E and KU constraints which require upgrades were identified in the steady state, stability or short circuit analyses. No third party constraints were identified in this study and no third party indicated a need for an Affected System study. However some parties have indicated a need for an Affected System Study when this request moves to the traditional SIS as indicated in Tables E-2 and E-3. The customer will need to work with the third parties at that time and keep the ITO and TO informed of the status of the studies.

The study determined that the inverters' 0.954 PF capability did not meet the +/- 0.95 power factor at the high side of the customer main transformer requirement. The study found that the customer would also need to provide a 14 MVAR capacitor at the collector bus to meet the at least +/- 0.95

power factor at the high side of the customer main transformer requirement. The 14 MVAR capacitor was included in the study models. The 14 MVAR capacitor is required to have automatic voltage control based on monitoring the voltage at the 138 kV bus.

6. References

[1]https://www.oasis.oati.com/woa/docs/LGEE/LGEEdocs/Allocation_of_Costs_for_Generator_Interconnections_effective_1-1-2018.pdf

Appendix A. Conceptual Substation Layout

The appendix A of this report is available on the LG&E and KU Critical Energy Infrastructure Information (CEII) File Transfer Protocol (FTP) site. The LG&E and KU secure CEII FTP site URL is: <https://eftws.lge-ku.com/EFTClient/Account/Login.htm>.



PPL companies

FS-LGE-GIS-2019-029
Provisional Facilities Study Report
Appendix A

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Study & Preliminary Report Completed By:
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