COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

IN THE MATTER OF:

ELECTRONIC APPLICATION OF EAST	)	
KENTUCKY POWER COOPERATIVE, INC.	)	
FOR A CERTIFICATE OF PUBLIC	)	**CASE NO.**
CONVENIENCE AND NECESSITY FOR	)	**2025-00311**
THE CONSTRUCTION OF A 161 kV	)	
TRANSMISSION LINE IN PULASKI	)	
COUNTY, KENTUCKY AND OTHER	)	
OTHER GENERAL RELIEF		

DIRECT TESTIMONY OF DARRIN ADAMS
DIRECTOR OF TRANSMISSION PLANNING & SYSTEM PROTECTION
ON BEHALF OF EAST KENTUCKY POWER COOPERATIVE, INC.

Filed: November 7, 2025
Erratta Filing: February 2, 2026

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

IN THE MATTER OF:

ELECTRONIC APPLICATION OF EAST KENTUCKY POWER COOPERATIVE, INC. FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR THE CONSTRUCTION OF A 161 kV TRANSMISSION LINE IN PULASKI COUNTY, KENTUCKY AND OTHER GENERAL RELIEF	)	**CASE NO. 2025-00311**

VERIFICATION OF DARRIN ADAMS

COMMONWEALTH OF KENTUCKY)
)
COUNTY OF CLARK)

Darrin Adams, Director of Transmission Planning & System Protection of East Kentucky Power Cooperative, Inc., being duly sworn, states that he has supervised the preparation of his Errata Testimony and Data Requests and certain filing requirements in the above-referenced case and that the matters and things set forth therein are true and accurate to the best of his knowledge, information and belief, formed after reasonable inquiry.

Darrin Adams

The foregoing Verification was signed, acknowledged and sworn to before me this 6th day of February, 2026, by Darrin Adams.

Notary Commission No. 1/18/28

Commission expiration: KYNP84425

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, AND OCCUPATION.

A. My name is Darrin Adams, and my business address is East Kentucky Power Cooperative, Inc. ("EKPC"), 4755 Lexington Road, Winchester, Kentucky 40391. I am the Director of Transmission Planning & System Protection for EKPC.

Q. PLEASE STATE YOUR EDUCATION AND PROFESSIONAL EXPERIENCE.

A. I am a graduate of Transylvania University with a Bachelor of Arts degree in Liberal Studies, and a graduate of the University of Kentucky with a Bachelor of Science degree in Electrical Engineering. I am a licensed Professional Engineer in the Commonwealth of Kentucky and have 31 years of experience in the electric utility industry. I have been employed at EKPC since 2004, and have been responsible for transmission planning activities throughout my career at EKPC. Prior to my current position at EKPC, I served as a senior engineer, the Supervisor of Transmission Planning, the Manager of Transmission Planning, and the Director of Planning, Design & Construction for Power Delivery. Prior to commencing employment with EKPC, I was employed at Louisville Gas & Electric Company and Kentucky Utilities ("LG&E/KU") for approximately 11 years in various roles in the transmission planning and operations areas of those companies.

Q. PLEASE PROVIDE A BRIEF DESCRIPTION OF YOUR DUTIES AT EKPC.

A. In my current role, I am responsible for overseeing the planning of the electric transmission line, transmission substation, and distribution substation facilities necessary to deliver energy reliably and economically to EKPC's Owner-Member's systems. In addition to the planning of EKPC-owned facilities, I oversee coordination of transmission-development plans with other electric utilities and the PJM Interconnection Regional Transmission Organization ("PJM"). PJM is a regional electric grid and market operator with operational control of over 180,000 MW of regional electric generation through all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. PJM operates the largest capacity and energy market in North America.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE KENTUCKY PUBLIC SERVICE COMMISSION?

A. Yes, I have testified before the Commission on multiple occasions.[1] In addition to the direct testimony supplied in these cases, I previously sponsored responses to data requests related to transmission planning topics in numerous EKPC cases that came before the Commission.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

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[1] *Electronic Application of East Kentucky Power Cooperative, Inc. for 1) Certificates of Public Convenience and Necessity to Construct a New Generation Resources; 2) For a Site Compatibility Certificate Relating to the Same; 3) Approval of Demand Side Management Tariffs; and 4) Other General Relief*, Case No. 2024-00370, (Ky. P.S.C., Nov. 20, 2024) ; *Electronic Application of East Kentucky Power Cooperative, Inc. for 1) a Certificate of Public Convenience and Necessity to Construct a New Generation Resources; 2) For a Site Compatibility Certificate Relating to the Same; 3) Approval of Demand Side Management Tariffs; and 4) Other General Relief*, Case No. 2024-00310, (Ky. P.S.C., Sept. 20, 2024); Case No. 2023-00009, *An Electronic Examination of the Application of the Fuel Adjustment Clause of East Kentucky Power Cooperative, Inc., From November 1, 2020 Through October 31, 2022,* Case No. 2023-00009, (Ky. P.S.C., Sept. 6, 2023).

A. My testimony will provide an explanation for the purpose and need for the proposed double-circuit 161 kV electric transmission line. I will describe the transmission-planning studies that were performed to determine these needs and provide a description of the results of those studies.

Q. ARE YOU SPONSORING ANY ATTACHMENTS?

A. Yes, I am sponsoring the report documenting the transmission-planning studies as Attachment DA-1.

Q. PLEASE DESCRIBE THE PROJECT THAT EKPC IS UNDERTAKING AS PART OF THIS APPLICATION.

A. EKPC proposes to construct a new 161 kV double-circuit electric transmission line between EKPC's Cooper Station and the LG&E/KU Alcalde Substation located southeast of Somerset, Kentucky. Both circuits of the line will connect at a new 161 kV substation at Cooper Station that will be constructed for integration of the new Cooper Combined-Cycle Gas Turbine[2] ("CCGT") generation facility into the electric transmission system. Both circuits will terminate on the other end at the existing LG&E/KU Alcalde 345-161 kV Substation. LG&E/KU will expand the Alcalde Substation to construct necessary infrastructure to accommodate the connection of these two circuits. The approximate length of the new line is ~~5.25~~ 4.54 miles.

Q. PLEASE DESCRIBE THE NEED FOR THE TRANSMISSION SYSTEM IMPROVEMENTS.

[2] Case No. 2024-00370, July 3, 2025 Order.

A. As a result of EKPC's plans to construct the Cooper CCGT and the Liberty Reciprocating Internal Combustion Engine[3] ("RICE") generation facilities, EKPC transmission-planning staff performed studies to determine expected system impacts and corresponding needed transmission-system upgrades. EKPC provided the results of these studies in Commission Case No. 2024-00310 and Case No. 2024-00370. In Case No. 2024-00370, EKPC indicated that a new Cooper-Alcalde 161 kV transmission line was identified as part of the overall transmission expansion plan for these generation facility additions, primarily due to the Cooper CCGT facility power output. This new line in combination with upgrades of several existing facilities on both the EKPC and LG&E/KU transmission systems was determined to provide sufficient capacity to meet the increased flows created by the additional generation in the region. Since the conclusion of Case No. 2024-00370, EKPC updated its analysis to incorporate the newest available modeling information for the transmission system. LG&E/KU performed a preliminary affected system study at EKPC's request in order to identify potential upgrades and associated scope required on the LG&E/KU transmission system. Based on the results of both EKPC's updated analysis and LG&E/KU's preliminary study, the need for and benefits of expanding the scope of the new Cooper-Alcalde 161 kV line from a single-circuit line to a double-circuit line were recognized.

Q. WHAT SPECIFIC STUDIES HAVE BEEN PERFORMED TO DETERMINE THE NEED FOR THE PROPOSED PROJECT?

[3] Case No. 2024-00310, May 20, 2025 Order.

A. EKPC transmission-planning staff performed power-flow and short-circuit analysis when EKPC began to formulate potential plans to construct the new Cooper CCGT and Liberty RICE facilities to identify the expected transmission-expansion plans for the facilities. EKPC continued to update these studies to refine the transmission plan and expected scope of projects based on updated system-model information. EKPC coordinated with LG&E/KU to request a preliminary affected-system study to identify expected impacts on the LG&E/KU system and associated transmission projects to address those impacts. Additionally, PJM Interconnection LLC ("PJM") performed power-flow analysis for Phase 1 of Transition Cycle #2 of the PJM generator-interconnection queue. The Cooper CCGT facility is included in these cycle studies due to its selection by PJM for its Reliability Resource Initiative ("RRI").

Q. HAS EKPC SUBMITTED THIS PROJECT TO PJM FOR ITS REVIEW AS EKPC'S REGIONAL TRANSMISSION PLANNER?

A. Yes, EKPC submitted the new Cooper-Alcalde double-circuit 161 kV line to PJM as a proposed network upgrade project to address various thermal violations that were identified in PJM's Phase 1 power-flow analysis for Transition Cycle #2. PJM is incorporating this transmission reinforcement project – along with all other proposed network upgrades identified by EKPC and the other PJM Transmission Owners – into its power-flow models that will be used for Phase 2 of the Transition Cycle #2 analysis. PJM's Phase 2 analysis will verify that all proposed network upgrades identified by the Transmission Owners will adequately mitigate the thermal violations identified in the Phase 1 analysis.

Q. PLEASE DESCRIBE THE NEED FOR ADDITIONAL CAPACITY IN THE AREA.

A. The addition of the Cooper CCGT and Liberty RICE generation facilities will install approximately 1 GW of new generation capacity in the area. Even with the possible deactivation of Cooper Unit #1,[4] this means that approximately 900 MW of new capacity will be installed. These generation additions will therefore increase power flows on the existing 161 kV and 69 kV transmission infrastructure in the area.

EKPC initially performed power-flow analysis with the proposed new generation facilities included in order to identify possible overloaded transmission facilities due to the added generation. EKPC began by considering only the Liberty RICE facility, since it will begin commercial operation in 2028. EKPC identified four (4) transmission system reinforcement projects to mitigate overloads that would be created by the output of the Liberty RICE facility. None of these transmission system reinforcement projects involve construction of new greenfield transmission lines – all are upgrades of the existing transmission facilities. EKPC next added the Cooper CCGT facility to the analysis. With this facility added, numerous overloaded facilities were identified in the area near Cooper Station. EKPC determined that many of these overloaded facilities could be mitigated by constructing a new 161 kV line between the Cooper Substation and LG&E/KU's Alcalde 345-161 kV Substation. This would provide a new direct path from Cooper into the LG&E/KU 345 kV and 161 kV systems. With this new line modeled,

[4] EKPC informed the Commission of the decision to possibly deactivate Cooper Unit #1. See Case No. 2024-00370, EKPC's Supplemental Response to Staff's Third Request, Item 12 (filed Apr. 11, 2025).

sixteen (16) overloaded facilities were identified on the EKPC transmission system and five (5) overloaded facilities were identified on the LG&E/KU transmission system. Therefore, upgrades of these overloaded facilities were specified in addition to the Cooper-Alcalde 161 kV line in order to fully mitigate all thermal overload violations.

EKPC next requested that LG&E/KU perform its own preliminary affected system analysis to verify EKPC's study results with regard to the necessary LG&E/KU transmission upgrades. LG&E/KU performed this analysis and provided results to EKPC indicating that nine (9) overloaded facilities were identified on its system, five (5) of which were associated with the Cooper CCGT generation addition. EKPC's review of these results indicated that modifying the scope of the Cooper-Alcalde 161 kV line from a single-circuit line to a double-circuit line would eliminate overloads on some of the LG&E/KU facilities, and would reduce the flows significantly on other LG&E/KU facilities such that the scope of the required upgrades could be reduced.

Finally, EKPC reviewed the Phase 1 power-flow analysis results provided by PJM for its Transition Cycle #2 generation interconnection cluster. PJM's results identified 93 overloaded facilities on the EKPC transmission system in total. The flows on 42 of these facilities are impacted by the Cooper CCGT generation output, with overload levels as high as 364% of the applicable facility emergency rating. EKPC's analysis indicates that the Cooper-Alcalde 161 kV double-circuit line will eliminate 37 of the overloads completely and will reduce the flows on the remaining five facilities. Therefore, this line is a very effective means to mitigate the large number of thermal overloads identified in the area due to the planned generation additions.

Q. ARE THERE ANY PLANS FOR ECONOMIC DEVELOPMENT IN THE AREA?

A. Yes, EKPC and its Owner-Member distribution cooperatives continue to see additions of industrial and commercial load in the area. Additionally, EKPC received numerous inquiries from prospective industrial project developers in this area recently. No large-scale projects have been confirmed, but EKPC received inquiries for projects with potential demand of 100 MW+ in the area.

Q. WHAT BENEFITS MAY BE DERIVED FROM THE TRANSMISSION PROJECTS?

A. First and foremost, the Cooper-Alcalde 161 kV double-circuit line will provide sufficient transmission capacity to allow operation of the existing Cooper generation units, the planned Cooper CCGT, and Liberty RICE units at full output without restrictions. This will ensure that the generation is available when economical and/or critical for reliability. Additionally, this line will increase overall transmission capacity in the area, which will enhance economic development opportunities that may arise. Furthermore, the addition of these two circuits will reduce losses on the transmission system, providing an economic benefit for EKPC members.

Q. WILL THIS PROJECT RESULT IN WASTEFUL DUPLICATION OF SERVICES OR UNNECESSARY CLUTTERING OF THE LANDSCAPE?

A. No, EKPC developed a transmission plan that best balances addition of new transmission lines with upgrades of existing facilities. As discussed earlier, EKPC determined that the new Cooper-Alcalde double-circuit 161 kV line will eliminate overloads of 37 transmission facilities on the EKPC system that were identified by PJM. Furthermore, it will reduce flows on other overloaded facilities in the area such that the scope of the required upgrades can be reduced. By building this new line, EKPC expects to need to upgrade approximately 55 miles of existing lines to accommodate the Liberty RICE and Cooper CCGT generation facilities. EKPC expects that upgrades of approximately 39 miles of existing line on the LG&E/KU transmission system will be required with the addition of the new line. Therefore, the addition of the new Cooper-Alcalde double-circuit 161 kV line is an efficient transmission plan that best utilizes the existing infrastructure while prudently adding new connections between two critical substations (Cooper and Alcalde) in this region.

Q. IS THERE ANY EXISTING FACILITY THAT IS REASONABLY AVAILABLE TO SERVE THE PRESENT AND FUTURE NEEDS OF THOSE WHO WILL BE SERVED BY THE PROPOSED PROJECT?

A. As I have discussed above, EKPC will upgrade existing infrastructure to utilize these facilities that are currently operational and enhance the capacity of the transmission system. These upgrades will coordinate efficiently with the addition of the new Cooper-Alcalde 161 kV double-circuit line to provide a robust transmission system in the vicinity of the Cooper and Liberty RICE stations. Without the new Cooper-Alcalde line, flows on existing facilities around Cooper

Station could be as high as 364% of current ratings. It is impractical to solely increase conductor size on existing facilities to accommodate flows at these levels. The conductor sizes required will be well beyond those used by EKPC currently, and well beyond what is typical in the industry for 161 kV and 69 kV facilities. By providing two new transmission outlets from Cooper Station, flows on all existing facilities in the area will be reduced to reasonable levels. This will eliminate the need to upgrade many facilities and will reduce the conductor sizes required for facilities that remain overloaded.

Q. WILL THE PROPOSED PROJECT INTERFERE WITH ANY OTHER UTILITY'S OPERATIONS?

A. No, the new Cooper-Alcalde 161 kV double-circuit line will not interfere with the operations of any other utility.

Q. WHAT ALTERNATIVES DID EKPC REVIEW?

A . As I have described in my testimony, EKPC first identified all facilities that would be overloaded as a result of the Liberty RICE and Cooper CCGT generation-facility additions, then upgrades were evaluated of all overloaded facilities without construction of any new transmission lines. For the Cooper CCGT addition, upgrades of 22 existing facilities on the EKPC and LG&E/KU transmission systems would be required at an estimated total cost of $184.1 million. Given that the highest flows on existing facilities are on the existing paths between Cooper Station and LG&E/KU's Alcalde Substation, EKPC determined that a new line between Cooper and Alcalde would likely be the most efficient new transmission-line option as an alternative to exclusively upgrading existing facilities. EKPC initially considered a new single circuit 161 kV line between these two substations. This single circuit provided substantial benefits, reducing the number of existing facilities that would need to be upgraded to 15 and reducing the estimated cost of the required transmission upgrades for the Cooper CCGT to $140.3 million. However, after LG&E/KU performed its own power-flow analysis and after EKPC updated its analysis based on the most recent system-modelling information available, the improved system performance that is garnered with a Cooper-Alcalde 161 kV double-circuit line has become apparent. The double-circuit line eliminates the need for two upgrades of existing LG&E/KU transmission lines, and thereby reduces the overall cost of the transmission upgrades to $112.7 million.

EKPC considered the possibility of constructing the Cooper-Alcalde line at 345 kV rather than 161 kV. However, there are limited benefits to increasing the voltage level of the new line to 345 kV, and these benefits do not justify the significant additional costs that would be incurred for construction of a 345 kV line.

Q. OUT OF THE ALTERNATIVES THAT EKPC REVIEWED, WAS THE PROPOSED PROJECT THE MOST REASONABLE OPTION? IF SO, WHAT MADE IT THE MOST REASONABLE OPTION?

A. For the reasons I discussed above, the proposed project that involves building a Cooper-Alcalde 161 kV double-circuit line is the most reasonable option considered. This option requires a relatively small increase in scope; building an approximate ~~5.25-mile~~ 4.54-mile line, but with double-circuit structures on this route rather than single-circuit structures, plus an additional 161 kV line exit at each terminus substation. That small increase in scope provides substantial benefits in terms of reduction in flows on existing facilities and elimination of one major transmission line upgrade on the LG&E/KU transmission system. Furthermore, additional reduction in system energy losses will result by adding the second circuit between the Cooper and Alcalde substations. Therefore, the construction of the Cooper-Alcalde double-circuit 161 kV line is a robust and efficient transmission plan to ensure that the Liberty RICE and Cooper CCGT stations have sufficient transmission capacity to reliably and economically operate to the benefit of EKPC's Owner-Members.

Q. HAS THE COST OF THE COOPER-ALCALDE 161 KV LINE PROJECT INCREASED FROM WHAT WAS ASSUMED AS PART OF THE OVERALL TRANSMISSION COST IN CASE NO. 2024-00370?

A. Yes, the current cost estimate is $24.13 million (including the LGE/KU 161 kV expansion at Alcalde Substation to provide necessary terminal equipment for the new line connections). This is an increase of $12.98 million compared to the $11.15 million cost estimate that was included in Case No. 2024-00370. Mr. Spencer's testimony explains the reasons for the estimated cost increase for the project. Even with the increased cost, EKPC's analysis indicates that the Cooper-Alcalde 161 kV double-circuit line provides the best system performance to accommodate the addition of the Cooper CCGT. In fact, the overall transmission costs necessary to address all transmission-system overloads is lower with this double-circuit line than without a new line or with only a single-circuit line. As I discussed earlier, the overall cost of transmission upgrades to eliminate overloads due to the Cooper CCGT is $184.1 million without a new Cooper-Alcalde line. This estimated overall cost is reduced to $140.3 million with a single-circuit Cooper-Alcalde line, and is further reduced to $112.7 million if the scope is modified from a single-circuit line to a double-circuit line. Therefore, the Cooper-Alcalde double-circuit line provides the most efficient and cost-effective overall transmission plan.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

ATTACHMENT DA-1

EKPC NEW GENERATION TRANSMISSION ANALYSIS REPORT

Prepared by EKPC Transmission Planning
October 2025

Contents

CERTIFICATION

I certify, as a Professional Engineer licensed in the state of Kentucky, that this report was produced under my direct supervision. The engineering analyses documented in this report were also conducted under my direct supervision.

By: ______________________

Darrin Adams, P.E. (KY License #23964)

Date: 10/23/2025

STATE OF KENTUCKY
DARRIN W. ADAMS
23964
LICENSED
PROFESSIONAL ENGINEER

1.0 Executive Summary

In support of the future generation portfolio plans of East Kentucky Power Cooperative ("EKPC"), the EKPC Transmission Planning Team evaluated the transmission system needs related to the planned natural gas fired generation facilities EKPC plans to construct in Casey and Pulaski counties. EKPC has received approval for two Certificates of Public Convenience and Necessity ("CPCN") from the Kentucky Public Service Commission ("KY PSC") and submitted applications to PJM Interconnection, LLC ("PJM") a Regional Transmission Organization ("RTO") regulated by the Federal Energy Regulatory Commission ("FERC") for the following generation facilities:

- Liberty RICE[1] – a 214/214 net megawatts ("MW") (summer/winter) reciprocating internal combustion engine plant
- Cooper CCGT[2] – a 761/789 net MW (summer/winter) combined cycle generation plant

In each of these KY PSC cases, EKPC provided a report documenting the methodology and results of the analysis performed to determine the transmission system needs as a result of these generation facility additions. Projects and costs identified in those reports can be seen below in Table 1.1, indicated in the columns labeled "CPCN Case" with a check mark.

At the time, EKPC presented the transmission needs identified for each generation facility analyzed throughout the strategic planning and selection of EKPC's future generation portfolio needed to serve its growing system load. This strategic planning and selection process originated in August 2022 when EKPC transmission planning began evaluating various generation scenarios using system models developed during that year. Due to this lengthy strategic planning and selection process, the results presented at the time that the CPCN cases were filed relied on model information and assumptions that were developed when the planning process began in 2022. This enabled consistent evaluation of scenarios back to the origination of the planning process for the generation facilities, but now provides modified results given the various model changes that have been identified in the intervening time period.

Since the filing of the CPCN applications, EKPC has developed updated system models (2025 Series) as part of the annual model build process. EKPC's annual model build process is a joint effort with Louisville Gas & Electric/Kentucky Utilities ("LG&E/KU") to ensure both parties have pertinent model data to effectively operate and plan the interconnected transmission system. In addition, EKPC has received preliminary results from the first phase of PJM's System Impact Studies for the generation interconnection cycle that includes the Cooper CCGT facility (but not the Liberty RICE facility). EKPC has also coordinated with LG&E/KU for a preliminary affected system study as part of a joint effort to identify transmission system needs prior to an official request via the PJM queue process. LG&E/KU's preliminary affected system analysis has provided more accurate information that has resulted in an increased number and scope of reinforcement projects on the LG&E/KU transmission system necessary to accommodate the power flows created by Liberty RICE and Cooper CCGT. Projects and costs identified based on the most current model information, including the LG&E/KU preliminary affected system study results, are listed below in Table 1.1, indicated in the column labeled "Update" with a check mark.

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[1] Liberty RICE: EKPC's plans as stated in the Kentucky Public Service Commission Case No. 2024-00310

[2] Cooper Station: EKPC's plans as stated in the Kentucky Public Service Commission Case No. 2024-00370

Table 1.1: Comparison Liberty RICE & Cooper CCGT Transmission Needs Comparison – Current Analysis versus Prior Analysis

Generation	Project	Scenario: Prior CPCN Case	Scenario: Update	Cost ($ in Millions): Prior CPCN Case	Cost ($ in Millions): Update
Liberty RICE	Construct a new 161 kV Switching Station ("Liberty RICE Substation") along the Casey County-Liberty Junction 161 kV Line	✓	✓	$12.00	$12.00
	Construct necessary transmission line facilities to loop the existing Casey County-Liberty Junction 161 kV Line into the new Liberty RICE Substation	✓	✓	$1.50	$1.50
	Install OPGW on the Liberty RICE - Casey County 161 kV Line (6.6 miles)	✓	✓	$0.80	$0.80
	Install OPGW on the Liberty RICE - Liberty Junction 161 kV Line (7.4 miles)	✓	✓	$1.01	$1.01
	Rebuild the LIberty RICE-Liberty Junction 161 kV Line using 795 MCM ACSR conductor (7.8 miles)	✓	✓	$13.70	$13.70
	Increase the maximum conductor operating temperature ("MOT") of the 636 MCM ACSR conductor in the Liberty RICE-Casey County 161 kV Line to 212 degrees F (6.2 miles)	✓	✓	$1.95	$1.95
	Increase the MOT of the 795 MCM ACSR conductor in the Marion County-Marion County Industrial Park Tap 161 kV Line to 212 degrees F (4.0 miles)	✓	✓	$1.15	$1.15
	Rebuild the Marion County-Lebanon 138 kV Line using 954 ACSR conductor (0.1 mile)	✓	✓	$0.20	$0.20
	Install a 100 MVA transformer at Liberty Jct to replace the existing 93 MVA unit.	✗	✓	-	$4.00
	Lebanon 138/69 transformer overloads: Add a second transformer at or near Lebanon.	✗	✓	-	$9.20
	Campbellsville Tap-Taylor Co 69 kV line: reconductor 0.38 miles using a minimum of 397 ACSR conductor	✗	✓	-	$0.95
	Mile Lan Tap-Campbellsville 69 kV line: Reconductor 2.21 miles with 556.5 MCM 26X7 ACSR.	✗	✓	-	$5.53
	Lebanon-Springfield KU 69 kV: Reconductor 6.58 miles with 556.5 MCM 26X7 ACSR.	✗	✓	-	$16.45
			Total	**$32.31**	**$68.44**
Cooper CCGT	Construct a new 161 kV substation for termination of the combined-cycle units (3 GSUs) and re-terminate existing Cooper-Laurel Dam and Cooper-Denny 161 kV lines into the new substation.	✓	✓	$25.00	$25.00
	Construct a new Cooper Alcalde 161 kV line (4.54 ~~5.25~~ miles) using 1272 ACSS conductor	✓	✓	$11.15	$15.10
	Replace all 161 kV circuit breakers at Cooper with 63 kA breakers.	✓	✓	$3.00	$3.00
	Rebuild the Cooper-Elihu 161 kV line (4.2 miles) using 1272 ACSS conductor	✓	✓	$10.33	$10.33
	Increase the MOT of the Laurel Dam-Laurel County 161 kV line (13.5 miles) to 212 degrees F	✓	✓	$3.85	$3.85
	Rebuild the South Lancaster-Garrard County 69 kV line (1.8 miles) using 556 ACSR conductor	✓	✗	$1.82	-
	Upgrade the Cooper 161/69 kV transformer with a 200 MVA unit, and purchase a spare 200 MVA transformer	✓	✓	$6.70	$6.70
	Upgrade the Marion County 161/138 kV transformer with a 300 MVA unit and purchase a spare 300 MVA transformer.	✓	✓	$8.83	$8.83
	Increase the MOT of the Casey County-Marion County 161 kV line (17.8 miles) to 212 degrees F	✓	✓	$5.08	$5.08
	Rebuild the Cooper - Laurel River Dam 161 kV line with 954 ACSR to replace the existing 795 ACSR conductor. (17.32 miles)	✗	✓	-	$19.80

	Rebuild the Cooper - Somerset 69kV double circuit line with 556 ACSR replacing the existing 266 ACSR conductor. (3.2 miles)	✗	✓	-	$5.03
	Increase the MOT on Taylor Co Jct-AF1-038 795 ACSR conductor to 212 degrees F. (0.92 miles)		✓	-	$0.28
	KU constructs a 345 kV bus at the Alcalde substation and installs a 2nd Alcalde 345/161 kV transformer	✓	✓	$18.00	$24.60
	KU expands the 161 kV bus at the Alcalde substation to accommodate the new Cooper – Alcalde 161 kV circuit.	✗	✓	-	$2.00
	Lebanon-Springfield KU 69 kV: Reconductor 6.58 miles with 556.5 MCM 26X7 ACSR.[1]	✓	✗	$9.78	-
	Alcalde-Elihu 161kV line: Reconductor 2.94 miles with 954 ACSS[2]	✓	✓	$5.90	$0.00
	Alcalde-Farley 161 kV: MOT increase of the existing line (27.19 miles)	✓	✓	$11.69	$20.40
	Farley – Artemus Tap 161 kV: MOT increase of the existing line (12.77 miles)	✓	✗	$5.49	
	Springfield KU- N Springfield 69 kV line: reconductor 3.24 miles of line with 397.5 MCM 18X1 ACSR	✗	✓	-	$8.10
	Corbin East-Sweet Hollow 69 kV line: reconductor 2.2 miles using a minimum of 556 ACSR conductor	✗	✓	-	$5.50
	Corbin 1-Corbin 2 69 kV line: reconductor 0.67 miles using a minimum of 556 ACSR conductor	✗	✓	-	$1.68
			Total	**$126.60**	**$165.28**
			Grand Total	**$158.91**	**$233.72**

Liberty RICE	**Cooper CCGT**	**New EKPC**	**LG&E/KU RICE**	**LG&E/KU Cooper CCGT**

Table 1.1 shows that the number of transmission projects necessary due to EKPC's new generation facilities has increased for both Liberty RICE and Cooper CCGT in the updated analysis. The estimated transmission cost increases are approximately $36.13 million for Liberty RICE and $38.69 million for Cooper CCGT. These changes are primarily attributable to the following:

- Various system modelling changes between EKPC's 2022 and 2025 Series models.
- Increased net generation injected into the EKPC transmission system for the Cooper CCGT facility (71 MW (summer) and 15 MW (winter)).
- 2,200 MW load added in the Maysville area, south of EKPC's Spurlock Station.
- Additional assumed generation facilities added on the EKPC and LG&E/KU transmission systems in the area.
- Updated information regarding LG&E/KU thermal overloads and costs to address.

Significant planned generation developments in the immediate area near the Liberty RICE and Cooper CCGT projects result in additional transmission needs in the area. Most notably, a 145 MW solar installation at LG&E/KU's Lebanon substation resulted in the need for additional reinforcement projects identified in the surrounding area with the addition of the Liberty RICE and Cooper CCGT facilities. In

[1] Project identified in EKPC initial analysis related to the Cooper CCGT, LG&E/KU results identified the project needed due to Liberty RICE. Cost total for the update does not reflect this project for Cooper CCGT.

[2] LG&E/ KU has an existing project to replace the conductor in the Alcalde to Elihu 161kV line. There is no cost included, since it is expected that the new conductor will provide the sufficient capacity needed after the generation additions. This line item will be removed from all future tables displaying projects and cost.

addition, the previously presented transmission projects relied on the assumption that the Liberty RICE and Cooper CCGT generating facilities would produce 216/216 MW and 690/774 MW (summer/winter) of net generation respectively. Since filing, EKPC has determined that the net output of the Cooper CCGT facility is 761/789 MW (summer/winter) and 214/214 MW (summer/winter) for Liberty RICE.

The notable net generation model differences between the 2022 and 2025 series models are summarized in Table 1.2 below, with significant differences being shown in green.

Table 1.2: Notable Generation Differences for 2022 vs. 2025 Models Used for EKPC's Analysis

Generator Location	Net Output (MW)			
	2032S 22Series	2030S 25Series	2032W 22Series	2030W 25Series
LG&E/KU's Lebanon 138 kV Station	0	145	0	0
LG&E/KU's Mill Creek 345 kV Station	0	661	0	676
Cooper Station	922	993	997	1012
Liberty RICE Station	216	214	216	214
Eighty-Eight Station	0	55	0	0
Avon 138kV Station	0	40	0	0

Given the increase in the number and cost of identified reinforcement projects related to the model updates discussed in Table 1.2, EKPC Transmission Planning evaluated the need for an additional high voltage transmission line or lines near Cooper Station. The additional transmission line(s) would allow another path for power to flow from the generating facilities to the surrounding transmission system. This would decrease the number and/or severity of thermal overloads of the existing transmission infrastructure in the vicinity of the new generating facilities. These new additions are deemed necessary to accommodate the increased generating capacity in the area and minimize the impact that the planned new generation has on the existing transmission system., Therefore, the overall cost of reinforcement projects EKPC expects to be required will be reduced. This evaluation resulted in the recommendation to construct a new 4.54 ~~5.25~~ mile double-circuit 161 kiloVolt ("kV") transmission line from EKPC's new Cooper Station CCGT substation to LG&E/KU's existing Alcalde substation, instead of the previous assumed addition of a new single circuit 161 kV Cooper CCGT to Alcalde transmission line. This new double-circuit line proves to be the most cost effective and reasonable solution to provide adequate transmission capacity in order to allow EKPC's existing and planned future generation resources to operate in a reliable and economical manner. The estimated costs for the overall transmission plan that includes this new Cooper-Alcalde 161 kV double circuit line is shown below in Table 1.3.

Table 1.3: Liberty RICE and Cooper CCGT Transmission Needs with Cooper-Alcalde Double Circuit 161 kV (4.54 ~~5.25~~ miles)

Generation	Project	Needed	Cost ($ in Millions)
Liberty RICE	Construct a new 161 kV Switching Station ("Liberty RICE Substation") along the Casey County-Liberty Junction 161 kV Line	✔	$12.00
	Construct necessary transmission line facilities to loop the existing Casey County-Liberty Junction 161 kV Line into the new Liberty RICE Substation	✔	$1.50
	Install OPGW on the Liberty RICE - Casey County 161 kV Line (6.6 miles)	✔	$0.80
	Install OPGW on the Liberty RICE - Liberty Junction 161 kV Line (7.4 miles)	✔	$1.01
	Rebuild the Liberty RICE-Liberty Junction 161 kV Line using 795 MCM ACSR conductor (7.8 miles)	✔	$13.70

	Increase the MOT of the 636 MCM ACSR conductor in the Liberty RICE-Casey County 161 kV Line to 212F (6.2 miles)	✓	$1.95
	Increase the MOT of the 795 MCM ACSR conductor in the Marion County-Marion County Industrial Park Tap 161 kV Line to 212F (4.0 miles)	✓	$1.15
	Rebuild the Marion County-Lebanon 138 kV Line using 954 MCM ACSR conductor (0.1 mile)	✓	$0.20
	Install a 100 MVA transformer at Liberty Jct to replace the existing 93 MVA unit.	✗	N/A
	Lebanon 138/69 transformer overloads: Add a second transformer at or near Lebanon.	✓	$9.20
	Campbellsville Tap-Taylor Co 69 kV line: reconductor 0.38 miles using a minimum of 397 ACSR conductor	✓	$0.95
	Mile Lan Tap-Campbellsville 69 kV line: Reconductor 2.21 miles with 556.5 MCM 26X7 ACSR	✓	$5.53
	Lebanon-Springfield KU 69 kV: Reconductor 6.58 miles with 556.5 MCM 26X7 ACSR	✓	$16.45
		Total	**$64.44**
Cooper CCGT	Construct a new 161 kV substation for termination of the combined-cycle units (3 GSUs) and re-terminate existing Cooper-Laurel Dam and Cooper-Denny 161 kV lines into the new substation.	✓	$25.00
	Construct a new double-circuit Cooper Alcalde 161 kV line (4.54 ~~5.25~~ miles) using 1272 ACSS conductor	✓	$20.13
	Replace all 161 kV circuit breakers at Cooper with 63 kA breakers.	✓	$3.00
	Rebuild the Cooper-Elihu 161 kV line (4.2 miles) using 1272 ACSS conductor	✓	$10.33
	Increase the MOT of the Laurel Dam-Laurel County 161 kV line (13.5 miles) to 212F	✓	$3.85
	Rebuild the South Lancaster-Garrard County 69 kV line (1.8 miles) using 556 ACSR conductor	✗	N/A
	Upgrade the Cooper 161/69 kV transformer with a 200 MVA unit, and purchase a spare 200 MVA transformer	✓	$6.70
	Upgrade the Marion County 161/138 kV with a 300 MVA unit, and purchase a spare 300 MVA transformer.	✓	$8.83
	Increase the MOT of the Casey County-Marion County 161 kV line (17.8 miles) to 212F	✓	$5.08
	Rebuild the Cooper - Laurel River Dam 161 kV line with 954 ACSR to replace the existing 795 ACSR conductor. (17.32 miles)	✗	N/A
	Rebuild the Cooper - Somerset 69kV double circuit with 556 ACSR replacing the existing 266 ACSR conductor. (3.2 miles)	✗	N/A
	Increase MOT on Taylor Co Jct-AF1-038 795 ACSR conductor to 212F. (0.92 miles)	✓	$0.28
	KU constructs a 345 kV bus at the Alcalde substation and installs a 2nd Alcalde 345/161 kV transformer	✓	$24.60
	KU expands the 161 kV bus at the Alcalde substation to accommodate the new Cooper – Alcalde 161 kV double circuit.	✓	$4.00
	Alcalde-Farley 161 kV: Increase MOT of the existing line 27.19 miles.	✓	$20.40
	Corbin East-Sweet Hollow 69 kV line: reconductor 2.2 miles on the using a minimum of 556 ACSR conductor	✓	$5.50
		Total	**$137.70**
		Grand Total	**$202.14**

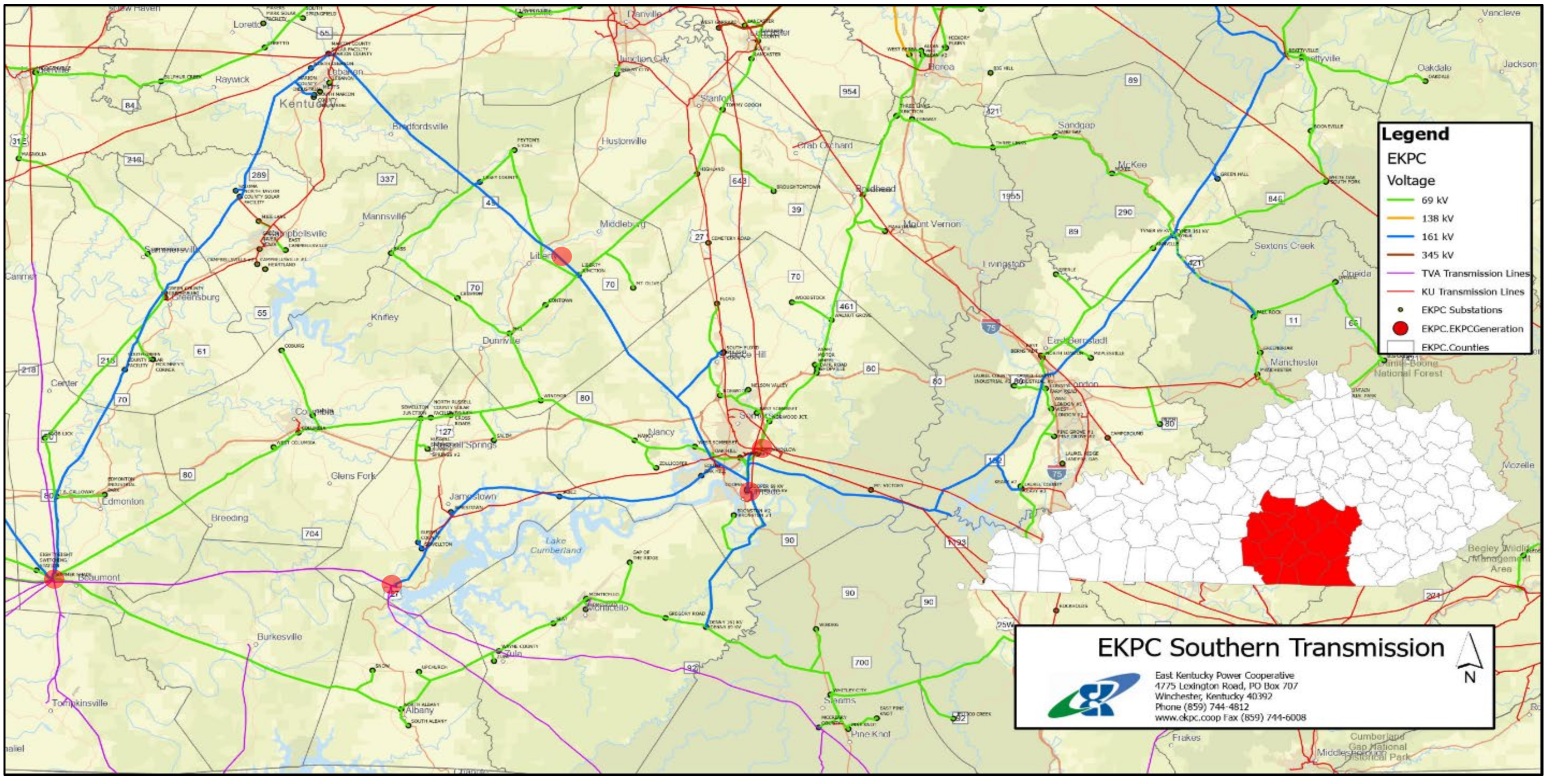
Liberty RICE	**Cooper CCGT**	**New EKPC**	**LG&E/KU RICE**	**LG&E/KU Cooper CCGT**

The studies performed by EKPC's Transmission Planning staff combined with initial PJM Queue study results, as well as LG&E/KU's collaboration with EKPC to perform a preliminary affected system analysis has allowed EKPC to better forecast the total transmission project costs associated with new planned generation at Liberty RICE and Cooper CCGT. The current expected cost for the transmission interconnection and identified transmission reinforcements is $203.42 million. This is a net increase of $43.23 million above the initial expected transmission costs associated with the Liberty RICE and Cooper CCGT projects ($32.31 million and $126.60 million respectively) but a $31.59 million decrease from the updated cost under the assumption EKPC proceeds with the single circuit Cooper – Alcalde 161 kV line. With the updated models and updated costs from LG&E/KU, the incremental cost increase of the single-circuit to double circuit scope change provides a more economical and efficient solution to enable the increased generation level in EKPC's southern portion of the transmission system to effectively supply its load.

2.0 Introduction

The EKPC transmission system in the southern portion of Kentucky, extending eastward from Summer Shade, KY in Metcalfe County to Tyner, KY in Jackson County was evaluated by the EKPC Transmission Planning Team to determine future transmission system needs as a result of EKPC's future generation portfolio plans in the area (Liberty RICE and Cooper Station CCGT). A current system map of the area is shown in Figure 2.1.

Figure 2.1: EKPC Southern Portion Area Map



The southern portion of the EKPC transmission system relies on four existing main sources to serve the electric demands of the member-owner cooperatives in the area. These sources consist of:

- Cooper Station, a coal-fired generation facility in Pulaski County;
- Free-flowing 161 kiloVolt ("kV") interconnections with Tennessee Valley Authority ("TVA") in Metcalfe County between TVA's Summer Shade substation and EKPC's Summer Shade substation
- Wolf Creek Dam, a United States Army Corps of Engineers hydroelectric generation facility in Russell County
- The free-flowing 161 kV interconnection with Louisville Gas & Electric/Kentucky Utilities ("LG&E/KU") in Pulaski County (Alcalde – Elihu – Cooper 161 kV).

EKPC's planned generation facilities -- "Liberty RICE" in Casey County and "Cooper CCGT" in Pulaski County -- that are planned to be operational by December 2028 and June 2030 respectively, will provide new/increased generation sources within the area. The four main existing sources and the additional Cooper CCGT and Liberty RICE sources are shown by the shaded circles on Figure 2.1.

The addition of the new Liberty RICE source and the substantial increase in output at the Cooper Station source will create constraints on the existing transmission system due to the significant impact on power flows in the region created by adding approximately 1 GW of new generation capacity in the area.

3.0 Area Transmission/Generation Plan

The basis of the analyses described herein considers the following:

- Potential deactivation of the coal-fired Cooper Unit 1 at Cooper Station,
- Installation of twelve (12) – Reciprocating Internal Combustion Engines (“RICE”) near the city of Liberty in Casey County, KY (“Liberty RICE”),
- Installation of a two-on-one combined cycle gas-turbine power generation plant at Cooper Station (“Cooper CCGT”),
- 100% re-firing Cooper Unit 2 with natural gas (“Cooper Unit 2”), resulting in no change in net output of the unit (240 MW gross output).

The Liberty RICE installation was assumed to provide 214/214 MW (summer/winter) of net generation to be injected into the EKPC transmission system. The Liberty RICE installation is to be connected along the Liberty Junction – Casey County 161 kV transmission line, approximately 7.4 miles from the Liberty Junction substation. The site and preliminary interconnection details for the Liberty RICE facility can be found below in Figures 3.1 and 3.2.

EKPC plans to interconnect the new Liberty RICE facility to the existing transmission system by:

- Constructing a new 161 kV Switching Station ("Liberty RICE Substation") along the Casey County-Liberty Junction 161 kV Line
- Constructing necessary transmission line facilities to loop the existing Casey County-Liberty Junction 161 kV Line into the new Liberty RICE Substation
- Installing OPGW on the Liberty RICE - Casey County 161 kV Line (6.6 miles)
- Installing OPGW on the Liberty RICE - Liberty Junction 161 kV Line (7.4 miles)

The Cooper CCGT installation was assumed to provide 761/789 MW (summer/winter) of net generation to be injected into the EKPC transmission system for this latest analysis. The Cooper CCGT installation is to be connected via the existing transmission infrastructure located at EKPC’s Cooper Station in conjunction with construction of a new 161 kV substation (“Cooper CCGT Substation”) adjacent to the existing Cooper Station 161 kV switchyard. The site and preliminary interconnection details for the Cooper CCGT can be found below in Figures 3.3 and 3.4.

EKPC plans to interconnect the new Cooper CCGT facility to the existing transmission system by:

- Constructing a new 161 kV substation in a breaker-and-a-half configuration (“Cooper CCGT Substation”)
- Constructing transmission line extensions from the existing nearby Cooper-Laurel Dam and Cooper-Denny 161 kV lines (estimated length of the extensions is less than 1 mile) in order to connect those lines in/out of the new Cooper CCGT Substation.

The transmission projects and estimated costs associated with the physical-interconnection requirements can be found in Table 3.1.

Figure 3.1 Liberty RICE Installation Location

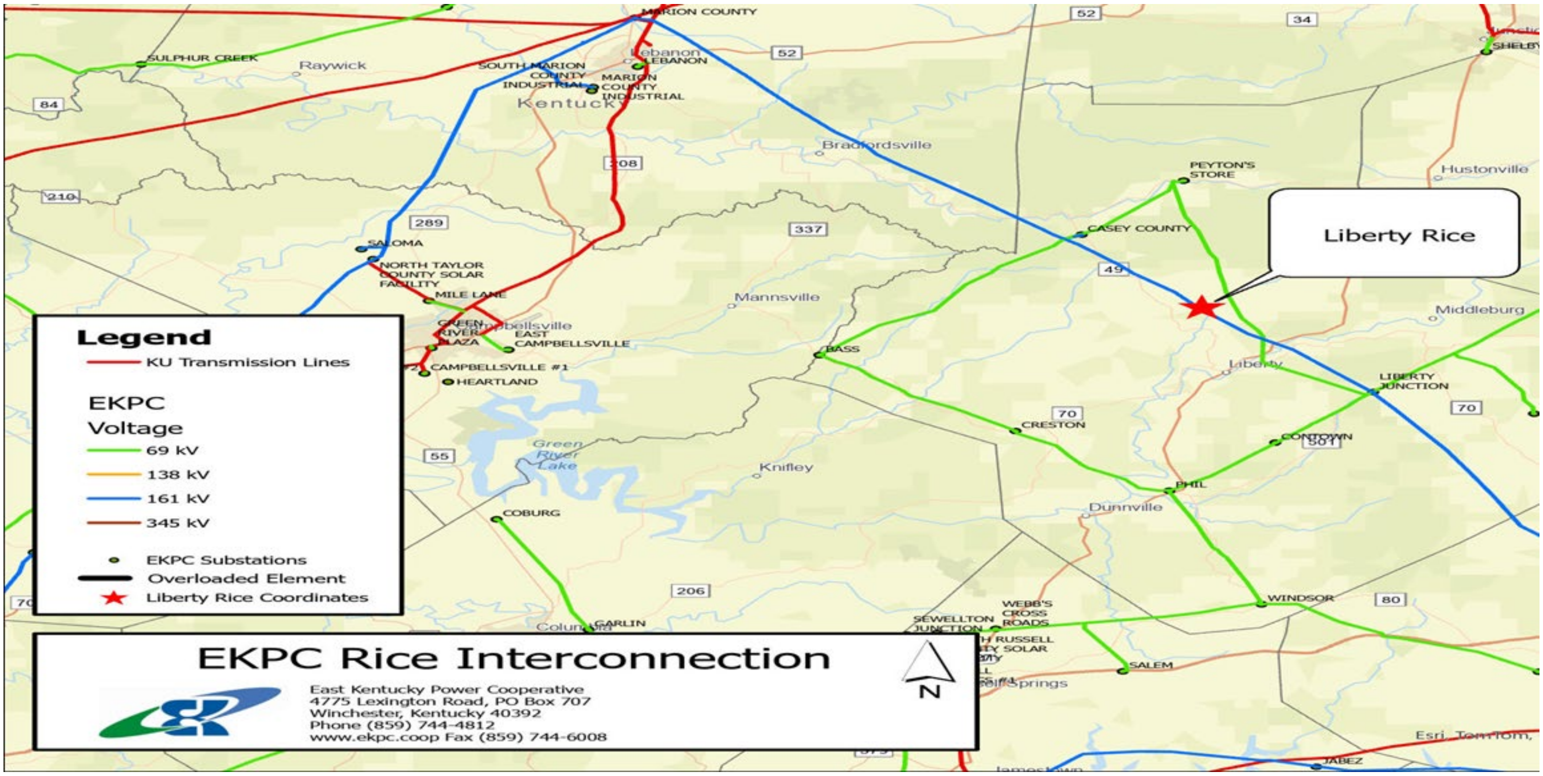


Figure 3.2 RICE Preliminary Interconnection Details

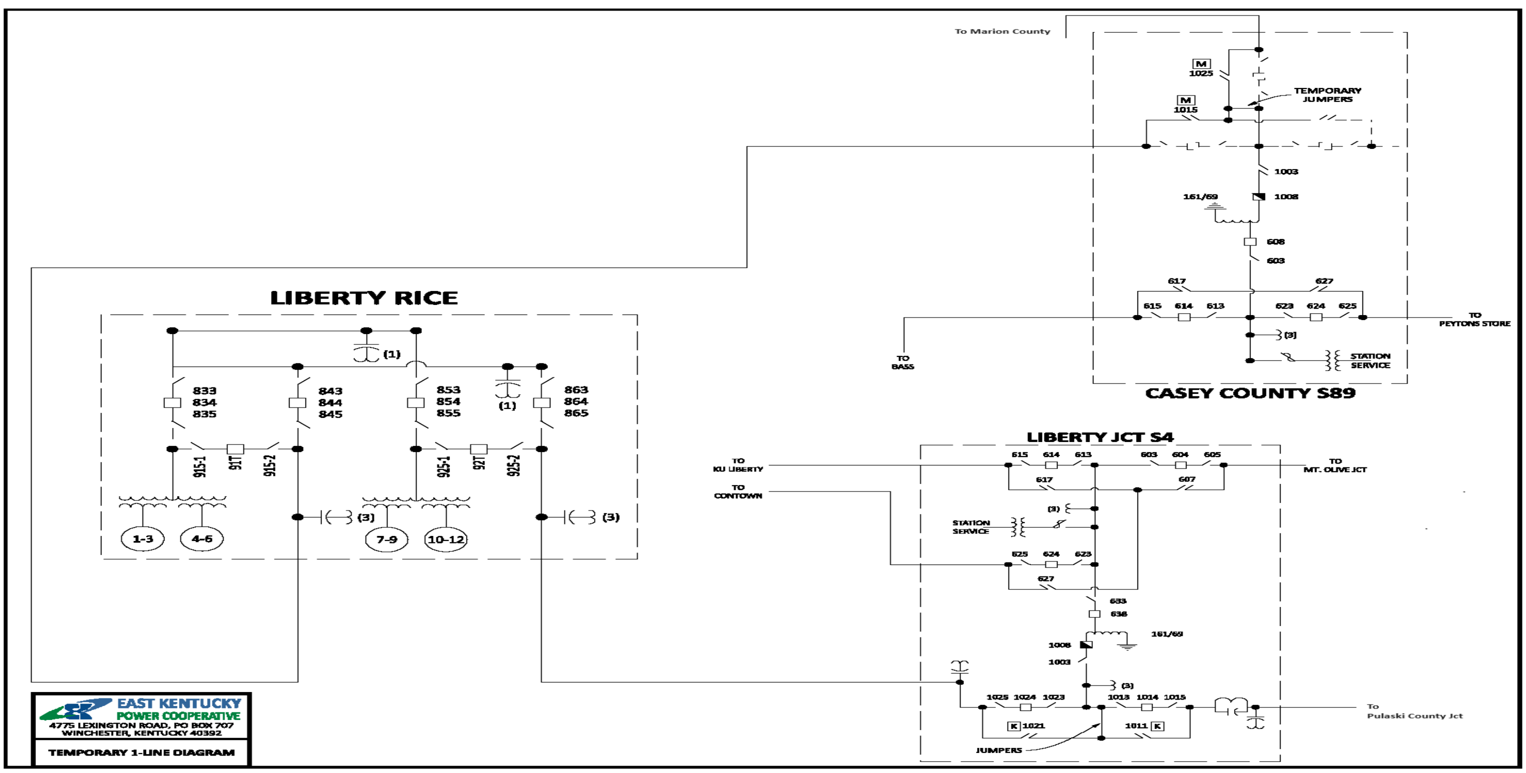


Figure 3.3 Cooper CCGT Plant Location

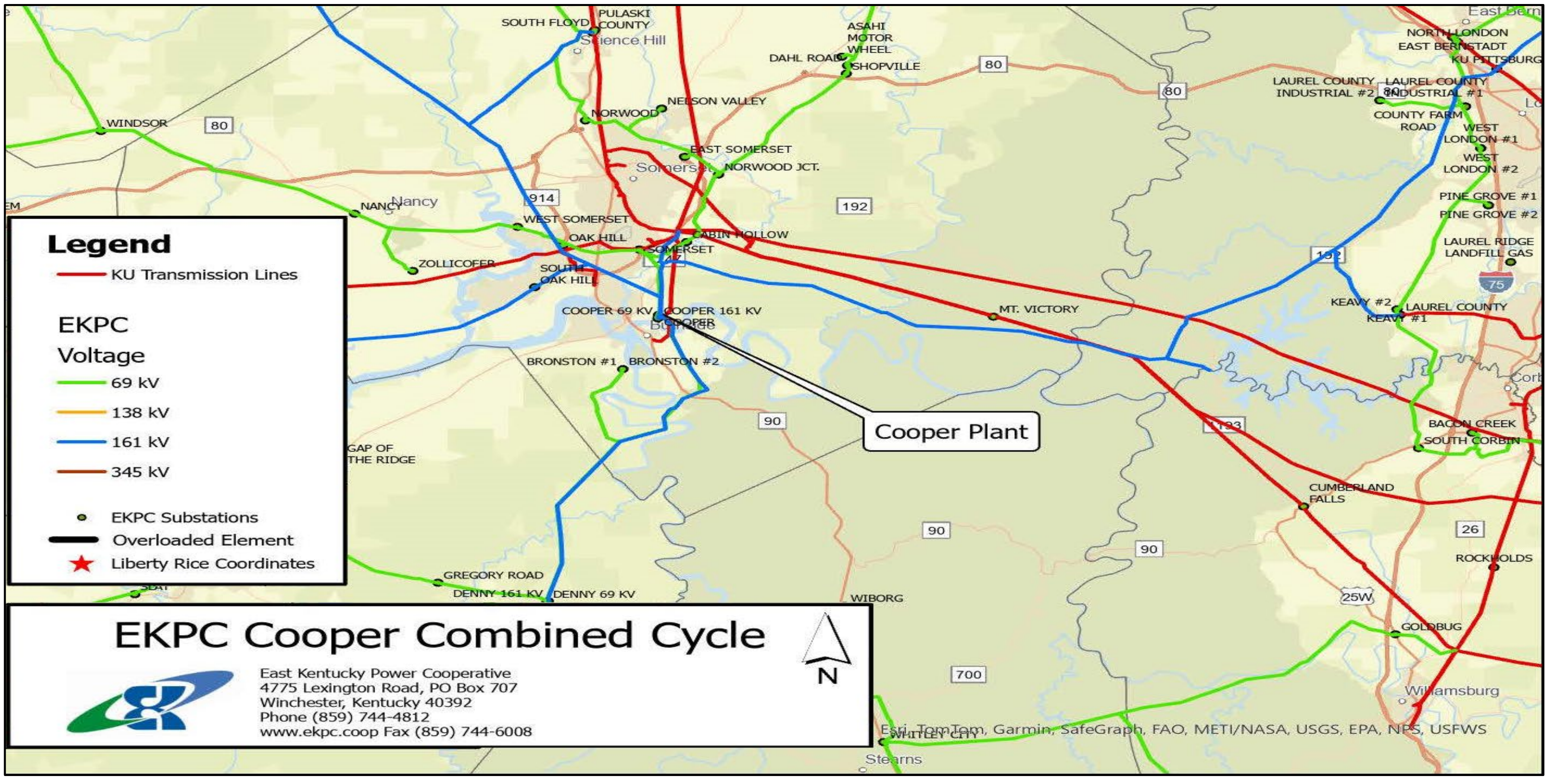


Figure 3.4 Cooper CCGT Plant Interconnection Detail

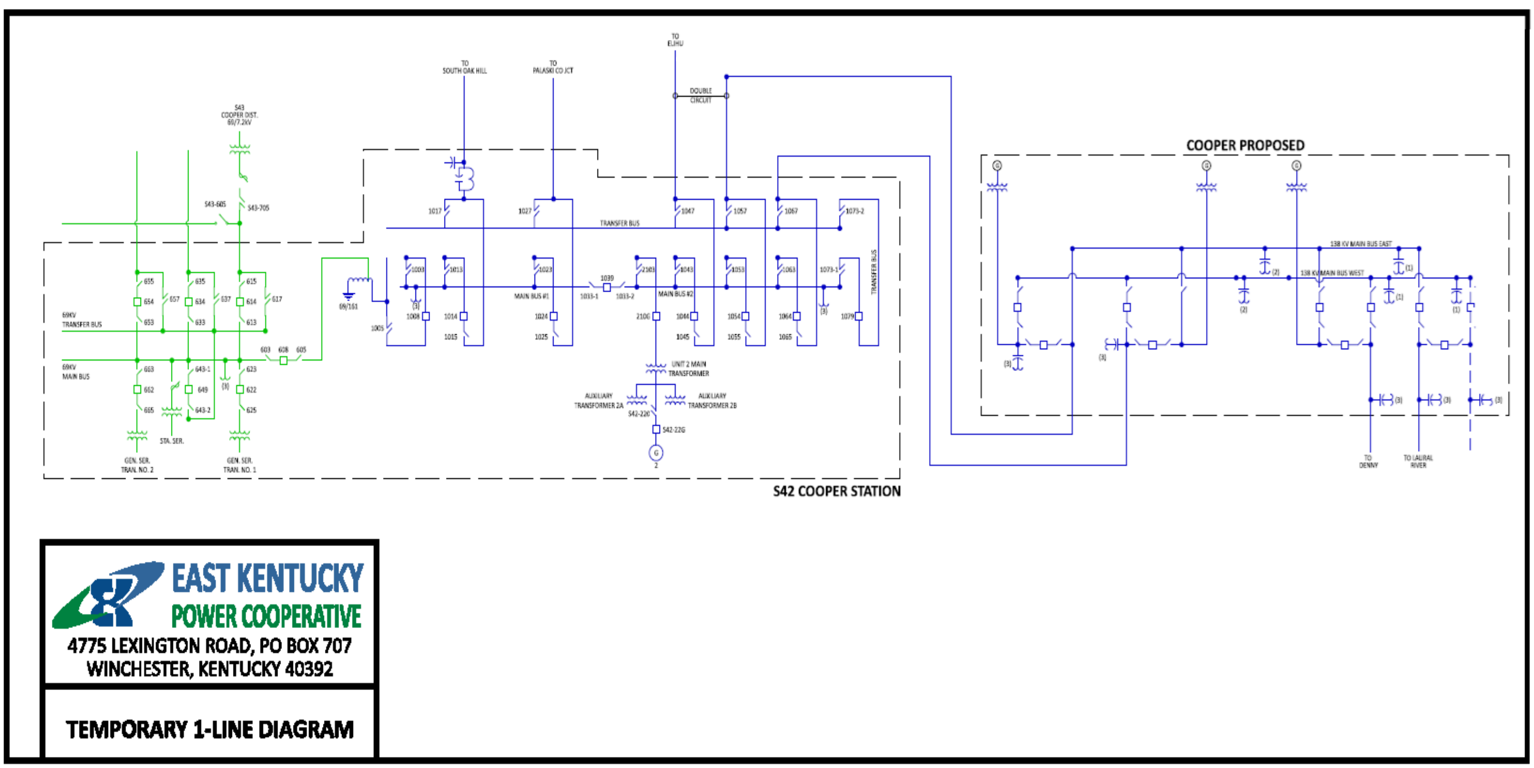


Table 3.1 Liberty RICE and Cooper CCGT Physical Interconnection Projects and Estimated Cost

Transmission Project Description	Estimated Cost ($MM)
Liberty RICE	
Construct a new 161 kV Switching Station ("Liberty RICE Substation") along the Casey County-Liberty Junction 161 kV Line	$12.00
Construct necessary transmission line facilities to loop the existing Casey County-Liberty Junction 161 kV Line into the new Liberty RICE Substation	$1.50
Install OPGW on the Liberty RICE - Casey County 161 kV Line (6.6 miles)	$0.80
Install OPGW on the Liberty RICE - Liberty Junction 161 kV Line (7.4 miles)	$1.01
TOTAL	**$15.31**
Cooper CCGT	
Construct a new 161 kV substation for termination of the combined-cycle units (3 GSUs) and re-terminate existing Cooper-Laurel Dam and Cooper-Denny 161 kV lines into the new substation.	$25.00
TOTAL	**$25.00**

4.0 Study Methodology, Criteria and Assumptions

The power-flow analyses were performed in an effort to identify transmission reinforcement projects necessary to facilitate the increased power flows in the area due to the installation of the Liberty RICE and Cooper CCGT generating facilities. Cost estimates were then developed based on planning-level values compiled from previously executed projects of similar scope.

These power-flow analyses include modeled generation for EKPC's plans as stated in the Kentucky PSC cases listed below:

- No. 2024-00310 - for a new reciprocating internal combustion engine generating facility in Casey County, KY (Liberty RICE), which proposes to inject approximately 214/214 MW (summer/winter) of net generation into the EKPC transmission system
- No. 2024-00370 – for a new two-on-one combined cycle gas turbine facility in Pulaski County, KY (Cooper CCGT), which proposes to inject approximately 761/789 MW (summer/winter) of net generation into the EKPC transmission system.

Modeling these generation additions identified in the referenced PSC cases enables EKPC to identify transmission reinforcements necessary to accommodate the increased generation injected into the transmission system in the area.

4.1 Analysis Approach (EKPC)

EKPC has coordinated with LG&E/KU to request a preliminary affected-system study to identify expected impacts on the LG&E/KU system and associated transmission projects to address those impacts. Results from this coordinated study and associated projects to address the impacts of the new Liberty RICE and Cooper CCGT are below in Section 5. Due to this coordinated request, EKPC performed power flow analysis to adhere to its own planning criteria as listed in EKPC FERC Form 715, as well as PJM's planning criteria, and incorporated LG&E/KU's study results as provided to EKPC.

Power-flow analysis (using Siemens PSS/E version 35.6 and PowerGEM TARA version 2302.2 software packages) was performed to identify any future planning-criteria violations and associated mitigation projects in the southern portion of the EKPC transmission system after installation of EKPC's planned Liberty RICE and Cooper CCGT facilities. These studies evaluated system performance under normal (N-

0), single-contingency (N-1) and double-contingency (N-1-1) conditions applicable to the EKPC FERC Form 715 criteria and PJM's planning criteria.

The targeted scope of this analysis was to capture thermal-overload conditions related to the added generation on the transmission system. Thermal loading was monitored within the study area and compared with applicable planning criteria.

4.2 Study Cases

The power flow models used were:

- 2025 Series 2030 Summer ("S")
- 2025 Series 2030/2031 Winter ("W")

The power-flow models listed above include all previously planned transmission projects, future known load additions, and PJM Queue projects with signed Generator Interconnection Agreements ("GIA").[1] These models were then updated to reflect the generation and associated transmission physical interconnection plans for Liberty RICE and Cooper CCGT described in Section 3.0 (shown below in Table 4.2 as **Base**). Where applicable, additional generation dispatch simulations were applied to be included in the EKPC FERC Form 715 evaluation (shown below in Table 4.2 as **Generation Dispatch**).

The descriptions of the various models developed and details of changes from the base model can be seen below in Table 4.2.

Table 4.2 Power Flow Models

Model	Generation	Evaluated Condition	Model Year & Season	Loads
Base	- Liberty RICE installation - Cooper CCGT installation	N-0 N-1 N-1-1	2030S 2030/31W	50% probability load forecast
Generation Dispatch	- Base - LG&E/KU Brown 3 generation Offline[2]	N-0 N-1		

4.3 Monitored Area

The monitored area was comprised of EKPC, LG&E/KU and TVA transmission equipment encompassed in the area shown in Figure 2.1. All branch thermal loadings were identified per the study criteria in Tables 4.6.1 and 4.6.2 below.

4.4 Contingency Analysis

EKPC FERC Form 715

Power-flow analysis was performed during single-contingency events (N-1 conditions). This included any pre-established restoration switching procedures to restore substation load. Additionally, contingencies defined in neighboring utilities' (TVA, LG&E/KU) contingency sets were included.

PJM Planning Criteria

Power-flow analysis was performed during single and double contingency events (N-1/N-1-1 conditions). The N-1/N-1-1 analyses included any category P0 – P7 condition as defined in the NERC TPL-001-5 Transmission System Planning Performing Requirements provided in Appendix C of this report. The NERC TPL-001-5 contingencies include defined P0-P7 contingencies for EKPC as well as any neighboring

[1] Associated PJM Queue projects included in the 2030 S and 2030/31 W models can be found in Appendix A.
[2] Replacement generation net imported from the Southern Company

transmission system of the study area for both members and non-members of PJM. The intent of this analysis is to identify potential transmission upgrades that could be required as a proxy until the PJM analysis that is required for the Liberty RICE and Cooper CCGT queue projects has been completed, at which time the "official" set of required transmission upgrades will be defined. PJM will perform N-1 and N-1-1 contingency analysis as applicable to PJM planning criteria.

EKPC performed contingency analysis to adhere to its own criteria, and to project results that PJM is likely to see in its analysis, in order to identify the transmission-reinforcement projects that could potentially be required. PJM has provided Transition Cycle 2 ("TC2") Phase 1 results that included the Cooper CCGT facility in those studies; these results can be seen in Appendix C. The PJM results are in line with the expected thermal overloads EKPC identified in the initial proxy analysis. The initial results from PJM TC2 Phase 1 include the Cooper CCGT facility, but not the Liberty RICE facility. The Cooper CCGT facility was selected as part of PJM's Reliability Resource Initiative ("RRI") that aims to fast-track new generation resources that are beneficial to grid reliability. Cooper CCGT is one of the 51 projects selected by PJM for the RRI initiative. EKPC has supplied PJM with reinforcement projects necessary to mitigate all overloaded facilities identified in Phase 1 results. The results from TC2 Phase 1 identified 93 EKPC overloaded facilities, of which 52 are impacted by the Cooper CCGT generation output. These facilities are highlighted in yellow in the table found in Appendix C. EKPC expects that the supplied reinforcement projects listed in Appendix D will eliminate all of the facility overloads completely when PJM performs its verification analysis in Phase 2 of the TC2 queue cycle. The projects highlighted in yellow in Appendix D are the projects associated with the Cooper CCGT projects.

4.5 Power-Flow Solutions

Load flow solution parameters were consistent across the software platforms used (PSS/E & TARA) and are summarized in Table 4.5.

Table 4.5: Power-Flow Solution Parameters

Contingency	**Solution Methodology**	**Taps**	**Shunts**	**Area Interchange Control**	**DC Taps**	**Phase Shifters**
N-0 N-1 N-1-1	FDNS[1]	Adjusting	Adjusting	Tie Lines and Loads	Adjusting	Locked

4.6 Study Criteria

The study criteria encompassed both EKPC's FERC Form 715 and PJM's planning criteria. Power-flow analyses were performed and evaluated against each of the criteria as applicable. Each set of criteria is summarized in Tables 4.6.1 and 4.6.2.

Table 4.6.1: EKPC FERC Form 715 Criteria

Criteria	Condition	Thermal	
		Normal	Emergency
		Rate A	Rate B
EKPC FERC Form 715	N-0	X	
	N-1		X

Table 4.6.2: PJM Planning Criteria

Criteria	Condition	Thermal

[1] FDNS: Fixed Slope Decoupled Newton-Raphson

		Normal	Emergency
		Rate A	Rate B
PJM Planning	N-0	X	
	N-1		X
	N-1-1	X[1]	X

5.0 Power Flow Analysis and Cost

Power-flow analysis was performed with the base and generation dispatch models to determine the transmission system needs due to the planned generation installed at the Liberty RICE and Cooper CCGT facilities. These results and associated conceptual costs can be found below in Section 5.1.

5.1 Power Flow Analysis Results and Conceptual Costs related to EKPC's New Generation Plan

EKPC transmission planning first analyzed the impact to the transmission system under the assumptions described above without any new greenfield facilities added. This analysis illustrates the significant impacts the additional generation presents on the system in the area.

The transmission system thermal overloads related to the Liberty RICE and Cooper CCGT installation under the assumptions described in Section 4 can be seen on Figure 5.1. Projects identified to relieve identified overloads and the associated conceptual cost estimates can be found in Table 5.1.

[1] Rate A is applied after the first contingency, Rate B is applied after the second contingency.

Figure 5.1 Thermal Overloads

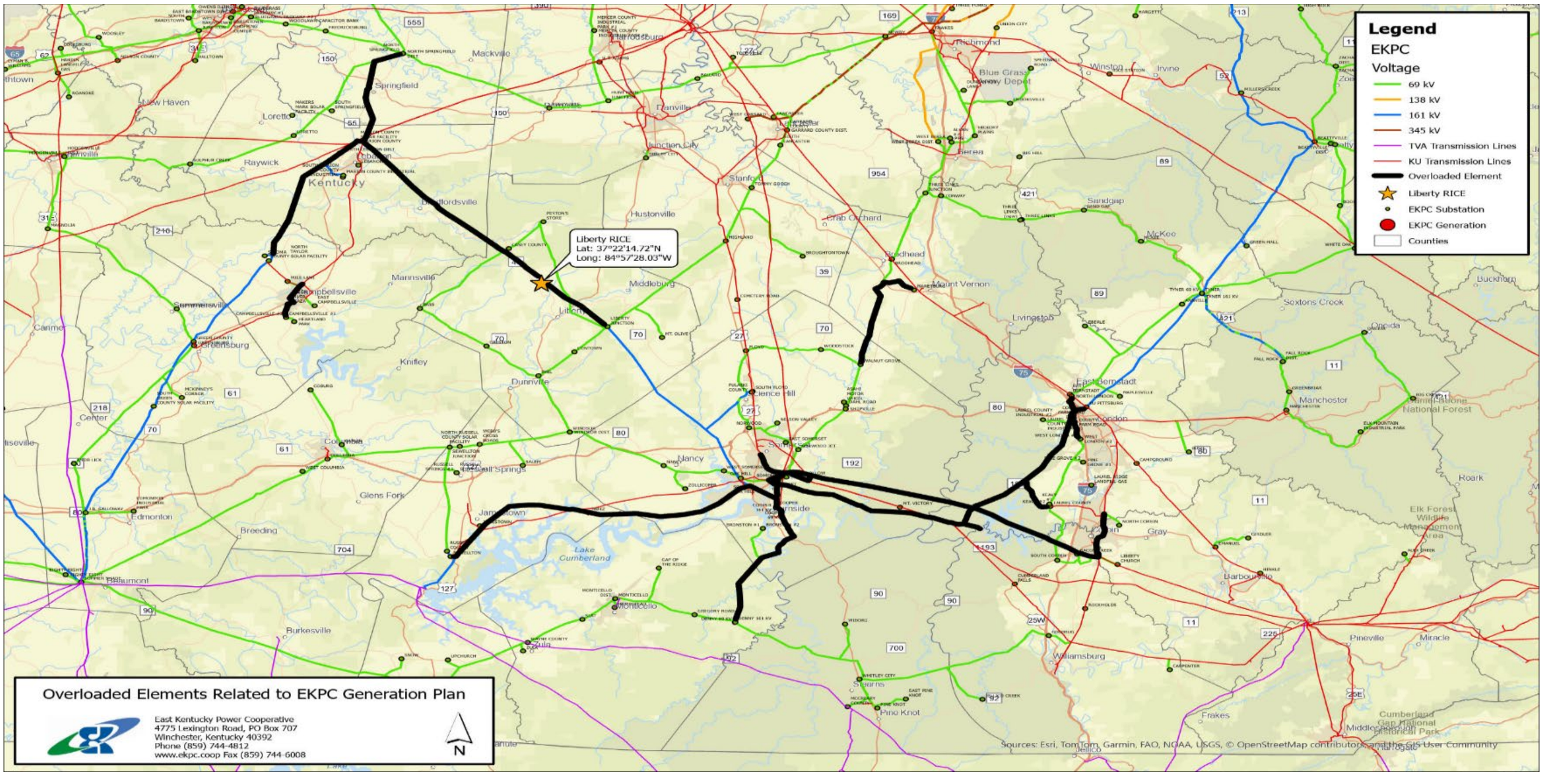


Table 5.1 Identified Transmission Network Upgrades and Estimated Costs

Generation	Project	Estimated Cost ($MM)
Liberty RICE	Rebuild the Liberty RICE-Liberty Junction 161 kV Line using 795 MCM ACSR conductor (7.8 miles)	$13.70
	Increase the MOT of the 636 MCM ACSR conductor in the Liberty RICE-Casey County 161 kV Line to 212F (6.2 miles)	$1.95
	Increase the MOT of the 795 MCM ACSR conductor in the Marion County-Marion County Industrial Park Tap 161 kV Line to 212F (4.0 miles)	$1.15
	Rebuild the Marion County-Lebanon 138 kV Line using 954 MCM ACSR conductor (0.1 mile)	$0.20
	Install a 100 MVA transformer at Liberty Jct to replace the existing 93 MVA unit.	$4.00
	Lebanon 138/69 transformer overloads: Add a second transformer at or near Lebanon.	$9.20
	Campbellsville Tap-Taylor Co 69 kV line: Reconductor 0.38 miles using a minimum of 397 MCM ACSR conductor	$0.95
	Green River Plaza-Campbellsville- 69 kV: Increase MOT and verify from 150F to 170F for 0.52 miles of line	$0.14
	Mile Lane Tap - Campbellsville 69 kV line: Reconductor 2.21 miles with 397 MCM ACSR	$5.53
	Lebanon-Springfield KU 69 kV: Reconductor 6.58 miles with 556.5 MCM 26X7 ACSR.	$16.45
	Total	**$53.27**
Cooper CCGT	Replace all 161 kV circuit breakers at Cooper with 63 kA breakers.	$3.00
	Rebuild the Cooper-Elihu 161 kV line (4.2 miles) using 1272 MCM ACSS conductor	$10.30
	Increase the MOT of the Laurel Dam-Laurel County 161 kV line (13.5 miles) to 212F	$3.85
	Rebuild the South Lancaster-Garrard County 69 kV line (1.8 miles) using 556 MCM ACSR conductor	$1.82

	Upgrade the Cooper 161/69 kV transformer with a 200 MVA unit, and purchase a spare 200 MVA transformer	$6.70
	Upgrade the Marion County 161/138 kV with a 300 MVA unit and purchase a spare 300 MVA transformer.	$8.83
	Increase the MOT of the Casey County-Marion County 161 kV line (17.8 miles) to 212 degrees F	$5.08
	Rebuild the Cooper - Laurel River Dam 161 kV line with 954 MCM ACSR to replace the existing 795 MCM ACSR conductor. (17.32 miles)	$19.80
	Rebuild the Cooper - Somerset 69kV double circuit with 556 MCM ACSR replacing the existing 266 MCM ACSR conductor. (3.2 miles)	$5.03
	Increase MOT on Taylor Co Jct-AF1-038 795 MCM ACSR conductor to 212F. (0.92 miles)	$0.28
	Increase the MOT of the County Farm Road-West London 69 kV line to 212 degrees F (0.92 miles)	$0.13
	Rebuild the Walnut Grove-Maretburg Tap 69 kV line using 556 MCM ACSR conductor replacing the existing 266 MCM ACSR conductor. (10.01 miles)	$10.12
	Rebuild the Somerset-KU Somerset 795 MCM ACSR bus tie using bundled 795 MCM ACSR conductor. (0.01 miles)	$0.25
	Increase the MOT of the 795 MCM ACSR conductor in the Cooper-Russell County Jct 161 kV Line to 212 degrees F (30.34 miles)	$8.65
	Replace the Distance Relay protecting the Cooper-Denny 161kV line at Cooper 161 kV station	$0.50
	Increase the MOT of the Laurel County-Pittsburg 161 kV line to 212 degrees F (10.41 miles)	$2.97
	Alcalde-Farley 161 kV: Reconductor 27.19 miles with 795 MCM ACSR	$74.77
	Elihu-Ferguson So 69 kV line: Replace station conductor (line riser) with 2156 MCM 84X19 ACSR; needs a 215 MVA rating; also, reconductor 0.74 miles of line with 556.5 MCM 26X7 bundled ACSR conductor[1]	$1.93
	Springfield KU- N Springfield 69 kV line: reconductor 3.24 miles of line with 397.5 MCM ACSR	$8.10
	Corbin East-Sweet Hollow 69 kV line: Reconductor 2.2 miles using a minimum of 556 MCM ACSR conductor	$5.50
	North London KU-Pittsburg 69 kV: Reconductor 1.9 miles with 397 MCM ACSR and replace Line Riser with similar conductor	$4.76
	Corbin 1-Corbin 2 69 kV line: reconductor 0.67 miles using a minimum of 556 ACSR conductor	$1.68
	Total	**$184.07**
	Grand Total	**$237.34**

Liberty RICE	Cooper CCGT	EKPC above CPCN Case	LG&E / KU

5.2 Interpretation of Results

The results listed in Table 5.1 show that there is extensive transmission reinforcement necessary to accommodate the planned generation additions on the EKPC transmission system. Several of these results for specific facilities do not indicate viable alternatives based on the driver of the thermal loading and/or the economics of potential solutions. For example, a maximum operating temperature increase to raise the capacity of a line section is a much less expensive alternative to building a new line or even upgrading conductor in the line section. However, there are a few identified projects that have very high cost estimates due to the scope of work that is required. For these, evaluation of potential alternatives to eliminate the identified need was a consideration.

The process of identifying whether or not to evaluate alternative solutions is not rigidly defined by a criteria or process, but one can reasonably conclude such exploration is necessary based on the power flow analyses results. A summary of the driving contingency for selected projects listed above is shown in Table 5.2 below.

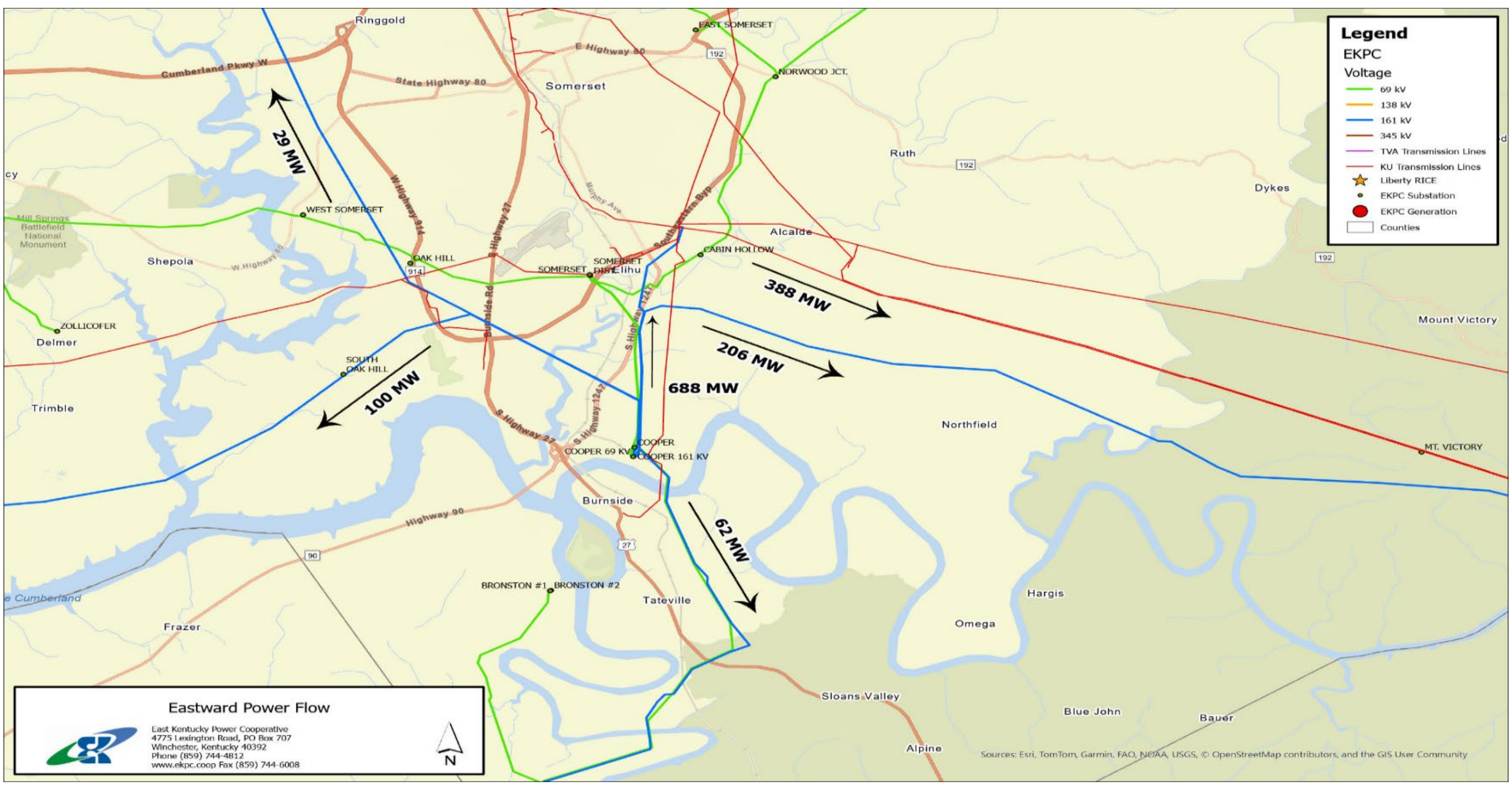
[1] LG&E/KU provided results of their studies that consider a contingency that is invalid. In discussions with LG&E/KU they believe this project will still be required once the invalid contingency is removed.

Table 5.2 Project Drivers Summary

Project	Driving Contingency
Rebuild the Cooper - Laurel River Dam 161 kV line with 954 ACSR to replace the existing 795 MCM ACSR conductor. (17.32 miles)	OPEN LINE FROM [5ALCALDE 161.00] TO [5ELIHU 161.00] CKT 1
Cooper-Elihu 161kV line: Reconductor 2.94 miles with 1272 MCM ACSS	OPEN LINE FROM [5COOPERNEW 161.00] TO [5LAUREL DAM 161.00] CKT 1
Alcalde-Farley 161 kV: Reconductor 27.19 miles with 795 MCM ACSR	OPEN LINE FROM [7ALCALDE 345.00] TO [5ALCALDE 161.00] CKT 1

The projects listed above are targeted due to significant overloads or extreme high cost to address. Exploration is warranted to reduce loading on adjacent 161kV lines exiting Cooper Station; the most logical option is to provide another path for power to flow from Cooper Station to the surrounding transmission system. Considering the map show in Figure 5.3, power is flowing eastward from the Cooper Station area via the area's high voltage transmission lines: EKPC's Cooper – Laurel Dam – Laurel County 161 kV line, the Cooper- Elihu - Alcalde EKPC and LG&E/KU 161 kV path; and LG&E/KU's Alcalde – Farley 161 kV and Alcalde – Brown North and Alcalde-Pineville 345 kV lines. The majority of the power that will be generated at Cooper Station (approximately 70%) flows across the Cooper – Laurel Dam – Laurel County 161 kV and Cooper – Elihu – Alcalde 161 kV lines, per EKPC's power-flow analysis results. Figure 5.3 shows that the summation of power flow across the high voltage lines traveling east is 688 MW under normal system conditions.

Figure 5.3 Eastward Power Flow



It's important to understand the direction of power flow for the affected transmission lines under normal conditions and during the contingencies noted above. The flow of power from source to load takes place similarly to the flow of water, which is via the path of least resistance. Typically, higher voltage transmission lines provide this path of least resistance. Under normal conditions, power will flow from Cooper Station to area loads via the high voltage transmission lines in the area. A significant portion of the generation from Cooper Station flows from EKPC's system to LG&E/KU's system in order to source local load as well as to flow onto LG&E/KU's 345 kV system at Alcalde Substation. The 345 kV transmission system is the path of least resistance for power to travel and disperse throughout the system to various load pockets. The driving contingencies listed above in Table 5.2 illustrate that an outage of one of the eastward paths from Cooper Station increases power flow on the remaining paths. The added generation at Cooper Station in conjunction with the Liberty RICE added generation is creating the need for more capacity exiting Cooper station so that the power generated can disperse throughout the transmission system, particularly via the LG&E/KU 345 kV system that connects to the area. Given that the cost of transmission upgrade projects identified in Table 5.1 to mitigate all thermal overloads in the area is $237.34 million dollars, alternative options that provide relief of the identified violations in a more efficient manner have been considered.

6.0 Alternative Plan Development

Based on the results of the analysis described in Section 5.0, the potential construction of additional transmission outlets from Cooper Station was deemed beneficial to allow the added generation at Cooper Station an additional path or paths for power flow into the nearby transmission system to reduce overloads of the existing transmission system. From Section 5.2 the existing transmission path from EKPC's transmission system to LG&E/KU's system (Cooper – Elihu – Alcalde 161 kV) is identified as a significant facilitator of power flow into the transmission system in the surrounding area. Given there exists a single high voltage path from EKPC's Cooper Station to LG&E/KU's transmission system in this immediate area, it is vital to consider alternatives that include additional paths between the two systems in the area.

The existing transmission infrastructure in the immediate area around EKPC's Cooper Station limits the logical options for direct connection of a new line from Cooper Station to either LG&E/KU's Elihu 161kV or Alcalde 161 & 345 kV substations. Recognition that the power flows from Cooper are largely to the high voltage 345 kV system present at LG&E/KU's Alcalde substation sets focus on Alcalde as being the optimal existing substation to direct power flow into from Cooper Station.

Therefore, the alternatives considered to address the transmission needs in the area are:

- Alternative 1: Upgrade existing overloaded facilities as necessary to mitigate criteria violations (therefore, no addition of new transmission facilities).
- Alternative 2: Construct a new 4.54 ~~5.25~~-mile Cooper Station – Alcalde single-circuit 161 kV line, LG&E/KU expands the Alcalde 161kV substation to accommodate the new line and reconfigures/installs high side protection at the Alcalde 345kV substation and installs a 2nd 345/161kV transformer.
- Alternative 3: Construct a new 4.54 ~~5.25~~-mile Cooper Station – Alcalde double-circuit 161 kV line, LG&E/KU expands the Alcalde 161 kV substation to accommodate two new lines and reconfigures/installs high side protection at the Alcalde 345 kV substation.

6.1 Alternative 1

Alternative 1 proposes to address all identified criteria violations via upgrades of all overloaded transmission facilities. For example, all thermal overload violations for transmission lines are addressed by increasing the conductor's maximum operating temperature ("MOT") or rebuilding the existing line with a new conductor capable of handling the anticipated flows. The projects listed in Table 5.1 above are the reinforcement projects required due to the added generation at Cooper Station and Liberty RICE station. The total capital cost estimate for this alternative is approximately $237.34 million dollars for the 32 projects identified.

6.2 Alternative 2

Alternative 2 was developed to provide a single additional transmission line exit from Cooper Station to LG&E/KU's transmission system. The following projects in Table 6.2 were identified for Alternative 2. The proposed line route for the new Cooper – Alcalde 161kV line can be seen in Figure 6.2.1 and reinforcement projects identified as needed due to the added generation in the area can be seen in Figure 6.2.2.

Table 6.2 Alternative 2 Projects

Generation	Project	Estimated Cost ($MM)
Liberty RICE	Rebuild the Liberty RICE-Liberty Junction 161 kV Line using 795 MCM ACSR conductor (7.8 miles)	$13.70
	Increase the MOT of the 636 MCM ACSR conductor in the Liberty RICE-Casey County 161 kV Line to 212 degrees F (6.2 miles)	$1.95
	Increase the MOT of the 795 MCM ACSR conductor in the Marion County-Marion County Industrial Park Tap (NR)161 kV Line to 212 degrees F (4.0 miles)	$1.15
	Rebuild the Marion County-Lebanon 138 kV Line using 954 MCM ACSR conductor (0.1 mile)	$0.20
	Install a 100 MVA transformer at Liberty Jct to replace the existing 93 MVA unit.	$4.00
	Lebanon 138/69 transformer overloads: Add a second transformer at or near Lebanon.	$9.20
	Campbellsville Tap-Taylor Co 69 kV line: Reconductor 0.38 miles using a minimum of 397 MCM ACSR conductor	$0.95
	Mile Lane Tap - Campbellsville 69 kV line: Reconductor 2.21 miles with 397 MCM ACSR	$5.53
	Lebanon-Springfield KU 69 kV: Reconductor 6.58 miles with 556.5 MCM 26X7 ACSR.	$16.45
	Total	**$53.13**
Cooper CCGT	Construct a new Cooper Alcalde 161 kV line (5 miles) using 1272 MCM ACSS conductor	$15.10
	Replace all 161 kV circuit breakers at Cooper with 63 kA breakers.	$3.00
	Rebuild the Cooper-Elihu 161 kV line (4.2 miles) using 1272 MCM ACSS conductor	$10.30
	Increase the MOT of the Laurel Dam-Laurel County 161 kV line (13.5 miles) to 212 degrees F	$3.85
	Upgrade the Cooper 161/69 kV transformer with a 200 MVA unit, and purchase a spare 200 MVA transformer	$6.70
	Upgrade the Marion County 161/138 kV with a 300 MVA unit, and purchase a spare 300 MVA transformer.	$8.83
	Increase the MOT of the Casey County-Marion County 161 kV line (17.8 miles) to 212 degrees F	$5.08
	Rebuild the Cooper - Laurel River Dam 161 kV line with 954 MCM ACSR to replace the existing 795 MCM ACSR conductor. (17.32 miles)	$19.80
	Rebuild the Cooper - Somerset 69kV double circuit with 556 MCM ACSR replacing the existing 266 MCM ACSR conductor. (3.2 miles)	$5.03
	Increase MOT on Taylor Co Jct-AF1-038 795 MCM ACSR conductor to 212F. (0.92 miles)	$0.28
	KU constructs a 345 kV bus at the Alcalde substation and installs a 2nd Alcalde 345/161 kV transformer	$24.60
	KU expands the 161 kV bus at the Alcalde substation to accommodate the new Cooper – Alcalde 161 kV circuit.	$2.00
	Alcalde-Farley 161 kV: Increase MOT of the existing line 27.19 miles	$20.40
	Springfield KU- N Springfield 69 kV line: reconductor 3.24 miles of line with 397.5 MCM 18X1 ACSR	$8.10
	Corbin East-Sweet Hollow 69 kV line: reconductor 2.2 miles on the using a minimum of 556 MCM ACSR conductor	$5.50
	Corbin 1-Corbin 2 69 kV line: reconductor 0.67 miles using a minimum of 556 ACSR conductor	$1.68
	Total	**$140.28**
	Grand Total	**$193.41**

Figure 6.2.1 Alternative 2 Line Route

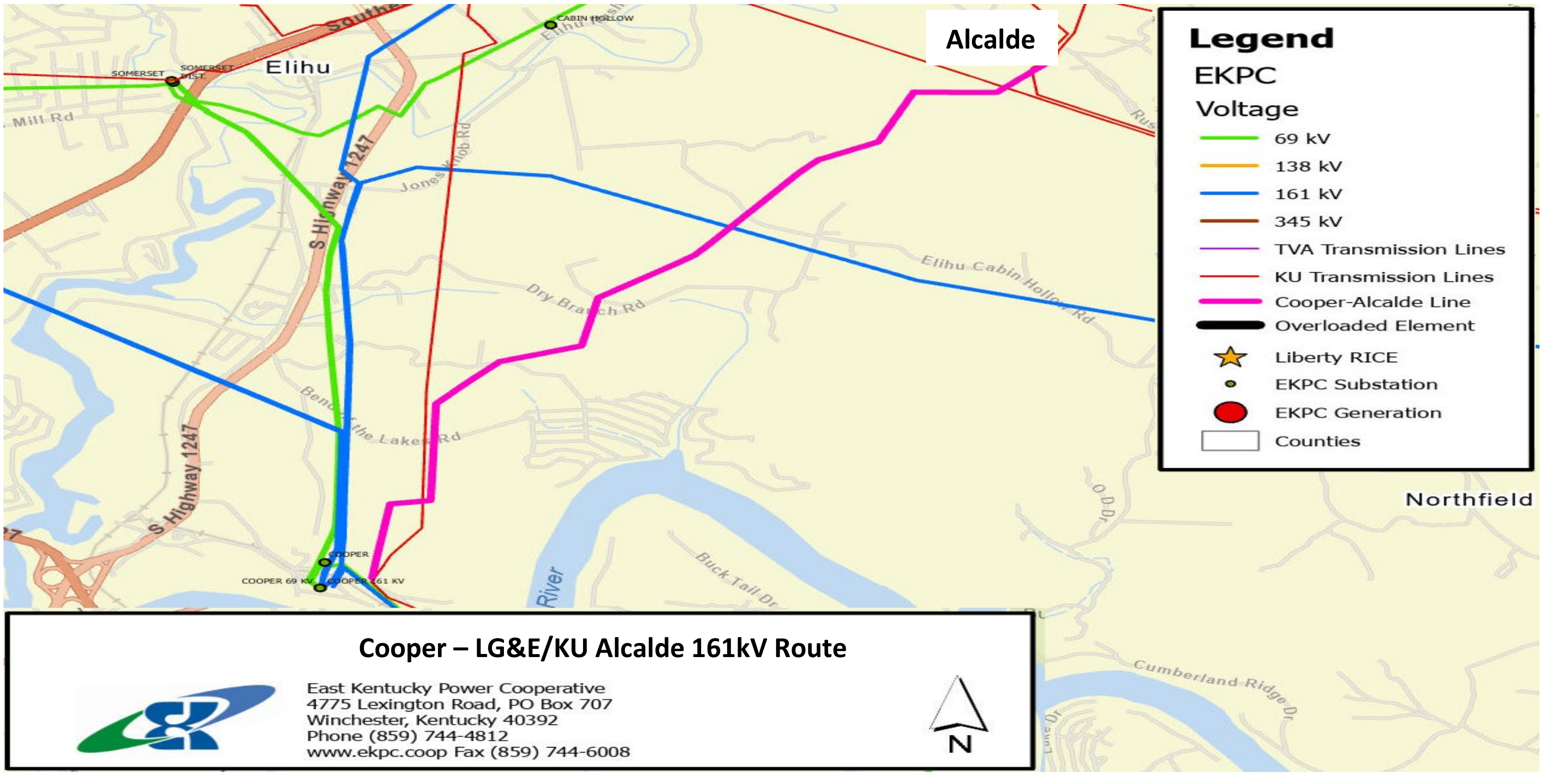
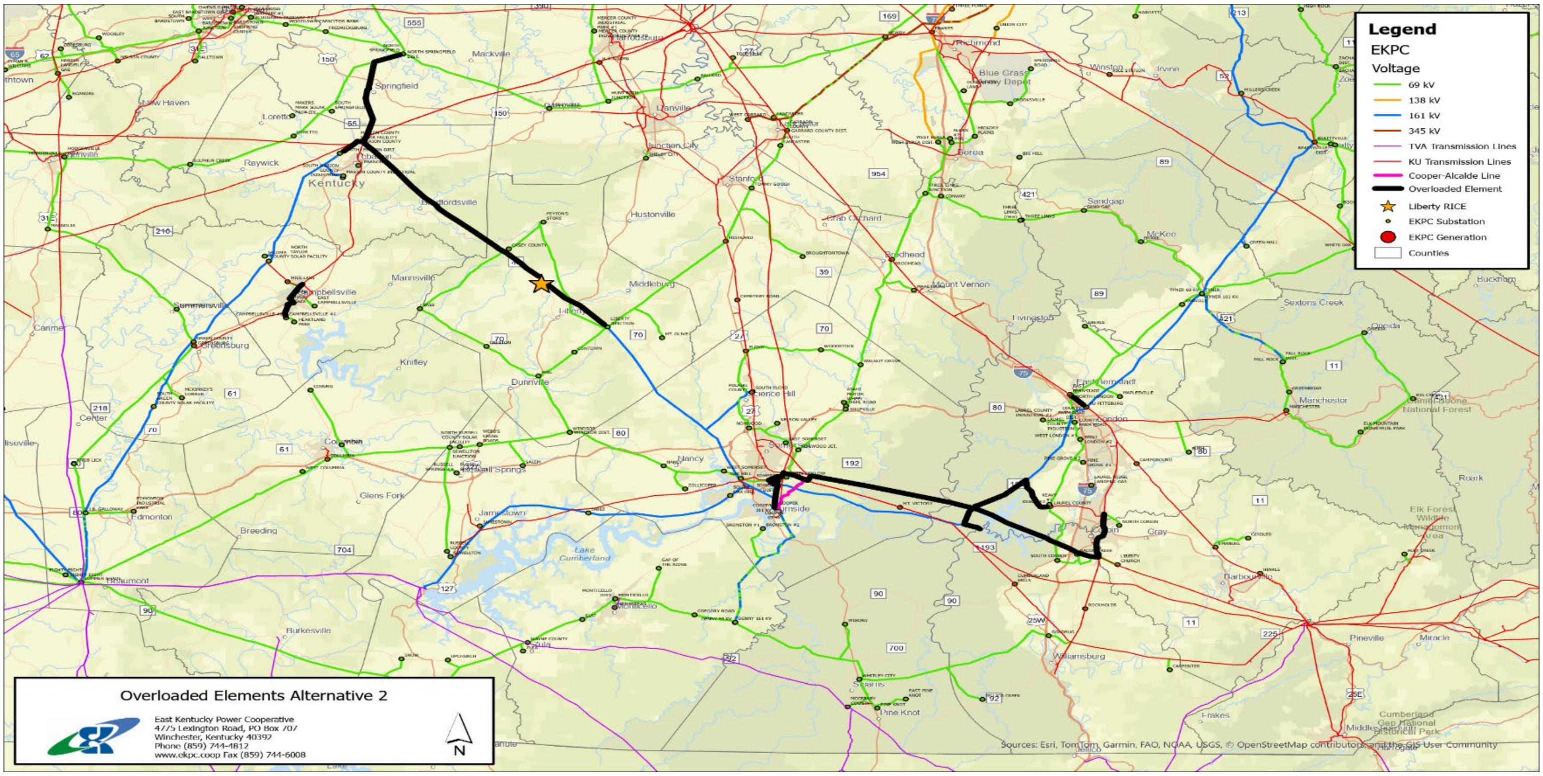


Figure 6.2.2 Alternative 2 Projects Map



6.3 Alternative 3

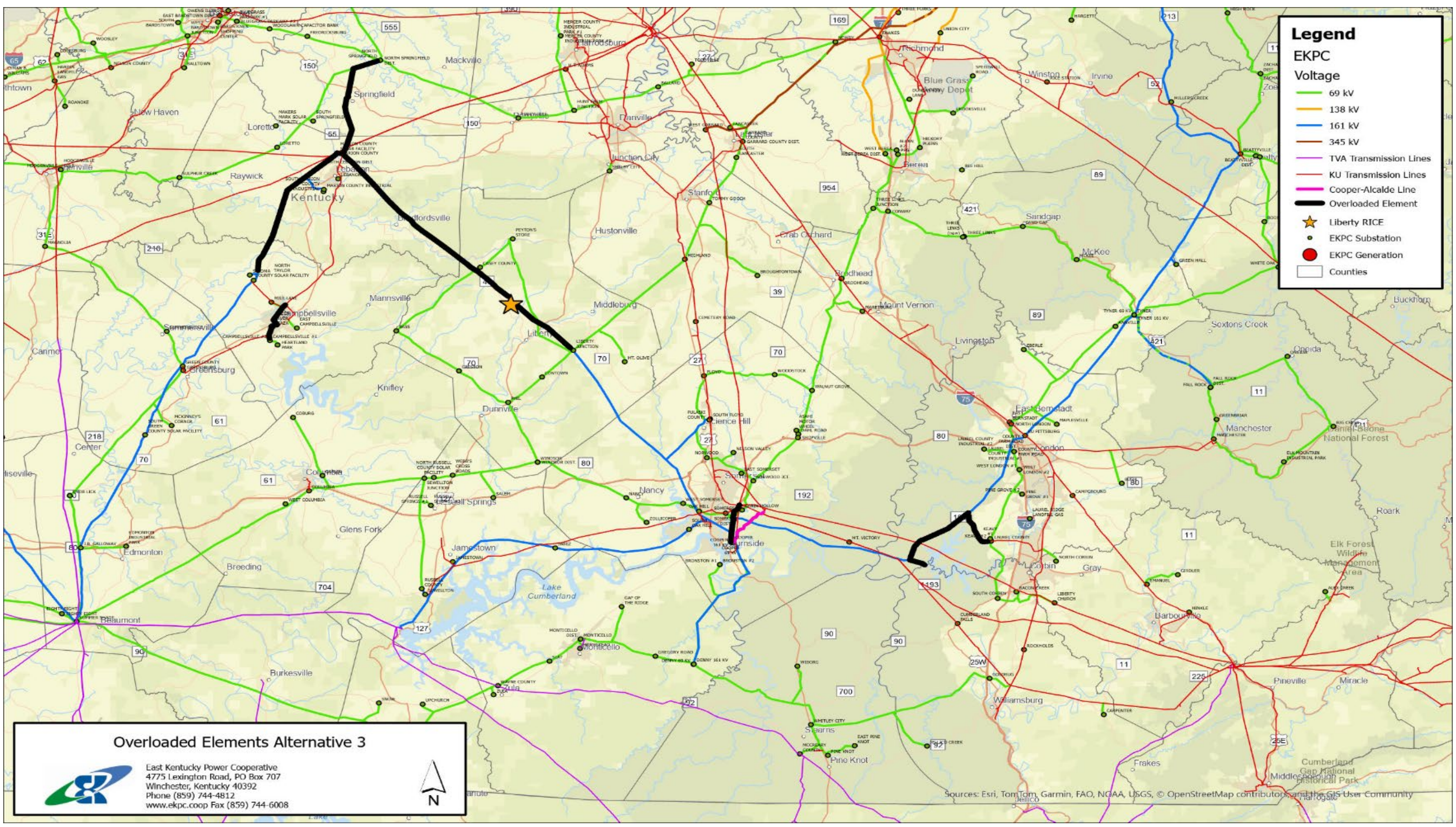
Alternative 3 was developed to provide two additional transmission line exits from Cooper Station to LG&E/KU's transmission system. This alternative provides mitigation to relieve PJM Planning Criteria constraints under N-1-1 conditions at a slightly increased marginal cost for a double circuit compared to a single circuit. The proposed line will follow the same line route illustrated in 6.2.1 but will be constructed using double circuit structures as opposed to single circuit structures. The following projects in Table 6.3 were identified for Alternative 3.

Table 6.3 Alternative 3 Projects

Generation	Project	Estimated Cost ($MM)
Liberty RICE	Rebuild the Liberty RICE-Liberty Junction 161 kV Line using 795 MCM ACSR conductor (7.8 miles)	$13.70
	Increase the MOT of the 636 MCM ACSR conductor in the Liberty RICE-Casey County 161 kV Line to 212 degrees F (6.2 miles)	$1.95
	Increase the MOT of the 795 MCM ACSR conductor in the Marion County-Marion County Industrial Park Tap 161 kV Line to 212 degrees F (4.0 miles)	$1.15
	Rebuild the Marion County-Lebanon 138 kV Line using 954 MCM ACSR conductor (0.1 mile)	$0.20
	Lebanon 138/69 transformer overloads: Add a second transformer at or near Lebanon.	$9.20
	Campbellsville Tap-Taylor Co 69 kV line: Reconductor 0.38 miles using a minimum of 397 MCM ACSR conductor	$0.95
	Mile Lane Tap - Campbellsville 69 kV line: Reconductor 2.21 miles with 397 MCM ACSR	$5.53
	Lebanon-Springfield KU 69 kV: Reconductor 6.58 miles with 556.5 MCM 26X7 ACSR.	$16.45
	Total	**$49.13**
	Construct a new double circuit Cooper-Alcalde 161 kV line (5 miles) using 1272 MCM ACSS conductor	$20.13

Cooper CCGT	Replace all 161 kV circuit breakers at Cooper with 63 kA breakers.	$3.00
	Rebuild the Cooper-Elihu 161 kV line (4.2 miles) using 1272 MCM ACSS conductor	$10.30
	Increase the MOT of the Laurel Dam-Laurel County 161 kV line (13.5 miles) to 212 degrees F	$3.85
	Upgrade the Cooper 161/69 kV transformer with a 200 MVA unit, and purchase a spare 200 MVA transformer	$6.70
	Upgrade the Marion County 161/138 kV with a 300 MVA unit, and purchase a spare 300 MVA transformer.	$8.83
	Increase the MOT of the Casey County-Marion County 161 kV line (17.8 miles) to 212 degrees F	$5.08
	Increase MOT on Taylor Co Jct-AF1-038 795 ACSR conductor to 212F. (0.92 miles)	$0.28
	KU constructs a 345 kV bus at the Alcalde substation and installs a 2nd Alcalde 345/161 kV transformer	$24.60
	KU expands the 161 kV bus at the Alcalde substation to accommodate the new Cooper – Alcalde 161 kV double circuit.	$4.00
	Alcalde-Farley 161 kV: Increase MOT of the existing line (27.19 miles)	$20.40
	Corbin East-Sweet Hollow 69 kV line: reconductor 2.2 miles on the using a minimum of 556 MCM ACSR conductor	$5.50
	Total	**$112.70**
	Grand Total	**$161.83**

Figure 6.3.2 Alternative 3 Projects Map



7.0 Alternative Cost Estimate Comparison

The estimated total capital transmission costs for the three alternatives considered to accommodate the planned generation (Liberty RICE and Cooper CCGT) can be seen below in Table 7.1. The individual-project breakdown of the estimated capital cost of each alternative is provided in Sections 3, 5, and 6;

the estimates below present transmission interconnection and reinforcement costs for the three alternatives.

Table 7.1 Alternative Total Capital Cost

Alternative	Description	Estimated Cost ($MM)
1	Address all identified criteria violations via upgrades of all overloaded transmission facilities.	$277.65
2	Construct a new Cooper-Alcalde 161 kV single-circuit line, and address all remaining criteria violations via upgrades of all overloaded transmission facilities.	$233.72
3	Construct a new Cooper-Alcalde 161 kV double-circuit line, and address all remaining criteria violations via upgrades of all overloaded transmission facilities.	$202.14

Table 7.1 shows that the single-circuit Cooper-Alcalde 161 kV line alternative plan is about 16% lower in cost than Alternative 1, which addresses all overload facilities via upgrades. The total number of projects is reduced from 32 to 26. Expanding the scope of the Cooper-Alcalde new single-circuit line to a double-circuit 161 kV line results in an incremental cost increase of approximately $7.03 million dollars for the double circuit line when compared to the single circuit. The overall total estimated cost for reinforcement projects required due to EKPC's planned generation at Liberty RICE and Cooper CCGT with this new double-circuit line is approximately $202.14 million, which is reduction of the total transmission plan cost of $31.58M (13.5%) compared to the plan with a new single-circuit Cooper-Alcalde 161 kV line. A total of 20 projects are identified for Alternative 3. Alternative 3 not only reduces the number of projects needed, but is the least-cost alternative considered. Therefore, the marginal increase in scope and cost from a single-circuit Cooper-Alcalde 161 kV line to a double-circuit line provides significant improvement in capacity exiting Cooper Station under various system conditions, aids in outage planning for the necessary transmission upgrades by reducing the number of projects required, and provides the overall least-cost transmission plan for the planned generation additions in the area.

8.0 Conclusion

The transmission reinforcement projects detailed above were selected to adhere to EKPC's guiding principles of reliability, affordability, environmental stewardship, and safety. Line rebuilds were selected rather than construction of new transmission lines where reasonable in order to make use of existing rights-of-way, and to minimize costs to integrate the Liberty RICE and Cooper CCGT generation into the transmission system. Due to the significant net increase of generation at Cooper Station, one new double-circuit line (Cooper-Alcalde 161 kV) has been identified to enable adequate transmission line outlet capacity under N-1 and N-1-1 system conditions.

The analyses discussed in this report enabled EKPC to identify projects necessary for integrating Liberty RICE and Cooper CCGT into the transmission system and facilitated coordination with LG&E/KU to accurately identify and scope projects required on its system. LG&E/KU will be requested to perform an affected system study as part of PJM's Queue process. The coordination prior to PJM's request to LG&E/KU for an affected system study was performed by EKPC to identify projects on a preliminary basis to best identify all projects likely to be required for Liberty RICE and Cooper CCGT. Additionally, EKPC's review of PJM's TC2 Phase 1 analysis indicates that results from PJM's analysis are in line with EKPC's results. EKPC expects PJM's evaluation of the reinforcement projects provided by EKPC for TC2 Phase 1 will mitigate all identified issues and no additional projects will be identified as part of PJM's Queue process.

This report provides an update to previous expected cost related to Cooper CCGT. The costs provided in the previous PSC cases for the expected transmission plans for Liberty RICE and Cooper CCGT presented a total of $158.91 million dollars of transmission projects associated with the new generation plans. This report details the changes to those costs, and has identified an increase in the required investment if EKPC proceeds with the original scope, which assumed a single-circuit Cooper-Alcalde 161 kV line. Given the coordinated efforts with LG&E/KU and the initial results from PJM's analysis that includes the Cooper CCGT facility, EKPC can more accurately quantify the cost required to integrate Liberty RICE and Cooper CCGT. With the Cooper-Alcalde 161 kV double-circuit line, the total transmission cost needed to integrate the new generation facilities into the transmission system is $202.14 million dollars. This is an increase of $43.23 million above the expected transmission cost provided in the PSC cases for Liberty RICE and Cooper CCGT. However, considering the updated system models and results from LG&E/KU's analysis, proceeding with the original single-circuit Cooper – Alcalde 161 kV line would result in $233.72 million dollars of transmission reinforcement needed, an increase of $74.81 million compared to the original cost provided in the PSC cases for Liberty RICE and Cooper CCGT. The Cooper-Alcalde 161 kV double-circuit line provides adequate capacity for power to flow through the transmission system and provides an economical solution that reduces total transmission investment and number of projects required. The results of the analyses described herein indicate that the expected transmission expenditures to accommodate the Liberty RICE and Cooper CCGT facilities are still relatively small compared to the overall project costs for the construction of the generation facilities.

Appendices

A: PJM Queue Projects with Signed ISAs Included in Base Models

Project ID	Location	MFO
AE1-143	Marion Co 161kV	96
AE2-254	South Lancaster 69kV	50
AE2-339	Avon 138kV	40
AE2-071	Eighty-Eight 69kV	35
AF1-203	Eighty-Eight 69 kV	20
AF1-038	Sewellton J-Webbs Crossroads 69 kV	60
AF1-050	Summershade-Green Co 161 kV	60
AF1-083	Green County-Saloma 161 kV	55
AC1-074/AC2-075	Jacksonville 138 kV	100

B: NERC TPL-001-5 Transmission System Planning Performing Requirements

Category	Initial Condition	Event [1]	Fault Type [2]	BES Level [3]	Interruption of Firm Transmission Service Allowed [4]	Non-Consequential Load Loss Allowed
P0 No Contingency	Normal System	None	N/A	EHV, HV	No	No
P1 Single Contingency	Normal System	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6]	3Ø	EHV, HV	No[9]	No[12]
		5. Single Pole of a DC line	SLG			
P2 Single Contingency	Normal System	1. Opening of a line section w/o a fault [7]	N/A	EHV, HV	No[9]	No[12]
		2. Bus Section Fault	SLG	EHV	No[9]	No
				HV	Yes	Yes
		3. Internal Breaker Fault[8] (non-Bus-tie Breaker)	SLG	EHV	No[9]	No
				HV	Yes	Yes
		4. Internal Breaker Fault (Bus-tie Breaker)[8]	SLG	EHV, HV	Yes	Yes

P3 Multiple Contingency	Loss of generator unit followed by System adjustments[9]	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6]	3Ø	EHV, HV	No[9]	No[12]
		5. Single pole of a DC line	SLG			
P4 Multiple Contingency *(Fault plus stuck breaker[10])*	Normal System	Loss of multiple elements caused by a stuck breaker[10](non-Bus-tie Breaker) attempting to clear a Fault on one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6] 5. Bus Section	SLG	EHV	No[9]	No
				HV	Yes	Yes
		6. Loss of multiple elements caused by a stuck breaker[10] (Bus-tie Breaker) attempting to clear a Fault on the associated bus	SLG	EHV, HV	Yes	Yes
P5 Multiple Contingency *(Fault plus non-redundant component of a Protection System failure to operate)*	Normal System	Delayed Fault Clearing due to the failure of a non-redundant component of a Protection System[13] protecting the Faulted element to operate as designed, for one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6] 5. Bus Section	SLG	EHV	No[9]	No
				HV	Yes	Yes
P6 Multiple Contingency *(Two*	Loss of one of the following followed by System	Loss of one of the following: 1. Transmission Circuit 2. Transformer[5] 3. Shunt Device[6]	3Ø	EHV, HV	Yes	Yes

overlapping singles)	adjustments.[9] 1. Transmission Circuit 2. Transformer [5] 3. Shunt Device[6] 4. Single pole of a DC line	4. Single pole of a DC line	SLG	EHV, HV	Yes	Yes
P7 Multiple Contingency *(Common Structure)*	Normal System	The loss of: 1. Any two adjacent (vertically or horizontally) circuits on common structure [11] 2. Loss of a bipolar DC line	SLG	EHV, HV	Yes	Yes

Table 1 – Steady State & Stability Performance Extreme Events

Steady State & Stability

For all extreme events evaluated:

a. Simulate the removal of all elements that Protection Systems and automatic controls are expected to disconnect for each Contingency.

b. Simulate Normal Clearing unless otherwise specified.

Steady State

1. Loss of a single generator, Transmission Circuit, single pole of a DC Line, shunt device, or transformer forced out of service followed by another single generator, Transmission Circuit, single pole of a different DC Line, shunt device, or transformer forced out of service prior to System adjustments.

2. Local area events affecting the Transmission System such as:

a. Loss of a tower line with three or more circuits.[11]

b. Loss of all Transmission lines on a common Right-of-Way[11].

c. Loss of a switching station or substation (loss of one voltage level plus transformers).

d. Loss of all generating units at a generating station.

e. Loss of a large Load or major Load center.

3. Wide area events affecting the Transmission System based on System topology such as:

a. Loss of two generating stations resulting from conditions such as:

i. Loss of a large gas pipeline into a region or multiple regions that have significant gas-fired generation.

Stability

1. With an initial condition of a single generator, Transmission circuit, single pole of a DC line, shunt device, or transformer forced out of service, apply a 3Ø fault on another single generator, Transmission circuit, single pole of a different DC line, shunt device, or transformer prior to System adjustments.

2. Local or wide area events affecting the Transmission System such as:

a. 3Ø fault on generator with stuck breaker[10] resulting in Delayed Fault Clearing.

b. 3Ø fault on Transmission circuit with stuck breaker[10] resulting in Delayed Fault Clearing.

c. 3Ø fault on transformer with stuck breaker[10] resulting in Delayed Fault Clearing.

d. 3Ø fault on bus section with stuck breaker[10] resulting in Delayed Fault Clearing.

e. 3Ø fault on generator with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing.

f. 3Ø fault on Transmission circuit with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing.

ii. Loss of the use of a large body of water as the cooling source for generation. iii. Wildfires. iv. Severe weather, e.g., hurricanes, tornadoes, etc. v. A successful cyber-attack. vi. Shutdown of a nuclear power plant(s) and related facilities for a day or more for common causes such as problems with similarly designed plants. b. Other events based upon operating experience that may result in wide area disturbances.	g. 3Ø fault on transformer with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing. h. 3Ø fault on bus section with failure of a non-redundant component of a Protection System[13] resulting in Delayed Fault Clearing. i. 3Ø internal breaker fault. j. Other events based upon operating experience, such as consideration of initiating events that experience suggests may result in wide area disturbances

Table 1 – Steady State & Stability Performance Footnotes (Planning Events and Extreme Events)
1. If the event analyzed involves BES elements at multiple System voltage levels, the lowest System voltage level of the element(s) removed for the analyzed event determines the stated performance criteria regarding allowances for interruptions of Firm Transmission Service and Non- Consequential Load Loss.
2. Unless specified otherwise, simulate Normal Clearing of faults. Single line to ground (SLG) or three-phase (3Ø) are the fault types that must be evaluated in Stability simulations for the event described. A 3Ø or a double line to ground fault study indicating the criteria are being met is sufficient evidence that a SLG condition would also meet the criteria.
3. Bulk Electric System (BES) level references include extra-high voltage (EHV) Facilities defined as greater than 300kV and high voltage (HV) Facilities defined as the 300kV and lower voltage Systems. The designation of EHV and HV is used to distinguish between stated performance criteria allowances for interruption of Firm Transmission Service and Non-Consequential Load Loss.
4. Curtailment of Conditional Firm Transmission Service is allowed when the conditions and/or events being studied formed the basis for the Conditional Firm Transmission Service.
5. For non-generator step up transformer outage events, the reference voltage, as used in footnote 1, applies to the low-side winding (excluding tertiary windings). For generator and Generator Step Up transformer outage events, the reference voltage applies to the BES connected voltage (high-side of the Generator Step Up transformer). Requirements which are applicable to transformers also apply to variable frequency transformers and phase shifting transformers.
6. Requirements which are applicable to shunt devices also apply to FACTS devices that are connected to ground.
7. Opening one end of a line section without a fault on a normally networked Transmission circuit such that the line is possibly serving Load radial from a single source point.
8. An internal breaker fault means a breaker failing internally, thus creating a System fault which must be cleared by protection on both sides of the breaker.
9. An objective of the planning process should be to minimize the likelihood and magnitude of interruption of Firm Transmission Service following Contingency events. Curtailment of Firm Transmission Service is allowed both as a System adjustment (as identified in the column entitled 'Initial Condition') and a corrective action when achieved through the appropriate re-dispatch of resources obligated to re- dispatch, where it can be demonstrated that Facilities, internal and external to the Transmission Planner's planning region, remain within applicable Facility Ratings and the re-dispatch does not result in any Non-Consequential Load Loss. Where limited options for re-dispatch exist, sensitivities associated with the availability of those resources should be considered.

Table 1 – Steady State & Stability Performance Footnotes (Planning Events and Extreme Events)
10. A stuck breaker means that for a gang-operated breaker, all three phases of the breaker have remained closed. For an independent pole operated (IPO) or an independent pole tripping (IPT) breaker, only one pole is assumed to remain closed. A stuck breaker results in Delayed Fault Clearing. 11. Excludes circuits that share a common structure (Planning event P7, Extreme event steady state 2a) or common Right-of-Way (Extreme event, steady state 2b) for 1 mile or less. 12. An objective of the planning process is to minimize the likelihood and magnitude of Non-Consequential Load Loss following planning events. In limited circumstances, Non-Consequential Load Loss may be needed throughout the planning horizon to ensure that BES performance requirements are met. However, when Non-Consequential Load Loss is utilized under footnote 12 within the Near-Term Transmission Planning Horizon to address BES performance requirements, such interruption is limited to circumstances where the Non-Consequential Load Loss meets the conditions shown in Attachment 1. In no case can the planned Non-Consequential Load Loss under footnote 12 exceed 75 MW for US registered entities. The amount of planned Non-Consequential Load Loss for a non-US Registered Entity should be implemented in a manner that is consistent with, or under the direction of, the applicable governmental authority or its agency in the non-US jurisdiction. 13. For purposes of this standard, non-redundant components of a Protection System to consider are as follows: a. A single protective relay which responds to electrical quantities, without an alternative (which may or may not respond to electrical quantities) that provides comparable Normal Clearing times; b. A single communications system associated with protective functions, necessary for correct operation of a communication-aided protection scheme required for Normal Clearing (an exception is a single communications system that is both monitored and reported at a Control Center); c. A single station dc supply associated with protective functions required for Normal Clearing (an exception is a single station dc supply that is both monitored and reported at a Control Center for both low voltage and open circuit); d. A single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (the trip coil may be excluded if it is both monitored and reported at a Control Center).

C: PJM TC2 Phase 1 Analysis Results related to Cooper CCGT

	PD Plant	Zone	Monitoring Facility	Contingency	Ctg Type	Analysis	Rating Type	Sensitivity
1		EKPC	2BACON CRK T 69.0 kV to 2LIBER CH T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
2		EKPC	2BRONSTON T 69.0 kV to 2COOPER DIST 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	SUM	B	Base
3		EKPC	2COOPER 69.0 kV to 2SOMERSET 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
4		EKPC	2COOPER 69.0 kV to 2SOMERSET 69.0 kV ckt 2	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
5		EKPC	2COOPER DIST 69.0 kV to 2COOPER 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	SUM	B	Base
6		EKPC	2DENNY 69.0 kV to 2BRONSTON T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	SUM	B	Base
7	AH1-721	EKPC	2DENNY 69.0 kV to 2GREGORY R T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-210G_SRT-A	Breaker	iWIN	B	Base

8	AH1-721	EKPC	2DENNY 69.0 kV to 2WIBORG T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-210G_SRT-A	Breaker	iSUM	B	Base
9	AH1-721	KU - EAST/EKPC	2FERGUSON SO 69.0 kV to 2SOMERSET KU 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1014_SRT-A	Breaker	iWIN	B	Base
10	AH1-721	EKPC	2GAP OF RG T 69.0 kV to 2MONTICELLO 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	iLL	B	Base
11		EKPC	2KEAVY 2 T 69.0 kV to 2S CORBIN 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
12		EKPC/KU EAST	2LAUREL CO 69.0 kV to 2HOPEWELL 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	WIN	B	Base
13		EKPC	2LAUREL CO 69.0 kV to 2KEAVY 2 T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
14		EKPC/KU - EAST	2LIBER CH T 69.0 kV to 2FARLEY KU 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
15		EKPC	2S CORBIN 69.0 kV to 2BACON CRK T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
16		EKPC	2SOMERSET 69.0 kV to 2SOMERSET KU 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
17		EKPC/KU - EAST	2SOMERSET KU 69.0 kV to 2FERGUSON SO 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
18		EKPC	2SOMERSET KU 69.0 kV to 2SOMERSET 69.0 kV ckt 1	EKPC_P1-2_COOP 161 TIE_SRT-A	Single	WIN	B	Base
19	AH1-721	EKPC	2TYNER 69.0 kV to 2MCKEE 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	iWIN	B	Base
20	AH1-721	EKPC	2WHITLEY CTY 69.0 kV to 2MCCREARY CO 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	iLL	B	Base
21		EKPC	5COOPER1 161.0 kV to 2COOPER 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
22		EKPC	5COOPER1 161.0 kV to 5PULASK CO J 161.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
23		EKPC	5COOPER2 161.0 kV to 5COOPER1 161.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	WIN	B	Base
24		EKPC/KU - EAST	5COOPER2 161.0 kV to 5ELIHU 161.0 kV ckt 1	EKPC_P7-1_LAURL 161 DBL_SRT-A	Tower	SUM	B	Base
25	AH1-721	EKPC	5DENNY 161.0 kV to 2DENNY 69.0 kV ckt 1	EKPC_P2-3_COOP S42-210G_SRT-A	Breaker	iWIN	B	Base
26		EKPC/KU - CENTRAL	5GREEN HAL T 161.0 kV to 5DELVINTA 161.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
27		EKPC	5LAUREL CO 161.0 kV to 2LAUREL CO 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	WIN	B	Base
28		EKPC	5LAUREL CO 161.0 kV to 5PITTSBURG 161.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	WIN	B	Base
29		EKPC	5LAUREL DAM 161.0 kV to 5LAUREL CO 161.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	WIN	B	Base
30		EKPC/KU - EAST	5PITTSBURG 161.0 kV to 2PITTSBRG KU 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	WIN	B	Base
31		EKPC	5PITTSBURG 161.0 kV to 5TYNER 161.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
32		EKPC	5TYNER 161.0 kV to 5GREEN HAL T 161.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	LL	B	Base
33		EKPC	AH1-721 TP 161.0 kV to 5COOPER2 161.0 kV ckt 1	EKPC_P1-2_COOP-DEN161_SRT-A-1	Single	LL	B	Base
34		EKPC	AH1-721 TP 161.0 kV to 5COOPER2 161.0 kV ckt 2	EKPC_P1-2_COOP-LAUREL161_SRT-A-1	Single	LL	B	Base

35	AH1-721	EKPC	AH1-721 TP 161.0 kV to 5DENNY 161.0 kV ckt 1	EKPC_P2-2_COOPER 2 161_SRT-A	Bus	iWIN	B	Base
36	AH1-721	EKPC	AH1-721 TP 161.0 kV to 5LAUREL DAM 161.0 kV ckt 1	EKPC_P2-3_COOP S42-1064_SRT-A	Breaker	iWIN	B	Base
37		EKPC	2BRODHEAD 69.0 kV to 2THREE LNK J 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
38		EKPC	2MARETBURG T 69.0 kV to 2BRODHEAD 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
39		EKPC	2SALEM EK T 69.0 kV to 2WINDSOR 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	SUM	B	Base
40		EKPC/KU - CENTRAL	2SEWELLTON 69.0 kV to 2UNION UNDWR 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	SUM	B	Base
41		KU - CENTRAL/EKPC	2SPRINGFL KU 69.0 kV to 2N SPRINGFLD 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
42		EKPC	2WALNUT GROV 69.0 kV to 2MARETBURG T 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
43		EKPC	2WEBB CR R T 69.0 kV to 2SALEM EK T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	SUM	B	Base
44		EKPC	2ZULA J NO 69.0 kV to 2WAYNE CO 69.0 kV ckt 1	EKPC_P2-2_COOPER 2 161_SRT-A	Bus	SUM	B	Base
45		EKPC/KU - CENTRAL	4MARION CO 138.0 kV to 4LEBANON 138.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
46		EKPC	5CASEY CO 161.0 kV to 5MARION CO 161.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
47		EKPC	5LIBERTY J 161.0 kV to 5CASEY CO 161.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
48		EKPC	5MARION CO 161.0 kV to 4MARION CO 138.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
49		EKPC	5PULASK CO J 161.0 kV to 5LIBERTY J 161.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
50		PJM/EKPC	AE2-254 POI 69.0 kV to 2GARRARD CO 69.0 kV ckt 1	EKPC_P7-1_COOP 161 DBL 2_SRT-A-2	Tower	SUM	B	Base
51		EKPC	AF1-038_TAP 69.0 kV to 2WEBB CR R T 69.0 kV ckt 1	EKPC_P2-3_COOP S42-1039_SRT-A	Breaker	SUM	B	Base
52		EKPC	AG1-471 TP 69.0 kV to 2ZULA J NO 69.0 kV ckt 1	EKPC_P2-2_COOPER 2 161_SRT-A	Bus	SUM	B	Base
53		EKPC	2W LONDON 69.0 kV to 2W LONDON T 69.0 kV ckt 1	EKPC_P2-3_TYNER E13-1014_SRT-A	Breaker	SUM	B	Base
54		DEO/DEK	08LONGBR 138.0 kV to 08MTZION 138.0 kV ckt 1	34541 34553_SRT-A	Tower	SUM	B	Base
55	AH1-239	EKPC	2ALBANY 69.0 kV to 2SNOW T 69.0 kV ckt 1	EKPC_P1-2_AG1-471 TP-AH1-239 TP-69_SRT-A	Single	iLL	B	Base
56	AH1-427	EKPC	2BROUGTWN T 69.0 kV to 2HIGHLAND EK 69.0 kV ckt 1	EKPC_P2-2_GAR 69_SRT-A	Bus	iLL	B	Base
57	AG2-073	EKPC	2CROOKSVIL 69.0 kV to 2CROOKSVIL T 69.0 kV ckt 1	Base Case	Single	iLL	A	Base
58		EKPC/KU - CENTRAL	2GREEN CO 69.0 kV to 2GRENSBRG KU 69.0 kV ckt 1	EKPC_P1-2_GRE-AF1-083161_SRT-A-2	Single	SUM	B	Base
59		EKPC	2GREEN CO 69.0 kV to 2SUMMERSVIL 69.0 kV ckt 1	EKPC_P2-3_MAR W38-1014_SRT-A	Breaker	SUM	B	Base
60	AH1-571	EKPC	2HEADQTRS 69.0 kV to 2SNOW HILL 69.0 kV ckt 1	EKPC_P2-2_KU CYNTH 69_SRT-A	Bus	iLL	B	Base
61		EKPC	2HICKORY PL 69.0 kV to 2PPG 69.0 kV ckt 1	EKPC_P2-3_WBEREA S49-808_SRT-A	Breaker	SUM	B	Base

62	AH1-427	EKPC	2HIGHLAND EK 69.0 kV to 2MT OLIVE J 69.0 kV ckt 1	EKPC_P2-2_GAR 69_SRT-A	Bus	iLL	B	Base
63		EKPC	2KNOB LICK 69.0 kV to 2MCKINNY T 69.0 kV ckt 1	EKPC_P2-3_GREEN W45-1014_SRT-A	Breaker	SUM	B	Base
64	AG2-298	EKPC	2LORETTO 69.0 kV to 2S SPRINGF T 69.0 kV ckt 1	EKPC_P1-2_AG2-298 TP-2SULPHUR CRK-69_SRT-A	Single	iLL	B	Base
65		EKPC	2MAGNOLIA 69.0 kV to 2HODGENVILLE 69.0 kV ckt 1	EKPC_P2-3_MAR W38-1014_SRT-A	Breaker	SUM	B	Base
66	AH1-427	EKPC	2MT OLIVE J 69.0 kV to 2LIBERTY J 69.0 kV ckt 1	EKPC_P2-2_GAR 69_SRT-A	Bus	iLL	B	Base
67		EKPC	2PATTON RD J 69.0 kV to 2FOX HOLLOW 69.0 kV ckt 1	EKPC_P2-3_SSHAD S11-1039_SRT-A	Breaker	SUM	B	Base
68		EKPC	2PATTON RD J 69.0 kV to 2ROSEVILLE T 69.0 kV ckt 1	EKPC_P1-2_AH1-034 TP-2SUMM SHAD J-69_SRT-A-2	Single	SUM	B	Base
69		EKPC	2PLUMVILLE 69.0 kV to 2MURPHYSVIL 69.0 kV ckt 1	EKPC_P7-1_SPUR 138 DBL _SRT-A	Tower	SUM	B	Base
70		EKPC	2PLUMVILLE 69.0 kV to 2RECTORVILLE 69.0 kV ckt 1	EKPC_P2-3_GODDARD E5-814_SRT-A-1	Breaker	SUM	B	Base
71		EKPC	2RECTORVILLE 69.0 kV to 2CHARTERS 69.0 kV ckt 1	EKPC_P2-3_GODDARD E5-814_SRT-A-1	Breaker	SUM	B	Base
72	AG2-298	EKPC	2S SPRINGF T 69.0 kV to 2N SPRINGFLD 69.0 kV ckt 1	EKPC_P1-2_AG2-298 TP-2SULPHUR CRK-69_SRT-A	Single	iLL	B	Base
73	AH1-034	EKPC	2SUMM SHAD J 69.0 kV to 2SUMM SHADE 69.0 kV ckt 1	EKPC_P1-2_AH1-034 TP-2PATTON RD J-69_SRT-A	Single	iLL	B	Base
74		EKPC	2SUMM SHADE 69.0 kV to 2EDM-JBGAL J 69.0 kV ckt 1	EKPC_P2-3_GREEN W45-1014_SRT-A	Breaker	SUM	B	Base
75	AG2-424	EKPC	2SUMMERSVIL 69.0 kV to 2GREEN CO 69.0 kV ckt 1	EKPC_P1-2_AG2-424 TP-2MAGNOLIA-69_SRT-A	Single	iLL	B	Base
76	AH1-427	EKPC	2TOMM GOOC T 69.0 kV to 2BROUGTWN T 69.0 kV ckt 1	EKPC_P2-2_GAR 69_SRT-A	Bus	iLL	B	Base
77	AH1-239	EKPC	2UPCHURCH T 69.0 kV to 2ALBANY 69.0 kV ckt 1	EKPC_P1-2_AG1-471 TP-AH1-239 TP-69_SRT-A	Single	iLL	B	Base
78		EKPC/KU - LEX	4AVON-R 138.0 kV to 4LOUDON AVE 138.0 kV ckt 1	34541 34553_SRT-A	Tower	SUM	B	Base
79		EKPC/DEO	4BOONE CO 138.0 kV to 08LONGBR 138.0 kV ckt 1	34541 34553_SRT-A	Tower	SUM	B	Base
80		EKPC	4FLEMINGSBRG 138.0 kV to 4GODDARD 138.0 kV ckt 1	EKPC_P7-1_SPUR 345&138_SRT-A	Tower	SUM	B	Base
81		EKPC	5GREEN CO 161.0 kV to 2GREEN CO 69.0 kV ckt 1	EKPC_P2-2_SUMMSHADE 161 #2_SRT-A	Bus	SUM	B	Base
82		EKPC/ZONE_1209	7SPURLOCK 345.0 kV to 09STUART 345.0 kV ckt 1	DEOK_P4_1445_ZIMMER_SRT-A	Breaker	SUM	B	Base
83	AH1-034	EKPC	AE2-071 POI 69.0 kV to 2SUMM SHAD J 69.0 kV ckt 1	EKPC_P1-2_AH1-034 TP-2PATTON RD J-69_SRT-A	Single	iSUM	B	Base
84		EKPC	AG1-405 TP 69.0 kV to 2WALNUT GROV 69.0 kV ckt 1	EKPC_P2-3_LAURL S50-1014_SRT-A	Breaker	SUM	B	Base
85	AG2-298	EKPC	AG2-298 TP 69.0 kV to 2LORETTO 69.0 kV ckt 1	EKPC_P1-2_AG2-298 TP-2SULPHUR CRK_SRT-A	Single	iSUM	B	Base
86	AG2-298	EKPC	AG2-298 TP 69.0 kV to 2SULPHUR CRK 69.0 kV ckt 1	EKPC_P1-2_AG2-298 TP-2LORETTO-69_SRT-A	Single	iSUM	B	Base
87	AH1-034	EKPC	AH1-034 TP 69.0 kV to 2PATTON RD J 69.0 kV ckt 1	EKPC_P1-2_AH1-034 TP-2SUMM SHAD J-69_SRT-A-2	Single	iSUM	B	Base

88	AH1-034	EKPC	AH1-034 TP 69.0 kV to AE2-071 POI 69.0 kV ckt 1	EKPC_P1-2_AH1-034 TP-2PATTON RD J-69_SRT-A	Single	iSUM	B	Base
89	AH1-239	EKPC	AH1-239 TP 69.0 kV to 2UPCHURCH T 69.0 kV ckt 1	EKPC_P1-2_AG1-471 TP-2ZULA J NO-69_SRT-A	Single	iWIN	B	Base
90	AH1-239	EKPC	AH1-239 TP 69.0 kV to AG1-471 TP 69.0 kV ckt 1	EKPC_P1-2_AH1-239 TP-2UPCHURCH T-69_SRT-A	Single	iSUM	B	Base
91	AH1-427	PJM/EKPC	AH1-427 TP 69.0 kV to 2TOMM GOOC T 69.0 kV ckt 1	EKPC_P2-2_GAR 69_SRT-A	Bus	iSUM	B	Base
92	AH1-427	PJM	AH1-427 TP 69.0 kV to AE2-254 POI 69.0 kV ckt 1	EKPC_P1-2_AH1-427 TP-2TOMM GOOC T-69_SRT-A	Single	iWIN	B	Base
93	AH1-665	EKPC	AH1-664 TP 138.0 kV to 4PLUMVILLE 138.0 kV ckt 1	EKPC_P1-2_GODD-PLUM 138_SRT-A-1	Single	iSUM	B	Base

D: Reinforcement Projects provided to PJM for TC2 Phase 1

RTEP ID	Trans Owner Reference Code	Title	Cost
	EKPC-tc2-nu008	Cooper 161/69 kV Transformer Upgrade	$6,700,000
	EKPC-tc2-nu016	Laurel County 161/69 kV Transformer CT Upgrade	$35,000
	EKPC-tc2-nu003	Cooper CCGT-Alcalde 161 kV Double-Circuit Line Addition	$15,730,000
n6832.2	EKPC-tc1-r0016a	Increase the maximum operating temperature of the 636 MCM ACSR conductor in the Marion County-Casey County 161 kV line section to 176 degrees F (17.2 miles)	$1,485,000
n8368.2	EKPC-tc1-r0012b	Rebuild the Cooper-Elihu 161 kV line section using 1272 MCM ACSS conductor (4.2 miles)	$10,335,000
n7771.1	r0013	Increase the maximum operating temperature of the Laurel County-Laurel Dam 161 kV line section 795 MCM conductor to 167 degrees F (~0.2 miles)	$35,000
n8369	EKPC-tc1-r0015a	Replace the existing Marion County 161/138 kV, 200 MVA transformer with a 300 MVA transformer.	$8,825,000
n8368.4	EKPC-tc1-r0012d	Upgrade the existing 795 MCM ACSR jumpers at the Cooper substation associated with the Cooper-Elihu 161 kV line using bundled 500 MCM CU or equivalent	$35,000
n8364.1	EKPC-tc1-r0009b	Replace the 636 MCM ACSR conductor in the Marion County-KU Lebanon 138 kV line with 954 MCM ACSS conductor.	$200,000
n7771.2	EKPC-tc1-r0014a	Increase the maximum operating temperature of the Laurel County-Laurel Dam 161 kV line section 795 MCM conductor to 212 degrees F (~4.47 miles)	$515,000
n6833.1	EKPC-tc1-r0011a	Increase the maximum operating temperature of the 636 MCM ACSR conductor in the Casey County-Liberty Junction 161 kV line section to 176 degrees F.	$1,155,000
	EKPC-tc2-nu033	Wayne County-Zula Junction N.O. 69 kV Jumper Replacement	$105,000

	EKPC-tc2-nu023	Patton Road Junction-AH1-034 Tap (East Barren County) 69 kV Line Disconnect Switch Upgrade	$220,000
	EKPC-tc2-nu027	Sulphur Creek-AG2-298 Tap (West Marion County) 69 kV Line Section Rebuild (9.14 miles)	$14,555,000
	EKPC-tc2-nu029	Tommy Gooch Tap-AH1-427 Tap (North Lincoln County) 69 kV Line Section Rebuild (2.25 miles)	$4,335,000
	EKPC-tc2-nu025	Salem Tap-Webbs Crossroads Tap 69 kV Line Section Rebuild (2.7 miles)	$4,300,000
	EKPC-tc2-nu018	Liberty Junction-Mount Olive Junction 69 kV Jumper Replacement	$105,000
	EKPC-tc2-nu019	Liberty Junction-Mount Olive Junction 69 kV Line Disconnect Switch Upgrade	$220,000
	EKPC-tc2-nu028	Summer Shade-Summer Shade Junction 69 kV Line Section Rebuild (0.15 miles)	$260,000
	EKPC-tc2-nu022	Patton Road Junction-AH1-034 Tap (East Barren County) 69 kV Line Section Rebuild (4.7 miles)	$8,965,000
	EKPC-tc2-nu037	AE2-071 Tap (Eighty Eight)-Summer Shade Junction 69 kV Line Section Rebuild (1.7 miles) with 954 ACSR Conductor	$3,130,000
	EKPC-tc2-nu046	Rebuild the AG1-471 Tap (Massingale Road)-AH1-239 Tap 69 kV line (Clinton County) (4.5 miles) using 556.5 MCM ACSR conductor.	$4,215,000
	EKPC-tc2-nu013	Highland-Mount Olive Junction 69 kV Line Disconnect Switch Upgrade	$220,000
	EKPC-tc2-nu042	AE2-254 POI (South Lancaster Substation)-Garrard County 69 kV Jumper Replacement	$105,000
	EKPC-tc2-nu010	Summer Shade-Edmonton Industrial/JB Galloway Tap 69 kV Line Section Rebuild	$12,425,000
	EKPC-tc2-nu045	Rebuild the AF1-038 Tap (North Russell County)-Webbs Crossroads Tap 69 kV line (1.6 miles) using 556.5 MCM ACSR conductor.	$1,495,000
	EKPC-tc2-nu002	Albany-Upchurch Tap 69 kV Jumper Replacement	$105,000
	EKPC-tc2-nu021	Loretto-AG2-298 Tap (West Marion County) 69 kV Line Conductor Temperature Upgrade (0.6 miles)	$35,000
	EKPC-tc-nu043	AE2-254 POI (South Lancaster Substation)-Garrard County 69 kV Jumper Replacement #2	$150,000
	EKPC-tc2-nu026	Salem Tap-Windsor 69 kV Line Section Rebuild (5.31 miles)	$8,455,000
	EKPC-tc2-nu040	AE2-071 Tap (Eighty Eight)-AH1-034 Tap (East Barren County) 69 kV Line Section Rebuild (5.9 miles) with 795 ACSR Conductor	$9,870,000
	EKPC-tc2-nu017	Liberty Junction-Mount Olive Junction 69 kV Line Section Rebuild (3.26 miles)	$5,710,000
	EKPC-tc2-nu004	Broughtontown Tap-Highland 69 kV Line Section Rebuild (3.70 miles)	$6,480,000

	EKPC-tc2-nu024	Plumville-Rectorville 69 kV Line Conductor Temperature Upgrade (2.9 miles)	$180,000
	EKPC-tc2-nu007	Charters-Rectorville 69 kV Line Conductor Temperature Upgrade (11.5 miles)	$650,000
	EKPC-tc2-nu034	Zula Junction N.O.-AG1-471 (Massingale Road) 69 kV Line Section Rebuild (0.6 miles)	$960,000
	EKPC-tc2-nu038	AE2-071 Tap (Eighty Eight Substation)-Summer Shade Junction 69 kV Zone 3 Relay Setting Increase	$10,000
	EKPC-tc2-nu031	Upchurch Tap-AH1-239 Tap (Clinton County) 69 kV Line Section Rebuild (1.5 miles)	$2,390,000
	EKPC-tc2-nu009	Crooksville Tap (Madison County)-Crooksville 69 kV Line Rebuild	$7,480,000
	EKPC-tc2-nu032	Wayne County-Zula Junction N.O. 69 kV Line Section Rebuild (0.78 miles)	$1,245,000
	EKPC-tc2-nu011	Fox Hollow-Patton Road Junction 69 kV Line Rebuild	$5,795,000
	EKPC-tc2-nu041	AE2-254 POI (South Lancaster Substation)-Garrard County 69 kV Breaker CT Upgrade	$100,000
	EKPC-tc2-nu005	Broughtontown Tap-Tommy Gooch 69 kV Line Section Rebuild (2.60 miles)	$4,555,000
	EKPC-tc2-nu036	AE2-071 Tap (Eighty Eight Substation)-Summer Shade Junction 69 kV Line Disconnect Switch Upgrade	$220,000
	EKPC-tc2-nu030	Tommy Gooch Tap-AH1-427 Tap 69 kV Line Disconnect Switch Upgrade	$220,000
	EKPC-tc2-nu012	Highland-Mount Olive Junction 69 kV Line Rebuild (10.91 miles)	$19,105,000
	EKPC-tc2-nu020	Liberty Junction-Mount Olive Junction 69 kV Breaker CT Setting Upgrade	$10,000
	EKPC-tc2-nu006	Broughtontown Tap-Tommy Gooch 69 kV Line Disconnect Upgrade	$220,000
	EKPC-tc2-nu035	Plumville-AH1-664 Tap (North Fleming County) 69 kV Line Conductor Temperature Upgrade (8.25 miles)	$660,000
	EKPC-tc2-nu044	Rebuild the AE2-254 POI (South Lancaster)-AH1-427 Tap (North Lincoln County) 69 kV line (3.34 miles) using 795 MCM ACSR conductor.	$3,465,000
	EKPC-tc2-nu015	Knob Lick-McKinney Corner Tap 69 kV Line Section Bus Conductor/Jumper Upgrade	$135,000
	EKPC-tc2-nu001	Albany-Upchurch Tap 69 kV Line Section Rebuild (3.79 miles)	$6,035,000
	EKPC-tc2-nu014	Green County-Summersville 69 kV Line Section Rebuild #2 (266.8 MCM ACSR section)	$265,000

n5780.3	EKPC-tc1-r0020b	Replace the 1500A interconnection metering CTs at Spurlock Station with 2000A equipment.	$1,295,000
n6463.3	EKPC-tc1-r0007a	Replace the 954 MCM ACSR line conductor in the Boone County-Longbranch 138 kV line with 795 MCM ACSS conductor (2.3 miles)	$5,400,000
n6480.1	EKPC-tc1-r0002a	Rebuild the Plumville-Murphysville 69 kV line section using 556 MCM ACSR conductor at 212 degrees F (9.9 miles)	$15,610,000
n7788.1	r0071	Rebuild the AE2-071-Summer Shade 69 kV line section using 795 MCM ACSR conductor at 212 degrees F (1.7 miles)	$2,708,000
n8368.3	EKPC-tc1-r0012c	Change the Zone 3 relay setting at Elihu substation associated with the line protection to at least 383 MVA LTE rating.	$10,000
n6496	r0004	Increase the maximum operating temperature of the Summershade-Edm. JB Galloway Jct 69kV line section 266 MCM conductor to 212F (7.88 miles)	$420,000
n6463.2	EKPC-tc1-r0007b	Upgrade jumpers associated with Boone 138 kV bus using 2-500 MCM 37 CU conductor or equivalent	$330,000
n6460.3	n6460.3	Rebuild the EKPC portion of the Longbranch-Mt. Zion 138 kV line section using 954 MCM ACSS conductor (3.7 miles).	$7,400,000
n6834.1	EKPC-tc1-r0001a	Rebuild the 4/0 ACSR Green County-Summersville 69 kV line section (4.2 miles) using 556 MCM ACSR.	$5,585,000
s3169.0	EKPC-tc1-r0005b	Rebuild the EKPC portion of the North Springfield-KU Springfield 69 kV line (2.6 mile) using 556 MCM ACSR conductor - Projected In-Service Date 6/1/2025	$0
	EKPC-tc1-r0021a	Rebuild the AE2-254 POI (South Lancaster)-Garrard County 69 kV line (1.81 miles) using 954 MCM ACSR conductor.	$2,085,000
s3169.0	s3169	Rebuild the 14.11 mile, North Springfield-Loretto 69 kV line using 556.5 conductor and steel pole construction	$12,970,000
s2475	s2475	Rebuild the 8.49 mile, Hodgenville-Magnolia 69 KV transmission line using 556.5 ACSR/TW conductor	$4,750,000
s3170.0	s3170	Rebuild the 4.4 mile, Snow Tap-North Albany 69 kV line using 556.5 conductor and steel pole construction.	$4,600,000