Comparison of West Garrard 345 kV Substation to Other Construction Alternatives in the Area

EKPC's Transmission Planning Team has performed a System Impact Study (SIS) for planned generator additions at the J.K. Smith Station. The planned additions are five combustion turbines (CTs) with net summer output of 84 MW each and one steam unit with net output of 278 MW. The five CTs are expected to be installed by the summer of 2009, and the baseload steam unit is expected to be commercial by spring of 2010. The purpose of the SIS was to identify the problems that would be created on the EKPC and neighboring transmission systems due to these unit additions, and to identify potential mitigation alternatives for the identified problems. The study considered a multitude of alternatives to provide the necessary additional transmission outlet capacity from the J.K. Smith Station. Ultimately, most of the transmission outlets were discarded for a variety of reasons related to system performance and economics. Three specific transmission alternatives were developed and studied in detail based on the results of the screening analysis. Two of these alternatives included as the primary component construction of a 345 kV line from J.K. Smith Station to the Tyner Substation. The other alternative included as the primary component construction of a 345 kV line from J.K. Smith to a new 345 kV substation to be constructed at West Garrard. The alternative that includes the J.K. Smith-West Garrard 345 kV line was ultimately identified in the study process as the desired alternative for implementation.

One of the transmission alternatives considered in the original SIS was construction of a 345 kV line from J.K. Smith to LGEE's Brown North Station. This alternative provided adequate electrical performance. In fact, the J.K. Smith-Brown North 345 kV line provides very similar electrical performance when compared with the J.K. Smith-West Garrard 345 kV line for both normal and single-contingency conditions. However, in the SIS it was determined that the J.K. Smith-Brown North 345 kV line should not be pursued further, because the length of the J.K. Smith-Brown North line was estimated to be about two miles more. Therefore, additional transmission line construction would be required to secure basically the same level of electrical performance. Furthermore, the West Garrard Station alternative appeared to be much more conducive to EKPC's future system expansion needs. LGEE's Brown Power Plant is a highly congested area, with three steam generating units, eight CT units, and five transmission substations with numerous transmission lines navigating the property. The general area where the West Garrard Substation was envisioned for location appeared to be a relatively open area that would allow EKPC to much more easily construct future lines to the western portions of its system, where limited high-voltage transmission is presently installed.

Although the SIS determined that the J.K. Smith-Brown North line should not be pursued further for the reasons discussed above, EKPC decided in August 2006 to perform a more detailed comparison of the J.K. Smith-Brown North line versus the J.K. Smith-West Garrard line. This analysis was felt to be necessary based on questions from the public concerning the possibility of constructing J.K. Smith-Brown North instead of J.K. Smith-West Garrard, as well as internal discussions between EKPC personnel that indicated that

these two projects could be very similar in terms of construction costs, impacts, and electrical system performance.

A 345 kV double-circuit transmission line exists from LGEE's Brown North Station to its Pineville Station. One of the two circuits is presently energized at 345 kV. The other circuit is energized at the Brown North end at 138 kV, while the other end is not connected. This configuration provides some additional reactive support to the system. As part of EKPC's proposed transmission plan to connect the J.K. Smith units, the second Brown North-Pineville circuit is requested to be energized at 345 kV. This would require LGEE to connect the circuit to the Brown North 345 kV bus and the Pineville 345 kV bus by adding the necessary terminal equipment (circuit breakers, disconnects, relays, etc.) at each site. The new West Garrard substation would then connect the J.K. Smith line to the second Brown North-Pineville circuit. EKPC evaluated whether this second Brown-Pineville circuit would need to be energized at 345 kV if the J.K. Smith-Brown North 345 kV line was constructed instead of the J.K. Smith-West Garrard project. This analysis determined that the second circuit would still need to be energized, since significant problems could occur on the LGEE system during an outage of the existing Brown North-Alcalde-Pineville 345 kV circuit. Therefore, this energization work would be needed regardless of whether the line is constructed to the proposed West Garrard site or to Brown North.

1. Comparison of Electrical Performance

a. Normal System Flows

Figures 1 through 8 show graphically the comparison of power flows in the J.K. Smith and Brown area for 2010 Summer, 2010-11 Winter, 2015 Summer, and 2015-16 Winter. The topology differences being compared are the system with a new 345 kV line from J.K. Smith to West Garrard versus J.K. Smith-Brown North. Figures 1-8 show that the flows are similar on most facilities. For the J.K. Smith-West Garrard Alternative, power flows are seen from West Garrard to Brown North. For the J.K. Smith-Brown North Alternative, the power flows are expected from J.K. Smith to Brown North, and then from Brown North to Pineville. However, the net flows to the Pineville/Alcalde 345 kV busses are similar for both cases. Likewise, the flows on the remaining 345 kV facilities connected at Brown change very little between the two alternatives. Tables 1 and 2 show the same flow results in tabular format, for summer and winter respectively, for the area facilities.

Table 1 2010 and 2015 Summer Flows on 345 kV System At Brown and JK Smith				
Transmission Facility	**2010 Summer MVA Flow With JK Smith-West Garrard 345 kV**	**2010 Summer MVA Flow With JK Smith-Brown North 345 kV**	**2015 Summer MVA Flow With JK Smith-West Garrard 345 kV**	**2015 Summer MVA Flow With JK Smith-Brown North 345 kV**
JK Smith-Brown North 345 kV Line	N/A	349.2	N/A	581.4
Brown North-Pineville 345 kV Line	N/A	223.8	N/A	. 251.2
JK Smith-West Garrard 345 kV Line	351.0	N/A	569.2	N/A
West Garrard-Brown North 345 kV Line	102.7	N/A	262.9	N/A
West Garrard-Pineville 345 kV Line	253.3	N/A	299.3	N/A
Brown North-Alcalde 345 kV Line	276.5	292.1	312.9	340.2
Hardin County-Brown North 345 kV Line	134.8	131.0	66.6	57.6
West Lexington-Brown North 345 kV Line	143.5	141.5	130.3	121.0
Brown North 345-138 kV Transformer	78.7	79.9	129.9	138.6
JK Smith-North Clark 345 kV Line	(37.2)	(36.6)	90.4	85.2
JK Smith 345-138 kV Transformers	73.8	71.8	254.8	250.2

For the summer peak load periods, the flows on the J.K. Smith-Brown 345 kV line versus the J.K. Smith-West Garrard 345 kV line differ by up to 2.1%. The combined flows on the 345 kV lines to Alcalde and Pineville differ by up to 3.5%.

Table 2 2010-11 and 2015-16 Winter Flows on 345 kV System At Brown and JK Smith				
Transmission Facility	**2010-11 Winter MVA Flow With JK Smith-West Garrard 345 kV**	**2010-11 Winter MVA Flow With JK Smith-Brown North 345 kV**	**2015-16 Winter MVA Flow With JK Smith-West Garrard 345 kV**	**2015-16 Winter MVA Flow With JK Smith-Brown North 345 kV**
JK Smith-Brown North 345 kV Line	N/A	560.4	N/A	672.6
Brown North-Pineville 345 kV Line	N/A	385.7	N/A	403.5
JK Smith-West Garrard 345 kV Line	567.4	N/A	672.8	N/A
West Garrard-Brown North 345 kV Line	124.1	N/A	200.1	N/A
West Garrard-Pineville 345 kV Line	436.1	N/A	461.8	N/A
Brown North-Alcalde 345 kV Line	469.5	494.1	502.8	534.2
Hardin County-Brown North 345 kV Line	215.1	209.4	185.3	177.7
West Lexington-Brown North 345 kV Line	201.3	194.8	194.2	184.9
Brown North 345-138 kV Transformer	84.3	87.5	109.2	114.0
JK Smith-North Clark 345 kV Line	39.8	41.5	123.7	122.8
JK Smith 345-138 kV Transformers	288.2	281.0	169.0	169.0

For the winter peak load periods, the flows on the J.K. Smith-Brown 345 kV line versus the J.K. Smith-West Garrard 345 kV line differ by up to 1.2%. The combined flows on the 345 kV lines to Alcalde and Pineville differ by up to 2.9%.

b. Single-Contingency Flows

Single contingency flows are again in general similar between the two alternatives. The only contingencies that result in area flows being somewhat different are outages of the Brown-Alcalde 345 kV, Brown-Pineville 345 kV, Brown-West Garrard 345 kV, or West Garrard-Pineville 345 kV lines. An outage of any one of these 345 kV lines will result in flows on the the remaining 345 kV system between J.K. Smith, Brown, Alcalde, and Pineville that differ somewhat between the two alternatives. Figure 9 illustrates the flows for the J.K. Smith-West Garrard Alternative during a contingency of the Brown-West

Garrard 345 kV line in 2015-16 Winter. Figure 10 illustrates the flows for the J.K. Smith-Brown North Alternative during a contingency of the Brown-Pineville 345 kV line in 2015-16 Winter. Note that although these contingencies are unique to each alternative, the resulting transmission-system flows are not an issue for either alternative.

Neither alternative has a significant advantage regarding single-contingency performance. The J.K. Smith-West Garrard Alternative does result in lower flows on the Brown-Alcalde 345 kV line during the outage of the Brown-West Garrard line than is seen during an outage of the Brown-Pineville line with the J.K. Smith-Brown North Alternative. The construction of the West Garrard Substation provides the benefits of maintaining the connection to Pineville from J.K. Smith via the West Garrard Substation during an outage of the Brown North-West Garrard line.

c. Multiple-Contingency Flows

The transmission system must be designed to reliably serve all customers without thermal overloads during single-contingency conditions. The system performance during multiple contingencies is less stringent. The system typically must be designed to withstand multiple contingencies without creating cascading outages, but some planned and controlled loss of load is acceptable.

The primary multiple contingency of concern for the J.K. Smith-West Garrard Alternative is a simultaneous outage of the Brown North-West Garrard and West Garrard-Pineville 345 kV lines. This scenario would result in the J.K. Smith-West Garrard line being disconnected from the transmission network. It is not expected that the Brown-West Garrard and West Garrard-Pineville lines will share any common points of failure. Therefore, the failure of these two circuits would be based on two independent events, which is a very low probability. The other possibility that would create the same topology would be an outage of the entire West Garrard Substation. This substation is being designed with two main busses with a breaker-and-a-half scheme. Therefore, the likelihood of the entire substation being out of service is very small. An analysis of this scenario was performed to ensure that the system would perform adequately. No problems were identified on the transmission system during these multiple contingencies. Generation would need to be reduced at J.K. Smith during this scenario to maintain flows within applicable limits for a subsequent contingency. However, for the J.K. Smith-Brown North Alternative, generation would need to be reduced at J.K. Smith by the same amount for a multiple contingency scenario that involves the J.K. Smith-Brown North 345 kV line being out of service.

The primary advantage when comparing the two alternatives is the performance during an outage of the double-circuit tower 345 kV line from Brown North to Pineville. Widespread voltage problems and an overload of the Lake Reba Tap-West Irvine Tap-Delvinta 161 kV line were identified using power flow analysis with the J.K. Smith-Brown North 345 kV Alternative modeled during periods of moderate north-south transfers. These problems were not present for this scenario with the J.K. Smith-West Garrard 345 kV Alternative modeled.

Another advantage of the J.K. Smith-West Garrard alternative is that a connection from the J.K. Smith Station to Pineville via West Garrard would still be in place during a station outage of the Brown North 345 kV Substation. This would not be true for the J.K. Smith-Brown North Alternative. Power flow analysis indicates that the Brown North Substation outage results in marginal system conditions. The J.K. Smith-West Garrard 345 kV Alternative provides some level of system improvement when compared to the J.K. Smith-Brown North alternative.

Therefore, the J.K. Smith-West Garrard 345 kV Alternative provides some advantages in terms of system performance during certain multiple contingencies. Although these contingencies have a low probability of occurrence, the potential problems can be fairly severe. The implementation of the J.K. Smith-West Garrard 345 kV Alternative will provide better performance during these periods.

d. Transmission System Losses

The relative level of transmission system losses for EKPC and LGEE was determined for each alternative. The results are contained in Table 3.

Table 3
Comparison of Transmission System Losses for EKPC and LGEE – J.K. Smith-West Garrard Alternative Versus J.K. Smith-Brown North Alternative

Company	2010 Summer MW Losses With JK Smith-West Garrard 345 kV	2010 Summer MW Losses With JK Smith-Brown North 345 kV	2015 Summer MW Losses With JK Smith-West Garrard 345 kV	2015 Summer MW Losses With JK Smith-Brown North 345 kV	2010-11 Winter MW Losses With JK Smith-West Garrard 345 kV	2010-11 Winter MW Losses With JK Smith-Brown North 345 kV	2015-16 Winter MW Losses With JK Smith-West Garrard 345 kV	2015-16 Winter MW Losses With JK Smith-Brown North 345 kV
EKPC	113.8	113.9	144.5	144.7	173.2	173.9	201.3	201.6
LGEE	226.2	226.1	276.8	276.0	233.0	233.0	273.0	272.3

Table 3 shows that the losses during peak load conditions are similar for the two alternatives. The J.K. Smith-West Garrard alternative provides slightly lower losses for EKPC and the J.K. Smith-Brown North alternative provides slightly lower losses for LGEE. The total for the two systems combined is very similar for both alternatives. Therefore, neither alternative has an advantage with respect to transmission system losses.

e. Conclusions

The electrical performance of these two alternatives is similar during normal-system or single-contingency conditions. The J.K. Smith-West Garrard 345 kV Alternative provides better system performance during certain multiple contingencies. Although these contingencies have a low probability of occurrence, the potential problems may be fairly severe. The implementation of the J.K. Smith-West Garrard 345 kV Alternative will provide better performance during these periods.

2. Economic Comparison

The estimated costs of the two Alternatives are shown in Tables 2-1 and 2-2. Note that the costs of the West Garrard Substation have been doubled from the original estimate to more accurately reflect the expected costs.

Table 2-1 Estimated Costs of the J.K. Smith-West Garrard Alternative				
Install Date	**Project Description**	**Planning Estimate (2006$)**	**Inflated Cost (2009$)**	**Present Worth (2006$)**
June 2009	Construct 35.5 miles of 345 kV line from JK Smith to LGEE's Brown-Pineville 345 kV double-circuit line at West Garrard using bundled 954 MCM ACSR conductor.	41,750,000	47,035,000	57,062,000
June 2009	Add 345 kV terminal facilities at JK Smith CFB Substation for the West Garrard line.	1,080,000	1,217,000	1,476,000
June 2009	Add terminal facilities at LGEE's Brown and Pineville Substations to energize the Brown-Pineville 345 kV circuit.	2,160,000	2,433,000	2,952,000
June 2009	Construct a 345 kV breaker station at West Garrard with three line exits. Loop the Brown-Pineville 345 kV line through the station to terminate the new line from JK Smith.	6,480,000	7,299,000	8,856,000
	Total	$51,470,000	$57,984,000	$70,346,000

Table 2-2 Estimated Costs of the J.K. Smith-Brown North Alternative				
Install Date	**Project Description**	**Planning Estimate (2006$)**	**Inflated Cost (2009$)**	**Present Worth (2006$)**
June 2009	Construct 37.5 miles of 345 kV line from JK Smith to LGEE's Brown-North Substation using bundled 954 MCM ACSR conductor.	45,750,000	51,542,000	62,530,000
June 2009	Add 345 kV terminal facilities at JK Smith CFB Substation for the West Garrard line.	1,080,000	1,217,000	1,476,000
June 2009	Add terminal facilities at LGEE's Brown and Pineville Substations to energize the Brown-Pineville 345 kV circuit.	2,160,000	2,433,000	2,952,000
June 2009	Add terminal facilities at LGEE's Brown North Substation for the new JK Smith-Brown North line.	3,240,000	3,650,000	4,428,000
	Total	$52,230,000	$58,842,000	$71,386,000

The comparison in Tables 2-1 and 2-2 indicates that the costs of the two alternatives are very similar. Based on the estimates given, the J.K. Smith-Brown North Alternative costs approximately $858,000 (1.5%) more in 2009 dollars. However, the accuracy of

the estimates is such that the assumption made for comparison purposes is that the costs of the two alternatives are essentially equal.

3. Comparison of Future Expansion Options

The primary advantage of the J.K. Smith-West Garrard alternative is the construction of the new West Garrard 345 kV Substation in the center of the EKPC transmission system. This provides a high-voltage source into an area of EKPC's system that currently consists of only 69 kV transmission facilities. The projected demand on the EKPC transmission system in the region of central Kentucky between Lancaster, Bardstown, Lawrenceburg and Liberty is 279 MW in 2015 Summer and 377 MW in 2015-16 Winter. EKPC has only 69 kV transmission facilities in this region. In fact, in this region, EKPC and LGEE have 262 miles of 69 kV networked transmission with no higher-voltage source (Figure 11). Therefore, this region has a large amount of load that is being served through a 69 kV system with relatively low capacity. EKPC also presently relies significantly on transmission capacitor banks in the area to provide needed voltage support. As a result, EKPC expects to need one or more higher-voltage sources in this area in the future. The West Garrard 345 kV Substation will provide this opportunity for future connections to the existing 69 kV system. The West Garrard Substation will be located approximately 3 miles west of EKPC's Garrard County 69 kV Substation. A 345-138 kV or 345-161 kV transformer can be installed at the West Garrard Substation and a new 138 kV or 161 kV line could be built to any point on the EKPC system in the area that needs a new source.

EKPC has evaluated its long-term needs in the central and western portions of its system. Based on long-range forecasts and extrapolation of transmission system voltages and flows from the power flow models, it is anticipated that new sources are needed as follows:

- The Casey County area in 2023
- The Garrard County area in 2026
- The Summer Shade area in 2039

EKPC evaluated four alternatives to determine the relative differences in trying to address EKPC's future system needs in these areas. The three alternatives are:

- The J.K. Smith-West Garrard 345 kV line (35.5 miles) and the West Garrard 345 kV Substation; EKPC's future expansion would be from the West Garrard Substation (Alternative A)
- The J.K. Smith-Brown North 345 kV line (37.5 miles) and expansion of LGEE's existing Brown North Substation; EKPC's future expansion would be from the Brown North Substation or a new adjacent substation (Alternative B)
- The J.K. Smith-Brown North 345 kV line (37.5 miles) and expansion of LGEE's existing Brown North Substation; EKPC's future expansion would be from a newly constructed substation near Newby using the J.K. Smith-Brown North 345 kV line (Alternative C)

- The J.K. Smith-Brown North 345 kV line (37.5 miles) and expansion of LGEE's existing Brown North Substation; EKPC's future expansion would be from a newly constructed substation at West Garrard.

Therefore, the following table shows the estimated line mileages to construct a new source to the areas listed above for each of the Alternatives.

Table 3-1
Comparison of Future Expansion Needs for Alternatives

	To Casey County Area	To Garrard County Area	To Summer Shade area
Alternative A – Miles of new line from West Garrard	25	3	83
Alternative B – Miles of new line from Brown North	30	13	88
Alternative C – Miles of new line from Newby	45	14	103
Alternative D – Miles of new line from West Garrard	25	3	83

Alternatives A and D provide the shortest line routes to each of the three areas identified. The estimated costs in 2006 dollars for the construction of new lines to these areas for each alternative is shown in Table 3-2.

Table 3-2
Comparison of Costs of Future Expansion for Alternatives Considered in 2006 Dollars

	To Casey County Area	To Garrard County Area	To Summer Shade area
Alternative A – Cost of new line from West Garrard	$27.5M	$1.5M	$91.3M
Alternative B – Cost of new line from Brown North	$33.0M	$6.5M	$96.8M
Alternative C – Cost of new line from Newby	$49.5M	$7.0M	$113.3M
Alternative D – Cost of new line from West Garrard	$27.5M	$1.5M	$91.3M

These costs assume 161 kV line construction to the Garrard County area, and double-circuit 345/161 kV construction to the Casey County and Summer Shade areas. These are conceptual plans that may change in the future. Detailed studies will be required to determine the specific needs of each area. Based on existing models and load projections, EKPC anticipates the needs as specified above.

This analysis indicates that the West Garrard Substation is better located to provide for EKPC's future system needs. The Brown North site is a few miles further away from EKPC's areas of need. Also, the expansion capability for EKPC at the Brown North site is not known. If LGEE does not provide EKPC with sufficient future line exits from the Brown North Substation, EKPC would need a new substation to satisfy its future expansion needs. One possibility would be to build a new substation at the Brown site or

in the surrounding area. This could increase the costs of the J.K. Smith-Brown North Alternative substantially. The other possibility is to build a new substation at some point along the J.K. Smith-Brown North line. EKPC chose the Newby site for Alternative C because of its location as the westernmost point where EKPC's existing 69 kV facilities would be in close proximity to the proposed J.K. Smith-Brown North line. However, as the data in Tables 3-1 and 3-2 show, the Newby site is significantly further removed from the future areas of need for EKPC.

EKPC has concluded for the reasons discussed above that the West Garrard Substation provides much better future system expansion possibilities than the Brown North Substation or the Newby Substation. Either Alternative A or Alternative D specifies this substation. Of these two alternatives, Alternative A is the lower-cost option. The economic comparison of the J.K. Smith-West Garrard and J.K. Smith-Brown North Alternatives shown in Tables 2-1 and 2-2 indicated that the costs are very similar. Alternative D as specified would include the cost of constructing the West Garrard Substation with a new 345-161 kV transformer in 2023. Alternative A would include only the cost of adding a 345-161 kV transformer at West Garrard in 2023. Tables 3-3 and 3-4 compare Alternatives A and D as specified through 2023.

Table 3-3
Estimated Costs of Alternative A (J.K. Smith-West Garrard 345 kV Line and West Garrard 345 kV Substation in 2009)

Install Date	Project Description	Planning Estimate (2006$)	Inflated Cost (2009$)	Present Worth (2006$)
June 2009	Construct 35.5 miles of 345 kV line from JK Smith to LGEE's Brown North-Pineville 345 kV double-circuit line at West Garrard using bundled 954 MCM ACSR conductor.	41,750,000	47,035,000	57,062,000
June 2009	Add 345 kV terminal facilities at JK Smith CFB Substation for the West Garrard line.	1,080,000	1,217,000	1,476,000
June 2009	Add terminal facilities at LGEE's Brown North and Pineville Substations to energize the Brown North-Pineville 345 kV circuit.	2,160,000	2,433,000	2,952,000
June 2009	Construct a 345 kV breaker station at West Garrard with three line exits. Loop the Brown North-Pineville 345 kV line through the station to terminate the new line from JK Smith.	6,480,000	7,299,000	8,856,000
June 2023	Install a 345-161 kV, 450 MVA transformer at West Garrard.	4,500,000	6,730,000	2,282,000
June 2023	Construct 25 miles of 345/161 kV double-circuit line from West Garrard to Casey County using 954 ACSS conductor (energize only the 161 kV circuit).	27,500,000	41,129,000	13,948,000
	Total	$78,970,000	$105,843,000	$86,576,000

Table 3-4 Estimated Costs of Alternative D (J.K. Smith-Brown North 345 kV Line in 2009; West Garrard Substation in 2023)				
Install Date	**Project Description**	**Planning Estimate (2006$)**	**Inflated Cost (2009$)**	**Present Worth (2006$)**
June 2009	Construct 37.5 miles of 345 kV line from JK Smith to LGEE's Brown North Substation using bundled 954 MCM ACSR conductor.	45,750,000	51,542,000	62,530,000
June 2009	Add 345 kV terminal facilities at JK Smith CFB Substation for the West Garrard line.	1,080,000	1,217,000	1,476,000
June 2009	Add terminal facilities at LGEE's Brown North and Pineville Substations to energize the Brown North-Pineville 345 kV circuit.	2,160,000	2,433,000	2,952,000
June 2009	Add terminal facilities at LGEE's Brown North Substation for the new JK Smith-Brown North line.	3,240,000	3,650,000	4,428,000
June 2023	Construct a 345 kV breaker station at West Garrard with three line exits. Loop the Brown North-Pineville 345 kV line through the station to terminate the new line from JK Smith. Install a 345-161 kV, 450 MVA transformer at West Garrard.	10,330,000	15,450,000	5,239,000
June 2023	Construct 25 miles of 345/161 kV double-circuit line from West Garrard to Casey County using 954 ACSS conductor (energize only the 161 kV circuit).	27,500,000	41,129,000	13,948,000
	Total	$90,060,000	$115,421,000	$90,573,000

The estimated total present worth cost of Alternative D is nearly 5% higher than for Alternative A. Also, Alternative D would require the establishment of two LGEE-EKPC interconnections – one at Brown North in 2009 and one at West Garrard in 2023. Alternative A requires the establishment of only one LGEE-EKPC interconnection – at West Garrard in 2009. Therefore, Alternative A is a more desirable plan than Alternative D.

Therefore, implementation of the J.K. Smith-West Garrard 345 kV Alternative is the preferred plan to address EKPC's future system expansion needs.

4. Reliability Issues Comparison

The J.K. Smith-West Garrard and J.K. Smith-Brown North 345 kV lines would be routed along the same corridor from the J.K. Smith site to the Newby area. The remainder of the

J.K. Smith-Brown North line would largely parallel LGEE's Brown Plant-Fawkes 138 kV line. The probability of simultaneous outages of these two circuits increases when they are located within a common corridor. Simultaneous outages of these two circuits could result in system problems requiring generation re-dispatch.

The remainder of the J.K. Smith-West Garrard line from Newby to the West Garrard site would be routed primarily along the Newby-Lancaster 69 kV line. This will be accomplished by either rebuilding the existing 69 kV line as double-circuit 345/69 kV line or by leaving the 69 kV line in place and building the new 345 kV line parallel to it. Again, this will increase the probability of simultaneous outages of the two circuits. However, these two circuits are independent of each other. Therefore, an outage of both circuits simultaneously does not create any more system issues than does an outage of either circuit independently.

Therefore, the reliability of the expected route for the J.K. Smith-West Garrard line is better than that of the expected route for the J.K. Smith-Brown North line.

Another advantage of the J.K. Smith-West Garrard line is that the exposure is slightly lower – 2 miles (5.6%) -- than that for the J.K. Smith-Brown North line. This indicates that in generic terms an outage of the J.K. Smith-Brown North line would be slightly more likely due to its longer distance between circuit breakers. Also, the J.K. Smith-West Garrard 345 kV Alternative reduces the exposure of the Brown North-Pineville 345 kV circuit by adding circuit breakers in this line at the new West Garrard Substation. This reduces the distance between circuit breakers from 102.5 miles between Brown North and Pineville to 13.5 miles between Brown North and West Garrard and 89 miles between West Garrard and Pineville.

5. Line Routing and Substation Construction Considerations

A comparison of the J.K. Smith-West Garrard 345 kV Alternative versus the the J.K. Smith-Brown North 345 kV Alternative indicates the following routing considerations:

- Approximately the same amount of clearing of rights-of-way would be required for both alternatives.
- The J.K. Smith-West Garrard 345 kV line is expected to be co-located with existing facilities over approximately 80% of the route (28 miles). The J.K. Smith-Brown North 345 kV line is expected to be co-located with existing facilities over approximately 90% of the route (34 miles).
- The J.K. Smith-Brown North 345 kV line would require two additional river crossings (Dix River).
- The J.K. Smith-West Garrard 345 kV Alternative requires construction of a new substation at West Garrard on a "green field" site, whereas the J.K. Smith-Brown North Alternative expands an existing substation.

6. Schedule Comparison

A substantial amount of work has been performed for the J.K. Smith-West Garrard Alternative. Aerial photography of the study area has been performed. Open houses have been conducted by both the Rural Utilities Service (RUS) and EKPC to solicit public comments regarding the proposed new line and substation. EKPC has identified a planned route for the J.K. Smith-West Garrard 345 kV line. This entire process has taken approximately 6 months. Some of the aerial photography and routing work used for the J.K. Smith-West Garrard 345 kV line could be used for the J.K. Smith-Brown North 345 kV line. However, the J.K. Smith-Brown North project would still be delayed by 6 to 12 months beyond the planned completion date for the J.K. Smith-West Garrard project due to the environmental and engineering work that would need to be performed on the front-end. This delay could result in significant incremental power purchase costs incurred by EKPC due to insufficient transmission to accommodate economic dispatch of the J.K. Smith generating units.

7. Conclusions

The analysis discussed above shows that the J.K. Smith-West Garrard 345 kV Alternative is a more desirable option than the J.K. Smith-Brown North 345 kV Alternative for the following reasons:

- The power flows for the two alternatives are very similar for normal-system and single-contingency conditions, but the J.K. Smith-West Garrard Alternative provides improved system performance for certain multiple-contingency scenarios, particularly a critical double-circuit tower outage scenario.
- The initial costs of the two alternatives are very similar. However, the J.K. Smith-West Garrard Alternative holds significant future expansion benefits that results in at least 5% lower present worth construction costs for potential future needs.
- The J.K. Smith-West Garrard 345 kV line provides much better system reliability due to shorter line length, less co-location with critical circuits in the area, and decreased exposure for the Brown North-Pineville 345 kV circuit.
- The J.K. Smith-West Garrard 345 kV Alternative can be completed 6 to 12 months sooner than the J.K. Smith-Brown North line, which could result in substantial generation dispatch savings for EKPC.

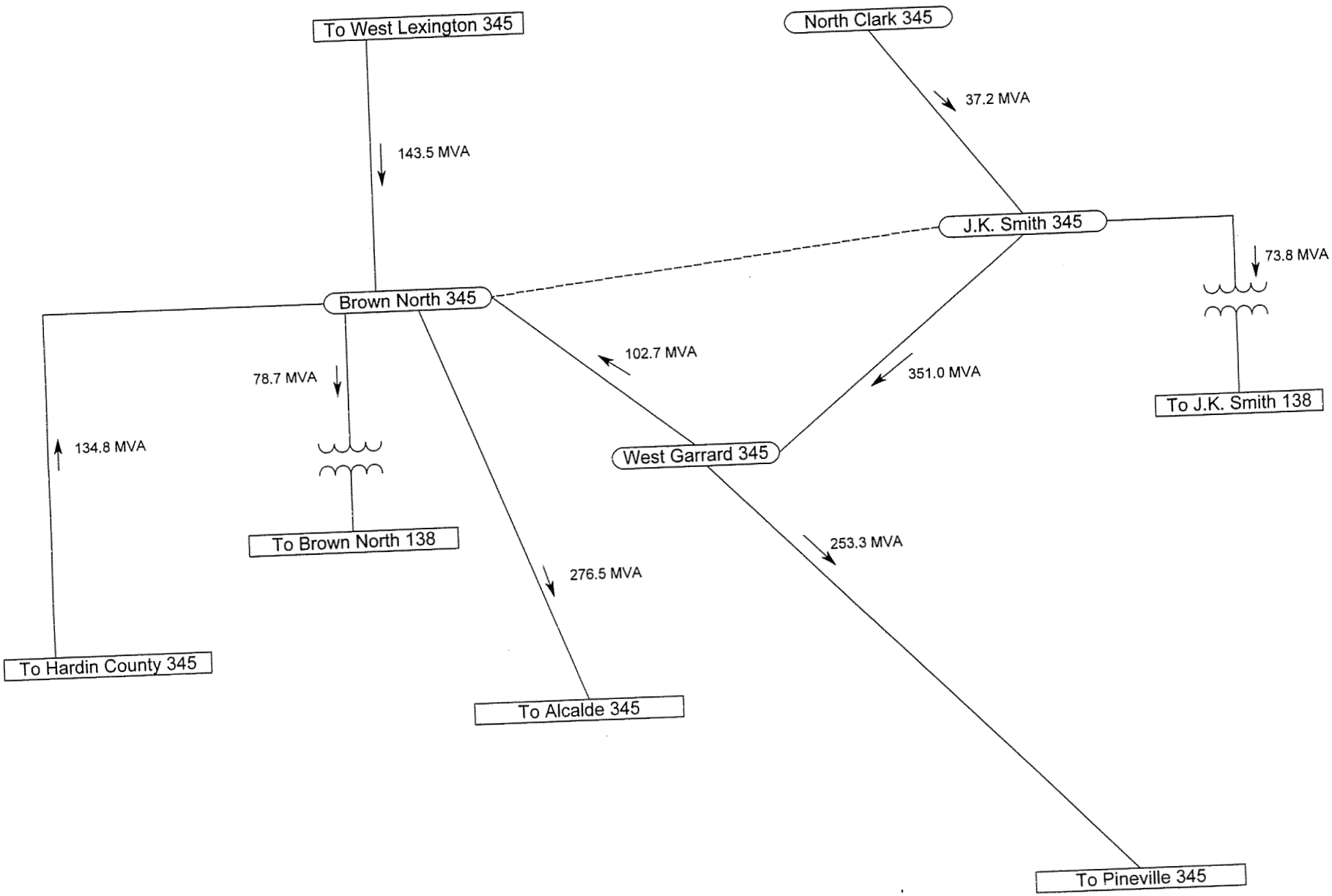


Figure 1
2010 Summer With J.K. Smith Generator Additions and J.K. Smith-West Garrard 345 kV Project

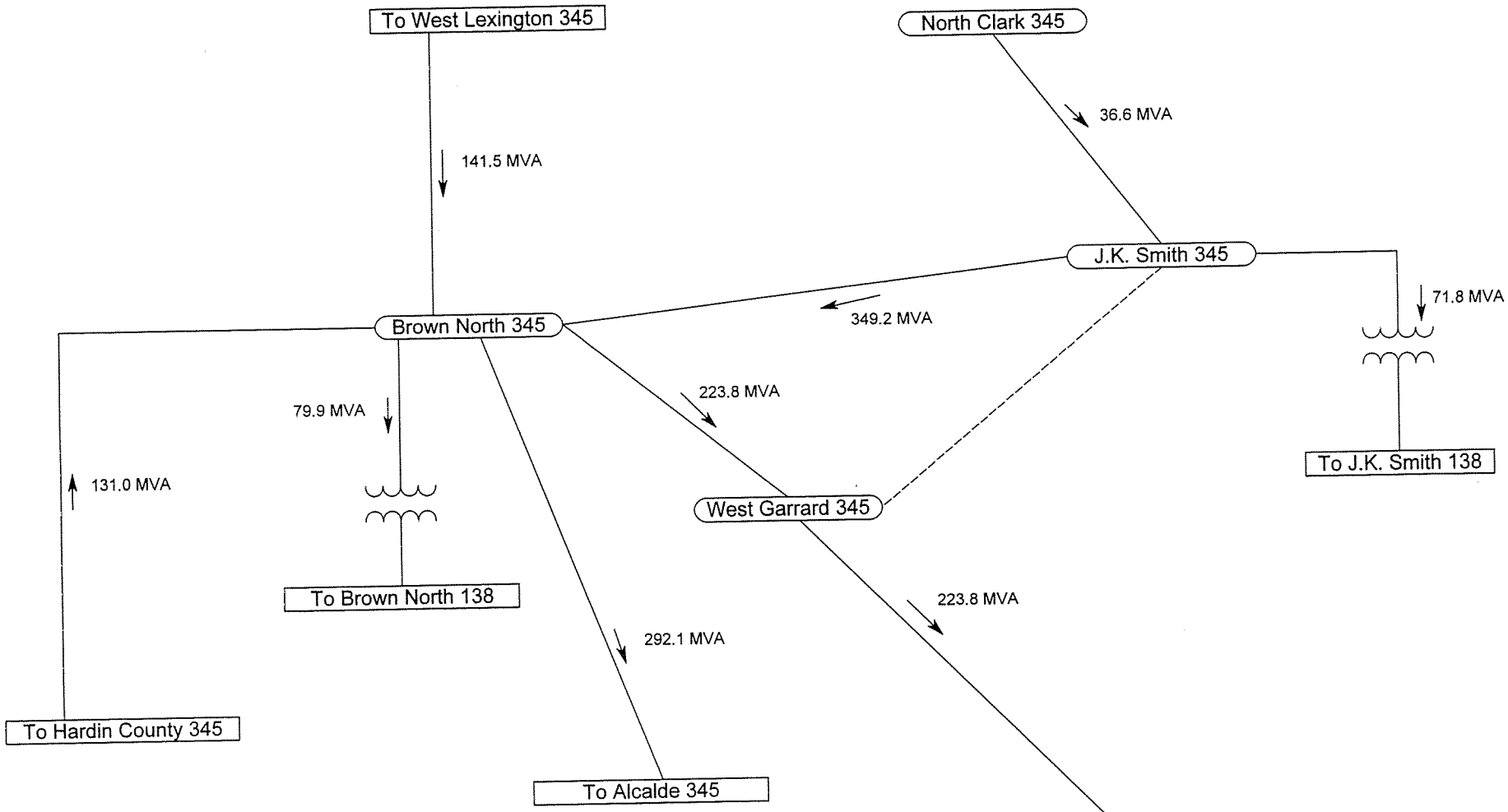


Figure 2
2010 Summer With J.K. Smith Generator Additions and J.K. Smith-Brown North 345 kV Project

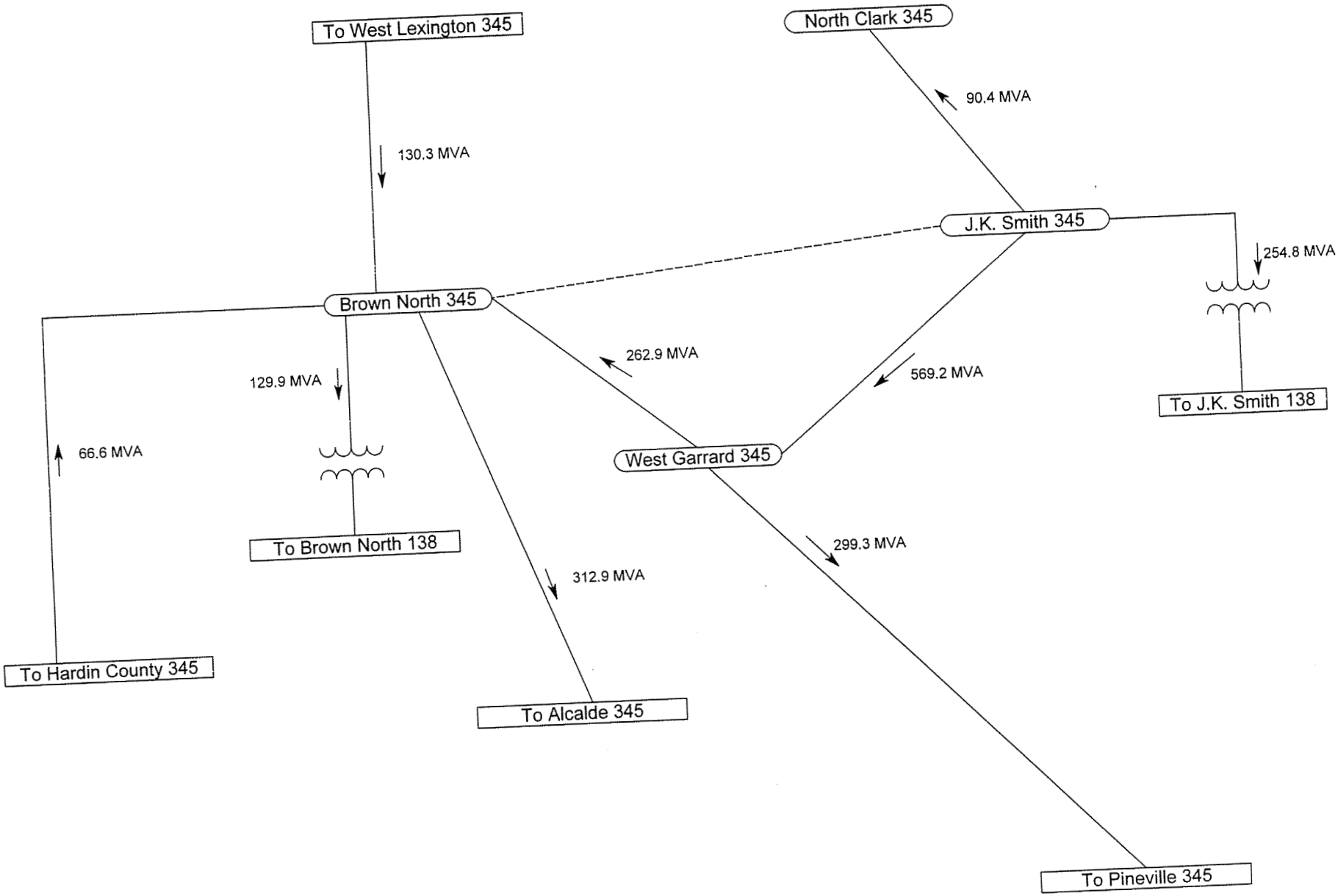


Figure 3
2015 Summer With J.K. Smith Generator Additions and J.K. Smith-West Garrard 345 kV Project

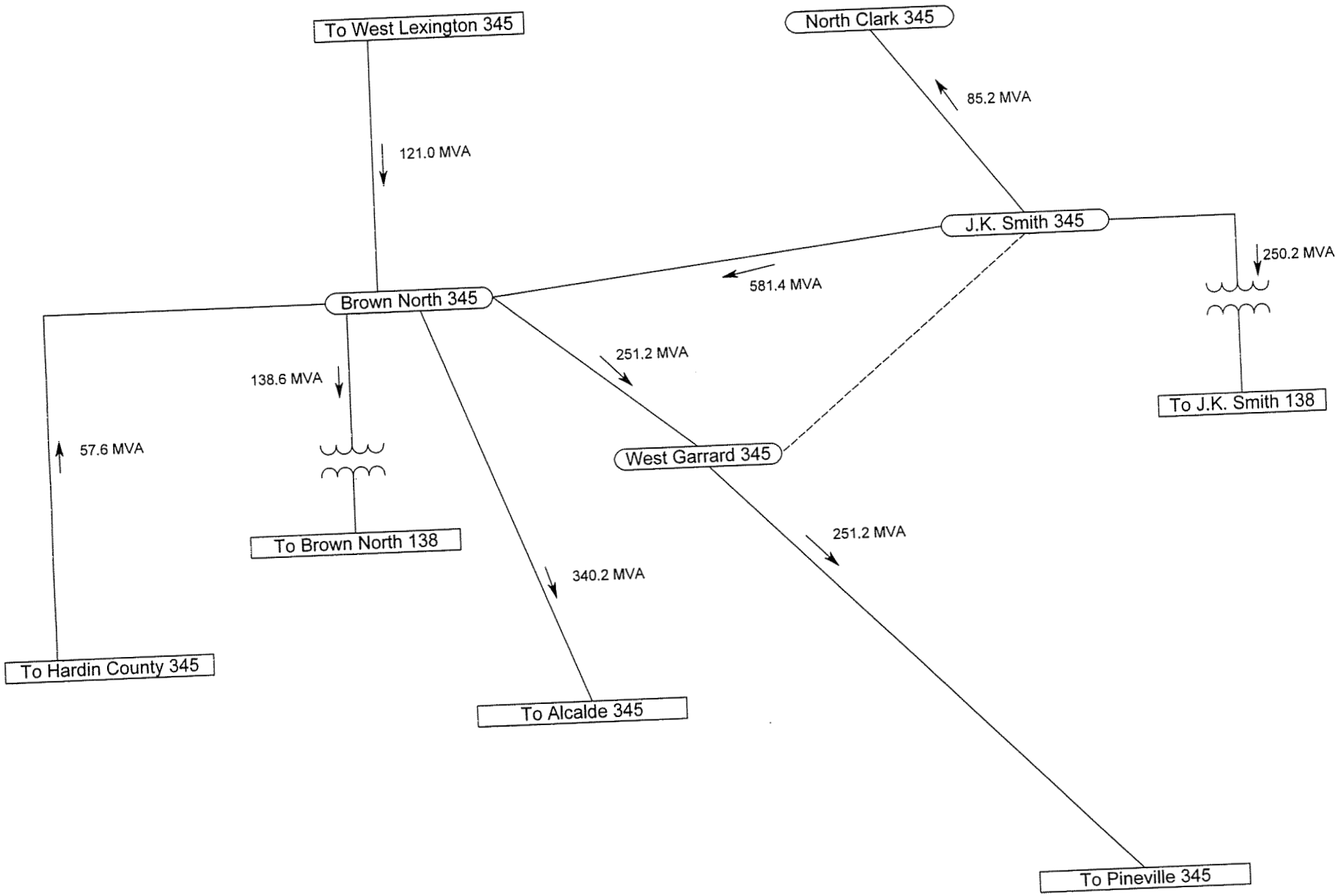


Figure 4
2015 Summer With J.K. Smith Generator Additions and J.K. Smith-Brown North 345 kV Project

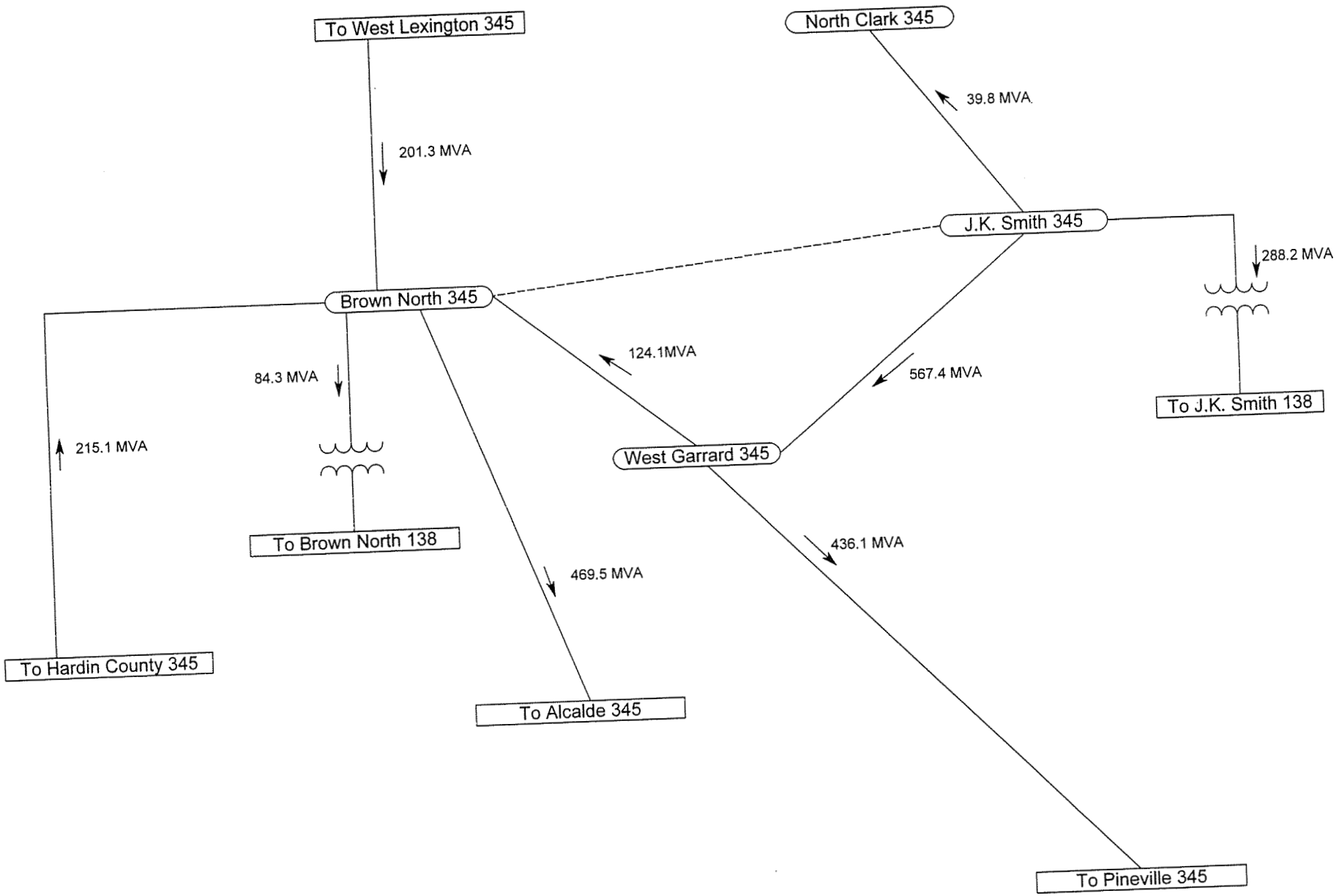


Figure 5
2010-11 Winter With J.K. Smith Generator Additions and J.K. Smith-West Garrard 345 kV Project

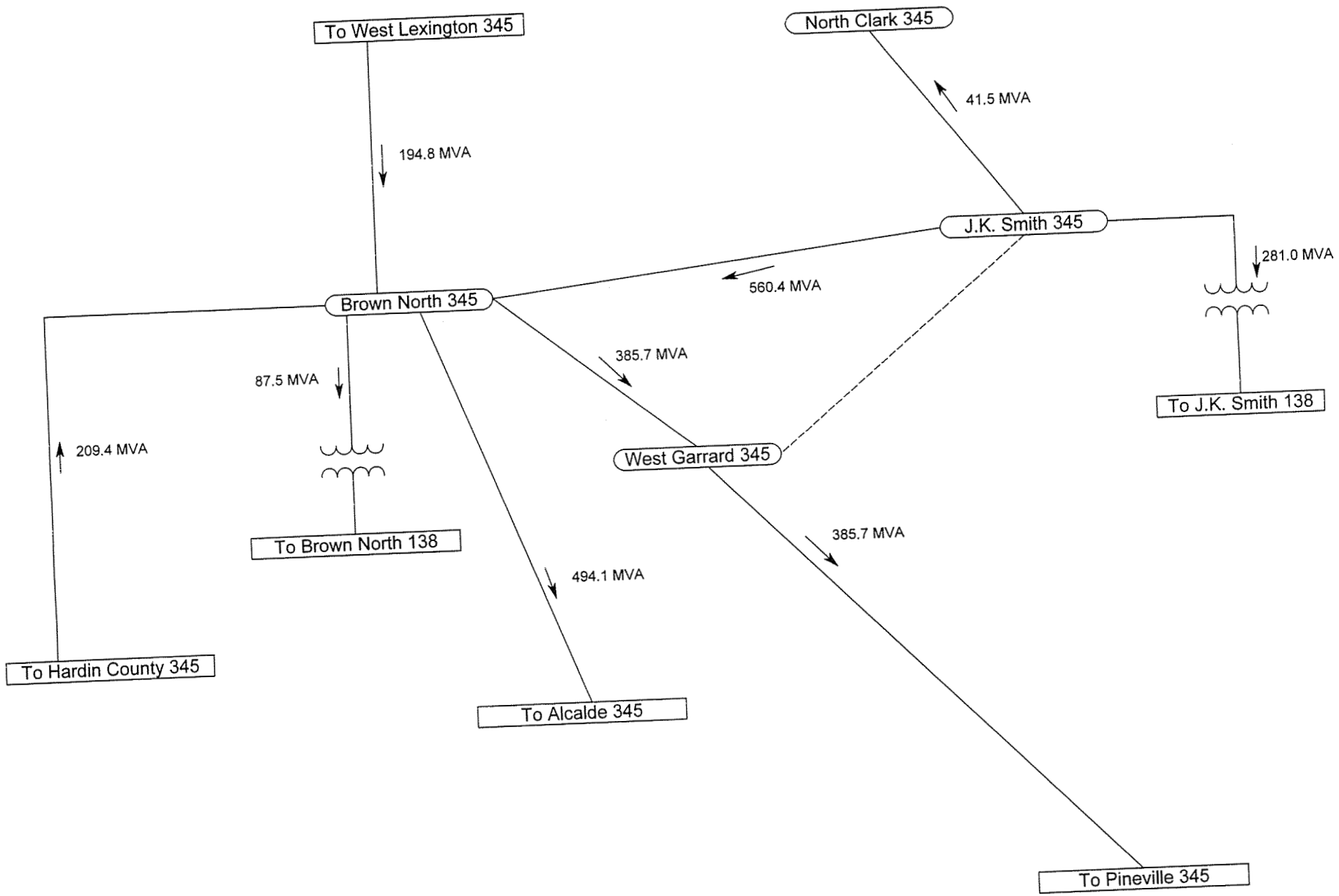


Figure 6
2010-11 Winter With J.K. Smith Generator Additions and J.K. Smith-Brown North 345 kV Project

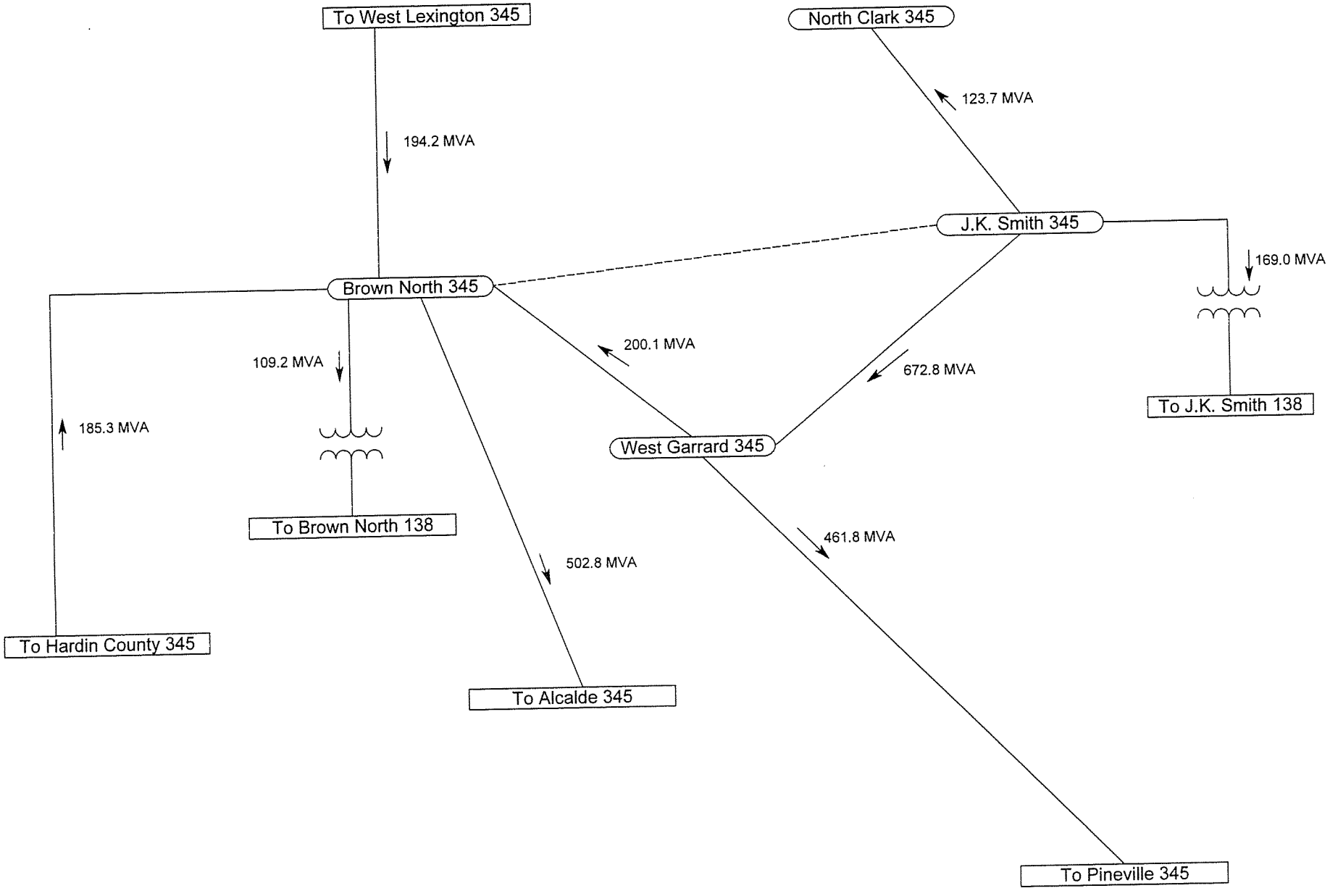


Figure 7
2015-16 Winter With J.K. Smith Generator Additions and J.K. Smith-West Garrard 345 kV Project

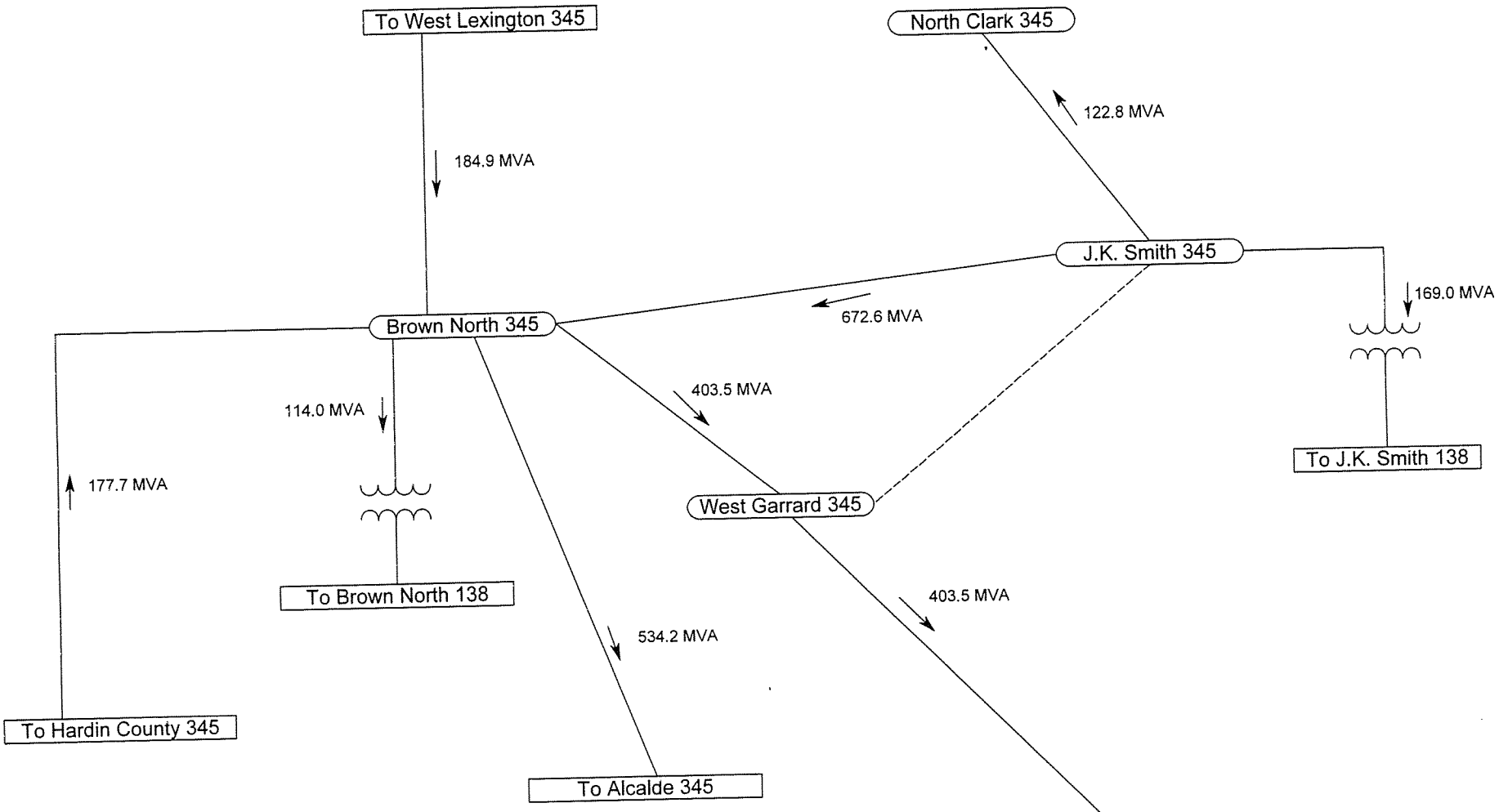


Figure 8
2015-16 Winter With J.K. Smith Generator Additions and J.K. Smith-Brown North 345 kV Project

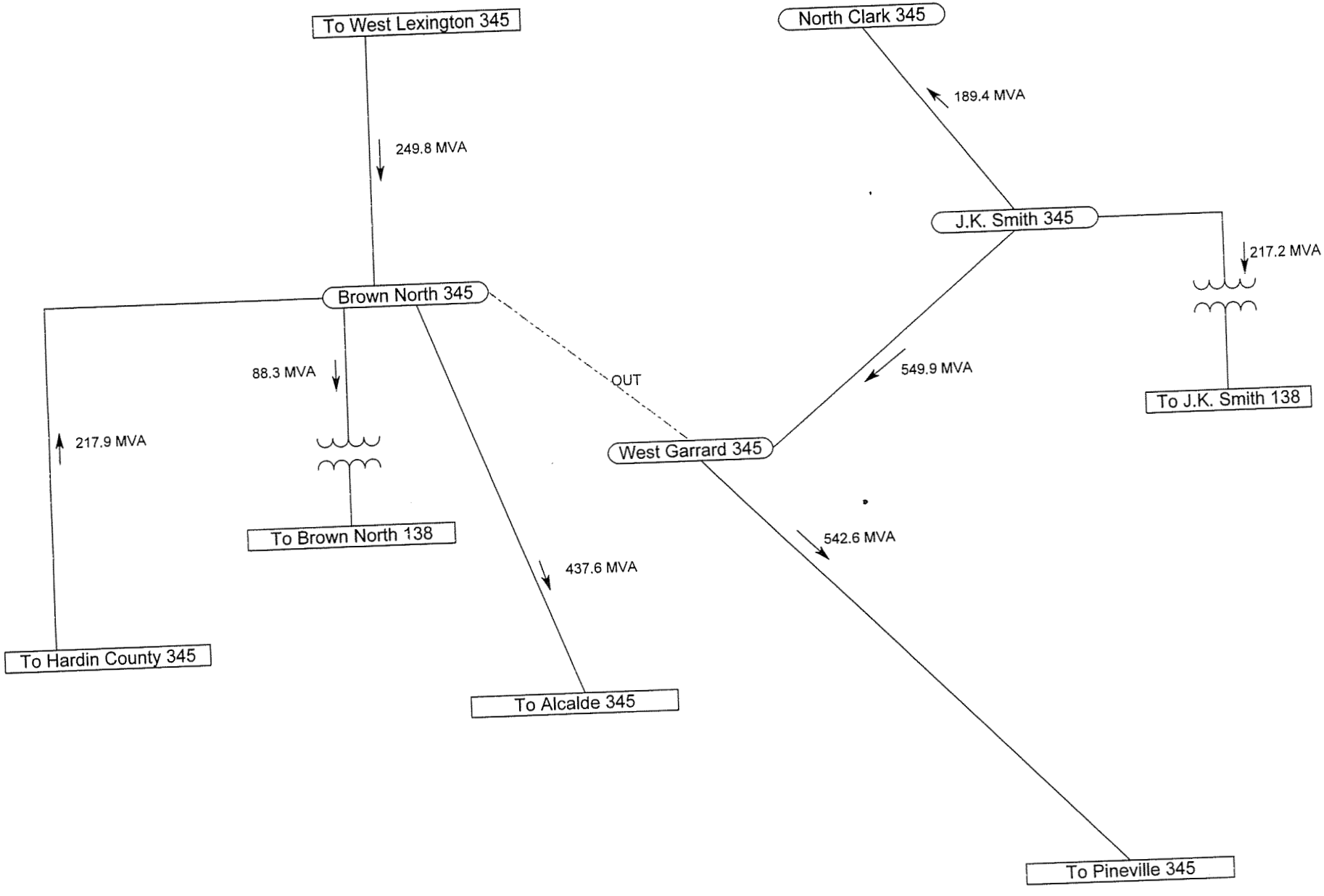


Figure 9
Brown North-West Garrard 345 kV Line Out
2015-16 Winter With J.K. Smith Generator Additions and J.K. Smith-West Garrard 345 kV Project

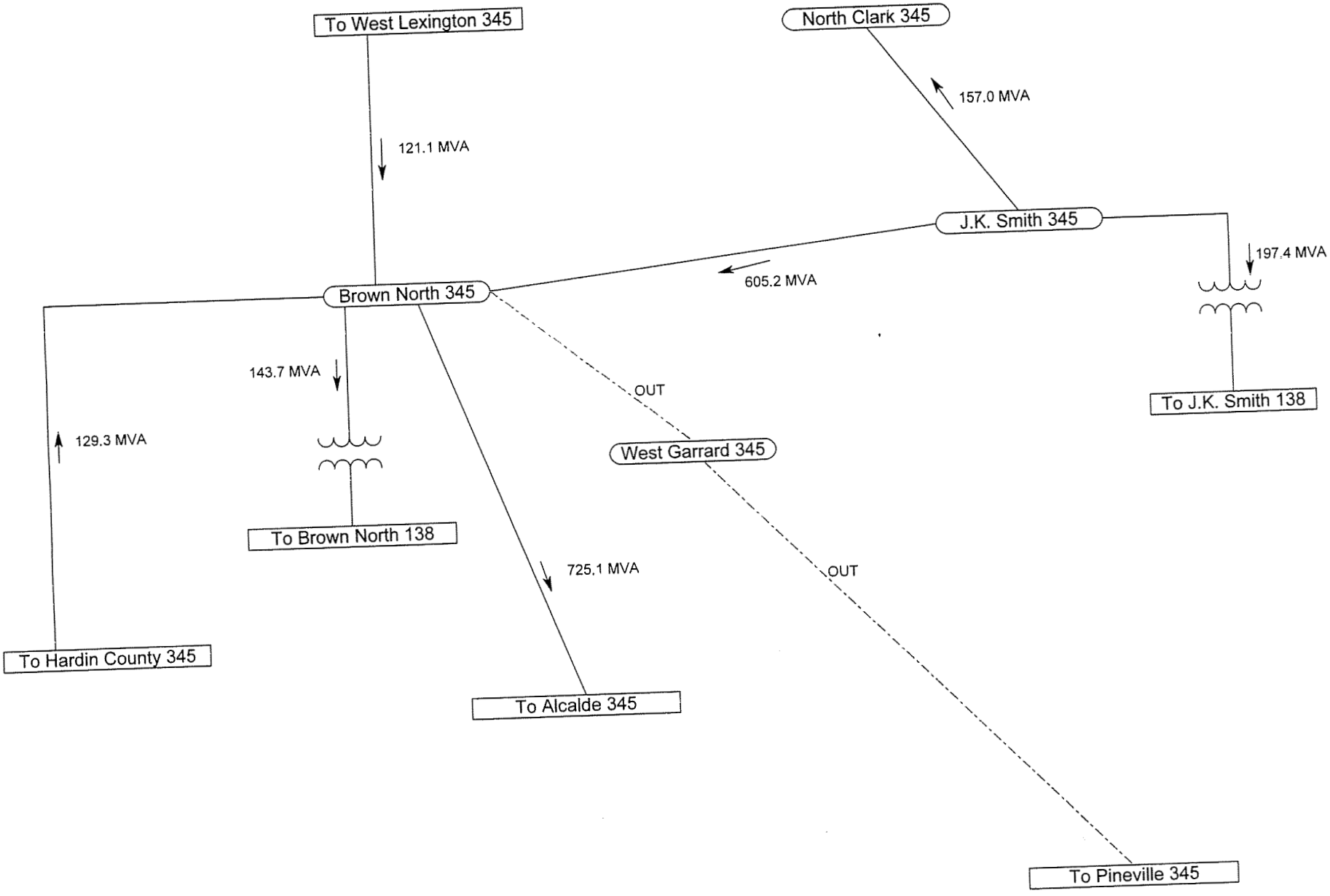


Figure 10
Brown-Pineville 345 kV Line Out
2015-16 Winter With J.K. Smith Generator Additions and J.K. Smith-Brown North 345 kV Project

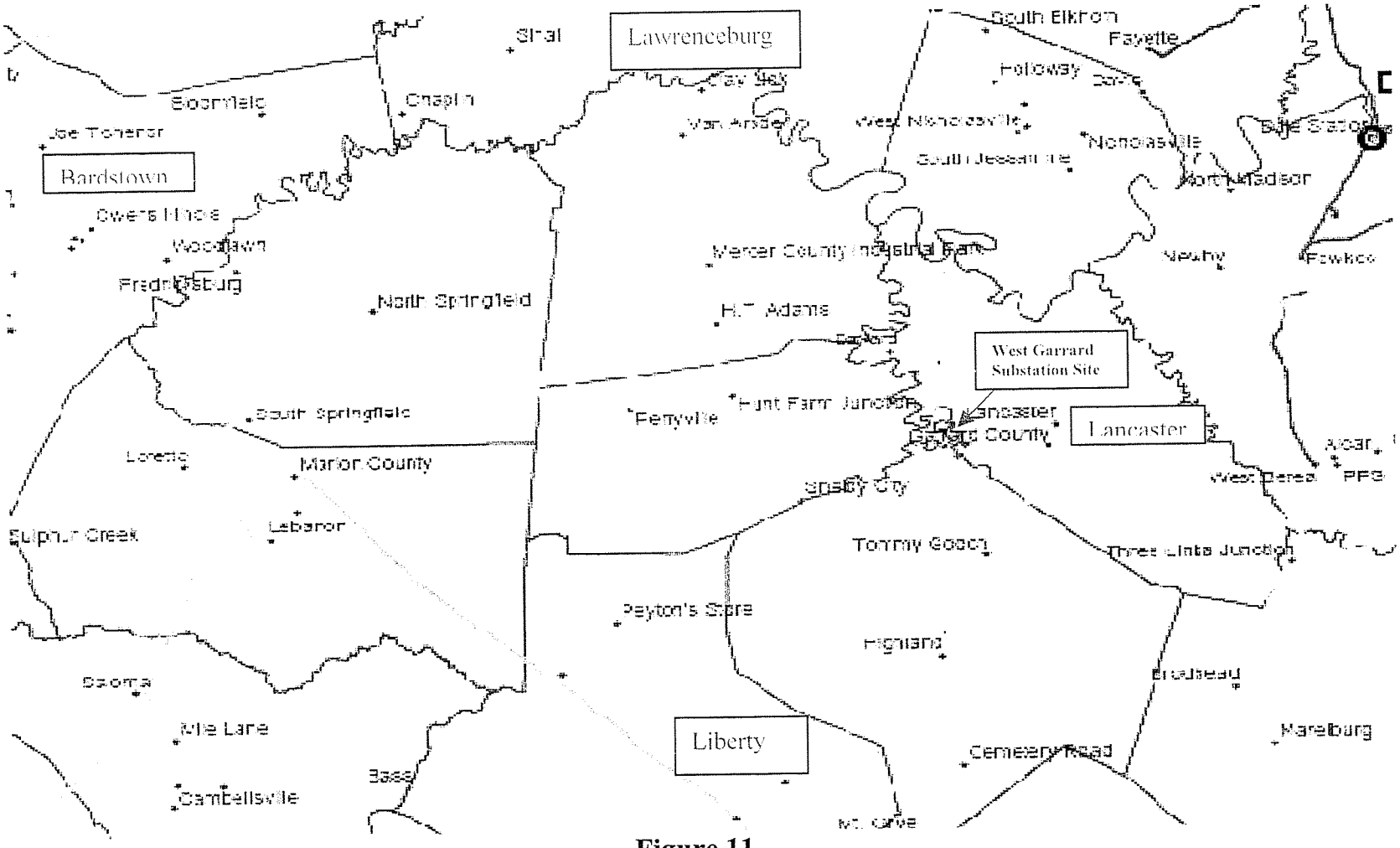


Figure 11

Map of EKPC Transmission System between Bardstown, Lancaster, Lawrenceburg, and Liberty

ADAMS EXHIBIT 3

UPDATE TO SYSTEM IMPACT STUDY

GENERATION INTERCONNECTION REQUESTS #30-33

JK SMITH COMBUSTION TURBINES #8-12 AND CFB UNIT #1 PROJECT IN CLARK COUNTY, KENTUCKY

February 13, 2007

Section 1: Introduction and Background

A System Impact Study (SIS) was conducted beginning in October 2004 to analyze the impacts of requested generation additions -- Generation Interconnection Requests #30-#33 in the East Kentucky Power Cooperative (EKPC) generation queue -- at the J.K. Smith Station in Trapp, KY. The final report documenting the results of that study was completed on May 17, 2006.

The generation additions evaluated in that SIS were as follows:

Table 1-1
J.K. Smith Planned Generation Additions as of May 2006

Requested Project	Commercial Operation Date	Summer Net Capacity (MW)	Winter Net Capacity (MW)
JK Smith #12	March 2008	84	98
JK Smith #11	April 2008	84	98
JK Smith #10	October 2008	84	98
JK Smith #9	November 2008	84	98
JK Smith #8	December 2008	84	98
JK Smith CFB #1	March 2010	278	278

The analysis performed in the SIS identified 41 overloaded facilities in 2010 Summer and 36 overloaded facilities in 2010-11 Winter due to the addition of these proposed generators. The analysis performed recommended implementation of a construction Alternative (Alternative 1) to address the thermal overloads caused by these proposed generating unit additions at J.K. Smith. The primary project of Alternative 1 was the J.K. Smith-West Garrard 345 kV line and associated terminal facilities. This project included the following components:

- Construction of approximately 35.5 miles of 345 kV line from the existing J.K. Smith Station to a point on LGEE's existing Brown-Pineville 345 kV line in Garrard County.
- Construction of a new 345 kV switching station (to be called West Garrard) at the point of intersection in Garrard County.
- Addition of terminal facilities at LGEE's Brown North and Pineville Substations, to energize the 2nd circuit on the Brown-Pineville 345 kV line. This 2nd circuit is to be connected to the J.K. Smith-West Garrard line at the new West Garrard Substation.

Nine other upgrades of existing transmission facilities were identified as part of Alternative 1.

The need for the proposed generating units in the period specified was driven in part by the plan of Warren Rural Electric Cooperative Cooperation (WRECC) to become a

member of EKPC on April 1, 2008. Furthermore, EKPC was planning to construct nearly 100 miles of 161 kV transmission line from its Barren County Substation to the Big Rivers Electric Corporation (BREC) Wilson Substation by this date. Three interconnections in the Bowling Green area connecting to this line were also planned to provide an adequate transmission system to reliably deliver energy from EKPC generating resources to the WRECC system.

On December 7, 2006, WRECC announced its decision to remain with TVA for its power supply needs and thereby cancel its plans to become a member of EKPC. This decision has resulted in EKPC re-evaluating its generation expansion needs without WRECC as a member system. The modifications that have been identified for EKPC's generation expansion plan have driven this updated analysis of the transmission needs.

Section 2: Criteria, Methodology, and Assumptions

The intent of this update to the original SIS is to use as much of the original study as possible. Engineering judgment has been used to determine which parts of the original study need to be conducted again. Much of the original study is still applicable, and has been used as the basis for the conclusions contained in this update.

2.1 Study Criteria

The same study criteria were used for this updated analysis as were used in the original SIS.

2.2 Transmission Planning Methodology

Only the steady-state power flow analysis was updated for this analysis. The results of the transient-stability and short-circuit analyses performed in the original study are still applicable based on the assumption that EKPC will ultimately add the generating units listed in Table 1-1 at J.K. Smith, though some of the units will be delayed.

2.2.1 Power Flow Analysis

EKPC updated the power flow analysis to reflect the following changes:

- A new generation expansion plan without EKPC serving the WRECC demand
- Continued supply of the WRECC demand by TVA generation and transmission assets
- Cancellation of the planned transmission additions by EKPC to connect its system to Warren RECC, BREC, and TVA in the Bowling Green area.
- Use of the latest available power flow models for Summer and Winter peak periods in 2007, 2010 and 2015.

EKPC's updated generation expansion plan without the requirement to serve the WRECC load is shown in Table 2-1.

Table 2-1
J.K. Smith Planned Generation Additions as of February 2007

Requested Project	Commercial Operation Date	Summer Net Capacity (MW)	Winter Net Capacity (MW)
JK Smith #9	January 2009	84	98
JK Smith #10	January 2009	84	98
JK Smith CFB #1	October 2010	278	278
JK Smith #8	October 2011	84	98
JK Smith #11	October 2012	84	98
JK Smith #12	October 2013	84	98

Comparing Tables 1-1 and 2-1 indicate that the total planned capacity additions at J.K. Smith are identical through 2013. The primary difference is that three of the CTs have been deferred at J.K. Smith for two to four years. The first two CTs to be installed are only delayed a few months from the previous plan. Likewise, the CFB Unit #1 is delayed by approximately seven months.

For the power flow analysis, EKPC started with its latest available 2007 Summer, 2007-08 Winter, 2010 Summer, 2010-11 Winter, 2015 Summer, and 2015-16 Winter models. These models were jointly developed by EKPC and LGEE in early 2006, and therefore include a detailed representation of the EKPC and LGEE transmission systems. The representation of EKPC's other neighboring utilities (AEP, BREC, CIN, DPL, and TVA) is the representation submitted by these utilities for the NERC MMWG 2005 Series Model Development. The remainder of the "outside world" is a reduced representation from that NERC MMWG 2005 Series.

EKPC then updated these power flow models to reflect the WRECC system being served by TVA. Therefore, TVA generation was increased to serve the WRECC load. EKPC generation was no longer modeled supplying any of the WRECC load. Also, the planned transmission system additions in the Bowling Green area needed for EKPC service to WRECC were removed from the models.

A list of thermal loading problems due to the addition of the proposed generators has been developed using the updated power flow models and the generation expansion schedule shown in Table 2-1. Any facilities that overload after the addition of the proposed generating units at J.K. Smith that are not already overloaded prior to the addition of these units has been identified.

2.3 Modeling & Assumptions

The models used for the power flow analysis were from EKPC's internal model library. The models used were the following peak-load representations:

2007 Summer	2007/08 Winter
2010 Summer	2010/11 Winter
2015 Summer	2015/16 Winter

These models were jointly developed by EKPC and LGEE in the first quarter of 2006, and therefore include a detailed representation of both the EKPC and LGEE transmission systems. The representation of EKPC's other neighboring utilities (AEP, BREC, CIN, DPL, and TVA) is the representation submitted by these utilities for the NERC MMWG 2005 Series Model Development. The remainder of the "outside world" is a reduced representation from that NERC MMWG 2005 Series.

For all utilities other than EKPC and LGEE, the analysis used the loads included in the base NERC MMWG cases for the appropriate year. For EKPC and LGEE, the loads in

the models are based on forecast data available to the two companies at the time these models were developed in the first quarter of 2006.

As with the loads modeled, the analysis used the future transmission projects that each utility had included in the NERC MMWG 2005 series of cases for all utilities other than EKPC and LGEE. For EKPC and LGEE, the future transmission projects in the models are those that were included by each company during development of the joint base cases. Any projects that were expected to be attributable to the J.K. Smith generation additions were removed, since the need for these projects will be addressed as part of this update to the SIS.

As mentioned earlier, all aspects of EKPC's transmission plan to serve WRECC have been removed. Also, the models have been revised to simulate TVA generation resources serving the WRECC load in 2008 and beyond instead of EKPC generation resources. The planned generation expansion at J.K. Smith has been revised to reflect EKPC's lower load forecast without WRECC. The revised plan has been provided in Table 2-1 above.

In addition to the planned generator additions at the J.K. Smith Station, a fourth generating unit is planned for EKPC's Spurlock Station. The plans for this new unit remain unchanged, despite WRECC's decision to remain with TVA. The fourth unit is scheduled to begin commercial operations on April 1, 2009. The power flow models used for this analysis include this unit addition on this date.

For the purposes of this study, the proposed units were modeled at maximum output in the analyses. If this resulted in excess generation (beyond EKPC's load requirements), the surplus generation was exported equally to "virtual" generators that were connected to AEP's Cook 765 kV bus and to the Bowen 500 kV bus in SERC. This effectively simulates equal exports to the north and south. This is necessary to ensure adequate transmission capacity for maximum output at the J.K. Smith Plant. All other EKPC units, including the future Spurlock #4, were modeled at maximum output. The Laurel Dam Hydro units were not dispatched in the models. Table 2-1 summarizes the generation output of the existing and future EKPC units dispatched for this study.

Table 2-2 EKPC Base Case Generation			
Unit	**Commercial Operation Date**	**Summer Net Capacity (MW)**	**Winter Net Capacity (MW)**
Cooper #1	existing	116	116
Cooper #2	existing	225	225
Dale #1	existing	24	24
Dale #2	existing	24	24
Dale #3	existing	80	80
Dale #4	existing	80	80
Spurlock #1	existing	325	325
Spurlock #2	existing	535	535
Gilbert #3	existing	268	268
Spurlock #4	April 2009	278	278
JK Smith CT #1	existing	98	142
JK Smith CT #2	existing	98	142
JK Smith CT #3	existing	98	142
JK Smith CT #4	existing	75	100
JK Smith CT #5	existing	75	100
JK Smith CT #6	existing	75	100
JK Smith CT #7	existing	75	100
JK Smith CT #8	October 2011	84	98
JK Smith CT #9	January 2009	84	98
JK Smith CT #10	January 2009	84	98
JK Smith CT #11	October 2012	84	98
JK Smith CT #12	October 2013	84	98
JK Smith CFB #1	October 2010	278	278

Section 3: Power Flow Analysis With Proposed Generators Added and Without Transmission Upgrades

3.1 Power Flow Analysis

The power flow analysis was conducted to identify and address critical contingencies and overloads on the EKPC and neighboring systems. The initial power flow analysis identified the overloads, including the magnitudes, with the proposed generators at J.K. Smith in 2007 Summer, 2007-08 Winter, 2010 Summer, 2010-11 Winter, and 2015 Summer, and 2015-16 Winter. This initial power flow analysis did not model any new transmission in the vicinity of the J.K. Smith Station. Tables 3-1 through 3-8 show the thermal overloads (for the worst-case contingency only) identified in the power flow analysis for the various periods, with the proposed generating units added and no transmission additions. For 2010 Summer and 2010-11 Winter, the overloads are shown for two scenarios. One scenario is the addition of CTs #9 and #10 only added at J.K. Smith. The other scenario is the addition of CFB Unit #1 in addition to CTs #9 and #10. The results in all the following Tables are sorted by the severity of the overload. Appendix A contains the complete listing of overloads identified in these periods.

Table 3-1
2007 Summer Thermal Overloads with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Hickory Plains-PPG 69 kV Line	LGEE	Fawkes EKPC-West Berea 138 kV Line (EKPC)	Cooper #2 off, import from AEP	54	54.8	101.5%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	288.5	100.5%

Table 3-2
2007-08 Winter Thermal Overloads with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	305.5	106.4%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	392.3	100.8%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	None	Base	167	168.0	100.6%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	237	238.0	100.4%

Table 3-3
2010 Summer Thermal Overloads with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	57.6	104.7%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	292.8	102.0%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	311	315.6	101.5%
Boonesboro North 138-69 kV Transformer	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	144.7	101.2%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	222.4	100.2%

Table 3-4
2010-11 Winter Thermal Overloads with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	317.8	110.7%
Fawkes Tap-Fawkes LGEE 138 kV Line	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	303	315.8	104.2%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	404.8	104.1%
Union City-Lake Reba Tap 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	377.7	101.8%
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Brown North-Alcalde-Pineville 345 kV Line (LGEE)	Cooper #2 off, import from AEP	101	101.9	100.9%

Table 3-5
2010 Summer Thermal Overloads with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	327.6	114.1%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	62.7	114.0%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	311	353.8	113.8%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	300	334.2	111.4%
Rice Tap-West Irvine 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	40	44.4	111.0%
Fawkes Tap-Fawkes LGEE 138 kV Line (LGEE)	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	317.7	110.7%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	311	338.4	108.8%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	51	55.0	107.8%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	239.2	107.7%
Boonesboro North 138-69 kV Transformer	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	151.9	106.2%
JK Smith-Union City 138 kV Line	EKPC	None	Base	251	264.2	105.3%
Fawkes LGEE-Clark County 138 kV Line	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Ghent #1 off, import from TVA	172	180.4	104.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	None	Base	241	251.3	104.3%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	231.5	104.3%
Fawkes Tap-Lake Reba Tap 138 kV Line	LGEE	JK Smith-Union City 138 kV Line (EKPC)	Cooper #2 off, import from AEP	176	183.1	104.0%

Table 3-5 2010 Summer Thermal Overloads with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission						
Limiting Facility	**Company**	**Contingency**	**Worst-Case Dispatch**	**Rating**	**MVA Flow**	**% Overload**
West Frankfort-Clay Village Tap 69 kV Line	LGEE	Bullitt County-Little Mount Jct. 161 kV Line (EKPC)	Mill Creek #4 off, import from AEP	43	44.2	102.8%
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	291.8	101.7%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	314.3	101.1%

Table 3-6
2010-11 Winter Thermal Overloads with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	341.6	119.0%
Fawkes Tap-Fawkes LGEE 138 kV Line	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	303	356.8	117.8%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	444.3	114.2%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	413.5	111.5%
Dale 138-69 kV Transformer	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #3 off, import from AEP	136	147.2	108.2%
Beattyville-Delvinta 161 kV Line	EKPC-LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	211	223.7	106.0%
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Dale #3 off, import from AEP	143	151.3	105.8%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	293.5	105.6%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Delvinta-Hyden Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	223	235.4	105.6%
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Brown North-Alcalde-Pineville 345 kV Line (LGEE)	Cooper #2 off, import from AEP	101	106.6	105.5%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	88	92.5	105.1%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	77	80.4	104.4%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	370	385.7	104.2%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	389	403.9	103.8%

Table 3-6
2010-11 Winter Thermal Overloads with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Powell County 161-138 kV Transformer	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	227.8	103.5%
Morehead-Hayward 69 kV	AEP	Rowan County-Skaggs 138 kV Line (EKPC)	Base	48	49.5	103.1%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	281.8	101.4%
Lake Reba Tap 138-161 kV Transformer	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	270	271.9	100.7%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	390.3	100.3%

Table 3-7
2015 Summer Thermal Overloads with CTs 8-12 and CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes Tap-Fawkes LGEE 138 kV Line (LGEE)	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	246	336.9	137.0%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	74.2	134.9%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	311	401.1	129.0%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	51	65.1	127.6%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	300	378.0	126.0%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	311	387.8	124.7%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	357.0	124.4%
JK Smith-Union City 138 kV Line	EKPC	None	Base	251	303.5	120.9%
Boonesboro North 138-69 kV Transformer	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	172.1	120.3%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	None	Base	241	287.1	119.1%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	261.2	117.7%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	354.3	113.9%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	252.7	113.8%
Beattyville 161-69 kV Transformer	LGEE	Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	64	71.2	111.3%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	205	227.4	110.9%

Table 3-7
2015 Summer Thermal Overloads with CTs 8-12 and CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Boonesboro North-Winchester Water Works 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	158.6	110.9%
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	314.5	109.6%
Dale 138-69 kV Transformer	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #3 off, import from AEP	111	119.6	107.7%
Winchester South-Winchester 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	110	118.4	107.6%
Beattyville-Oakdale Jct. 69 kV Line	EKPC	Delvinta-Green Hall Jct. 161 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	47	50.5	107.4%
West Irvine Tap-Delvinta 161 kV Line	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	201	208.1	103.5%
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Dale #3 off, import from AEP	129	132.7	102.9%
Clark County-Sylvania 69 kV Line	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	137	139.6	101.9%
Paris 138-69 kV Transformer	LGEE	Avon-Loudon Avenue 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	173	175.9	101.7%
Farmers 138-69 kV Transformer	LGEE	Rodburn 138-69 kV Transformer (LGEE)	Base	48	48.5	101.0%
Winchester Water Works-Boone Avenue 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	150	151.3	100.9%
Fawkes LGEE-Richmond 69 kV Line	LGEE	Lake Reba 138-69 kV Transformer (LGEE)	Cooper #2 off, import from AEP	117	118.0	100.9%
Loudon Avenue 138-69 kV Transformer #628	LGEE	Loudon Avenue 138-69 kV Transformer #618 (LGEE)	Brown #3 off, import from AEP	128	128.9	100.7%
Powell County 138-161 kV Transformer	EKPC	Lake Reba Tap-West Irvine-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	193	193.8	100.4%
West Irvine-Dark Hollow 69 kV Line	LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	55.1	100.2%
Clark County 138-69 kV Transformer	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	143	143.1	100.1%

Table 3-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 and CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes Tap-Fawkes LGEE 138 kV Line	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	303	403.8	133.3%
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	378.1	131.7%
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	374.9	130.6%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	500.7	128.7%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	None	Base	277	353.9	127.8%
Dale 138-69 kV Transformer	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #3 off, import from AEP	136	169.7	124.8%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	462.7	124.7%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	389	470.4	120.9%
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Dale #3 off, import from AEP	143	169.4	118.5%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	322.5	116.0%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	370	428.6	115.8%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	442.5	113.8%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Delvinta-Hyden Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	223	253.1	113.5%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	88	99.5	113.1%

Table 3-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 and CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Beattyville-Delvinta 161 kV Line	EKPC-LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	211	235.1	111.4%
Boonesboro North-Winchester Water Works 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	159.3	111.4%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	308.4	110.9%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	77	85.3	110.8%
Powell County 138-161 kV Transformer	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	243.3	110.6%
JK Smith-Union City 138 kV Line	EKPC	None	Base	349	381.1	109.2%
JK Smith-Powell County 138 kV Line	EKPC	None	Base	287	308.3	107.4%
Beattyville-Oakdale Jct. 69 kV Line	EKPC	Delvinta-Green Hall Jct. 161 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	62	66.6	107.4%
Lake Reba Tap 138-161 kV Transformer	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	270	289.5	107.2%
West Berea 138-69 kV Transformer	EKPC	Fawkes LGEE-Crooksville Jct. 69 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	152	162.4	106.8%
Dale-Newby #1 69 kV Line	EKPC	Dix Dam-Buena Vista 69 kV Line (LGEE)	Cooper #2 off, import from AEP	87	92.6	106.4%
Morehead-Hayward 69 kV	AEP	Rowan County-Skaggs 138 kV Line (EKPC)	Base	48	50.7	105.6%
Fawkes LGEE-Clark County 138 kV Line	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Ghent #1 off, import from TVA	194	202.5	104.4%
Green Hall Jct.-Tyner 161 kV Line	EKPC	Delvinta-Hyden Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	237	246.5	104.0%
Powell County 138-161 kV Transformer	EKPC	None	Base	178	181.2	101.8%
West Irvine 161-69 kV Transformer	LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	62	62.9	101.5%

Table 3-8 2015-16 Winter Complete List of Identified Problems with CTs 8-12 and CFB Unit #1 Installed at JK Smith and with no Additional Transmission						
Limiting Facility	**Company**	**Contingency**	**Worst-Case Dispatch**	**Rating**	**MVA Flow**	**% Overload**
Spurlock-Kenton 138 kV Line	EKPC-LGEE	Spurlock-Maysville Industrial Jct. 138 kV Line (EKPC)	Ghent #1 off, import from TVA	287	288.2	100.4%
Farmers 138-69 kV Transformer	LGEE	Rodburn 138-69 kV Transformer (LGEE)	Base	58	58.1	100.2%

The power flow results contained in Tables 3-1 through 3-8 indicate the following:

- 2 transmission facilities are overloaded in 2007 Summer with CTs 9 and 10 added
- 3 transmission facilities are overloaded in 2007-08 Winter with CTs 9 and 10 added
- 5 transmission facilities are overloaded in 2010 Summer with CTs 9 and 10 added
- 5 transmission facilities are overloaded in 2010-11 Winter with CTs 9 and 10 added
- 16 transmission facilities are overloaded in 2010 Summer with CTs 9-10 and CFB #1 added
- 19 transmission facilities are overloaded in 2010-11 Winter with CTs 9-10 and CFB #1 added
- 29 transmission facilities are overloaded in 2015 Summer with CTs 8-12 and CFB #1 added
- 28 transmission facilities are overloaded in 2015-16 Winter with CTs 8-12 and CFB #1 added

Table 3-9 Summary of Thermal Overloads with Planned Generation Additions at J.K. Smith and without Transmission Additions				
	Total Generation Modeled at JK Smith	**Number of Overloaded Facilities**	**Number of Critical Contingencies**	**Overload Ranges**
2007 Summer[1]	762 MW	2	2	100.5%-101.5%
2007-08 Winter[1]	1022 MW	3	5	100.4%-106.4%
2010 Summer[1]	762 MW	5	6	100.2%-104.7%
2010-11 Winter[1]	1022 MW	5	6	100.4%-110.7%
2010 Summer[2]	1040 MW	16	20	100.4%-114.1%
2010-11 Winter[2]	1300 MW	19	21	100.1%-119.0%
2015 Summer[3]	1292 MW	29	32	100.1%-137.0%
2015-16 Winter[3]	1578 MW	28	43	100.2%-133.3%

[1]Simulates addition of CTs 9 and 10
[2]Simulates addition of CTs 9-10 and CFB #1
[3]Simulates addition of CTs 8-12 and CFB #1

A breakdown of the ownership of these facilities is provided in Table 3-10.

Table 3-10
Summary of Ownership of Overloaded Facilities

Period	Number of AEP Facilities	Number of EKPC Facilities	Number of LGEE Facilities	Number of EKPC-LGEE Interconnected Facilities
2007 Summer	0	0	1	1
2007-08 Winter	0	1	1	1
2010 Summer – CTs 9 and 10 added	0	2	2	1
2010-11 Winter – CTs 9 and 10 added	0	4	1	0
2010 Summer – CTs 9-10 and CFB #1 added	0	5	8	3
2010-11 Winter – CTs 9-10 and CFB #1 added	1	10	4	4
2015 Summer	0	9	17	3
2015-16 Winter	1	13	8	6

These power flow results indicate that substantial thermal overloading of the existing transmission system will be created by the addition of the proposed generators at the J.K. Smith site. Although these results do differ somewhat from those obtained in the original SIS, they are fairly consistent. Many of the same facilities were identified as overloaded in both studies, and the magnitudes are generally of similar magnitudes. Several factors other than those already described may have contributed to the differences that are observed. These factors include:

- Inclusion of the J.K. Smith-North Clark 345 kV Line Project in this updated SIS. This line was not included in the power flow analysis performed in the original SIS that identified the thermal overloads without transmission added. It was included in the power flow analysis for the various transmission Alternatives in the original SIS.
- Increases of LGEE facility ratings in the winter across its system, which have eliminated some winter problems on the LGEE transmission system
- Updated load forecasts which have resulted in some shifts in the direction of flows

However, the results still indicate that a large number of problems of potentially severe magnitude could occur in the region without any transmission system additions.

Section 4: Alternatives Considered

4.1 Review of Alternatives Considered in Original SIS

In the original SIS, several transmission options were considered to alleviate overloading of area transmission facilities. Upgrading existing transmission facilities was eliminated from further consideration for the following reasons:

- An excessive number of major system upgrades (significant reconductoring/rebuilding of lines, replacement or addition of high voltage transformers, etc.) would be required.
- Taking the existing facilities out of service to perform the upgrades would be an extremely difficult task, and would result in decreased system reliability and generation restrictions for much of the next several years.
- Higher transmission-system losses would be incurred if new facilities are not added.
- Upgrading existing facilities does not provide significant margin for system operations during multiple contingency conditions. If no new facilities are added, the ability to withstand more extreme contingencies is less sure.
- The scope, cost, and schedule for these upgrades is very uncertain. A detailed and lengthy analysis would be required to determine these items for all of the overloaded facilities.

All of these factors are still applicable to the system based upon the results of the updated SIS. Therefore, upgrading of existing facilities as the sole means of accommodating the J.K. Smith proposed generating units is still neither viable nor desirable.

In the original SIS, a numerous set of new outlets for the J.K. Smith Station were screened singularly and in various combinations to evaluate the performance with the proposed generators added at J.K. Smith. The screening process eliminated most of these outlet options for one of the following two reasons:

- An outlet either singularly or in combination with other outlets did not eliminate a substantial number of the thermal overloads caused by the proposed generators
- An outlet did not provide any significant additional benefits when compared to the performance of another outlet that would be shorter and/or less expensive

As shown in Figure B-1 in Appendix B, the problems identified in this updated SIS with the proposed generators and without any transmission system additions through 2015 are primarily concentrated in two areas:

1. The immediate area around the J.K. Smith, Dale, Fawkes, Lake Reba Tap, Powell County, and Clark County Substations.

2. Along the 161 kV system extending southeast from the Lake Reba Tap Substation through the Delvinta Substation.

Other isolated problems (Beattyville-Oakdale Jct., Morehead AEP-Hayward AEP 69 kV, West Berea-Three Links Jct. 69 kV) were identified outside of the two primarily impacted areas.

The screening results indicate that power flows are similar for the power flow analyses conducted with the updated models and with the models used in the original SIS. The number, severity, and location of problems are consistent between the two studies. Therefore, the same rationale for eliminating the majority of these outlet options is still applicable.

The original screening analysis determined that two of the outlet options considered have a greater impact on the transmission-system problems identified than did the remainder of the outlet options. These two outlet options are:

- ✓ The J.K. Smith-Tyner 345 kV line and the installation of a 345-161 kV transformer at Tyner
- ✓ The J.K. Smith-West Garrard 345 kV line and a new 345 kV switching station at West Garrard connecting this line with LGEE's Brown-Pineville 345 kV circuit

These two outlets substantially reduced the number and severity of overloads caused by the proposed generators. These options appeared to provide these benefits for two primary reasons:

- o Each is a 345 kV outlet providing a high outlet capacity from the J.K. Smith site
- o Each provides a connection to the transmission system in the southern and southeastern parts of the Kentucky transmission system. A small amount of generation exists in this area. Therefore, a large amount of the power required by customers in this area presently flows into the area on the 138 kV and 161 kV interfaces in the Richmond, KY area (through the Fawkes and Lake Reba Tap substations). Either the J.K. Smith-Tyner or J.K. Smith-West Garrard 345 kV line would provide an EHV path bypassing these heavily loaded 138 and 161 kV interfaces.

The other outlet options considered either did not provide as much benefit as either of these two options or provided similar benefits at the expense of much more construction. Again, based on the similarity between the results obtained in the original SIS and in the updated SIS, these conclusions are still valid.

The original SIS determined that the Alternative developed that included the J.K. Smith-West Garrard 345 kV line (Alternative 1) was the preferred transmission plan to address the thermal overloads caused by the generator additions. This conclusion was reached for the following reasons:

- Alternative 1 was much less expensive to implement than the other Alternatives
- Alternative 1 required a substantially smaller number of ancillary upgrade projects to implement
- Alternative 1 provided the best steady-state power flow performance
- Alternative 1 provided the best transient-stability performance
- Alternative 1 provided the best opportunities for future expansion by EKPC
- Alternative 1 appeared to provide significant advantages over the other Alternatives with regard to the physical issues associated with construction and expansion.

None of the changes that have occurred since the original SIS have changed these conclusions. Therefore, Alternative 1 is still the preferred Alternative for the reasons listed above.

4.2 Common Facilities Required

As discussed in the original SIS, some common facilities are required at the J.K. Smith site to accommodate the proposed generator additions. These requirements are necessary regardless of the new outlet or outlets to be built. These system additions/modifications are necessary to accommodate the connection of the proposed generators to EKPC's transmission network. Table 4-1 lists these proposed system additions, the reason for which each is needed, and the date needed based on the latest schedule that has been provided for the generation additions.

Table 4-1
Common Transmission Facilities Required to Connect the Proposed J.K. Smith Units

Install Date	Project Description	Reason for Need
June 2007	Install a second 345-138 kV, 450 MVA transformer at JK Smith CT Substation	Addition of CTs #9 & #10 at JK Smith; needed for desired redundancy for this critical connection between the 345 kV and 138 kV buses at J.K. Smith
June 2007	Add 345 kV Terminal Facilities at JK Smith CT Substation for CTs #9 & #10	Addition of CTs #9 & #10 at JK Smith
June 2009	Construct a second 345 kV substation at JK Smith for the CFB Unit(†)	Addition of CFB Unit #1 at JK Smith
June 2009	Add 345 kV Terminal Facilities at JK Smith CFB Substation for CFB Unit #1(†)	Addition of CFB Unit #1 at JK Smith
June 2009	Construct two 345 kV lines (0.8 miles each) between the JK Smith CT 345 kV substation and the JK Smith CFB 345 kV substation using bundled 954 MCM ACSR conductor(†)	Addition of CFB Unit #1 at JK Smith
June 2009	Add 345 kV Terminal Facilities at JK Smith CT Substation for the two 345 kV lines to the JK Smith CFB Substation(†)	Addition of CFB Unit #1 at JK Smith
June 2009	Add 345 kV Terminal Facilities at JK Smith CFB Substation for the two 345 kV lines to the JK Smith CT Substation(†)	Addition of CFB Unit #1 at JK Smith

Table 4-1 Common Transmission Facilities Required to Connect the Proposed J.K. Smith Units		
Install Date	**Project Description**	**Reason for Need**
June 2011	Add 138 kV Terminal Facilities at JK Smith CT Substation for CT #8	Addition of CT #8 at JK Smith
June 2012	Add 345 kV Terminal Facilities at JK Smith CT Substation for CTs #11 & #12	Addition of CTs #11 & #12 at JK Smith

(T) EKPC is evaluating the possibility of deferring construction of this substation until CFB Unit #2 is added at J.K. Smith. If the substation is deferred, CFB Unit #1 will be connected directly to the J.K. Smith CT Substation.

The facilities listed in Table 4-1 include the following:

- Terminal facilities to connect J.K. Smith CT #8 to the existing 138 kV bus at J.K. Smith
- Terminal facilities to connect J.K. Smith CTs #9 through #12 to a new 345 kV switchyard to be constructed at the J.K. Smith CT Substation
- A new 345 kV switchyard near the J.K. Smith CFB Unit #1 with terminal facilities to connect J.K. Smith CFB Unit #1
- Construction of a two 345 kV lines connecting the J.K. Smith 345 kV CT Substation and the J.K. Smith 345 kV CFB Substation

EKPC is evaluating the possibility of deferring the J.K. Smith 345 kV CFB Substation until CFB Unit #2 is constructed. If this is feasible, it will provide significant savings to EKPC. Prior to making a final decision, EKPC will evaluate both the feasibility and the potential reliability/availability issues for CFB Unit #1 at J.K. Smith.

Table 4-2 provides the planning estimates for costs of the projects listed in Table 4-1. Cost information is provided for the expected costs in 2006 dollars, install year dollars, and present worth dollars.

Table 4-2
Estimated Costs of Common Transmission Facilities Required to Connect the Proposed J.K. Smith Units

Install Date	Project Description	Planning Estimate (2006$)	Inflated Cost (Install Year $)	Present Worth (2006$)
June 2007	Install a second 345-138 kV, 450 MVA transformer at JK Smith CT Substation	2,850,000	3,064,000	4,363,000
June 2007	Add 345 kV Terminal Facilities at JK Smith CT Substation for CTs #9 & #10	2,160,000	2,322,000	3,307,000
June 2009	Construct a second 345 kV substation at JK Smith for the CFB Unit #1	2,160,000	2,433,000	2,952,000
June 2009	Add 345 kV Terminal Facilities at JK Smith CFB Substation for CFB Unit #1	1,080,000	1,217,000	1,476,000
June 2009	Construct two 345 kV lines (0.8 miles each) between the JK Smith CT 345 kV substation and the JK Smith CFB 345 kV substation using bundled 954 MCM ACSR conductor	1,880,000	2,118,000	2,569,000
June 2009	Add 345 kV Terminal Facilities at JK Smith CT Substation for the two 345 kV lines to the JK Smith CFB Substation	4,310,000	4,856,000	5,891,000
June 2009	Add 345 kV Terminal Facilities at JK Smith CFB Substation for the two 345 kV lines to the JK Smith CT Substation	4,310,000	4,856,000	5,891,000
June 2011	Add 138 kV Terminal Facilities at JK Smith CT Substation for CT #8	540,000	638,000	620,000

Table 4-2 Estimated Costs of Common Transmission Facilities Required to Connect the Proposed J.K. Smith Units				
Install Date	**Project Description**	**Planning Estimate (2006$)**	**Inflated Cost (Install Year $)**	**Present Worth (2006$)**
June 2012	Add 345 kV Terminal Facilities at JK Smith CT Substation for CTs #9 & #10	2,160,000	2,612,000	2,337,000
	Total	$21,450,000	$24,116,000	$29,406,000

4.3 Update of J.K. Smith-West Garrard Alternative

Table 4-3 shows the updated transmission expansion plan for the preferred alternative.

Table 4-3
Alternative 1 – Project Descriptions and Reasons for Need

Install Date	Project Ref #	Project Description	Reason for Need	Critical Contingency	Unit Outage
June 2009	1.1	Construct 35.5 miles of 345 kV line from JK Smith to LGEE's Brown-Pineville double-circuit line at West Garrard using bundled 954 MCM ACSR conductor	Numerous Overloads (See Tables 3-1, 3-2, C-1, & C-2)	Numerous Contingencies (See Tables 3-1, 3-2, C-1, & C-2)	
June 2009	1.2	Add 345 kV Terminal Facilities at JK Smith CFB Substation for the West Garrard line. (†)	Numerous Overloads (See Tables 3-1, 3-2, C-1, & C-2)	Numerous Contingencies (See Tables 3-1, 3-2, C-1, & C-2)	
June 2009	1.3	Add terminal facilities at LGEE's Brown and Pineville Substations to energize the Brown-Pineville 345 kV circuit	Numerous Overloads (See Tables 3-1, 3-2, C-1, & C-2)	Numerous Contingencies (See Tables 3-1, 3-2, C-1, & C-2)	
June 2009	1.4	Construct a 345 kV breaker station at West Garrard with three line exits. Loop the Brown-Pineville 345 kV line through the station and terminate the new line from JK Smith	Numerous Overloads (See Tables 3-1, 3-2, C-1, & C-2)	Numerous Contingencies (See Tables 3-1, 3-2, C-1, & C-2)	
November 2009	1.5	Increase the terminal limits at LGEE's Pineville Substation associated with the low side of the Pineville 345-161 kV transformer to at least 2150A (600 MVA) winter emergency.	Overload of the 558 MVA winter emergency rating of the Pineville 345-161 kV transformer	Alcalde 345-161 kV Transformer	Cooper #2
November 2009	1.6	Increase the limits of LGEE's Alcalde-Elihu 161 kV line to at least 1105A (308 MVA) winter emergency.	Overload of the 288 MVA winter emergency rating of the Alcalde-Elihu 161 kV line	Wolf Creek TVA-Russell County Junction 161 kV Line	Cooper #2
June 2010	1.7	Increase the terminal limits at LGEE's Boonesboro North associated with the Boonesboro North 138-69 kV transformer to at least 1320A (158 MVA) summer emergency.	Overload of the 143 MVA summer emergency rating of the Boonesboro North 138-69 kV transformer	Fawkes-Clark County 138 kV Line	Ghent #1

Table 4-3
Alternative 1 – Project Descriptions and Reasons for Need

Install Date	Project Ref #	Project Description	Reason for Need	Critical Contingency	Unit Outage
November 2010	1.8	Increase the limits of the Ferguson South-Somerset (LGEE-EKPC) 69 kV line to at least 855A (102 MVA) winter emergency.	Overload of the 101 MVA winter emergency rating of the Ferguson South-Somerset 69 kV line	Cooper 161-69 kV Transformer	Mill Creek #4
November 2012	1.9	Reconductor EKPC's JK Smith-Union City 138 kV line using 954 MCM ACSS conductor.	Overload of the 389 MVA winter emergency rating of the JK Smith-Union City 138 kV line	JK Smith-Fawkes 138 kV Line	Brown #3
November 2012	1.10	Increase the terminal limits of EKPC's Powell County 138-69 kV transformer to 147 MVA winter emergency.	Overload of the 143 MVA winter emergency rating of the Powell County 138-69 kV transformer	Powell County-Beattyville-Delvinta 161 kV Line	Dale #3
June 2013	1.11	Increase the terminal limits of the Union City-Lake Reba Tap 138 kV line (EKPC-LGEE) to at least 301 MVA summer emergency.	Overload of the 300 MVA summer emergency rating of the Union City-Lake Reba Tap 138 kV line	JK Smith-Fawkes 138 kV Line	Brown #3
June 2014	1.12	Increase the limits of LGEE's Alcalde-Elihu 161 kV line to at least 950A (265 MVA) summer emergency and 1220A (340 MVA) winter emergency.	Overload of the 254 MVA summer emergency rating and the 330 MVA winter emergency rating of the Alcalde-Elihu 161 kV line	Wolf Creek TVA-Russell County Junction 161 kV Line	Cooper #2
June 2014	1.13	Increase the limits of LGEE's Artemus 161-69 kV transformer to at least 65 MVA summer emergency.	Overload of the 64 MVA summer emergency rating of the Artemus 161-69 kV transformer	Pineville-KU Park 69 kV Line	Cooper #2

Table 4-3
Alternative 1 – Project Descriptions and Reasons for Need

Install Date	Project Ref #	Project Description	Reason for Need	Critical Contingency	Unit Outage
June 2014	1.14	Increase the terminal limits at LGEE's Boonesboro North associated with the Boonesboro North 138-69 kV transformer to at least 163 MVA summer emergency.	Overload of the 158 MVA summer emergency rating of the Boonesboro North 138-69 kV transformer	Fawkes-Clark County 138 kV Line	Ghent #1
June 2014	1.15	Increase the terminal limits at LGEE's Boonesboro North associated with the Boonesboro North-Winchester Water Works 69 kV circuit to at least 1245A (149 MVA) summer emergency.	Overload of the 143 MVA summer emergency rating of the Boonesboro North-Winchester Water Works 69 kV line	Fawkes-Clark County 138 kV Line	Ghent #1
November 2014	1.16	Replace EKPC's Powell County 138-69 kV, 100 MVA transformer with a 140 MVA transformer.	Overload of the 147 MVA winter emergency rating of the Powell County 138-69 kV transformer	Powell County-Beattyville-Delvinta 161 kV Line	Dale #3
June 2015	1.17	Increase the limits of LGEE's Pineville 161-69 kV transformer #2 to at least 139 MVA summer emergency.	Overload of the 138 MVA summer emergency rating of the Pineville 161-69 kV transformer #2	Pineville 161-69 kV Transformer #1	Cooper #2
June 2015	1.18	Reconductor EKPC's Union City-Lake Reba Tap 138 kV line using 954 MCM ACSS conductor.	Overload of the 311 MVA summer emergency rating of the Union City-Lake Reba Tap 138 kV line	JK Smith-Fawkes 138 kV Line	Brown #3
November 2015	1.19	Increase the limits of LGEE's Artemus 161-69 kV transformer and the Artemus-Barbourville City 69 kV line to at least 74 MVA winter emergency.	Overload of the 72 MVA winter emergency rating of the Artemus 161-69 kV transformer and the Artemus-Barbourville City 69 kV line	Pineville-KU Park 69 kV Line	Cooper #2

Table 4-3 Alternative 1 – Project Descriptions and Reasons for Need					
Install Date	**Project Ref #**	**Project Description**	**Reason for Need**	**Critical Contingency**	**Unit Outage**
November 2015	1.20	Increase the limits of LGEE's Elihu-Ferguson South 69 kV line to at least 118 MVA winter emergency.	Overload of the 115 MVA winter emergency rating of the Elihu-Ferguson South 69 kV line	Cooper 161-69 kV Transformer	Cooper #2

(†) EKPC is evaluating the possibility of deferring construction of this substation until CFB Unit #2 is added at J.K. Smith. If the substation is deferred, the J.K. Smith-West Garrard 345 kV line will be connected to the J.K. Smith CT Substation.

Projects 1.1 through 1.4 in Table 4-3 are the projects necessary to establish a 345 kV line from J.K. Smith to West Garrard. The need for Projects 1.5, 1.6, and 1.8 is created primarily due to the establishment of the new West Garrard interconnection, which provides substantial increases in flows into the region of southern Kentucky between Pineville and Somerset. Project 1.7 is needed due to the increased contingency flows on the Boonesboro North 138-69 kV transformer, even with the new West Garrard interconnection. The remaining Projects listed in Table 4-3 are needed to address problems caused by the future additions of CTs 8, 11, and 12 at JK Smith, which are now deferred beyond 2010. Those problems will be evaluated in more detail in a subsequent SIS to analyze the requirements for these future CTs, which are no longer specifically being addressed as part of this SIS.

Therefore, the transmission requirements identified for the planned additions of CTs #9 and #10 and CFB Unit #1 at JK Smith are Projects 1.1 through 1.8. Projects 1.1 through 1.4 are major projects necessary to implement the new West Garrard interconnection with LGEE. Projects 1.5 through 1.8 are expected to be relatively minor in scope – terminal equipment replacements and/or increases of line conductor clearances on the LGEE transmission system. Therefore, the construction of the new J.K. Smith-West Garrard 345 kV line is effective in eliminating most or all of the significant problems. Some relatively minor problems remain that will need to be addressed. Some additional projects will be necessary as additional generation is added at J.K. Smith beyond 2010. Based on the power flow analysis results from this updated SIS, none of these additional problems are expected at this time to require new line or substation construction. When the SIS is performed for these additional generator additions at J.K. Smith beyond 2010, the specific determination of the projects needed to address the additional problems will be made.

The planning cost estimates for this updated Alternative are listed by project in Table 4-4. Costs are provided in 2006 dollars, install year dollars, and present worth dollars.

Table 4-4 Estimated Costs for Alternative 1				
Install Date	**Project Description**	**Planning Estimate (2006$)**	**Inflated Cost (Install Year $)**	**Present Worth (2006$)**
June 2009	Construct 35.5 miles of 345 kV line from JK Smith to LGEE's Brown-Pineville double-circuit line at West Garrard using bundled 954 MCM ACSR conductor	41,750,000	47,035,000	57,062,000
June 2009	Add 345 kV Terminal Facilities at JK Smith CFB Substation for the West Garrard line. (†)	1,080,000	1,217,000	1,476,000
June 2009	Add terminal facilities at LGEE's Brown and Pineville Substations to energize the Brown-Pineville 345 kV circuit	2,160,000	2,433,000	2,952,000
June 2009	Construct a 345 kV breaker station at West Garrard with three line exits. Loop the Brown-Pineville 345 kV line through the station and terminate the new line from JK Smith	6,480,000	7,299,000	8,856,000
November 2009	Increase the terminal limits at LGEE's Pineville Substation associated with the low side of the Pineville 345-161 kV transformer to at least 2150A (600 MVA) winter emergency.	160,000	180,000	219,000
November 2009	Increase the limits of LGEE's Alcalde-Elihu 161 kV line to at least 1105A (308 MVA) winter emergency.	50,000	56,000	65,000
June 2010	Increase the terminal limits at LGEE's Boonesboro North associated with the Boonesboro North 138-69 kV transformer to at least 1320A (158 MVA) summer emergency.	140,000	161,000	171,000
November 2010	Increase the limits of the Ferguson South-Somerset (LGEE-EKPC) 69 kV line to at least 855A (102 MVA) winter emergency.	10,000	12,000	12,000
November 2012	Reconductor EKPC's JK Smith-Union City 138 kV line using 954 MCM ACSS conductor.	2,290,000	2,769,000	2,478,000
November 2012	Increase the terminal limits of EKPC's Powell County 138-69 kV transformer to 147 MVA winter emergency.	110,000	133,000	119,000

Table 4-4
Estimated Costs for Alternative 1

Install Date	Project Description	Planning Estimate (2006$)	Inflated Cost (Install Year $)	Present Worth (2006$)
June 2013	Increase the terminal limits of the Union City-Lake Reba Tap 138 kV line (EKPC-LGEE) to at least 301 MVA summer emergency.	10,000	12,000	10,000
June 2014	Increase the limits of LGEE's Alcalde-Elihu 161 kV line to at least 950A (265 MVA) summer emergency and 1220A (340 MVA) winter emergency.	1,400,000	1,775,000	1,340,000
June 2014	Increase the limits of LGEE's Artemus 161-69 kV transformer to at least 65 MVA summer emergency.	1,100,000	1,395,000	1,053,000
June 2014	Increase the terminal limits at LGEE's Boonesboro North associated with the Boonesboro North 138-69 kV transformer to at least 163 MVA summer emergency.	30,000	38,000	29,000
June 2014	Increase the terminal limits at LGEE's Boonesboro North associated with the Boonesboro North-Winchester Water Works 69 kV circuit to at least 1245A (149 MVA) summer emergency.	110,000	139,000	105,000
November 2014	Replace EKPC's Powell County 138-69 kV, 100 MVA transformer with a 140 MVA transformer.	1,700,000	2,155,000	1,627,000
June 2015	Increase the limits of LGEE's Pineville 161-69 kV transformer #2 to at least 139 MVA summer emergency.	2,120,000	2,752,000	1,904,000
June 2015	Reconductor EKPC's Union City-Lake Reba Tap 138 kV line using 954 MCM ACSS conductor.	290,000	376,000	260,000
November 2015	Increase the limits of LGEE's Artemus 161-69 kV transformer and the Artemus-Barbourville City 69 kV line to at least 74 MVA winter emergency.	110,000	143,000	99,000
November 2015	Increase the limits of LGEE's Elihu-Ferguson South 69 kV line to at least 118 MVA winter emergency.	10,000	13,000	9,000
	Total	$61,110,000	$70,093,000	$79,846,000

Both LGEE and AEP have performed some independent analysis, and have provided some of the resulting information to EKPC. The information provided indicates that some additional facility overloads have been attributed to the J.K. Smith generation and transmission additions based upon these companies' study methodologies and criteria. However, this work was performed based upon EKPC's previous plans to add five CTs and a CFB Unit at J.K. Smith by 2010. Also, the AEP analysis included EKPC's plans to provide power supply to Warren RECC. EKPC continues to work with LGEE and AEP to identify the transmission problems caused by EKPC's updated plans for J.K. Smith. This includes verification of the results provided in Tables 4-3 and 4-4 above, as well as other problems which may be identified by these companies based on updated models, study criteria, etc.

Section 5: Conclusions from Updated Analysis

The analysis did not re-create the analysis performed in the original SIS. Instead, engineering judgment and selected power flow analysis have been used to verify that the results and conclusions from the original SIS are still applicable. The transmission Alternative recommended in the original SIS still provides advantages over other possible Alternatives that make it the desired Alternative for implementation. Based upon the analysis performed and engineering judgment, Alternative 1 still provides the best transient generating-unit performance at J.K. Smith during system disturbances. Furthermore, Alternative 1 provides the best opportunities for construction and future expansion. The cost of this Alternative is still lower than the other Alternatives that were considered in the original SIS. Alternative 1 requires a small number of system upgrades to accommodate the next three generating units at J.K. Smith. Therefore, more significant upgrades that may be required are deferred.

In the original SIS, several sensitivities were analyzed at the request of the ad hoc study group. These sensitivity analyses were not updated as part of this analysis. The only sensitivity that now appears to be an issue is LGEE's generation dispatch scenario at Brown. LGEE has performed its own independent analysis for its desired dispatch scenario. As stated earlier, EKPC continues to work with LGEE to address these issues.

Based on the results contained in this report, as well as the results, obtained in the original SIS, EKPC recommends proceeding with implementation of Alternative 1 to accommodate the addition of J.K. Smith CTs #9 and #10 and CFB Unit #1.

The following recommendations are made based on these conclusions:

1. The following common transmission facilities should be completed for connection of the proposed J.K. Smith units to the transmission network:
   a) Install a second 345-138 kV, 450 MVA autotransformer at the J.K. Smith CT Substation by June 1, 2007.
   b) Add 345 kV terminal facilities at the J.K. Smith CT Substation to connect CTs #9 and #10 by June 1, 2007.
   c) Construct a second 345 kV Substation at J.K. Smith for the CFB Unit #1 (J.K. Smith CFB Substation) by June 1, 2009. (EKPC is evaluating the possibility of deferring construction of this substation until CFB Unit #2 is added at J.K. Smith. If the substation is deferred, CFB Unit #1 will be connected directly to the J.K. Smith CT Substation).
   d) Add 345 kV terminal facilities at the J.K. Smith CFB Substation to connect CFB Unit #1 by June 1, 2009.
   e) Construct two 345 kV lines between the J.K. Smith CT 345 kV Substation and the J.K. Smith CFB Substation (using bundled 954 MCM ACSR conductor) and associated terminal facilities by June 1, 2009.

2. The following transmission system additions and upgrades should be completed to provide sufficient capacity for delivery of the additional generation at J.K. Smith:
   a) Construct a 345 kV line from J.K. Smith to LGEE's Brown-Pineville double-circuit 345 kV line (using bundled 954 MCM ACSR conductor) and associated terminal facilities at the J.K. Smith CFB Substation by June 30, 2009.
   b) Add 345 kV terminal facilities at LGEE's Brown Substation and Pineville Substation to energize the existing Brown-Pineville 345 kV circuit by June 30, 2009.
   c) Construct a 345 kV switching substation (West Garrard) to connect the new 345 kV line from J.K. Smith to LGEE's Brown-Pineville 345 kV circuit by June 30, 2009.
   d) Increase the limits of LGEE's Pineville 345-161 kV transformer to at least 600 MVA winter emergency by November 30, 2009.
   e) Increase the limits of LGEE's Alcalde-Elihu 161 kV line to at least 308 MVA winter emergency by November 30, 2009.
   f) Increase the limits of LGEE's Boonesboro North 138-69 kV transformer to at least 158 MVA summer emergency by June 30, 2010.
   g) Increase the limits of the LGEE-EKPC Ferguson South-Somerset 69 kV line to at least 102 MVA winter emergency by November 30, 2010.

EKPC is coordinating with LGEE to determine the scope, cost, and schedule of the required upgrades on its system.

Appendix A: List of Overloads Identified Via Power Flow Analysis

Tables A-1 through A-8 contain complete lists of the thermal overloads identified in 2007 Summer, 2007-08 Winter, 2010 Summer, 2010-11 Winter, 2015 Summer, and 2015-16 Winter with the proposed generating units and with no transmission additions. An entry is included for all transmission contingencies that result in an overload, but only the worst-case generation dispatch is included.

Table A-1
2007 Summer Complete List of Identified Problems with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	288.5	100.5%
Hickory Plains-PPG 69 kV Line	LGEE	Fawkes EKPC-West Berea 138 kV Line (EKPC)	Cooper #2 off, import from AEP	54	54.8	101.5%

Table A-2
2007-08 Winter Complete List of Identified Problems with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	305.5	106.4%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	392.3	100.8%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	392.0	100.8%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	237	238.0	100.4%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	None	Base	167	168.0	100.6%

Table A-3
2010 Summer Complete List of Identified Problems with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Boonesboro North 138-69 kV Transformer	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	144.7	101.2%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	222.4	100.2%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	292.8	102.0%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	287	291.0	101.4%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	311	315.6	101.5%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line	Brown #3 off, import from AEP	311	315.3	101.4%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	57.6	104.7%

Table A-4
2010-11 Winter Complete List of Identified Problems with CTs 9 and 10 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes Tap-Fawkes LGEE 138 kV Line	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	303	315.8	104.2%
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	317.8	110.7%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	404.8	104.1%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	404.5	104.0%
Union City-Lake Reba Tap 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	377.7	101.8%
Union City-Lake Reba Tap 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	377.4	101.7%
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Brown North-Alcalde-Pineville 345 kV Line (LGEE)	Cooper #2 off, import from AEP	101	101.9	100.9%
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Brown North-Alcalde 345 kV Line (LGEE)	Cooper #2 off, import from AEP	101	101.4	100.4%

Table A-5
2010 Summer Complete List of Identified Problems with CTs 9- 10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Boonesboro North 138-69 kV Transformer	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	151.9	106.2%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	239.2	107.7%
Dale-Three Forks Jct. 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	222	237.5	107.0%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	234.7	105.7%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	222	233.9	105.4%
Dale-Three Forks Jct. 138 kV Line	EKPC	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	223.3	100.6%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	327.6	114.1%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	287	325.9	113.6%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes Tap-Fawkes LGEE 138 kV Line (LGEE)	Brown #3 off, import from AEP	287	318.9	111.1%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes LGEE-Fawkes Tap-Lake Reba Tap 138 kV Line (LGEE)	Brown #3 off, import from AEP	287	308.5	107.5%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	287	293.8	102.4%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Dale-Boonesboro North Tap-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	289.9	101.0%
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	291.8	101.7%
Fawkes LGEE-Clark County 138 kV Line	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Ghent #1 off, import from TVA	172	180.4	104.9%

Table A-5
2010 Summer Complete List of Identified Problems with CTs 9- 10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes LGEE-Clark County 138 kV Line	LGEE	Boonesboro North 138-69 kV Transformer (LGEE)	Ghent #1 off, import from TVA	172	176.2	102.4%
Fawkes Tap-Fawkes LGEE 138 kV Line (LGEE)	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	317.7	110.7%
Fawkes Tap-Lake Reba Tap 138 kV Line	LGEE	JK Smith-Union City 138 kV Line (EKPC)	Cooper #2 off, import from AEP	176	183.1	104.0%
Fawkes Tap-Lake Reba Tap 138 kV Line	LGEE	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	176	179.1	101.8%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	311	338.4	108.8%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	314.3	101.1%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	311	312.3	100.4%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	311	353.8	113.8%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line	Brown #3 off, import from AEP	311	353.5	113.7%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	329.5	105.9%
JK Smith-Union City 138 kV Line	EKPC	None	Base	251	264.2	105.3%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	326.6	105.0%
JK Smith-Union City 138 kV Line	EKPC	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	319.8	102.8%
JK Smith-Union City 138 kV Line	EKPC	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	318.6	102.4%
JK Smith-Union City 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Brown #3 off, import from AEP	311	315.9	101.6%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	62.7	114.0%

Table A-5
2010 Summer Complete List of Identified Problems with CTs 9- 10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Rice Tap-West Irvine 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	40	44.4	111.0%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	231.5	104.3%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	222	229.9	103.6%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Fawkes 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	227.2	102.3%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	222	226.3	101.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	300	334.2	111.4%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC 138 kV Line	Brown #3 off, import from AEP	300	333.9	111.3%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	None	Base	241	251.3	104.3%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	312.6	104.2%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	309.2	103.1%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	302.8	100.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	301.7	100.6%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	51	55.0	107.8%
West Frankfort-Clay Village Tap 69 kV Line	LGEE	Bullitt County-Little Mount Jct. 161 kV Line (EKPC)	Mill Creek #4 off, import from AEP	43	44.2	102.8%

Table A-5 2010 Summer Complete List of Identified Problems with CTs 9- 10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission						
Limiting Facility	**Company**	**Contingency**	**Worst-Case Dispatch**	**Rating**	**MVA Flow**	**% Overload**
West Frankfort-Clay Village Tap 69 kV Line	LGEE	Blue Lick 345-161 kV Transformer (LGEE)	Mill Creek #4 off, import from AEP	43	43.3	100.7%

Table A-6
2010-11 Winter Complete List of Identified Problems with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Beattyville-Delvinta 161 kV Line	EKPC-LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	211	223.7	106.0%
Beattyville-Delvinta 161 kV Line	EKPC-LGEE	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	211	216.9	102.8%
Dale 138-69 kV Transformer	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #3 off, import from AEP	136	147.2	108.2%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	293.5	105.6%
Dale-Three Forks Jct. 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	278	290.5	104.5%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	286.4	103.0%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	278	285.4	102.7%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Delvinta-Hyden Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	223	235.4	105.6%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	370	385.7	104.2%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	370	382.7	103.4%
Fawkes Tap-Fawkes LGEE 138 kV Line	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	303	356.8	117.8%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	389	403.9	103.8%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	390.3	100.3%
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	341.6	119.0%
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	335.1	116.8%

Table A-6
2010-11 Winter Complete List of Identified Problems with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
JK Smith-Powell County 138 kV Line	EKPC	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	333.9	116.3%
JK Smith-Powell County 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Cooper #2 off, import from AEP	287	320.4	111.6%
JK Smith-Powell County 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	287	319.3	111.3%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	444.3	114.2%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	444.0	114.1%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	416.4	107.0%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	415.2	106.7%
JK Smith-Union City 138 kV Line	EKPC	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	401.7	103.3%
JK Smith-Union City 138 kV Line	EKPC	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	399.7	102.8%
JK Smith-Union City 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Brown #3 off, import from AEP	389	389.6	100.2%
JK Smith-Union City 138 kV Line	EKPC	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	389.6	100.2%
JK Smith-Union City 138 kV Line	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Brown #3 off, import from AEP	389	389.3	100.1%
Lake Reba Tap 138-161 kV Transformer	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	270	271.9	100.7%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	88	92.5	105.1%
Morehead-Hayward 69 kV	AEP	Rowan County-Skaggs 138 kV Line (EKPC)	Base	48	49.5	103.1%

Table A-6
2010-11 Winter Complete List of Identified Problems with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Dale #3 off, import from AEP	143	151.3	105.8%
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Dale #3 off, import from AEP	143	150.8	105.5%
Powell County 161-138 kV Transformer	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	227.8	103.5%
Powell County 161-138 kV Transformer	EKPC	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	223.2	101.5%
Powell County 161-138 kV Transformer	EKPC	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	220.3	100.1%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	281.8	101.4%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	278	279.0	100.4%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	413.5	111.5%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	413.2	111.4%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	388.2	104.6%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	387.8	104.5%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	374.3	100.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	372.6	100.4%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	77	80.4	104.4%
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Brown North-Alcalde-Pineville 345 kV Line (LGEE)	Cooper #2 off, import from AEP	101	106.6	105.5%

Table A-6
2010-11 Winter Complete List of Identified Problems with CTs 9-10 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Delvinta-Green Hall Junction 161 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	101	106.4	105.3%
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Brown North-Alcalde 345 kV Line (LGEE)	Cooper #2 off, import from AEP	101	106.4	105.3%
West Berea Jct.-Three Links Jct. 69 kV Line	EKPC	Green Hall Junction-Tyner 161 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	101	106.0	105.0%

Table A-7
2015 Summer Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Beattyville-Oakdale Jct. 69 kV Line	EKPC	Delvinta-Green Hall Jct. 161 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	47	50.5	107.4%
Beattyville-Oakdale Jct. 69 kV Line	EKPC	Green Hall Jct.-Tyner 161 kV Line (EKPC)	Cooper #2 off, import from AEP	47	50.0	106.4%
Beattyville 161-69 kV Transformer	LGEE	Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	64	71.2	111.3%
Boonesboro North 138-69 kV Transformer	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	172.1	120.3%
Boonesboro North-Winchester Water Works 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	158.6	110.9%
Clark County 138-69 kV Transformer	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	143	143.1	100.1%
Clark County-Sylvania 69 kV Line	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	137	139.6	101.9%
Clark County-Sylvania 69 kV Line	LGEE	Boonesboro North 138-69 kV Transformer (LGEE)	Brown #3 off, import from AEP	137	137.9	100.7%
Dale 138-69 kV Transformer	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #3 off, import from AEP	111	119.6	107.7%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	261.2	117.7%
Dale-Three Forks Jct. 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	222	259.2	116.8%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	255.6	115.1%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	222	254.7	114.7%
Dale-Three Forks Jct. 138 kV Line	EKPC	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	239.4	107.8%
Dale-Three Forks Jct. 138 kV Line	EKPC	Dale-Boonesboro North Tap 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	228.1	102.7%

Table A-7
2015 Summer Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Farmers 138-69 kV Transformer	LGEE	Rodburn 138-69 kV Transformer (LGEE)	Base	48	48.5	101.0%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	357.0	124.4%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	287	355.0	123.7%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes Tap-Fawkes LGEE 138 kV Line (LGEE)	Brown #3 off, import from AEP	287	338.2	117.8%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes LGEE-Fawkes Tap-Lake Reba Tap 138 kV Line (LGEE)	Brown #3 off, import from AEP	287	329.7	114.9%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	287	316.6	110.3%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Dale-Boonesboro North Tap-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	311.5	108.5%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes-West Berea 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	304.7	106.2%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Boonesboro North 138-69 kV Transformer (LGEE)	Brown #3 off, import from AEP	287	298.8	104.1%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Dale-Boonesboro North Tap 138 kV Line (EKPC)	Brown #3 off, import from AEP	287	291.5	101.6%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-North Clark 345 kV Line (EKPC)	Brown #3 off, import from AEP	287	287.1	100.1%
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	314.5	109.6%
Fawkes LGEE-Richmond 69 kV Line	LGEE	Lake Reba 138-69 kV Transformer (LGEE)	Cooper #2 off, import from AEP	117	118.0	100.9%
Fawkes Tap-Fawkes LGEE 138 kV Line (LGEE)	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	246	336.9	137.0%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	311	387.8	124.7%

Table A-7
2015 Summer Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
JK Smith-Dale 138 kV Line	EKPC	JK Smith-North Clark 345 kV Line (EKPC)	Dale #4 off, import from AEP	311	375.0	120.6%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Dale #4 off, import from AEP	311	351.8	113.1%
JK Smith-Dale 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Dale #4 off, import from AEP	311	349.9	112.5%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Dale #4 off, import from AEP	311	339.3	109.1%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC)	Dale #4 off, import from AEP	311	339.0	109.0%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #4 off, import from AEP	311	320.7	103.1%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	354.3	113.9%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	311	352.0	113.2%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	313.3	100.7%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	311	401.1	129.0%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line	Brown #3 off, import from AEP	311	400.8	128.9%
JK Smith-Union City 138 kV Line	EKPC	None	Base	251	303.5	120.9%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	375.2	120.6%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	372.6	119.8%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-North Clark 345 kV Line (EKPC)	Brown #3 off, import from AEP	311	372.3	119.7%
JK Smith-Union City 138 kV Line	EKPC	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	360.6	115.9%

Table A-7
2015 Summer Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
JK Smith-Union City 138 kV Line	EKPC	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	311	359.2	115.5%
JK Smith-Union City 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Brown #3 off, import from AEP	311	357.9	115.1%
JK Smith-Union City 138 kV Line	EKPC	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	311	349.1	112.3%
JK Smith-Union City 138 kV Line	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Brown #3 off, import from AEP	311	349.0	112.2%
JK Smith-Union City 138 kV Line	EKPC	Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	311	335.4	107.8%
JK Smith-Union City 138 kV Line	EKPC	None	Brown #3 off, import from AEP	311	315.2	101.4%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	74.2	134.9%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	205	227.4	110.9%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	205	215.2	105.0%
Lake Reba Tap-West Irvine Tap 161 kV Line	LGEE	Powell County-Beattyville 161 kV Line (EKPC)	Cooper #2 off, import from AEP	205	215.0	104.9%
Loudon Avenue 138-69 kV Transformer #628	LGEE	Loudon Avenue 138-69 kV Transformer #618 (LGEE)	Brown #3 off, import from AEP	128	128.9	100.7%
Paris 138-69 kV Transformer	LGEE	Avon-Loudon Avenue 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	173	175.9	101.7%
Powell County 138-161 kV Transformer	EKPC	Lake Reba Tap-West Irvine-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	193	193.8	100.4%
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Dale #3 off, import from AEP	129	132.7	102.9%

Table A-7
2015 Summer Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Dale #3 off, import from AEP	129	132.3	102.6%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	252.7	113.8%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	222	250.9	113.0%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Fawkes 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	247.7	111.6%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	222	246.8	111.2%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Brown #3 off, import from AEP	222	231.0	104.1%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	300	378.0	126.0%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC 138 kV Line	Brown #3 off, import from AEP	300	377.7	125.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	None	Base	241	287.1	119.1%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	355.0	118.3%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-North Clark 345 kV Line (EKPC)	Brown #3 off, import from AEP	300	351.8	117.3%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	350.8	116.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	340.9	113.6%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	300	339.7	113.2%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	North Clark-Avon 345 kV Line (EKPC)	Brown #3 off, import from AEP	300	338.4	112.8%

Table A-7
2015 Summer Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	300	329.3	109.8%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Powell County-Beattyville 161 kV Line (EKPC)	Brown #3 off, import from AEP	300	329.2	109.7%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	300	317.1	105.7%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	51	65.1	127.6%
West Irvine-Dark Hollow 69 kV Line	LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	55	55.1	100.2%
West Irvine Tap-Delvinta 161 kV Line	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	201	208.1	103.5%
West Irvine Tap-Delvinta 161 kV Line	LGEE	Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	201	202.4	100.7%
Winchester South-Winchester 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	110	118.4	107.6%
Winchester Water Works-Boone Avenue 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	150	151.3	100.9%

Table A-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Beattyville-Delvinta 161 kV Line	EKPC-LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	211	235.1	111.4%
Beattyville-Delvinta 161 kV Line	EKPC-LGEE	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	211	227.4	107.8%
Beattyville-Oakdale Jct. 69 kV Line	EKPC	Delvinta-Green Hall Jct. 161 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	62	66.6	107.4%
Beattyville-Oakdale Jct. 69 kV Line	EKPC	Green Hall Jct.-Tyner 161 kV Line (EKPC)	Cooper #2 off, import from AEP	62	65.7	106.0%
Boonesboro North-Winchester Water Works 69 kV Line	LGEE	Fawkes LGEE-Clark County 138 kV Line (LGEE)	Ghent #1 off, import from TVA	143	159.3	111.4%
Dale 138-69 kV Transformer	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #3 off, import from AEP	136	169.7	124.8%
Dale 138-69 kV Transformer	EKPC	Powell County 138-69 kV Transformer (EKPC)	Dale #3 off, import from AEP	136	159.3	117.1%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	322.5	116.0%
Dale-Three Forks Jct. 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	278	319.1	114.8%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	315.8	113.6%
Dale-Three Forks Jct. 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	278	314.7	113.2%
Dale-Newby #1 69 kV Line	EKPC	Dix Dam-Buena Vista 69 kV Line (LGEE)	Cooper #2 off, import from AEP	87	92.6	106.4%
Dale-Newby #1 69 kV Line	EKPC	Garrard CT-Lancaster 69 kV Line (LGEE)	Cooper #2 off, import from AEP	87	88.9	102.2%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Delvinta-Hyden Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	223	253.1	113.5%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Brown North-Alcalde-Pineville 345 kV Line (LGEE)	Cooper #2 off, import from AEP	223	238.2	106.8%

Table A-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Brown North-Alcalde 345 kV Line (LGEE)	Cooper #2 off, import from AEP	223	234.9	105.3%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Cooper-Laurel Dam 161 kV Line (EKPC)	Cooper #2 off, import from AEP	223	230.1	103.2%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	Alcalde 345-161 kV Transformer (LGEE)	Cooper #2 off, import from AEP	223	228.0	102.2%
Delvinta-Green Hall Jct. 161 kV Line	LGEE-EKPC	West Berea Jct.-Three Links Jct. 69 kV Line (EKPC)	Cooper #2 off, import from AEP	223	223.7	100.3%
Farmers 138-69 kV Transformer	LGEE	Rodburn 138-69 kV Transformer (LGEE)	Base	58	58.1	100.2%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	370	428.6	115.8%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	370	425.2	114.9%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes Tap-Fawkes LGEE 138 kV Line (LGEE)	Brown #3 off, import from AEP	370	405.3	109.5%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes LGEE-Fawkes Tap-Lake Reba Tap 138 kV Line (LGEE)	Brown #3 off, import from AEP	370	394.6	106.6%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	370	377.5	102.0%
Fawkes EKPC-Fawkes LGEE 138 kV Line	EKPC-LGEE	Fawkes EKPC-West Berea 138 kV Line (EKPC)	Brown #3 off, import from AEP	370	371.0	100.3%
Fawkes EKPC-Fawkes Tap 138 kV Line	EKPC-LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	287	374.9	130.6%
Fawkes LGEE-Clark County 138 kV Line	LGEE	Dale-Boonesboro North-Avon 138 kV Line (EKPC)	Ghent #1 off, import from TVA	194	202.5	104.4%
Fawkes LGEE-Clark County 138 kV Line	LGEE	Boonesboro North 138-69 kV Transformer (LGEE)	Ghent #1 off, import from TVA	194	199.7	102.9%
Fawkes Tap-Fawkes LGEE 138 kV Line	LGEE	Fawkes EKPC-Fawkes LGEE 138 kV Line	Brown #3 off, import from AEP	303	403.8	133.3%

Table A-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Fawkes Tap-Fawkes LGEE 138 kV Line	LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	303	321.0	105.9%
Green Hall Jct.-Tyner 161 kV Line	EKPC	Delvinta-Hyden Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	237	246.5	104.0%
JK Smith-Dale 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Dale #4 off, import from AEP	389	470.4	120.9%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-North Clark 345 kV Line (EKPC)	Dale #4 off, import from AEP	389	454.6	116.9%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Dale #4 off, import from AEP	389	440.2	113.2%
JK Smith-Dale 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Dale #4 off, import from AEP	389	436.7	112.3%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Dale #4 off, import from AEP	389	424.9	109.2%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Dale #4 off, import from AEP	389	424.5	109.1%
JK Smith-Dale 138 kV Line	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Dale #4 off, import from AEP	389	403.4	103.7%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	442.5	113.8%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	438.8	112.8%
JK Smith-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	392.3	100.8%
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	378.1	131.7%
JK Smith-Powell County 138 kV Line	EKPC	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	371.4	129.4%
JK Smith-Powell County 138 kV Line	EKPC	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	287	369.6	128.8%

Table A-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
JK Smith-Powell County 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Cooper #2 off, import from AEP	287	358.3	124.8%
JK Smith-Powell County 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	287	356.9	124.4%
JK Smith-Powell County 138 kV Line	EKPC	JK Smith-North Clark 345 kV Line (EKPC)	Cooper #2 off, import from AEP	287	355.6	123.9%
JK Smith-Powell County 138 kV Line	EKPC	Dale 138-69 kV Transformer (EKPC)	Dale #3 off, import from AEP	287	346.7	120.8%
JK Smith-Powell County 138 kV Line	EKPC	Brown North-Alcalde-Pineville 345 kV Line (EKPC)	Cooper #2 off, import from AEP	287	345.8	120.5%
JK Smith-Powell County 138 kV Line	EKPC	Brown North-Alcalde 345 kV Line (EKPC)	Cooper #2 off, import from AEP	287	344.4	120.0%
JK Smith-Powell County 138 kV Line	EKPC	JK Smith-Dale 138 kV Line (EKPC)	Cooper #2 off, import from AEP	287	341.6	119.0%
JK Smith-Powell County 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Cooper #2 off, import from AEP	287	337.5	117.6%
JK Smith-Powell County 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	287	337.5	117.6%
JK Smith-Powell County 138 kV Line	EKPC	Goddard-Hillsboro 69 kV Line (EKPC)	Cooper #2 off, import from AEP	287	335.3	116.8%
JK Smith-Powell County 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Cooper #2 off, import from AEP	287	330.8	115.3%
JK Smith-Powell County 138 kV Line	EKPC	Broadford-Sullivan 500 kV Line (AEP-TVA)	Cooper #2 off, import from AEP	287	330.6	115.2%
JK Smith-Powell County 138 kV Line	EKPC	None	Base	287	308.3	107.4%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	500.7	128.7%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	500.4	128.6%

Table A-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

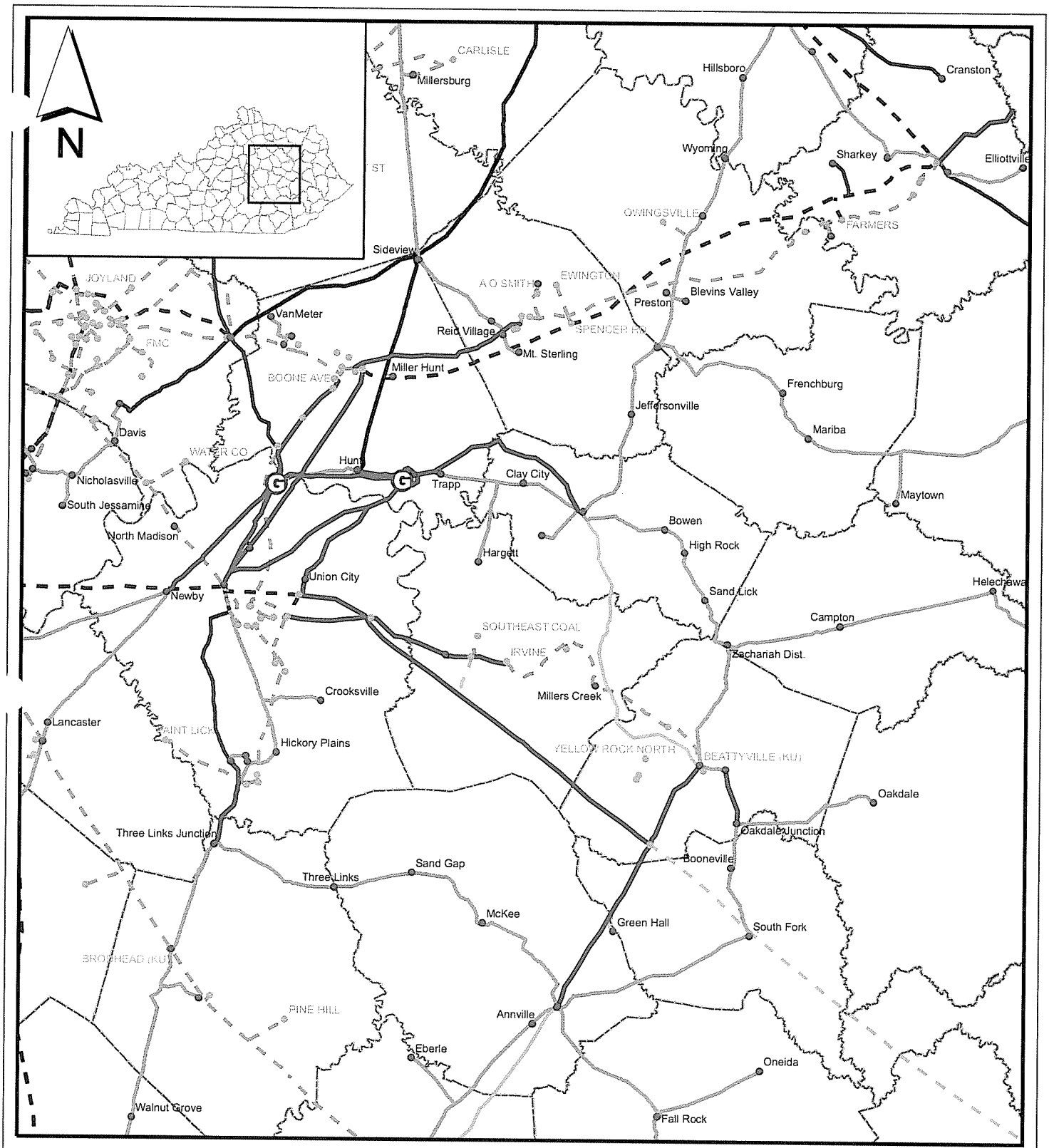
Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	469.2	120.6%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	468.7	120.5%
JK Smith-Union City 138 kV Line	EKPC	JK Smith-North Clark 345 kV Line (EKPC)	Brown #3 off, import from AEP	389	458.1	117.8%
JK Smith-Union City 138 kV Line	EKPC	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	449.4	115.5%
JK Smith-Union City 138 kV Line	EKPC	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	389	447.1	114.9%
JK Smith-Union City 138 kV Line	EKPC	North Clark-Avon 345 kV Line (EKPC)	Brown #3 off, import from AEP	389	442.6	113.8%
JK Smith-Union City 138 kV Line	EKPC	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	437.5	112.5%
JK Smith-Union City 138 kV Line	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Brown #3 off, import from AEP	389	437.2	112.4%
JK Smith-Union City 138 kV Line	EKPC	None	Base	349	381.1	109.2%
JK Smith-Union City 138 kV Line	EKPC	Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	389	419.6	107.9%
Lake Reba Tap 138-161 kV Transformer	LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Cooper #2 off, import from AEP	270	289.5	107.2%
Lake Reba Tap 138-161 kV Transformer	LGEE	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Cooper #2 off, import from AEP	270	274.2	101.6%
Lake Reba Tap 138-161 kV Transformer	LGEE	Powell County-Beattyville 161 kV Line (EKPC)	Cooper #2 off, import from AEP	270	273.6	101.3%
Lake Reba-Waco 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	88	99.5	113.1%
Morehead-Hayward 69 kV	AEP	Rowan County-Skaggs 138 kV Line (EKPC)	Base	48	50.7	105.6%

Table A-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville 161 kV Line (EKPC)	Dale #3 off, import from AEP	143	169.4	118.5%
Powell County 138-69 kV Transformer	EKPC	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Dale #3 off, import from AEP	143	168.4	117.8%
Powell County 138-69 kV Transformer	EKPC	Dale 138-69 kV Transformer (EKPC)	Dale #3 off, import from AEP	143	155.6	108.8%
Powell County 138-161 kV Transformer	EKPC	Lake Reba Tap-West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	243.3	110.6%
Powell County 138-161 kV Transformer	EKPC	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	238.5	108.4%
Powell County 138-161 kV Transformer	EKPC	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	220	235.8	107.2%
Powell County 138-161 kV Transformer	EKPC	Powell County 138-69 kV Transformer (EKPC)	Cooper #2 off, import from AEP	220	227.1	103.2%
Powell County 138-161 kV Transformer	EKPC	None	Base	178	181.2	101.8%
Spurlock-Kenton 138 kV Line	EKPC-LGEE	Spurlock-Maysville Industrial Jct. 138 kV Line (EKPC)	Ghent #1 off, import from TVA	287	288.2	100.4%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Union City 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	308.4	110.9%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	Union City-Lake Reba Tap 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	278	305.3	109.8%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Fawkes 138 kV Line (EKPC)	Brown #3 off, import from AEP	278	302.6	108.8%
Three Forks Jct.-Fawkes EKPC 138 kV Line	EKPC	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	278	301.5	108.5%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	None	Base	277	353.9	127.8%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes EKPC-Fawkes LGEE 138 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	462.7	124.7%

Table A-8
2015-16 Winter Complete List of Identified Problems with CTs 8-12 & CFB Unit #1 Installed at JK Smith and with no Additional Transmission

Limiting Facility	Company	Contingency	Worst-Case Dispatch	Rating	MVA Flow	% Overload
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Fawkes 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	462.4	124.6%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Dale 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	436.0	117.5%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-Powell County 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	431.7	116.4%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	JK Smith-North Clark 345 kV Line (EKPC)	Brown #3 off, import from AEP	371	424.2	114.3%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Dale-Three Forks Jct. 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	416.9	112.4%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Three Forks Jct.-Fawkes EKPC 138 kV Line (EKPC)	Brown #3 off, import from AEP	371	415.0	111.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	North Clark-Avon 345 kV Line (EKPC)	Brown #3 off, import from AEP	371	409.9	110.5%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Powell County-Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	404.2	108.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Powell County-Beattyville 161 kV Line (EKPC)	Brown #3 off, import from AEP	371	404.1	108.9%
Union City-Lake Reba Tap 138 kV Line	EKPC-LGEE	Beattyville-Delvinta 161 kV Line (EKPC-LGEE)	Brown #3 off, import from AEP	371	389.1	104.9%
Waco-Rice Tap 69 kV Line	LGEE	Lake Reba Tap-West Irvine Tap 161 kV Line (LGEE)	Cooper #2 off, import from AEP	77	85.3	110.8%
West Berea 138-69 kV Transformer	EKPC	Fawkes LGEE-Crooksville Jct. 69 kV Line (LGEE-EKPC)	Cooper #2 off, import from AEP	152	162.4	106.8%
West Irvine 161-69 kV Transformer	LGEE	West Irvine Tap-Delvinta 161 kV Line (LGEE)	Cooper #2 off, import from AEP	62	62.9	101.5%



Legend

- EKPC Generation
- EKPC Substation
- KU Substation
- Overloaded Lines

EKPC Transmission	KU Transmission
EKPC 69 kV	69 kV
EKPC 138 kV	138 kV
EKPC 161 kV	161 kV
EKPC 345 kV	345 kV

Revised: 2-6-07

Figure B-1
Updated Identification of Overloaded Facilities with J.K. Smith Proposed Generator Additions Through 2015

0 5 10 15 20 25 Miles

ADAMS EXHIBIT 4

INTEROFFICE MEMORANDUM

TO: BRANDON GRILLON

FROM: DARRIN ADAMS

SUBJECT: PLANNING EVALUATION OF CONSTRUCTING JK SMITH-WEST GARRARD 345 KV ON THE SAME STRUCTURES WITH JK SMITH-FAWKES 138 KV

DATE: 1/24/2007

CC: JIM LAMB, MARY JANE WARNER, DOMINIC BALLARD, NICK COMER

Per your email correspondence dated January 11, 2007, I have performed an evaluation of our ability to construct the new J.K. Smith-West Garrard 345 kV line along with the existing J.K. Smith-Fawkes 138 kV line as a double-circuit line.

As you may recall, we performed system analysis and provided information to you on May 31, 2006 that indicated that the JK Smith-Fawkes 138 kV line is not a viable candidate for rebuilding as double circuit. This conclusion was reached based on the assumption that the existing line would be de-energized, torn down, and then rebuilt as a new double-circuit line. Our analysis indicates that the outage of the JK Smith-Fawkes line required for this scenario would result in severe system problems on the EKPC transmission system for the duration of the outage window. These problems would occur even if EKPC did not dispatch any of its generation at JK Smith. Additional generation re-dispatch at the Spurlock station would therefore be required. This would result in substantial incremental energy costs to EKPC ratepayers. Therefore, this alternative is cost prohibitive.

Another possibility for building the double-circuit line has been presented. This approach would be to build a new double-circuit line consisting of the JK Smith-West Garrard 345 kV circuit and the JK Smith-Fawkes 138 kV circuit beside the existing JK Smith-Fawkes 138 kV line. Once this new double-circuit line is completed and energized, the existing JK Smith-Fawkes 138 kV line would be torn down. This approach would eliminate the problems created by a lengthy outage of the JK Smith-Fawkes line. However, our analysis concludes that the new double-circuit line provides an unacceptable level of reliability for the region's transmission network. The scenario with the JK Smith-West Garrard line parallel to the existing JK Smith-Fawkes 138 kV line does not create this reliability risk. An explanation of the differences in the level of reliability are detailed below.

I have attached the applicable Reliability Standard that the North American Reliability Electric Corporation (NERC) has developed to ensure the integrity of the transmission network. To help explain the issue, I'll provide you with some background. NERC develops and enforces standards that are designed to ensure the reliability and security of the bulk electric system. All utilities in North America that are connected to the bulk electric system must comply with these standards. Presently, there are more than 100 active standards that we must comply with. All of these standards are important. However, the consequences of violating a standard can vary greatly. Violating some standards may create some problems, but have very little impact on the bulk electric system. Others, such as the TPL-003-0 standard that is attached, can have very severe consequences if they are not adhered to.

The requirement of TPL-003-0 is that for a Category C event (detailed in Table I of the Standard) cascading outages cannot occur for an event or events resulting in the loss of two or more (multiple) elements. One of these events is an outage of any two circuits of a multiple circuit towerline. Therefore, to comply with this NERC Reliability Standard, EKPC would need to ensure that an outage of the proposed JK Smith-West Garrard/JK Smith-Fawkes double-circuit line does not result in cascading outages. If this double-circuit outage does result in subsequent cascading outages, EKPC would be in violation of this Reliability Standard, and subject to fines by NERC of up to $1,000,000 per day until the problem is remedied.

We have performed a power flow analysis simulating the impacts of the simultaneous outage of both of these circuits. This analysis was performed for expected 2010 Summer, 2010-11 Winter, 2015 Summer, and 2015-16 Winter conditions. The 2010 Summer and 2010-11 Winter simulations include the planned addition of two Combustion Turbines (CTs) and the new CFB unit at JK Smith. The 2015 Summer and 2015-16 Winter simulations include further possible additions of three CTs at JK Smith. For each of these simulations, two transfer scenarios were considered. One transfer scenario is the base scenario – i.e., no incremental north-south transfer simulated. The other scenario simulates a 4000 MW incremental north-south transfer, which is a typical occurrence based on historical operating experience. These simulations that were conducted indicate that cascading outages are likely for an outage of the double-circuit line for either transfer scenario in any of the periods considered.

The details of this analysis are attached. The results for the 2010 Summer analysis with a 0 MW north-south transfer will be used to illustrate how this analysis is conducted and interpreted. Step 1 is to trip the JK Smith-West Garrard and JK Smith-Fawkes double-circuit line. All overloaded facilities are then identified for these conditions. In this particular case, the resulting flow on the JK Smith-Union City 138 kV line is 334.1 MVA, which is 107.4% of the line's summer emergency rating. When the flow on a facility exceeds its emergency rating, the likelihood of the facility tripping out of service increases. The higher the overload, the more likely a subsequent outage is. For this type of analysis, we assume that the facility with the largest percentage overload will trip if the overload is more than 5% above the facility's emergency rating. (Note that this 5% value is consistent with that used for the analysis in the Kentucky Public Service Commission's Administrative Case 387 to assess the vulnerability of the Kentucky transmission system to electrical disturbances). After each subsequent trip, the resulting overloads are identified, and the facility with the highest percentage overload is then tripped if the facility loading exceeds 105% of the emergency rating. This process is repeated until either the electric system returns to a state where all flows are at 105% or less of applicable facility ratings or the simulation will no longer converge. Inability to converge is indicative of a transmission system that is not capable of supporting the system demand, which would result in system collapse. For the 2010 Summer case cited as an example, the analysis simulated five steps of facility trips before the case would not converge. Therefore, the expected end result is system collapse after an outage of the proposed double-circuit line.

In order to comply with NERC Reliability Standard TPL-003-0, two alternatives would exist if the double-circuit line is constructed. These alternative are:

1. Restrict generation output at JK Smith to the level necessary to avoid possible cascading outages for an outage of the double-circuit line.

2. Upgrade the transmission lines in the area such that an outage of the double-circuit line does not result in system overloads that could lead to cascading outages.

Restrictions on generation output at JK Smith would have to be implemented at all times such that if the double-circuit line were to trip, all facility flows would remain within applicable system ratings. The table below shows the estimated generation restrictions that would have to be imposed at JK Smith to comply with TPL-003-0.

Period	Level of North-South Transfer	Maximum Possible JK Smith Generation	Maximum Allowable JK Smith Generation to Comply with NERC TPL-003-0
2010 Summer	0 MW	1040 MW	905 MW
2010 Summer	4000 MW	1040 MW	665 MW
2010-11 Winter	0 MW	1300 MW	1100 MW
2010-11 Winter	4000 MW	1300 MW	875 MW
2015 Summer	0 MW	1292 MW	780 MW
2015 Summer	4000 MW	1292 MW	550 MW
2010-11 Winter	0 MW	1594 MW	970 MW
2015-16 Winter	4000 MW	1594 MW	755 MW

This table shows that in order to comply with TPL-003-0, the generation at JK Smith would have to be restricted to a range that is anywhere from 43% to 87% of the maximum possible output at JK Smith at all times. This inability to dispatch generation at JK Smith would result in substantial costs for replacement power. Of even more concern is the uncertainty that the power that would have to be imported into the EKPC system would be available. If the necessary power is not available, load shedding/rolling blackouts would be required. Therefore, generation restrictions at JK Smith are not a viable means to comply with TPL-003-0.

The other alternative to comply with TPL-003-0 if the double-circuit line is constructed is to upgrade the facilities impacted by the double-circuit outage. These are the JK Smith-Union City, Union City-Lake Reba Tap, Dale-Three Forks Jct., Three Forks Jct.-Fawkes, and JK Smith-Dale 138 kV lines. These upgrades are estimated to cost approximately $5,000,000. Furthermore, finding an outage window to take these lines out of service to perform the upgrades will be very difficult. All of these lines are critical facilities for the transmission network in the area. The outages necessary to perform these upgrades will result in significant system problems that will require substantial generation restrictions. This will result in additional incremental costs to EKPC ratepayers that make this alternative cost prohibitive.

Note that the requirements of the TPL-003-0 Standard must also be met for the scenario for which a facility trips followed by a subsequent trip of another facility. Therefore, even if the JK Smith-West Garrard line and the JK Smith-Fawkes line are constructed parallel to each other, the system must be designed to prevent cascading outages with both circuits out of service. However,

there is one crucial difference in the two scenarios. TPL-003-0 allows for manual system adjustments, such as generation re-dispatch, after the first outage, but prior to the second outage. For example, with the JK Smith-West Garrard line and the JK Smith-Fawkes line parallel to each other, the JK Smith generation can be dispatched at full output. If the JK Smith-West Garrard line trips, EKPC would then be required to reduce generation at JK Smith so that a subsequent trip of the JK Smith-Fawkes line would not result in any overloaded facilities. Therefore, generation reductions are not necessary until a facility actually trips, which should be a very rare occurrence. If the lines are on the same double-circuit structures, generation must be reduced at JK Smith prior to any outages in anticipation of an event that results in the loss of both circuits, and this would result in generation restrictions for basically all periods.

Based on our analysis and the rationale provided above, our conclusion is that constructing the JK Smith-West Garrard 345 kV circuit and the JK Smith-Fawkes 138 kV circuit as a double-circuit line would create unacceptable reliability risks in violation of NERC Reliability Standards. EKPC would have to substantially restrict generation at the JK Smith site frequently, which would create both an enormous economic burden and a significant risk of inadequate power supply for EKPC customers. Therefore, the JK Smith-West Garrard 345 kV line should be built using separate transmission structures.

A. Introduction

1. **Title:** **System Performance Following Loss of Two or More Bulk Electric System Elements (Category C)**

2. **Number:** TPL-003-0

3. **Purpose:** System simulations and associated assessments are needed periodically to ensure that reliable systems are developed that meet specified performance requirements, with sufficient lead time and continue to be modified or upgraded as necessary to meet present and future System needs.

4. **Applicability:**

   4.1. Planning Authority

   4.2. Transmission Planner

5. **Effective Date:** April 1, 2005

B. Requirements

R1. The Planning Authority and Transmission Planner shall each demonstrate through a valid assessment that its portion of the interconnected transmission systems is planned such that the network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services, at all demand Levels over the range of forecast system demands, under the contingency conditions as defined in Category C of Table I (attached). The controlled interruption of customer Demand, the planned removal of generators, or the Curtailment of firm (non-recallable reserved) power transfers may be necessary to meet this standard. To be valid, the Planning Authority and Transmission Planner assessments shall:

R1.1. Be made annually.

R1.2. Be conducted for near-term (years one through five) and longer-term (years six through ten) planning horizons.

R1.3. Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category C of Table 1 (multiple contingencies). The specific elements selected (from each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).

R1.3.1. Be performed and evaluated only for those Category C contingencies that would produce the more severe system results or impacts. The rationale for the contingencies selected for evaluation shall be available as supporting information. An explanation of why the remaining simulations would produce less severe system results shall be available as supporting information.

R1.3.2. Cover critical system conditions and study years as deemed appropriate by the responsible entity.

R1.3.3. Be conducted annually unless changes to system conditions do not warrant such analyses.

R1.3.4. Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.

R1.3.5. Have all projected firm transfers modeled.

R1.3.6. Be performed and evaluated for selected demand levels over the range of forecast system demands.

R1.3.7. Demonstrate that System performance meets Table 1 for Category C contingencies.

R1.3.8. Include existing and planned facilities.

R1.3.9. Include Reactive Power resources to ensure that adequate reactive resources are available to meet System performance.

R1.3.10. Include the effects of existing and planned protection systems, including any backup or redundant systems.

R1.3.11. Include the effects of existing and planned control devices.

R1.3.12. Include the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) at those Demand levels for which planned (including maintenance) outages are performed.

R1.4. Address any planned upgrades needed to meet the performance requirements of Category C.

R1.5. Consider all contingencies applicable to Category C.

R2. When system simulations indicate an inability of the systems to respond as prescribed in Reliability Standard TPL-003-0_R1, the Planning Authority and Transmission Planner shall each:

R2.1. Provide a written summary of its plans to achieve the required system performance as described above throughout the planning horizon:

R2.1.1. Including a schedule for implementation.

R2.1.2. Including a discussion of expected required in-service dates of facilities.

R2.1.3. Consider lead times necessary to implement plans.

R2.2. Review, in subsequent annual assessments, (where sufficient lead time exists), the continuing need for identified system facilities. Detailed implementation plans are not needed.

R3. The Planning Authority and Transmission Planner shall each document the results of these Reliability Assessments and corrective plans and shall annually provide these to its respective NERC Regional Reliability Organization(s), as required by the Regional Reliability Organization.

C. Measures

M1. The Planning Authority and Transmission Planner shall have a valid assessment and corrective plans as specified in Reliability Standard TPL-003-0_R1 and TPL-003-0_R2.

M2. The Planning Authority and Transmission Planner shall have evidence it reported documentation of results of its reliability assessments and corrective plans per Reliability Standard TPL-003-0_R3.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Monitoring Responsibility

Compliance Monitor: Regional Reliability Organizations.

1.2. Compliance Monitoring Period and Reset Timeframe

Annually.

1.3. Data Retention

None specified.

1.4. Additional Compliance Information

None.

2. Levels of Non-Compliance

2.1. Level 1: Not applicable.

2.2. Level 2: A valid assessment and corrective plan for the longer-term planning horizon is not available.

2.3. Level 3: Not applicable.

2.4. Level 4: A valid assessment and corrective plan for the near-term planning horizon is not available.

E. Regional Differences

1. None identified.

Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New
0	April 1, 2005	Add parenthesis to item "e" on page 8.	Errata

Table I. Transmission System Standards – Normal and Emergency Conditions

Category	Contingencies	System Limits or Impacts		
	Initiating Event(s) and Contingency Element(s)	System Stable and both Thermal and Voltage Limits within Applicable Rating [a]	Loss of Demand or Curtailed Firm Transfers	Cascading [c] Outages
A No Contingencies	All Facilities in Service	Yes	No	No
B Event resulting in the loss of a single element.	Single Line Ground (SLG) or 3-Phase (3Ø) Fault, with Normal Clearing: 1. Generator 2. Transmission Circuit 3. Transformer Loss of an Element without a Fault.	Yes Yes Yes Yes	No [b] No [b] No [b] No [b]	No No No No
	Single Pole Block, Normal Clearing [e]: 4. Single Pole (dc) Line	Yes	No [b]	No
C Event(s) resulting in the loss of two or more (multiple) elements.	SLG Fault, with Normal Clearing [e]: 1. Bus Section 2. Breaker (failure or internal Fault)	Yes Yes	Planned/ Controlled [c] Planned/ Controlled [c]	No No
	SLG or 3Ø Fault, with Normal Clearing [e], Manual System Adjustments, followed by another SLG or 3Ø Fault, with Normal Clearing [e]: 3. Category B (B1, B2, B3, or B4) contingency, manual system adjustments, followed by another Category B (B1, B2, B3, or B4) contingency	Yes	Planned/ Controlled [c]	No
	Bipolar Block, with Normal Clearing [e]: 4. Bipolar (dc) Line Fault (non 3Ø), with Normal Clearing [e]: 5. Any two circuits of a multiple circuit towerline [f]	Yes Yes	Planned/ Controlled [c] Planned/ Controlled [c]	No No
	SLG Fault, with Delayed Clearing [e] (stuck breaker or protection system failure): 6. Generator 7. Transformer 8. Transmission Circuit 9. Bus Section	Yes Yes Yes Yes	Planned/ Controlled [c] Planned/ Controlled [c] Planned/ Controlled [c] Planned/ Controlled [c]	No No No No

D [d] Extreme event resulting in two or more (multiple) elements removed or Cascading out of service	3Ø Fault, with Delayed Clearing [e] (stuck breaker or protection system failure): 1. Generator 2. Transmission Circuit 3. Transformer 4. Bus Section 3Ø Fault, with Normal Clearing [e]: 5. Breaker (failure or internal Fault) 6. Loss of towerline with three or more circuits 7. All transmission lines on a common right-of way 8. Loss of a substation (one voltage level plus transformers) 9. Loss of a switching station (one voltage level plus transformers) 10. Loss of all generating units at a station 11. Loss of a large Load or major Load center 12. Failure of a fully redundant Special Protection System (or remedial action scheme) to operate when required 13. Operation, partial operation, or misoperation of a fully redundant Special Protection System (or Remedial Action Scheme) in response to an event or abnormal system condition for which it was not intended to operate 14. Impact of severe power swings or oscillations from Disturbances in another Regional Reliability Organization.	Evaluate for risks and consequences. ▪ May involve substantial loss of customer Demand and generation in a widespread area or areas. ▪ Portions or all of the interconnected systems may or may not achieve a new, stable operating point. ▪ Evaluation of these events may *require joint studies with* neighboring systems.

a) Applicable rating refers to the applicable Normal and Emergency facility thermal Rating or system voltage limit as determined and consistently applied by the system or facility owner. Applicable Ratings may include Emergency Ratings applicable for short durations as required to permit operating steps necessary to maintain system control. All Ratings must be established consistent with applicable NERC Reliability Standards addressing Facility Ratings.

b) Planned or controlled interruption of electric supply to radial customers or some local Network customers, connected to or supplied by the Faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted Firm (non-recallable reserved) electric power Transfers.

c) Depending on system design and expected system impacts, the controlled interruption of electric supply to customers (load shedding), the planned removal from service of certain generators, and/or the curtailment of contracted Firm (non-recallable reserved) electric power transfers may be necessary to maintain the overall reliability of the interconnected transmission systems.

d) A number of extreme contingencies that are listed under Category D and judged to be critical by the transmission planning entity(ies) will be selected for evaluation. It is not expected that all possible facility outages under each listed contingency of Category D will be evaluated.

e) Normal clearing is when the protection system operates as designed and the Fault is cleared in the time normally expected with proper functioning of the installed protection systems. Delayed clearing of a Fault is due to failure of any protection system component such as a relay, circuit breaker, or current transformer, and not because of an intentional design delay.

f) System assessments may exclude these events where multiple circuit towers are used over short distances (e.g., station entrance, river crossings) in accordance with Regional exemption criteria.

Cascading Analysis for NERC Reliability Standard TPL-003-0
2010 Summer with 0 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	334.1	311	107.4%
Union City-Lake Reba Tap 138 kV	317.3	300	105.8%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	374.3	222	168.6%
Three Forks Jct.-Fawkes 138 kV	363.6	222	163.8%
JK Smith-Dale 138 kV	419.4	311	134.9%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester South-Winchester 69 kV	135.9	110	123.5%
Boonesboro North-Winchester Water Works 69 kV	172.8	143	120.8%
Boonesboro North 138-69 kV	188.9	160	118.1%
Winchester Water Works-Boone Avenue 69 kV	165.6	150	110.4%
Powell County 161-138 kV	206.8	193	107.2%
Wilson Downing Tap-Ashland Pipe 69 kV	57.1	55	103.8%
JK Smith-Powell County 138 kV	316.5	311	101.8%

Step 4) Subsequent Trip of Boonesboro North-Winchester 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Brown Plant-Fawkes 138 kV	251.6	218	115.4%
Wilson Downing Tap-Ashland Pipe 69 kV	63.4	55	115.3%
Powell County 161-138 kV	220.6	193	114.3%
Dale-Newby #1 69 kV	75.7	69	109.7%
JK Smith-Powell County 138 kV	337.7	311	108.6%
Avon-Loudon Avenue 138 kV	288.5	274	105.3%
Higby Mill-Southpoint 69 kV	88.1	86	102.4%

Step 5) Subsequent Trip of Brown Plant-Fawkes 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Wilson Downing Tap-Ashland Pipe 69 kV	109.4	55	198.9%
31 OTHER OVERLOADS			

Step 6) Subsequent Trip of Higby Mill-Fawkes 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
POWER FLOW CASE IS NON-CONVERGENT			

Cascading Analysis for NERC Reliability Standard TPL-003-0
2010 Summer with 4000 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	374.8	311	120.5%
Union City-Lake Reba Tap 138 kV	354.3	300	118.1%
Dale-Three Forks Jct. 138 kV	246.8	222	111.2%
Three Forks Jct.-Fawkes 138 kV	239.3	222	107.8%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	421.9	222	190.0%
Three Forks Jct.-Fawkes 138 kV	409.5	222	184.5%
JK Smith-Dale 138 kV	462	311	148.6%
Powell County 161-138 kV	193.3	193	100.2%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester South-Winchester 69 kV	144.6	110	131.5%
Boonesboro North-Winchester Water Works 69 kV	182.7	143	127.8%
Powell County 161-138 kV	241.7	193	125.2%
Boonesboro North 138-69 kV	200	160	125.0%
Winchester Water Works-Boone Avenue 69 kV	174.8	150	116.5%
Dale-Newby #1 69 kV	80.3	69	116.4%
JK Smith-Powell County 138 kV	358	311	115.1%
Wilson Downing Tap-Ashland Pipe 69 kV	59.1	55	107.5%
Avon-Loudon Avenue 138 kV	292	274	106.6%
Beattyville-Delvinta 161 kV	211.7	201	105.3%
Powell County-Beattyville 161 kV	240	232	103.4%
Newby #1-Lancaster 69 kV	70.8	69	102.6%

Step 4) Subsequent Trip of Boonesboro North-Winchester 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 161-138 kV	256.6	193	133.0%
Dale-Newby #1 69 kV	89	69	129.0%
JK Smith-Powell County 138 kV	381.1	311	122.5%
Avon-Loudon Avenue 138 kV	328.3	274	119.8%
Wilson Downing Tap-Ashland Pipe 69 kV	65.6	55	119.3%
Brown Plant-Fawkes 138 kV	249.6	218	114.5%
Beattyville-Delvinta 161 kV	222	201	110.4%
Powell County-Beattyville 161 kV	254.1	232	109.5%
Newby #1-Lancaster 69 kV	78.3	69	113.5%
Lancaster EK-Garrard County 69 kV	73	69	105.8%
Higby Mill-Southpoint 69 kV	90.4	86	105.1%
Paris 138-69 kV	176.9	173	102.3%
Paris-CMC Tap 69 kV	87.7	86	102.0%

Step 5) Subsequent Trip of Powell County 161-138 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Zachariah-Beattyville 69 kV	78.5	47	167.0%

24 OTHER OVERLOADS

Step 6) Subsequent Trip of Zachariah-Beattyville 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Newby #1 69 kV	106.4	69	154.2%
22 OTHER OVERLOADS			

Step 7) Subsequent Trip of Dale-Newby #1 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Avon-Loudon Avenue 138 kV	384.9	274	140.5%
24 OTHER OVERLOADS			

Step 8) Subsequent Trip of Avon-Loudon Avenue 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Newby #2 69 kV	80.2	69	116.2%
13 OTHER OVERLOADS			

Step 9) Subsequent Trip of Dale-Newby #2 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
POWER FLOW CASE IS NON-CONVERGENT			

Cascading Analysis for NERC Reliability Standard TPL-003-0
2010-11 Winter with 0 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	423.9	389	109.0%
Union City-Lake Reba Tap 138 kV	396.7	371	106.9%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	464.4	278	167.1%
Three Forks Jct.-Fawkes 138 kV	447.5	278	161.0%
JK Smith-Dale 138 kV	531.3	389	136.6%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester-Parker Seal 69 kV	109.6	72	152.2%
Boonesboro North-Winchester Water Works 69 kV	192.1	143	134.3%
Powell County 161-138 kV	268.6	220	122.1%
Boonesboro North 138-69 kV	213.2	185	115.2%
Winchester South-Winchester 69 kV	155.1	143	108.5%
Beattyville-Delvinta 161 kV	228.7	211	108.4%
JK Smith-Powell County 138 kV	419	389	107.7%
Powell County-Beattyville 161 kV	266.9	266	100.3%

Step 4) Subsequent Trip of Winchester-Parker Seal 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 161-138 kV	275.1	220	125.0%
JK Smith-Powell County 138 kV	431.9	389	111.0%
Beattyville-Delvinta 161 kV	232.4	211	110.1%
Brown Plant-Fawkes 138 kV	296.4	283	104.7%
Higby Mill-Southpoint 69 kV	101.4	97	104.5%
Powell County-Beattyville 161 kV	272.6	266	102.5%
Avon-Loudon Avenue 138 kV	291.3	287	101.5%

Step 5) Subsequent Trip of Powell County 161-138 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 138-69 kV	212.3	143	148.5%
Powell County-Bowen 69 kV	130.7	93	140.5%
Bowen-High Rock 69 kV	123	93	132.3%
High Rock-Sand Lick 69 kV	121.9	93	131.1%
Sand Lick-Zachariah 69 kV	121.6	93	130.8%
Brown Plant-Fawkes 138 kV	346	283	122.3%
Zachariah-Beattyville 69 kV	75.2	62	121.3%
Higby Mill-Southpoint 69 kV	113.9	97	117.4%
Dale-Newby #1 69 kV	104.3	91	114.6%
Avon-Loudon Avenue 138 kV	323.3	287	112.6%
Southpoint-Wilson Downing Tap 69 kV	107	97	110.3%
Farley 161-69 kV	143.4	143	100.3%
Dale-Boonesboro North Tap 138 kV	330.2	330	100.1%

Step 6) Subsequent Trip of Powell County 138-69 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale 138-69 kV	183.5	141	130.1%
Dale-Hunt #2 69 kV	117.8	91	129.5%
Brown Plant-Fawkes 138 kV	364.5	283	128.8%
Higby Mill-Southpoint 69 kV	118.2	97	121.9%
Hunt #2-JK Smith 69 kV	109.2	91	120.0%
Avon-Loudon Avenue 138 kV	338.6	287	118.0%
JK Smith-Dale 138 kV	453.5	389	116.6%
JK Smith-Trapp 69 kV	105.5	91	115.9%
Southpoint-Wilson Downing Tap 69 kV	111.1	97	114.5%
Trapp-Hargett Jct. 69 kV	100.3	91	110.2%
Dale-Newby #1 69 kV	96.5	91	106.0%
Farley 161-69 kV	148	143	103.5%
Dale-Boonesboro North Tap 138 kV	336.7	330	102.0%
Davis-Nicholasville 69 kV	94.8	93	101.9%

Step 7) Subsequent Trip of Dale 138-69 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Boonesboro North Tap 138 kV	439.4	330	133.2%
Brown Plant-Fawkes 138 kV	367.8	283	130.0%
Avon-Loudon Avenue 138 kV	370.8	287	129.2%
Higby Mill-Southpoint 69 kV	119.6	97	123.3%
Southpoint-Wilson Downing Tap 69 kV	112.5	97	116.0%
Davis-Nicholasville 69 kV	103.8	93	111.6%
Farley 161-69 kV	151.6	143	106.0%
Boonesboro North-Winchester Water Works 69 kV	150.9	143	105.5%
Spurlock-Kenton 138 kV	287.9	287	100.3%

Step 8) Subsequent Trip of Dale-Boonesboro North 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Brown Plant-Fawkes 138 kV	362.8	283	128.2%
Avon 345-138 kV	797.3	655	121.7%
Higby Mill-Southpoint 69 kV	117.1	97	120.7%
JK Smith-North Clark 345 kV	1380.7	1195	115.5%
Avon-Loudon Avenue 138 kV	330.5	287	115.2%
Southpoint-Wilson Downing Tap 69 kV	110.1	97	113.5%
Farley 161-69 kV	152	143	106.3%
Spurlock-Kenton 138 kV	295.2	287	102.9%
Davis-Nicholasville 69 kV	93.2	93	100.2%

Step 9) Subsequent Trip of Brown Plant-Fawkes 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
POWER FLOW CASE IS NON-CONVERGENT			

Cascading Analysis for NERC Reliability Standard TPL-003-0
2010-11 Winter with 4000 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	464.7	389	119.5%
Union City-Lake Reba Tap 138 kV	431.9	371	116.4%
Dale-Three Forks Jct. 138 kV	297	278	106.8%
Three Forks Jct.-Fawkes 138 kV	285.6	278	102.7%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	507.9	278	182.7%
Three Forks Jct.-Fawkes 138 kV	488.7	278	175.8%
JK Smith-Dale 138 kV	572.5	389	147.2%
Powell County 161-138 kV	245.9	220	111.8%
Beattyville-Delvinta 161 kV	213.3	211	101.1%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester-Parker Seal 69 kV	115	72	159.7%
Boonesboro North-Winchester Water Works 69 kV	200.9	143	140.5%
Powell County 161-138 kV	298.3	220	135.6%
Beattyville-Delvinta 161 kV	259.4	211	122.9%
Boonesboro North 138-69 kV	223.4	185	120.8%
JK Smith-Powell County 138 kV	459.1	389	118.0%
Winchester South-Winchester 69 kV	162.5	143	113.6%
Avon-Loudon Avenue 138 kV	324.6	287	113.1%
Powell County-Beattyville 161 kV	294.5	266	110.7%
Dale-Newby #1 69 kV	100	91	109.9%

Step 4) Subsequent Trip of Winchester-Parker Seal 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 161-138 kV	304.3	220	138.3%
Beattyville-Delvinta 161 kV	262.1	211	124.2%
JK Smith-Powell County 138 kV	472.6	389	121.5%
Avon-Loudon Avenue 138 kV	331.1	287	115.4%
Dale-Newby #1 69 kV	104	91	114.3%
Powell County-Beattyville 161 kV	299.3	266	112.5%
Higby Mill-Southpoint 69 kV	106.4	97	109.7%
Brown Plant-Fawkes 138 kV	301.2	283	106.4%
Southpoint-Wilson Downing Tap 69 kV	99.6	97	102.7%
Davis-Nicholasville 69 kV	93.3	93	100.3%

Step 5) Subsequent Trip of Powell County 161-138 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 138-69 kV	222.4	143	155.5%
Powell County-Bowen 69 kV	141.8	93	152.5%
Bowen-High Rock 69 kV	132.3	93	142.3%
Zachariah-Beattyville 69 kV	87.6	62	141.3%
High Rock-Sand Lick 69 kV	130.9	93	140.8%

Sand Lick-Zachariah 69 kV	130.1	93	139.9%
Dale-Newby #1 69 kV	119.3	91	131.1%
Avon-Loudon Avenue 138 kV	363.3	287	126.6%
Brown Plant-Fawkes 138 kV	355.3	283	125.5%
Higby Mill-Southpoint 69 kV	119.1	97	122.8%
Southpoint-Wilson Downing Tap 69 kV	111.9	97	115.4%
Davis-Nicholasville 69 kV	101.9	93	109.6%
Newby #1-Lancaster EK 69 kV	96.4	91	105.9%
JK Smith-Dale 138 kV	397.6	389	102.2%
Dale-Boonesboro North Tap 138 kV	335.6	330	101.7%

Step 6) Subsequent Trip of Powell County 138-69 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale 138-69 kV	204.9	141	145.3%
Dale-Hunt #2 69 kV	121.1	91	133.1%
Brown Plant-Fawkes 138 kV	375.3	283	132.6%
Avon-Loudon Avenue 138 kV	378.1	287	131.7%
Higby Mill-Southpoint 69 kV	123.8	97	127.6%
JK Smith-Dale 138 kV	485	389	124.7%
Hunt #2-JK Smith 69 kV	111.1	91	122.1%
Southpoint-Wilson Downing Tap 69 kV	116.4	97	120.0%
Dale-Newby #1 69 kV	109	91	119.8%
JK Smith-Trapp 69 kV	106.6	91	117.1%
Davis-Nicholasville 69 kV	105.3	93	113.2%
Trapp-Hargett Jct. 69 kV	100.9	91	110.9%
Dale-Boonesboro North Tap 138 kV	342.2	330	103.7%
Spurlock-Kenton 138 kV	296.1	287	103.2%
Boonesboro North-Winchester Water Works 69 kV	145.1	143	101.5%
Farley 161-69 kV	143.8	143	100.6%
Wilson Downing Tap-Ashland Pipe 69 kV	94.4	94	100.4%

Step 7) Subsequent Trip of Dale 138-69 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Avon-Loudon Avenue 138 kV	413.5	287	144.1%
Dale-Boonesboro North Tap 138 kV	457.3	330	138.6%
Brown Plant-Fawkes 138 kV	377.4	283	133.4%
Higby Mill-Southpoint 69 kV	124.7	97	128.6%
Davis-Nicholasville 69 kV	114.9	93	123.5%
Southpoint-Wilson Downing Tap 69 kV	117.2	97	120.8%
Boonesboro North-Winchester Water Works 69 kV	158.8	143	111.0%
Garrard CT-Lancaster KU 69 kV	99.3	93	106.8%
Spurlock-Kenton 138 kV	303.3	287	105.7%
Fayette 138-69 kV	148.6	143	103.9%
Buena Vista-Garrard CT 69 kV	100.4	97	103.5%
Nicholasville-South Jessamine 69 kV	96.2	93	103.4%
Farley 161-69 kV	146.8	143	102.7%
Wilson Downing Tap-Ashland Pipe 69 kV	95.2	94	101.3%
Winchester-Rockwell 69 kV	97.8	97	100.8%

Step 8) Subsequent Trip of Avon-Loudon Avenue 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Davis-Nicholasville 69 kV	153.8	93	165.4%

27 OTHER OVERLOADS

Step 9) Subsequent Trip of Davis-Nicholasville 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Boonesboro North-Winchester Water Works 69 kV	204.9	143	143.3%

24 OTHER OVERLOADS

Step 10) Subsequent Trip of Boonesboro North-Winchester Water Works 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading

POWER FLOW CASE IS NON-CONVERGENT

Cascading Analysis for NERC Reliability Standard TPL-003-0
2015 Summer with 0 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	383.1	311	123.2%
Union City-Lake Reba Tap 138 kV	361.5	300	120.5%
Dale-Three Forks Jct. 138 kV	238.2	222	107.3%
Three Forks Jct.-Fawkes 138 kV	230.6	222	103.9%
JK Smith-Dale 138 kV	315.9	311	101.6%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	415.8	222	187.3%
Three Forks Jct.-Fawkes 138 kV	402.7	222	181.4%
JK Smith-Dale 138 kV	484.2	311	155.7%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester South-Winchester 69 kV	150.6	110	136.9%
Boonesboro North-Winchester Water Works 69 kV	193.6	143	135.4%
Boonesboro North 138-69 kV	212.4	160	132.8%
Brown Plant-Fawkes 138 kV	276.4	218	126.8%
Winchester Water Works-Boone Avenue 69 kV	185.3	150	123.5%
Powell County 161-138 kV	236.8	193	122.7%
Wilson Downing Tap-Ashland Pipe 69 kV	67.2	55	122.2%
JK Smith-Powell County 138 kV	364.8	311	117.3%
Higby Mill-Southpoint 69 kV	98.1	89	110.2%
Dale-Boonesboro North Tap 138 kV	321	298	107.7%
Avon-Loudon Avenue 138 kV	287.4	276	104.1%
Boone Avenue-Winchester South 69 kV	155.1	150	103.4%
JK Smith-Dale 138 kV	320.6	311	103.1%
Dale-Newby #1 69 kV	70.8	69	102.6%
Powell County-Beattyville 161 kV	235.2	232	101.4%
Southpoint-Wilson Downing Tap 69 kV	86.5	86	100.6%

Step 4) Subsequent Trip of Boonesboro North-Winchester 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Brown Plant-Fawkes 138 kV	316.4	218	145.1%
Wilson Downing Tap-Ashland Pipe 69 kV	74.1	55	134.7%
Powell County 161-138 kV	252.7	193	130.9%
JK Smith-Powell County 138 kV	387.4	311	124.6%
Higby Mill-Southpoint 69 kV	105.4	86	122.6%
Avon-Loudon Avenue 138 kV	329.2	276	119.3%
Dale-Newby #1 69 kV	79.7	69	115.5%
Southpoint-Wilson Downing Tap 69 kV	93.6	86	108.8%
Powell County-Beattyville 161 kV	250.7	232	108.1%
Loudon Avenue-Haley 69 kV	71.2	66	107.9%
Beattyville-Delvinta 161 kV	214.1	201	106.5%
Paris 138-69 kV	181.2	173	104.7%
Newby #1-Lancaster 69 kV	69.9	69	101.3%

Avon-Paris Tap 138 kV	215.9	214	100.9%

Step 5) Subsequent Trip of Brown Plant-Fawkes 138 kV Line Due to Excessive Loading

Limiting Facility	**MVA Flow**	**Rating**	**% Loading**

POWER FLOW CASE IS NON-CONVERGENT

Cascading Analysis for NERC Reliability Standard TPL-003-0
2015 Summer with 4000 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	424.4	311	136.5%
Union City-Lake Reba Tap 138 kV	398.2	300	132.7%
Dale-Three Forks Jct. 138 kV	268.3	222	120.9%
Three Forks Jct.-Fawkes 138 kV	259.9	222	117.1%
JK Smith-Dale 138 kV	342.4	311	110.1%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	463.1	222	208.6%
Three Forks Jct.-Fawkes 138 kV	448	222	201.8%
JK Smith-Dale 138 kV	528	311	169.8%
Powell County 161-138 kV	219.2	193	113.6%
JK Smith-Powell County 138 kV	341.1	311	109.7%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester South-Winchester 69 kV	159.1	110	144.6%
Boonesboro North-Winchester Water Works 69 kV	203.2	143	142.1%
Powell County 161-138 kV	270.6	193	140.2%
Boonesboro North 138-69 kV	223	160	139.4%
JK Smith-Powell County 138 kV	405.4	311	130.4%
Winchester Water Works-Boone Avenue 69 kV	194.3	150	129.5%
Brown Plant-Fawkes 138 kV	274.4	218	125.9%
Wilson Downing Tap-Ashland Pipe 69 kV	69.2	55	125.8%
Dale-Newby #1 69 kV	83	69	120.3%
Avon-Loudon Avenue 138 kV	328.7	276	119.1%
Beattyville-Delvinta 161 kV	237.2	201	118.0%
Powell County-Beattyville 161 kV	268.3	232	115.6%
Higby Mill-Southpoint 69 kV	100.2	89	112.6%
JK Smith-Dale 138 kV	345.9	311	111.2%
Dale-Boonesboro North Tap 138 kV	325.2	298	109.1%
Boone Avenue-Winchester South 69 kV	163.6	150	109.1%
Newby #1-Lancaster EK 69 kV	72.7	69	105.4%
Paris 138-69 kV	179	173	103.5%
Southpoint-Wilson Downing Tap 69 kV	88.5	86	102.9%
Boonesboro North Tap-Boonesboro North 138 kV	223.2	220	101.5%
Winchester-Parker Seal 69 kV	87	86	101.2%

Step 4) Subsequent Trip of Boonesboro North-Winchester 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 161-138 kV	285.3	193	147.8%
Brown Plant-Fawkes 138 kV	319.2	218	146.4%
Wilson Downing Tap-Ashland Pipe 69 kV	76.9	55	139.8%
JK Smith-Powell County 138 kV	428.7	311	137.8%
Avon-Loudon Avenue 138 kV	372.9	276	135.1%
Dale-Newby #1 69 kV	93	69	134.8%

Higby Mill-Southpoint 69 kV	108.3	86	125.9%
Beattyville-Delvinta 161 kV	249.2	201	124.0%
Powell County-Beattyville 161 kV	281.9	232	121.5%
Newby #1-Lancaster 69 kV	82.1	69	119.0%
Paris 138-69 kV	194.4	173	112.4%
Southpoint-Wilson Downing Tap 69 kV	96.3	86	112.0%
Lancaster-Garrard County 69 kV	77.2	69	111.9%
Dale 138-69 kV	120.1	111	108.2%
Paris-CMC Tap 69 kV	93	86	108.1%
Loudon Avenue-Haley 69 kV	71.2	66	107.9%
Avon-Paris Tap 138 kV	214.9	214	100.4%

Step 5) Subsequent Trip of Brown Plant-Fawkes 138 kV Line Due to Excessive Loading

Limiting Facility	**MVA Flow**	**Rating**	**% Loading**

POWER FLOW CASE IS NON-CONVERGENT

Cascading Analysis for NERC Reliability Standard TPL-003-0
2015-16 Winter with 0 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	482.4	389	124.0%
Union City-Lake Reba Tap 138 kV	447.3	371	120.6%
Dale-Three Forks Jct. 138 kV	298.9	278	107.5%
JK Smith-Dale 138 kV	402.9	389	103.6%
Three Forks Jct.-Fawkes 138 kV	286.5	278	103.1%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	517.2	278	186.0%
Three Forks Jct.-Fawkes 138 kV	496	278	178.4%
JK Smith-Dale 138 kV	614.8	389	158.0%
Powell County 161-138 kV	237.4	220	107.9%
JK Smith-Powell County 138 kV	398	389	102.3%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester-Parker Seal 69 kV	124.4	72	172.8%
Boonesboro North-Winchester Water Works 69 kV	214.4	143	149.9%
Powell County 161-138 kV	291.3	220	132.4%
Boonesboro North 138-69 kV	238.2	185	128.8%
Winchester South-Winchester 69 kV	172.6	143	120.7%
JK Smith-Powell County 138 kV	468.1	389	120.3%
Beattyville-Delvinta 161 kV	245.3	211	116.3%
Avon-Loudon Avenue 138 kV	327.8	287	114.2%
Powell County-Beattyville 161 kV	288	266	108.3%
Dale-Boonesboro North Tap 138 kV	353	330	107.0%
Winchester Water Works-Boone Avenue 69 kV	205.3	194	105.8%
JK Smith-Dale 138 kV	409.8	389	105.3%
Dale-Newby #1 69 kV	95.3	91	104.7%
Brown Plant-Fawkes 138 kV	290.2	283	102.5%
Southpoint-Wilson Downing Tap 69 kV	98.5	97	101.5%

Step 4) Subsequent Trip of Winchester-Parker Seal 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 161-138 kV	297.9	220	135.4%
JK Smith-Powell County 138 kV	483.4	389	124.3%
Brown Plant-Fawkes 138 kV	343.6	283	121.4%
Beattyville-Delvinta 161 kV	247.7	211	117.4%
Avon-Loudon Avenue 138 kV	335.4	287	116.9%
Southpoint-Wilson Downing Tap 69 kV	110.5	97	113.9%
Powell County-Beattyville 161 kV	293	266	110.2%
Dale-Newby #1 69 kV	99.2	91	109.0%
Higby Mill-Southpoint 69 kV	120	114	105.3%

Step 5) Subsequent Trip of Powell County 161-138 kV Transformer Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading

POWER FLOW CASE IS NON-CONVERGENT

Cascading Analysis for NERC Reliability Standard TPL-003-0
2015-16 Winter with 4000 MW North-South Transfer

Step 1) Simulate JK Smith-West Garrard 345 kV Line and JK Smith-Fawkes 138 kV Line Simultaneous Outage

Limiting Facility	MVA Flow	Rating	% Loading
JK Smith-Union City 138 kV	523	389	134.4%
Union City-Lake Reba Tap 138 kV	482.5	371	130.1%
Dale-Three Forks Jct. 138 kV	329	278	118.3%
Three Forks Jct.-Fawkes 138 kV	315.6	278	113.5%
JK Smith-Dale 138 kV	402.9	389	103.6%

Step 2) Subsequent Trip of JK Smith-Union City 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Dale-Three Forks Jct. 138 kV	562.6	278	202.4%
Three Forks Jct.-Fawkes 138 kV	536.4	278	192.9%
JK Smith-Dale 138 kV	663.8	389	170.6%
Powell County 161-138 kV	264	220	120.0%
JK Smith-Powell County 138 kV	434.1	389	111.6%
Beattyville-Delvinta 161 kV	223.4	211	105.9%

Step 3) Subsequent Trip of Dale-Three Forks Jct. 138 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Winchester-Parker Seal 69 kV	128.4	72	178.3%
Boonesboro North-Winchester Water Works 69 kV	223.3	143	156.2%
Powell County 161-138 kV	320.9	220	145.9%
Boonesboro North 138-69 kV	248.6	185	134.4%
Beattyville-Delvinta 161 kV	277.9	211	131.7%
JK Smith-Powell County 138 kV	509.4	389	131.0%
Avon-Loudon Avenue 138 kV	369.1	287	128.6%
Winchester South-Winchester 69 kV	180.1	143	125.9%
Dale-Newby #1 69 kV	109	91	119.8%
Powell County-Beattyville 161 kV	315.8	266	118.7%
JK Smith-Dale 138 kV	437	389	112.3%
Winchester Water Works-Boone Avenue 69 kV	213.2	194	109.9%
Dale-Boonesboro North Tap 138 kV	357.6	330	108.4%
Dale 138-69 kV	150.2	141	106.5%
Southpoint-Wilson Downing Tap 69 kV	101.2	97	104.3%
Brown Plant-Fawkes 138 kV	289.5	283	102.3%

Step 4) Subsequent Trip of Winchester-Parker Seal 69 kV Line Due to Excessive Loading

Limiting Facility	MVA Flow	Rating	% Loading
Powell County 161-138 kV	326.2	220	148.3%
JK Smith-Powell County 138 kV	525.6	389	135.1%
Beattyville-Delvinta 161 kV	277.8	211	131.7%
Avon-Loudon Avenue 138 kV	377.2	287	131.4%
Dale-Newby #1 69 kV	112.8	91	124.0%
Brown Plant-Fawkes 138 kV	347.2	283	122.7%
Powell County-Beattyville 161 kV	319	266	119.9%
Southpoint-Wilson Downing Tap 69 kV	114	97	117.5%
Dale 138-69 kV	159.7	141	113.3%
Higby Mill-Southpoint 69 kV	123.7	114	108.5%

JK Smith-Dale 138 kV	408	389	104.9%
Boonesboro North-Winchester Water Works 69 kV	148.9	143	104.1%
Fayette 138-69 kV	144.3	143	100.9%
Spurlock-Kenton 138 kV	288.2	287	100.4%

Step 5) Subsequent Trip of Powell County 161-138 kV Transformer Due to Excessive Loading

Limiting Facility	**MVA Flow**	**Rating**	**% Loading**
POWER FLOW CASE IS NON-CONVERGENT			