APPENDIX J

APPENDIX TO AN ORDER OF THE KENTUCKY PUBLIC SERVICE COMMISSION IN ADMINISTRATIVE CASE NO. 387 DATED DECEMBER 20, 2001

KENTUCKY TRANSMISSION SYSTEM EVALUATION

VOLUME 1

Prepared for

Kentucky Public Service Commission

Prepared by

Commonwealth Associates, Inc.

engineers • consultants • construction managers

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KENTUCKY TRANSMISSION SYSTEM EVALUATION

Foreword

On June 20, 2001, Governor Paul Patton issued an Executive Order directing state agencies to suspend, for 180 days beginning June 20, the acceptance of applications for new electric generating facilities. In the interim, the Public Service Commission and other state agencies, as appropriate, were directed to review and study issues relating to the need for development of new electric generating capacity, including, but not limited to, the impact on the electric supply grid, facility siting issues, and economic development matters, with the goal of ensuring a continued, reliable source of supply of electricity for the citizens of the Commonwealth and the continued environmental and economic vitality of the Commonwealth and its communities. The results of the review and study are to be provided to the Governor in the form of written recommendations no later than December 7, 2001.

This report addresses the impact of proposed generating facilities on the electric transmission grid in Kentucky.

Comment on the existing EHV transmission grid in Kentucky.

One general observation is that the existing extra-high-voltage (EHV) transmission grid in Kentucky is not integrated into a grid arrangement. There are several instances where the EHV transmission lines terminate at a substation serving lower-voltage transmission lines. The transfer capability across the system would be enhanced if the EHV lines were better interconnected.

From the national EHV transmission grid perspective, Kentucky truly is the border between the north and the south. EHV transmission is designed to move large blocks of power (i.e., 500 MW or more) long distances. The standard transmission voltages used for the EHV grid are 345 kV, 500 kV, and 765 kV. Typical capabilities for EHV transmission lines are:

345 kV - about 1000 MW
500 kV - about 2000 MW
765 kV - about 3000 MW

Kentucky is bordered on the south by the Tennessee Valley Authority (TVA) power system, which uses 500 kV transmission. There are three 500 kV lines in Kentucky that tie to the TVA system. Kentucky is bordered on the north by several utilities, all of which use 345 kV EHV transmission. There are eight 345 kV transmission interconnections to the northern utilities. On the far eastern parts of Kentucky, American Electric Power (AEP) has a strong 765 kV EHV grid comprising of one 765 kV from Kentucky to Virginia, one to West Virginia, and one to Ohio.

The Kentucky EHV transmission system is shown on Exhibit 12.

There are three EHV north-south transmission paths across Kentucky:

1. TVA Shawnee-Marshall-Benton-Cumberland 500 kV. The Cumberland 500 kV substation is located in Tennessee. This path is rated 1735 MVA and is located in the far western portion of Kentucky.

2. Louisville Gas & Electric (LGEE) Ghent-W. Lexington-Brown-Pineville 345 kV and Pineville-Pocket 500 kV. The Pocket 500 kV substation is located in Virginia and connects to TVA at Phipps Bend, Tennessee. The path is rated approximately 500 MVA and is limited by the 345-500 kV transformer at Pineville. This path is approximately in the center of Kentucky.

3. AEP Hanging Rock-Baker-Broadford 765 kV. The Broadford 765 kV substation is located in Virginia. A 500 kV line extends from Broadford to TVA at Sullivan substation in Tennessee. The 765 kV Baker-Broadford line is rated 4174 MVA and the 500 line to TVA is rated 1710 MVA. This path is located in the far eastern portion of Kentucky.

There are three EHV east-west transmission paths across Kentucky:

1. LGEE Smith-Hardinsburg-Brown 345 kV. This east-west transmission path is in the center of the state and has its eastern termination at the north-south Ghent-W. Lexington-Brown-Pineville 345 kV path mentioned above. Its western termination is into the lower-voltage transmission grid. The Smith-Hardinsburg 345 kV line is rated 1195 MVA and the Hardinsburg-Brown, 717 MVA.

2. AEP Hanging Rock-Jefferson 765 kV. The AEP Hanging Rock-Jefferson 765 kV line interconnects the AEP 765 kV transmission system in western Kentucky with the AEP system in southern Indiana.

3. OVEC Pierce-Clifty Creek double-circuit 345 kV. The Pierce 345 kV substation is in Ohio, and Clifty Creek is in Indiana. The OVEC Pierce-Clifty Creek double-circuit 345 kV line crosses the extreme northern portion of Kentucky.

Both the AEP Hanging Rock-Jefferson 765 kV line and the OVEC Pierce-Clifty Creek double-circuit 345 kV line cross northern Kentucky but do not have a connection to the lower-voltage transmission in Kentucky. Only the LGEE Smith-Hardinsburg-Brown 345 kV line directly interconnects with the underlying 161 and 138 kV transmission serving central Kentucky loads.

The EHV transmission grid services a 161 and 138 kV transmission system. The TVA and southern portion of Kentucky is composed of 161 kV transmission, whereas the northern portion of Kentucky is 138 kV. The result of having two different voltages is that it is more difficult and expensive to interconnect the grids. A substation and transformer are required where the 138 and 161 kV transmission systems are interconnected and, similarly, where the 345 and 500 kV EHV systems are interconnected. The substations and transformers are expensive to build and also serve as a bottleneck to the flow of power between systems.

In conclusion, the EHV transmission and the underlying 161 and 138 kV transmission in Kentucky are not strongly interconnected and, therefore, limit the power transfer capability from north to south or east to west across the state. The addition of key EHV transmission lines would result in a much stronger transmission grid.

Study Approach and Assumptions

Given the magnitude of the undertaking, limited time frame, and uncertainties regarding the intentions of the unregulated Independent Power Producers (IPPs), such as whether or not the proposed generation would actually be built and if so, to serve what market, Commission Staff first determined that it was necessary to identify and use existing resources to perform the transmission study. A task force was assembled to model the transmission system in Kentucky. It comprised transmission engineers from each utility (LGEE, Cinergy, AEP, Big Rivers, EKPC, and TVA[1]) that operates EHV transmission facilities in the state, in addition to Commission engineers. This Task Force acquired the East Central Area Reliability Coordination Agreement[2] (ECAR) 2005 Summer Peak transmission model,[3] updated it to reflect known changes that had not been reflected in the model, and inserted the 24[4] power plants proposed for construction in Kentucky.[5] This model was selected because it was the latest year for which projections were currently available and provided a reasonable time frame in which proposed generation could be completed.

The Task Force held its first meeting on July 5, 2001. The scope and approach for evaluating transmission grid capability were established as follows:

1. In regard to the time constraints, the scope of the Task Force review was limited to determining the upper limit of available transmission capacity above the summer peak loads.

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[1] It should be noted that TVA is not jurisdictional to the Commission. However, they gave their full cooperation in assisting the Commission to accomplish the Governor's directive.

[2] The North American Electric Reliability Council (NERC) was formed in 1968 by the electric utilities to promote the reliability of their generation and transmission systems. NERC consists of ten Regional Reliability Councils and one affiliate encompassing virtually all of the electric systems in the United States, Canada, and a portion of Baja California NORTE, Mexico. Kentucky utilities are part of the ECAR council.

[3] The ECAR model is compiled from information submitted to the Federal Energy Regulatory Commission (FERC) by each utility and is universally accepted and used in the industry for transmission planning. The utility industry, under the auspices of the reliability councils (ECAR is one), NERC, and FERC, provides transmission data and updates on a yearly basis to build models of the EHV transmission grid. This is an important and tremendous undertaking that results in very accurate models of the entire interconnected transmission system in the U.S. These are the best and only models available for undertaking a study of this nature.

[4] Two of the 24 plants included in the list compiled by the PSC were modeled as two plants, each with half of the generating capacity listed with the PSC. Therefore, there are 26 plants modeled.

[5] See Exhibit 1.

2. The power flow base case model used in the study was the ECAR 2005 summer model.

3. Each utility was responsible for reviewing its system in the model and updating the base case model with the most recent data.

4. After model update, the Task Force developed a model with the addition of the proposed generating plants.[6] Two scenarios were studied: one with the new generation flowing south, the other with new generation flowing north.

5. Each utility was responsible for reviewing the results, and if any lines were overloaded, the utility was asked to carefully review the line ratings supplied in the case and make any necessary corrections. The cases were rerun with corrected rating information.

6. A single-contingency study was performed to identify overloaded transmission lines.

7. Power Transfer Distribution Factors (PTDFs) were calculated for each new generation addition to determine which line overloads were caused by that generator. The generator causing the highest PTDF on the overload line was then reduced until the transmission loading was within its rating. The generation that remained was taken as an indicator of the total amount of generation the existing grid can accommodate.

The Task Force completed its work and submitted its study results in the form of an electronic spreadsheet and email on October 2, 2001.

In the base case model, the new generating units were modeled as "turned off," except where needed to serve system demand. LGEE dispatched 80 MW and EKPC dispatched 437 MW to meet their native loads. As generation and load must be balanced at all times, turning the new generators "on" means either that demand is increased or another generator is turned off to result in a model that has a generation and load match. Demand in Kentucky was not altered, but rather the model assumed that the extra generation would be exported out of the system by turning off generators outside Kentucky.

It was assumed that generation would be exported south, which reflects historical flows under system peak conditions. Accordingly, generation was exported as follows: Florida 22%, Southwest Power Pool 20%, SERC-EQ 38% and Entergy 20%. It should be noted that this is a very significant assumption. However, in the absence of specific information regarding the markets expected to be served by the new generators, it was necessary to make these assumptions.

Standard reliability principles reflect the "need to plan Bulk Electric Systems that will withstand adverse credible disturbances without experiencing uncontrolled interruptions" and the "importance of providing a high degree of reliability for local

[6] See Exhibit 1.

power supply but the impossibility of providing 100 percent reliability to every customer or every local area."[7] Consequently, simulated reliability testing involves simulating credible disturbances or outages of important facilities, referred to as "contingencies," to estimate the effect of the outage on the system. Typically, the system is designed to operate reliably with any random generation and transmission line outage. In this situation, generation outages were not simulated given the nature of the problem being studied - the effect of excess generation on Kentucky's transmission system.

Single contingencies of facilities 100 kV and above were simulated in AEP, BREC, Cinergy, EKPC, LGEE, and TVA territories. Overloads that could easily be corrected were identified by the utilities, and the model was updated to reflect these corrections. As an example, a conductor might not be listed at its full rating because of inadequate clearances. The changes made to the model assumed that the clearance would be altered so that the maximum rating of the conductor would be reflected. A list of these upgrades is shown in Exhibit 2. It was assumed that these were minor and could be made at the time the generators came on line. The remaining overloads are listed in Appendix A (OvallSol). It should be noted that while these overloads would occur only if there were an outage on another facility, NERC Operating Policy and good utility practice prohibit scheduling more power over the lines than indicated by the first contingency transfer capability.

Generation was then reduced to relieve the facility overloads. The worst overloads were decreased first by reducing generation with the highest Power Transfer Distribution Factor (PTDF), a measure of the significance of the effect that generator has on the line. The generation reduction applied to the proposed units identified in Exhibit 1 and not to existing units, and reductions applied to both utility- and non-utility-owned generation. The facilities that dictated the generator reductions were:

- TVA - Cumberland to Davidson 500 kV
- TVA - Gallatin to Lebanon IPT 161 kV
- BREC - Reid to Hopkins Co 161 kV
- BREC - New Hardinsburg 161-138 kV
- BREC - Marshall to Livingston Co 161 kV
- LGEE - Smith to Green River Steel 138 kV
- LGEE - Blue Lick 345-161 kV
- EKPC - Marion Co 161-138 kV

Relieving the overloads on the above facilities also eliminated the overloads on the other transmission facilities listed in Appendix A.

7 ECAR Document No. 1, Reliability Criteria for Evaluation and Simulated Testing of the ECAR Bulk Electric Systems.

Independent Review of Results

In addition to the analysis provided by the Task Force, the Public Service Commission Staff contracted with Commonwealth Associates, Inc. (CAI) to provide an independent review of the results. CAI is a consulting engineering firm that specializes in the analysis and design of high-voltage transmission systems.

In evaluating the Task Force's results, CAI obtained the power flow study models from the Task Force and performed its own simulations. CAI reviewed the base case model and the model with all generation included and dispatched to the south, and also used the same contingency file provided by the Task Force. The contingency files included over 900 contingencies of transmission lines 138 kV and above. CAI's review focused on overloaded facilities of transmission lines in Kentucky and TVA.

In addition to looking at the impact of all generators simultaneously, CAI subdivided the state into six regions and studied each region separately. Since CAI is not as familiar with the Kentucky transmission system as the members of the Task Force, they could better determine the impact of the new generators on the transmission system by studying the regions separately. This also presented the opportunity to compare slightly different scenarios.

The generators, by group, are listed in Exhibit 1 and shown geographically on Exhibit 7. Normal overloaded transmission lines 138 kV and above are summarized on Exhibit 3. Contingency overloaded transmission lines are summarized on Exhibit 4. Because of the number of overloaded facilities, only overloads greater than 105% of rating for lines rated 138 kV and above are shown on the summary tables. A complete list of all overload facilities is provided in Appendix B.

Limitations of the Model

There are limitations to the models that need to be understood, as follows:

1. The model is only a snapshot of an instant in time. For example, the model used in this study is a snapshot of the transmission grid during expected coincident summer peak loads in Summer 2005. Since not all systems peak at the same time, actual loads may be higher in some systems and lower in others. Also, a peak load condition is being used for a benchmark study, even though during most of the year the loads will be considerably lower than peak.

2. Existing generating plants that are not scheduled out of service during this period are assumed to be available and dispatched to serve loads. In actuality, some of the generators may likely be out of service because of a forced outage.

3. Many anticipated out-of-state power plants are not included in the base case models since there may be uncertainty as to their completion date, availability, and intended market.

4. Location is extremely important when determining the impact a generator has on

the transmission system, as well as the location of the load it serves. Generators do not necessarily “use up” valuable transmission capacity, but instead, if properly located, can even support the transmission grid to operate more reliably and efficiently. The placement of a generator could actually relieve transmission constraints. For example, if a transmission line into Louisville were heavily loaded with imports into Louisville, placing a generator inside Louisville could relieve the transmission constraints. So, it cannot be concluded that if only half of the generation were built, the transmission problems would also drop by half. It is quite possible that a lesser number could make matters worse, if ill-chosen sites were selected. This study cannot be used to determine that a specific generator has no adverse effect on the transmission system unless all of the proposed generation is built and operated as assumed here.

5. In past years, utilities included planned transmission lines in the future system transmission models sufficient to meet their planning criteria. These models did not have overloaded lines or low-voltage conditions. Because of uncertainties in the need for transmission lines, the location of independent power producers and the financial return on transmission investments, utilities are reluctant to commit to EHV transmission upgrades more than one or two years into the future. As a result, utilities do not include new EHV transmission upgrades in the future year models, and, therefore, many of the future year models do not meet the utilities' planning criteria. In other words, future year transmission models often have overloaded lines and low voltages. These problems will eventually have to be corrected. The user of these models needs to take into consideration these types of problems.

6 In actual system operation, there are many short-term and economic power transfers that take place over the transmission grid. These are not included in the base case models, since most of these types of transactions are negotiated only a few days or months ahead and, therefore, are not known at this time.

7. The ECAR model is developed from a larger NERC model. In the ECAR model, the transmission systems that are remote from ECAR, such as Florida and New England, are reduced to an equivalent. The nearby neighbors of ECAR, such as TVA, are included in full detail. By making equivalents, the model is smaller and, thereby less cumbersome to use for studies. As long as the focus of a study is within ECAR or its nearby neighbor, such as TVA, the equivalent areas will have little impact on the study results. However, the model would not be valid for analyzing the transmission flows in the equivalent areas.

Model Results

The results of this model indicate the level of additional generation that the transmission system in Kentucky can accommodate given the summer 2005 peak condition.

CAI's comments and results of the models are stated below by region.

Base Case

Review of Exhibit 3, base case overloads, shows that only Cases 200 and 400 had normal overloads. Review of Exhibit 4, contingency overloads, shows that with a few exceptions, discussed below, the contingency overloads are also associated with Cases 200 and 400.

Case 100 – Central Kentucky (Clark, Mason and Estill Counties) – 1121 MW

Case 100 includes 1121 MW of new generation added in Clark, Mason and Estill counties in the center of the state. As mentioned above, the base case included 437 MW of the new generation to serve native load. Therefore, the incremental generation addition in Case 100 was 684 MW. The EHV transmission in this area comprises East Kentucky Power's JKSmith-Avon-Spurlock 345 kV lines. There is no EHV line between JKSmith and the TVA system to the south, though there are 138 and 161 kV transmission lines.

No normal transmission system overloads were observed for this addition of generation. There were 69 kV overloads that would need to be addressed.

One contingency overload was noted: The Brown 345/138 kV transformer loaded to 105% of emergency rating of 515 MVA for outage of the Brown-W Lexington 345 kV transmission line.

CAI concludes that the incremental 684 MW of generation can be added into the existing transmission grid with upgrade of existing lines and the Brown 345/138 kV transformer. The Task Force results, based on all of the new generation added into the model, concluded that not all of the generators in this area could be dispatched simultaneously. The Task Force results showed that this area generation would need to be reduced by 317 MW to avoid transmission line overloads. CAI would get a comparable answer based on the contingency limit of the existing Brown 345/138 kV transformer.

Case 200/201 – Western Kentucky (Marshall and Ballard Counties) – 2335/900 MW

Case 200 includes 2335 MW of new generation added in Marshall and Ballard counties. None of this generation was included in the base case, so Case 200 is an incremental increase in this amount of generation. Marshall and Ballard counties are the far western counties in the state. The EHV transmission in Marshall County comprises the TVA Shawnee-Marshall-Benton-Cumberland 500 kV transmission line.

With this new generation in service, a normal overload was observed on the Barkley-Livingston 161 kV circuit. Numerous contingency overloads were observed, as shown on Exhibit 4. The normal and contingency overloads are also shown geographically on Exhibit 8. The TVA 500 kV EHV system in the area is overloaded. The CAI study and the Task Force study concluded that the Cumberland-Davidson 500 kV line (located in Tennessee) could be used as an indicator of the maximum generation that could be added in the area without adding a new EHV transmission line.

Using the Cumberland-Davidson 500 kV line as the limiting element, CAI estimated that the approximate generation that could be added is only 900 MW. To evaluate this estimate, a new power flow model was set up with the new generation in Marshall and Ballard counties scaled to this level. CAI identified this case as Case 201.

The following two contingency overloads were noted in Case 201:

1. Johnsonville-Davidson 500 kV line (Tennessee) loaded to 104% of its emergency rating of 1732 MVA for outage of the Cumberland-Davidson 500 kV line.

2. Smyrna-Blckmnt-Murfreesboro 161 kV line (Tennessee) loaded to 104% of its emergency rating of 235 MVA for outage of the Gallatin-Lascass 161 kV line.

The Task Force results, based on all of the new generation added into the model, concluded that this area generation would need to be reduced to 475 MW. CAI would expect a comparable answer if the generation were scaled down to get within the rating of the Johnsonville-Davidson 500 kV rating.

Case 300 – Metcalfe County – 745 MW

Case 300 includes 745 MW of new generation added in Metcalfe County near Summershade. There are no EHV transmission lines in the area. The transmission in the area is 161 kV.

No normal transmission system overloads were observed for this condition. The contingency study identified overloads on the Summershade 161 kV transmission as follows:

1. Summershade(TVA)-Summershade Tap(EKP) 161 kV line loads to 145% of its emergency rating of 240 MVA for outage of the Summershade(TVA)-Sshade(EKP) 161 kV line.

2. Summershade(TVA)-Sshade(EKP) 161 kV line loads to 107% of its emergency rating of 327 MVA for outage of the Summershade(TVA)-Summershade Tap(EKP)161 kV line.

Refer to Exhibit 9 for a diagram of the transmission in the vicinity of Summershade. Review of the above-listed overloaded lines show they are short sections of lines, close to the new power plant addition, that would most likely be relatively easy to upgrade as part of the power plant project.

Additional overloads were noted in the Gallatin, Tennessee, area. Gallatin is connected to Summershade via 161 kV transmission:

1. Gallatin2-W.GallatinT 161 kV line (Tennessee) loads to 105% of its emergency rating of 279 MVA for outage of the Gallatin2-Cairo 161 kV line.

2. Gallatin-Lebanon IPT 161 kV line (Tennessee) loads to 103% of its emergency rating of 319 MVA for outage of the Gallatin-WilsonTN 161 kV line.

CAI concludes that all 745 MW of generation can be added with some upgrade of the existing 161 kV transmission system. The Task Force study identified the Gallatin-Lebanon IPT 161 kV line (Tennessee) as a limiting element and indicated that none of the 745 MW could be dispatched.

Case 400 – Henderson, Muhlenberg, and Breckenridge Counties – 3380 MW

Case 400 includes 3380 MW of new generation added in Henderson, Muhlenberg, and Breckenridge counties. One 750 MW generator connects to the TVA 500 KV transmission at Paradise Substation. Two generators, 480 MW and 750 MW, connect to Big Rivers Electric Corporation at the Reid and Wilson 345 kV substations. Two generators, 1000 MW and 400 MW, connect to the Smith 345 kV and N. Hardinsburg 161 kV substations, respectively. The Reid and Wilson 345 kV substations are not interconnected into an EHV grid but connect only to the lower voltage 138 and 161 kV area transmission. The Smith 345 kV and N. Hardinsburg 161 kV substations are connected into the east-west 345 kV Smith-Brown 345 kV circuit. This circuit is connected into the EHV grid at Brown only.

The addition of these generators onto the existing transmission system caused numerous overloads in the normal system model and many more overloads for single-contingency study. Refer to Exhibits 10.1, 10.2, 10.3, and 12 for a diagram showing the transmission overloads. Because of the large number of overloaded lines, it is not reasonable to assume that this amount of generation can be added without also adding significant EHV transmission lines in the area.

The Task Force study concluded that the 750 MW generator connected into TVA Paradise 500 kV substation could be dispatched. The other generators were reduced as listed below.

Generator	Rated MW	Max Dispatch
Columbia Crane Creek (Reid 345 kV)	480	0
Cash Creek (Smith 345 kV)	1000	190
Thoroughbred (Wilson 345 kV)	750	80
Thoroughbred (Paradise 500 kV)	750	750
Dayton P&L (N. Hardinsburg 161 kV)	400	245
Totals	3380	1265

CAI developed a case with generation reduced to the levels listed above (Case 401). The following single-contingency overloads were noted:

1. Smyrna-Blckmnt-Murfreesboro 161 kV line (Tennessee) loaded to 108% of its emergency rating of 235 MVA for outage of the Gallatin-Lascass 161 kV line.

2. Bowling Green-Russ.ss-Paradise 161 kV line (Kentucky) loads to 105% of its emergency rating of 180 MVA for outage of the Bowling Green-Paradise 161 kV

line. Note that this line loads to 100% of emergency rating for the same contingency in the base case without any new generation added.

3. Pinhook-Cane RI 161 kV line (Tennessee) loads to 105% of its emergency rating of 271 MVA for outage of the Davidson 500/161 kV transformer.

CAI reviewed the Cash Creek 1000 MW plant (located on Smith 345 kV) in detail and concurs with the Task Force study that 190 MW is the maximum on the existing system as limited by the Smith-Green River Steel 138 kV line, emergency rating of 365 MVA, for outage of the Smith-Hardinsburg 345 kV line.

Based on the limiting testing performed, CAI concurs with the Task Force study that little additional generation can be added to the existing transmission in Henderson, Muhlenberg and Breckenridge counties.

Case 500 – Jefferson, Oldham, Trimble, and Kenton Counties – 1738 MW

Case 500 includes 1738 MW of new generation added in Jefferson, Oldham, Trimble, and Kenton counties. The base case included 80 MW. Thus, the incremental increase in Case 500 is 1658 MW. Most of this generation is added in the vicinity of Louisville, which is encircled via a 345 kV transmission grid.

No normal transmission system overloads were observed for this condition. Three overloads were identified in the contingency testing:

1. Blue Lick 345/161 kV transformer loads to 108% of its emergency rating of 276 MVA for outage of the Clifty Creek-Trimble 345 kV line.

2. Brown 345/138 kV transformer loads to 106% of its emergency rating of 515 MVA for outage of the Brown-W.Lexington 345 kV line.

3. Middletown 345/138 transformer #2 loads to 104% of its emergency rating of 478 MVA for outage of the Middletown 345/138 kV transformer #1.

The Blue Lick 345/161 kV transformer was identified in the Task Force study as the limiting element. The Blue Lick 345/161 transformer is rated 276 MVA. As 345 kV transformers go, this is not a large transformer and could be replaced with one of larger size. A parallel transformer could be added at Brown, and a larger transformer could be added at Middletown. With these upgrades, CAI concludes that all of the generation could be dispatched without need for major new EHV lines. The Task Force conclusion showed a small reduction in generation to keep within the rating of the Blue Lick transformer. Refer to Exhibit 11 for a diagram showing the area transmission.

Case 600 – Knott, Lawrence, and Martin Counties – 2002 MW

Case 600 includes 2002 MW of new generation added in Knott, Lawrence, and Martin counties. This generation interconnected into the AEP Kentucky Power system in eastern Kentucky.

No normal transmission system overloads were observed for this condition. No contingency overloads were noted on Kentucky transmission other than 69 kV, which are not considered in this study. A 102% overload was noted on the Gallatin-W GallatinTP 161 kV line (Tennessee) for outage of the Gallatin2-Cairo B 161 kV circuit.

CAI concurs with the Task Force study that all the generation in these counties can be dispatched without major addition of EHV transmission. Upgrade of existing 161, 138 or 69 kV transmission lines would, most likely, be required.

Case 700 - Modified Case with 7771 MW Generation In-Service

As a final test, CAI prepared a power flow model with the generation in service as described in Cases 100, 201, 300, 401, 500 and 600. Exhibit 5 provides a summary of the generation included in Case 700. The studies of the individual areas identified the impact of adding generation in a given area on the transmission system. The purpose of this combined model is to review the impact of these generating plants simultaneously. The original study prepared by the Task Force includes all of the proposed new generation, which totaled 11,321 MW, whereas Case 700 includes 7771 MW. The base case included 517 MW of new generation, so Case 700 represents an increase of 7254 MW.

A comparison of the individual case results with Case 700 is provided as Exhibit 6. This exhibit shows that Case 700, as might be expected, creates a greater overload on some facilities already identified, creates overloads on some facilities that were not overloaded in the individual studies, and eliminates some overloads that were previously identified. The most significant increased or new overloads for single contingency conditions are listed below:

1. Cumberland-Davidson 500 kV, 108% of 2597 MVA emergency rating
2. Cumberland-Johnsonville 500 kV, 108% of 2597 MVA emergency rating
3. Brown 345/138 kV transformer, 119% of 515 MVA emergency rating
4. Summershade-Lafayette 161 kV, 119% of 270 MVA emergency rating
5. Gallatin-Lebanon IPT 161 kV, 119% of 319 MVA emergency rating

Summary of Model Results

1. Generation proposed in Marshall, Henderson, Muhlenberg, and Breckenridge counties greatly exceed the capabilities of the existing transmission systems in these areas. Additional EHV transmission lines at 345 and 500 kV would be required to integrate all of the proposed new power plants in these counties into the transmission grid under the assumed conditions.

2. Generation proposed in Clark, Mason, Estill, Ballard, Metcalfe, Jefferson, Oldham, Trimble, Kenton, Knott, Lawrence, and Martin counties can be integrated into the existing transmission grid by upgrading existing transmission lines and substations.

3. The Task Force study concluded that approximately 6100 MW of new generation can be accommodated without major new EHV transmission lines, but would require upgrade of existing lines. CAI concurs with that finding. CAI's study indicates that approximately 7800 MW of new generation can be accommodated but required upgrade of more existing transmission facilities than did the Task Force study.[8] The location of this 6100 MW is very important. If it were located differently than as studied, a different result would be expected. For example, if all of the proposed generation was installed in Marshall County, the CAI study indicated that only about 900 MW could be accommodated on the existing transmission system.

4. Portions of an EHV 345 kV transmission grid exist in Henderson, Muhlenberg, and Breckenridge counties. A few key additional 345 kV lines in this region would greatly improve the EHV transmission capability in these areas. Similarly, in Marshall County, the EHV grid is limited by the 500 kV transmission to Cumberland, Tennessee. A few additions to the EHV grid may accommodate all of the proposed generation. Planning for these additions should be conducted by the appropriate utilities and Regional Transmission Organizations.

5. The results and conclusions in this study are based on the one condition studied: summer 2005 peak load, all generation in service, all excess generation exported to the south, and existing transmission lines upgraded to their maximum conductor ratings. It would be necessary to perform additional studies that considered different load levels, outage of generation, and other power transactions across the network before final conclusions could be reached with regard to transmission system needs.

6. The results of this study should not be interpreted as indicating that limiting new generation in Kentucky will avoid need for future transmission system improvements. This study evaluated only exporting power from Kentucky. There will likely be transmission upgrades and additions required in Kentucky and Tennessee over the next five years to accommodate economical power transfers across the grid. Planning for these additions should be conducted by the appropriate utilities and Regional Transmission Organizations.

[8] The task force study limited improvements to upgrading transmission lines to the conductor capacity.

EXHIBITS