

Facility Study Report

Project G218 (MISO Queue #37356-01) 750 MW Generating Power Plant at Trimble County, KY

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Executive Summary

A request for a generation interconnection of a 750 MW generating power plant in Trimble County, KY (Generator) was made to Midwest ISO and was assigned Queue Number 37356-01 and Project Number G218. A generation interconnection evaluation study was performed by MISO and a study report was published. MISO has performed the corresponding facility study. The results of this study have been presented in this report.

An earlier study on the delivery of power from this generator (see system impact study report on project A024 for request # 75052130 posted on MISO OASIS) has revealed that there were multiple system deficiencies. Four facility upgrade options were identified to alleviate system network problems. After further review, LG&E Energy Transmission chose Option #4 as the preferred option. The looping of the Ghent-Speed 345 KV line through the Trimble Co. 345 KV substation was identified as the minimum necessary upgrades to facilitate interconnection of the generator and was included in this study.

The total cost to interconnect the proposed generator to the network has been estimated to be \$8,569,112 in 2007 dollars. All the system upgrades are in the LG&E Energy Transmission system.

The total interconnection cost was further analyzed to identify the direct interconnection cost and the system upgrade cost. MISO's definition of direct connect is the radial from the GSU to the substation. Usually breakers in a breaker and a half scheme are considered upgrades. If breaker is direct connect between the GSU and the sub (i.e. radial) it is a direct connect cost to the Generator otherwise in any network flow through configuration it is a system upgrade. The cost of the take-off structure at the Trimble 345 KV substation and the associated work was assigned to the direct interconnection cost. Therefore, the remaining cost of \$8,443,857 in 2007 dollars is eligible for credits to the developer toward the future use of the transmission services. LG&E Energy Transmission contests the MISO definition. LG&E Energy Transmission considers the take-off structure, one breaker, two disconnects and the associated facilities as part of the cost to connect the Generator. The associated costs for this project is \$745,766 in 2007 dollars.

The study has identified the key events and the schedule for those events in order to achieve a commercial operation date of January 1, 2007. The necessary time for the transmission-line work related to looping the Speed – Ghent 345 KV line through the Trimble 345 KV substation has been identified as one of the longest, and must start around October 1, 2003 in order to meet the deadline. The schedule in the report will need to be updated in the event the in-service date of the proposed generator changes.

1. Introduction

A request for a generation interconnection of a 750 MW generating power plant in Trimble County, KY (Generator) was made to Midwest ISO. The MISO Generation Interconnection Request Queue Number for this request is 37356-01. This project is also known as Project G218. MISO has coordinated the Generation Interconnection Facility Study (the "Study") for this project. The results of this study are presented in this report.

An earlier study on the delivery of power from this generator (see system impact study report on project A024 for request # 75052130 posted on MISO OASIS) has revealed that there were multiple system deficiencies. Four facility upgrade options were identified to alleviate system network problems. After further review, LG&E Energy Transmission chose Option #4 as the preferred option.

The facility upgrades related to option 4 are given below –

Loop the existing Ghent (LGEE)-Speed (CIN) 345 kV line through the Trimble County substation.

Construct a 345kV line from Mill Creek to Hardin County

Construct a 138kV line from West Lexington to Higby Mill

Construct a 138 kV line from West Frankfort to Tyrone

Re-conductor the 138kV line from Ghent to Owen County Tap

Re-conductor the 138kV line from Hardin County to Etown

Open the 69kV tie from Shelby County (EKPC) to Shelby County Tap (LGEE)

Upgrade the West Frankfort 345/138 KV transformer low-side breaker

Upgrade the disconnects at Carrolton on the Carrolton to Frankfort East 138 KV line

The facility study was split into two separate studies. One related to the generation interconnection request and the other related to the delivery request. This report covers the facility study related to the generation interconnection request.

The looping of the Ghent-Speed 345 KV line through the Trimble Co. 345 KV substation was identified as the minimum necessary upgrades to facilitate interconnection of the generator. The remaining facility upgrades have been addressed as part of the delivery request #75052130.

Cinergy and LG&E Energy Transmission performed the facility study. Cinergy assessed the work to be done at the Speed 345 KV substation and LG&E Energy Transmission assessed the work to be done at the Trimble and Ghent 345 KV substations. The results from these two studies have been compiled in this report.

2. Assumptions

- **In-service date**
 The in-service date of this project is January 1, 2007.
- **Testing Period**
 As informed by the developer, the testing period will be 6-months. All the electrical work on the transmission owners system must be ready by July 1, 2006.
- **Dollar conversion from one year to another**
 All dollar figures are year end 2003 dollars. Dollar conversion rate from one year to the other has been assumed to be 3.3% per year
- **Substation Equipment Procurement and Construction**
 The procurement of substation equipment and construction will start 12 months before the generator in-service date.
- **10% Markup**
 A 10% cost markup has been applied to all estimates.
- **Lead time**
 Total time necessary to complete the identified task

3. Construction Cost and Schedule

Construction Cost

Task	Cost in 2003 Dollars	Cost in 2007 Dollars
<u>Trimble Co. 345 KV Substation Cost without Take-off Structure</u>	\$3,940,275	\$4,486,708
<u>Cost of the interconnection take off structure at the Trimble 345 KV substation</u>	\$110,000	\$125,255
<u>Line from Trimble 345 KV substation to the new tap on Speed – Ghent 345 KV line</u>	\$3,475,210	\$3,957,149
Material – Cables; steel structures, etc Dead-end structure at the new tap New line from Trimble 345 KV substation to the new tap on Speed – Ghent 345 KV line		
Total	\$7,525,485	\$8,569,112

LG&E Energy Transmission estimates do not include any cost for construction of facilities between the generator and the point of connection at the take-off structure in the Trimble Co. substation.

Cinergy has estimated that \$304,384 (in 2007 dollars) will be required to replace equipment at the Speed 345 KV substation to match the new equipment installed at the Trimble 345 KV substation. LG&E Energy Transmission will relocate the existing protective equipment at Ghent to Trimble Co. as part of this project. Therefore, no significant work will be needed at the Speed 345 KV substation and the Ghent 345 KV substation.

All of the identified facilities must be completed 6 months before the commercial operation date of January 1, 2007 to facilitate testing of the new unit. Therefore, all the transmission work must be finished by July 1, 2006. A schedule of the key tasks are given below -

Start Date	Task/Item
October 1, 2003	Looping of Ghent – Speed 345 KV line through Trimble 345 KV substation – Engineering Design
July 1, 2004	Looping of Ghent – Speed 345 KV line through Trimble 345 KV substation <ul style="list-style-type: none"> • Right of way acquisition
April 1, 2005	Looping of Ghent – Speed 345 KV line through Trimble 345 KV substation <ul style="list-style-type: none"> • New Line Material Acquisition
July 1, 2005	Trimble 345 KV substation <ul style="list-style-type: none"> • Order all substation materials
January 1, 2006	Looping of Ghent – Speed 345 KV line through Trimble 345 KV substation <ul style="list-style-type: none"> • New Line Construction

4. Identification of Costs Eligible for Credits

The total interconnection cost was further analyzed to identify the direct interconnection cost and the system upgrade cost. MISO's definition of direct connect is the radial from the GSU to the substation. Usually breakers in a breaker and a half scheme are considered upgrades. If breaker is direct connect between the GSU and the sub (i.e. radial) it is a direct connect cost to the Generator otherwise in any network flow through configuration it is a system upgrade. The cost of the take-off structure at the Trimble 345 KV substation and the associated work was assigned to the direct interconnection cost. Therefore, the remaining cost of \$8,443,857 in 2007 dollars is eligible for credits to the developer toward the future use of the transmission services. LG&E Energy

Transmission contests the MISO definition. LG&E Energy Transmission considers the take-off structure, one breaker, two disconnects and the associated facilities as part of the cost to connect the Generator. The associated costs for this project is \$745,766 in 2007 dollars.

5. Review and Analysis of Generation Interconnection Evaluation Study

The purpose of this review and analysis is to adequately address all the issues that were identified in the evaluation study and establish that the new facility upgrades will satisfy all pertinent criteria, and will not deteriorate the system.

Prior to proceeding with the facility study, MISO had performed the generation interconnection evaluation study and has published a study report.

Dynamic Stability Analysis – The dynamic stability analysis revealed that the system with the new generator (project G218) installed remained stable when tested with SIS study facility upgrade Options 1, 3, and 4 but unstable for Option 2. The stability analysis also revealed that the looping the Speed – Ghent 345 KV line through the Trimble 345 KV substation was sufficient for the system to remain stable after the addition of TC2 generator. Since the LG&E Energy Transmission chose to proceed with facility upgrade option 4, the system dynamic stability is of no concern.

Short Circuit Analysis – The short circuit analysis revealed that the addition of the new generator TC2 caused an increase in the fault currents seen by a number of breakers in the system. The increased fault currents were within the breaker current interruption capabilities. Therefore, no breaker replacements were needed due to the interconnection of this generator to the system.

The evaluation study revealed that, at OVEC's Clifty Creek 345 kV, duties imposed on at least two circuit breakers were shown to be approaching their nameplate capabilities. Further analysis was performed by AEP to establish that sufficient margin exists at these two breakers after installation of TC unit #2 and the proposed facility upgrades. After additional fault studies (using the model from the Interconnection Evaluation study) and consultation with AEP Station Engineering staff, it has been determined that all of the Clifty Creek 345 kV breaker interrupting capabilities are adequate for the increased duties to be imposed by the Trimble County generator addition and associated transmission reinforcements as presently proposed (Identified as Option 4 in the Interconnection Evaluation study.)

Cascading Outage Analysis – The study revealed that there were no new cascading outages introduced due to the addition of the new generator TC2.

6. Conclusions

The total cost to interconnect the proposed generator to the network has been estimated to be \$8,569,112 in 2007 dollars. All the system upgrades are in the LG&E Energy Transmission system.

The total interconnection cost was further analyzed to identify the direct interconnection cost and the system upgrade cost. MISO's definition of direct connect is the radial from the GSU to the substation. Usually breakers in a breaker and a half scheme are considered upgrades. If breaker is direct connect between the GSU and the sub (i.e. radial) it is a direct connect cost to the Generator otherwise in any network flow through configuration it is a system upgrade. The cost of the take-off structure at the Trimble 345 KV substation and the associated work was assigned to the direct interconnection cost. Therefore, the remaining cost of \$8,443,857 in 2007 dollars is eligible for credits to the developer toward the future use of the transmission services. LG&E Energy Transmission contests the MISO definition. LG&E Energy Transmission considers the take-off structure, one breaker, two disconnects and the associated facilities as part of the cost to connect the Generator. The associated costs for this project is \$745,766 in 2007 dollars.

The study has identified the key events and the schedule for those events in order to achieve a commercial operation date of January 1, 2007. The necessary time for the transmission-line work related to looping the Speed – Ghent 345 KV line through the Trimble 345 KV substation has been identified as one of the longest, and must start around October 1, 2003 in order to meet the deadline. The schedule in the report will need to be updated in the event the in-service date of the proposed generator changes



System Impact Study A-024 for MISO OASIS
Request Number 75052130

For Transmission Service Requested by LG&E
Energy Corp.

From LGEE to LGEE

For a Reserved Amount of 750 MW
From 1/1/07 To 12/30/11

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1. Executive Summary

LG&E Energy Corp. has requested a system impact study for MISO OASIS request number 75052130, which is a yearly, firm, network designated request that has a source and sink of LGEE. This request represents the new proposed 750MW of generation at Trimble County, beginning in January of 2007.

The principal objective of this study is to identify constraints on the MISO transmission system, along with adjacent non-MISO transmission systems, that may limit the transfer to less than the total 750 MW that has been requested.

The LGEE to LGEE 750 MW transfer causes overloads on the MISO transmission system. In order to provide the 750 MW of service requested, a facility study must be completed to determine the upgrades necessary to increase the ATC to 750 MW.

2. Introduction

LG&E Energy Corp. has requested a system impact study for MISO OASIS request number 75052130, which is a yearly, firm, network designated request that has a source and sink of LGEE. This request represents the new proposed 750MW of generation at Trimble County, beginning in January of 2007.

The principal objective of this study was to identify constraints on the MISO transmission system, along with adjacent non-MISO transmission systems, that limited the transfer to less than the total 750 MW that has been requested.

This study included steady-state contingency analyses for the requested service period. The steady-state analysis considered the impact of the 750 MW transfer on transmission line loading and transmission bus voltages for outages of single and selected multiple transmission lines and transformers on the MISO and surrounding systems.

3. Study Methodology

A. Description

A 2007 NERC MMWG summer peak model was used to conduct the study. Both peak and shoulder (75-80% of peak) scenarios were analyzed. The shoulder case represented an economic dispatch scenario in which LG&E Energy dispatched all coal-fired units in the Louisville area at or near maximum level, and the coal-fired units at Brown were at minimum level. No CTs were dispatched in this case. All neighboring control areas had their load and generation scaled down in the shoulder case. In both the peak and off-peak case, generation in LGEE and surrounding areas was dispatched economically, based on information that was submitted for this study. In addition, the six CTs located at Trimble County, including the four which are not in service at this time, were included in the base model, and were dispatched at maximum output in the peak model.

All future system (non-generation) projects included in the base model, which were located in the impacted area, were looked at to determine if this transmission service request would be contingent upon them being built. These facilities included:

1. A second 345/230 XFMR at Cayuga located in Cinergy
2. A 161/69 kV XFMR at Victory located between SIGE and HE.
3. Removing the Bedford 345/138 ckt 3 XFMR located in Cinergy.

The MISO solicited input from all TOs in the impacted area to determine any transmission facilities that are included in the models for queued generator interconnection and/or transmission service requests. These were evaluated to determine which were appropriate to include in the base model for this study. This included:

1. Adding the Gilbert #3 generator at the Spurlock bus in EKPC.

All long-term monthly and yearly firm, confirmed reservations were included in the model. This included all long-term reservations that were confirmed and had roll-over rights.

B. CBM and TRM

CBM was applied to the LGEE area by taking Brown #3 out of service (441 MW) and importing this amount of power from Cinergy for the peak model. For the shoulder peak model, Brown #3 was taken off-line, and generation was increased internally based on a dispatch provided by LG&E Energy. TRM is zero for LGEE. CBM and TRM were included in the non-LGEE areas' flowgate analysis.

C. Transfer Analysis

This transfer was studied by turning on the new generation at Trimble County and ramping down generation located elsewhere in LGEE, based on a merit order dispatch provided by LG&E Energy. For the contingency analysis, a DC screen against the MISO contingency list and n-1 criteria was performed to isolate the most severe contingencies. MUST was then used to do an AC analysis, using these specified contingencies. For the flowgate analysis, MUST was used to do an AC analysis on the full MISO flowgate list. Because flowgate ratings include CBM and TRM, and a CBM outage scenario was included for LGEE, all flowgates located within LGEE had their CBM value added back into them.

4. Study Results

Tables 1 and 2 located in Appendix A show the initial results of the study using both the peak and off-peak cases. Since the peak results showed the same constrained facilities as the off-peak case with the addition of several others, the task of finding appropriate upgrades was done using only the peak case.

Four different upgrade schemes were used to try to find the best way to relieve the constraints on the transmission system. These four schemes are listed below:

Option 1:

Construct a 345kV line from Trimble County to West Frankfort

Construct a 345kV line from West Frankfort to Brown

Construct a 138kV line from West Lexington to Higby Mill

Construct a 138kV line from West Frankfort to Tyrone

Add a second 345/138 XFMR at Brown

The results from this option are in Appendix A, Table 3. Below is a list of each remaining overloaded facility after the implementation of option 1 .

Limiting Circuit
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR
27007 11MIDDLT 345 27119 11MIDDLT 138 1 TR
27007 11MIDDLT 345 27119 11MIDDLT 138 3 TR
27014 11W FRNK 345 27151 11W FRNK 138 1 TR
27075 11CARROL 138 27112 11LOCKPO 138 1 LN
27091 11FFRT E 138 27140 11SHADRA 138 1 LN
27099 11HARDBG 138 27100 11HARDN 138 1 LN
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN
27113 11LOUDON 138 29202 20AVON 138 1 LN
27148 11TYRONE 138 27151 11W FRNK 138 1 LN

The estimated cost to construct the identified facilities and eliminate the remaining overloads in LGEE is approximately \$90 million based on rule-of-thumb estimates. The cost to add a second Buffington transformer in Cinergy would cost approximately \$4 million.

Option 2:

- Construct a 345kV line from West Frankfort to Brown
- Construct a 345kV line from Mill Creek to Hardin County
- Construct a 138kV line from West Lexington to Higby Mill
- Reconductor the 138kV line from Hardin County to Etown
- Open the 69kV tie from Shelby County (EKPC) to Shelby County Tap (LGEE)
- Add a second 345/138 XFMR at Brown

The results from this option are in Appendix A, Table 4. Below is a list of each remaining overloaded facility after the implementation of option 2.

25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR
27005 11GHENT 345 27014 11W FRNK 345 1 LN
27006 11HARDN 345 27100 11HARDN 138 2 TR
27007 11MIDDLT 345 27013 11TRIMBL 345 2 LN
27007 11MIDDLT 345 27338 11BUCKNR 345 1 LN
27019 11BLUE L 161 29248 20BLIT C 161 1 LN
27075 11CARROL 138 24953 06CLIFTY 138 1 LN
27075 11CARROL 138 27112 11LOCKPO 138 1 LN
27085 11ETOWN 138 27124 11NELSON 138 1 LN
27091 11FFRT E 138 27140 11SHADRA 138 1 LN
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN
27113 11LOUDON 138 29202 20AVON 138 1 LN

The estimated cost to construct the identified facilities and eliminate the remaining overloads in LGEE is approximately \$96 million based on rule-of-thumb estimates. The cost to add a second Buffington transformer in Cinergy would cost approximately \$4 million.

Option 3:

Loop the existing Ghent (LGEE)-Speed (CIN) 345 kV line through the Trimble County substation.

Construct a 345kV line from West Frankfort to Brown

Construct a 138kV line from West Lexington to Higby Mill

Reconductor the 138kV line from Ghent to Owen County Tap

Open the 69kV tie from Shelby County (EKPC) to Shelby County Tap (LGEE)

Construct a 138 kV line from Ghent to NAS and serve NAS from this line.

Add a second 345/138XFMR at Brown

The results from this option are in Appendix A, Table 5. Below is a list of each remaining overloaded facility after the implementation of option 3.

25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR
27005 11GHENT 345 27014 11W FRNK 345 1 LN
27007 11MIDDLT 345 27119 11MIDDLT 138 1 TR
27015 11W LEXN 345 27153 11W LEXN 138 1 TR
27019 11BLUE L 161 29248 20BLIT C 161 1 LN
27075 11CARROL 138 27112 11LOCKPO 138 1 LN
27091 11FFRT E 138 27140 11SHADRA 138 1 LN
27092 11GHENT 138 27120 11MIDWAY 138 1 LN
27099 11HARDBG 138 27100 11HARDN 138 1 LN
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN
27113 11LOUDON 138 29202 20AVON 138 1 LN
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN
27137 11RODBRN 138 27336 11SHARKE 138 1 LN

The estimated cost to construct the identified facilities and eliminate the remaining overloads in LGEE is approximately \$56 million based on rule-of-thumb estimates. The cost to add a second Buffington transformer in Cinergy would cost approximately \$4 million.

Option 4:

Loop the existing Ghent (LGEE)-Speed (CIN) 345 kV line through the Trimble County substation.

Construct a 345kV line from Mill Creek to Hardin County

Construct a 138kV line from West Lexington to Higby Mill

Construct a 138 kV line from West Frankfort to Tyrone

Reconductor the 138kV line from Ghent to Owen County Tap

Reconductor the 138kV line from Hardin County to Etown

Open the 69kV tie from Shelby County (EKPC) to Shelby County Tap (LGEE)

The results from this option are in Appendix A, Table 6. Below is a list of each remaining overloaded facility after the implementation of option 4.

25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR
27006 11HARDN 345 27100 11HARDN 138 2 TR
27014 11W FRNK 345 27151 11W FRNK 138 1 TR
27015 11W LEXN 345 27153 11W LEXN 138 1 TR
27051 11ADAMS 138 27148 11TYRONE 138 1 LN
27075 11CARROL 138 27112 11LOCKPO 138 1 LN
27085 11ETOWN 138 27124 11NELSON 138 1 LN
27091 11FFRT E 138 27140 11SHADRA 138 1 LN
27092 11GHENT 138 27120 11MIDWAY 138 1 LN
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN
27113 11LOUDON 138 29202 20AVON 138 1 LN
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN
27137 11RODBRN 138 27336 11SHARKE 138 1 LN
27148 11TYRONE 138 27151 11W FRNK 138 1 LN

The estimated cost to construct the identified facilities and eliminate the remaining overloads in LGEE is approximately \$66 million based on rule-of-thumb estimates. The cost to add a second Buffington transformer in Cinergy would cost approximately \$4 million.

5. Conclusion

The request from LGEE to LGEE of 750 MW causes constraints on the MISO transmission system. To provide the 750 MW of service requested, upgrades must be completed for those facilities given in tables 1 through 6, which limit the ATC to 0 MW.

The final cost and assignment of facilities that need to be upgraded will be determined upon the completion of a facility study.

Appendix A. Study Results

Table 1. Off-peak constraints due to additional 750 MW at Trimble County

Limiting Circuit	Contin.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
27006 11HARDN 345 27012 11SMITH 345 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	108.4	90.9	334.0	280.1	308.0
27015 11W LEXN 345 27153 11W LEXN 138 1 TR	27004 11BRWN N 345 27064 11BRWN N 138 1	101.6	80.0	485.8	382.6	478.0
27019 11BLUE L 161 29248 20BLIT C 161 1 LN	24952 06CLIFTY 345 27013 11TRIMBL 345 1	105.0	72.6	250.9	173.6	239.0
27053 11AMERI 138 27097 11HAEFLI 138 1 LN	27004 11BRWN N 345 27064 11BRWN N 138 1	144.0	101.4	269.3	189.5	187.0
27053 11AMERI 138 27097 11HAEFLI 138 1 LN	** Base Case **	105.3	80.2	196.9	149.9	187.0
27053 11AMERI 138 27136 11REYNOL 138 1 LN	27004 11BRWN N 345 27015 11W LEXN 345 1	106.4	77.0	169.2	122.4	159.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	105.3	71.8	142.2	96.9	135.0
27086 11FARM T 138 27336 11SHARKE 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	137.3	93.3	133.2	90.5	97.0
27090 11FLEMING 138 27093 11GODDRD 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	112.4	93.9	177.5	148.3	158.0
27090 11FLEMING 138 27157 11WEDONI 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	101.9	85.4	182.3	152.8	179.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	27005 11GHENT 345 27014 11W FRNK 345 1	134.5	106.2	181.6	143.3	135.0
27091 11FFRT E 138 27148 11TYRONE 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	155.2	106.4	344.6	236.3	222.0
27091 11FFRT E 138 27148 11TYRONE 138 1 LN	27005 11GHENT 345 27015 11W LEXN 345 1	145.3	104.6	322.7	232.3	222.0
27091 11FFRT E 138 27151 11W FRNK 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	126.2	95.7	382.4	290.1	303.0
27092 11GHENT 138 27120 11MIDWAY 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	143.4	107.5	251.0	188.1	175.0
27092 11GHENT 138 27128 11OC TAP 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	117.7	95.0	326.1	263.1	277.0
27105 11KENTON 138 27157 11WEDONI 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	104.5	87.8	187.1	157.2	179.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	27014 11W FRNK 345 27151 11W FRNK 138 1	138.4	109.8	186.9	148.2	135.0

Limiting Circuit	Contin.Description		% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
27113 11LOUDON 138 29202 20AVON 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138		162.6	109.9	466.8	315.5	287.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	** Base Case **		114.3	91.0	283.5	225.6	248.0
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138		135.8	101.7	237.7	178.0	175.0
27128 11OC TAP 138 27139 11SCOTT 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138		108.1	79.4	299.4	219.9	277.0
27128 11OC TAP 138 27139 11SCOTT 138 1 LN	** Base Case **		101.8	86.2	178.1	150.8	175.0
27132 11PISGAH 138 27153 11W LEXN 138 1 LN	27004 11BRWN N 345 27064 11BRWN N 138 1		126.1	78.8	205.5	128.4	163.0
27137 11RODBRN 138 27336 11SHARKE 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138		146.0	100.6	141.6	97.6	97.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow	delta		
9901:11BLUE L 161 20BLIT C 161 1 for lo	Cont	239.0	248.8	176.0	72.8		
2483:Avon - Loudon 138 kV	Base	199.0	251.3	211.3	40		

Table 2. Peak constraints due to additional 750 MW at Trimble County

Limiting Circuit	Contin.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	24962 06PIERC2 345 25981 08FOSTER 345 1	110.4	102.0	551.0	508.8	499.0
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	** Base Case **	105.7	97.5	460.8	425.1	436.0
27006 11HARDN 345 27012 11SMITH 345 1 LN	27005 11GHENT 345 27015 11W LEXN 345 1	134.2	78.8	413.3	242.6	308.0
27007 11MIDDLT 345 27119 11MIDDLT 138 1 TR	24952 06CLIFTY 345 27013 11TRIMBL 345 1	114.3	94.0	546.4	449.3	478.0
27012 11SMITH 345 27142 11SMITH 138 1 TR	27005 11GHENT 345 27015 11W LEXN 345 1	113.9	78.1	351.0	240.5	308.0
27014 11W FRNK 345 27151 11W FRNK 138 1 TR	27005 11GHENT 345 27015 11W LEXN 345 1	108.9	80.8	520.5	386.2	478.0
27015 11W LEXN 345 27153 11W LEXN 138 1 TR	27004 11BRWN N 345 27015 11W LEXN 345 1	118.0	95.3	563.8	455.5	478.0
27019 11BLUE L 161 27003 11BLUELI 345 1 TR	24952 06CLIFTY 345 27013 11TRIMBL 345 1	128.5	98.0	354.6	270.6	276.0
27019 11BLUE L 161 27003 11BLUELI 345 1 TR	** Base Case **	114.6	96.7	275.0	232.0	240.0
27019 11BLUE L 161 29248 20BLIT C 161 1 LN	24952 06CLIFTY 345 27013 11TRIMBL 345 1	145.8	110.2	348.5	263.4	239.0
27019 11BLUE L 161 29248 20BLIT C 161 1 LN	** Base Case **	112.1	94.4	268.0	225.7	239.0
27032 11IMBODE 161 27040 11POCK N 161 1 LN	27005 11GHENT 345 27015 11W LEXN 345 1	104.3	71.0	164.8	112.2	158.0
27051 11ADAMS 138 27148 11TYRONE 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	159.7	106.1	154.9	102.9	97.0
27053 11AMERI 138 27097 11HAEFLI 138 1 LN	27004 11BRWN N 345 27015 11W LEXN 345 1	147.8	94.3	276.3	176.4	187.0
27075 11CARROL 138 24953 06CLIFTY 138 1 LN	27092 11GHENT 138 27123 11NAS 138 1	108.5	89.3	227.8	187.6	210.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	123.4	74.4	166.6	100.4	135.0
27076 11CENTRF 138 27147 11TRIMBL 138 1 LN	24952 06CLIFTY 345 27013 11TRIMBL 345 1	101.5	75.6	218.2	162.6	215.0
27080 11DANVIL 138 27118 11MERCRCR 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	124.6	75.1	175.7	105.9	141.0
27086 11FARM T 138 27336 11SHARKE 138 1 LN	20SPURLK 345' TO BUS '20AVON 345 20AVON 345' TO BUS '20AVON 138	116.5	80.8	113.0	78.4	97.0
27090 11FLEMIN 138 27093 11GODDRD 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	126.7	94.6	200.2	149.5	158.0
27090 11FLEMIN 138 27157 11WEDONI 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	115.4	86.7	206.6	155.2	179.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	27005 11GHENT 345 27014 11W FRNK 345 1	143.9	108.1	194.2	145.9	135.0
27091 11FFRT E 138 27148 11TYRONE 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	163.0	88.7	361.8	197.0	222.0
27091 11FFRT E 138 27151 11W FRNK 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	142.8	93.3	432.8	282.6	303.0
	Contin.Description	% Load Post	% Load Pre	Post Trans Cont	Pre Trans Cont Flow	Rating

Limiting Circuit		Trans	Trans	Flow		
27092 11GHENT 138 27120 11MIDWAY 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	162.5	100.2	284.3	175.3	175.0
27092 11GHENT 138 27128 11OC TAP 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	137.2	96.3	380.0	266.7	277.0
27092 11GHENT 138 27128 11OC TAP 138 1 LN	** Base Case **	104.5	89.9	237.3	204.2	227.0
27097 11HAEFLI 138 27149 11VILEY 138 1 LN	27097 11HAEFLI 138 27153 11W LEXN 138 1	101.1	88.7	254.8	223.5	252.0
27097 11HAEFLI 138 27153 11W LEXN 138 1 LN	27149 11VILEY 138 27153 11W LEXN 138 1	102.1	90.1	286.0	252.4	280.0
27099 11HARDBG 138 27100 11HARDN 138 1 LN	11HARDN 345' TO BUS '11BRWN N 345 11SMITH 345' TO BUS '11HARDN 345 11HARDN 345' TO BUS '11HARDN 138	121.8	96.0	307.1	242.0	252.0
27105 11KENTON 138 27157 11WEDONI 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	119.0	89.8	213.0	160.7	179.0
27106 11KNOB C 138 27121 11MILL C 138 1 LN	24952 06CLIFTY 345 27013 11TRIMBL 345 1	105.1	74.7	207.1	147.2	197.0
27110 11LR TAP 138 27111 11LK REB 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	123.5	79.3	118.5	76.1	96.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	119.8	71.0	161.7	95.9	135.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	203.4	111.9	583.6	321.1	287.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	** Base Case **	136.0	102.4	337.2	253.9	248.0
27114 11LYNDON 138 27119 11MIDDLT 138 1 LN	24952 06CLIFTY 345 27013 11TRIMBL 345 1	111.7	79.3	240.1	170.5	215.0
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	151.9	93.6	265.8	163.8	175.0
27126 11OHIO C 138 27141 11SHREWS 138 1 LN	27005 11GHENT 345 27015 11W LEXN 345 1	137.0	93.9	226.0	155.0	165.0
27128 11OC TAP 138 27139 11SCOTT 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	123.3	73.9	341.7	204.6	277.0
27128 11OC TAP 138 27139 11SCOTT 138 1 LN	** Base Case **	105.6	82.1	184.8	143.7	175.0
27132 11PISGAH 138 27153 11W LEXN 138 1 LN	27004 11BRWN N 345 27015 11W LEXN 345 1	126.1	73.1	205.5	119.1	163.0
27137 11RODBRN 138 27336 11SHARKE 138 1 LN	20SPURLK 345' TO BUS '20AVON 345 20AVON 345' TO BUS '20AVON 138	126.4	88.4	122.6	85.7	97.0
27141 11SHREWS 138 27337 11MERIDT 138 1 LN	27005 11GHENT 345 27015 11W LEXN 345 1	119.1	78.9	167.9	111.3	141.0
27149 11VILEY 138 27153 11W LEXN 138 1 LN	27097 11HAEFLI 138 27153 11W LEXN 138 1	103.4	91.4	289.4	256.0	280.0

FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow	delta
2483:Avon - Loudon 138 kV	Base	199.0	309.7	247.8	61.9
2198:Blue Lick 345/161 XFMR-Baker-Broad	Cont	239.0	277.4	241.0	36.4
2196:Blue Lick 345/161 XFMR	Base	239.0	264.7	227.7	37
9901:11BLUE L 161 20BLIT C 161 1 for lo	Cont	239.0	334.9	264.2	70.7
9902:11BLUE L 161 20BLIT C 161 1 for lo	Cont	239.0	275.4	248.0	27.4
2096:11BLUE L 161 20BLIT C 161 1	Base	239.0	264.7	227.7	37
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	541.2	499.6	41.6
60016:Clifty Creek (OVEC)-Carrollton 138	Base	154.0	162.8	111.6	51.2

Table 3. Results after adding Option 1 to the transmission system

Limiting Circuit	Contin.Description		% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	24962 06PIERC2 345 25981 08FOSTER 345 1		101.0	95.7	503.9	477.6	499.0
27007 11MIDDLT 345 27119 11MIDDLT 138 1 TR	27007 11MIDDLT 345 27119 11MIDDLT 138 3		105.19	99.73	502.8	476.7	478.0
27007 11MIDDLT 345 27119 11MIDDLT 138 3 TR	27007 11MIDDLT 345 27119 11MIDDLT 138 1		101.76	96.49	486.4	461.2	478.0
27014 11W FRNK 345 27151 11W FRNK 138 1 TR	27004 11BRWN N 345 27014 11W FRNK 345 O1		104.73	85.54	500.6	408.9	478.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'		125.3	100.4	169.2	135.5	135.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'		117.0	92.5	157.9	124.9	135.0
27099 11HARDBG 138 27100 11HARDN 138 1 LN	11HARDN 345' TO BUS '11BRWN N 345 11SMITH 345' TO BUS '11HARDN 345 11HARDN 345' TO BUS '11HARDN 138		104.5	92.0	263.3	231.8	252.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'		121.6	96.8	164.2	130.7	135.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138		122.2	93.3	350.7	267.7	287.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	** Base Case **		106.3	85.2	263.7	211.3	248.0
27148 11TYRONE 138 27151 11W FRNK 138 1 LN	27004 11BRWN N 345 27014 11W FRNK 345 O1		104.2	73.4	229.2	161.5	220.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow	delta		
2483:Avon - Loudon 138 kV	Base	199.0	246.4	205.4	41		
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	494.4	468.3	26.1		

Table 4. Results after adding Option 2 to the transmission system

Limiting Circuit	Contin.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	24962 06PIERC2 345 25981 08FOSTER 345 1	106.6	99.2	531.8	494.9	499.0
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	** Base Case **	102.2	95.1	445.8	414.5	436.0
27005 11GHENT 345 27014 11W FRNK 345 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	100.7	81.4	794.7	641.9	789.0
27006 11HARDN 345 27100 11HARDN 138 2 TR	11HARDN 345' TO BUS '11BRWN N 345 11SMITH 345' TO BUS '11HARDN 345 11HARDN 345' TO BUS '11HARDN 138	109.3	93.4	439.2	375.6	402.0
27007 11MIDDLT 345 27013 11TRIMBL 345 2 LN	27007 11MIDDLT 345 27338 11BUCKNR 345 1	104.2	82.8	1257.4	999.1	1207.0
27007 11MIDDLT 345 27338 11BUCKNR 345 1 LN	27007 11MIDDLT 345 27013 11TRIMBL 345 2	105.8	84.7	1277.4	1022.0	1207.0
27019 11BLUE L 161 29248 20BLIT C 161 1 LN	27006 11HARDN 345 27008 11MIL CK 345 O2	100.4	86.5	240.0	206.7	239.0
27075 11CARROL 138 24953 06CLIFTY 138 1 LN	27092 11GHENT 138 27123 11NAS 138 1	104.8	87.8	220.2	184.3	210.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	135.1	107.9	182.4	145.7	135.0
27085 11ETOWN 138 27124 11NELSON 138 1 LN	27004 11BRWN N 345 27006 11HARDN 345 1	107.1	79.5	160.6	119.2	150.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	126.8	99.9	171.2	134.9	135.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	131.4	104.3	177.5	140.8	135.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	131.2	98.8	376.6	283.6	287.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	** Base Case **	117.5	92.1	291.5	228.5	248.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow	delta	
2483:Avon - Loudon 138 kV	Base	199.0	274.7	223.0	51.7	
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	522.3	485.8	36.5	

Table 5. Results after adding Option 3 to the transmission system

Limiting Circuit	Contn.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
25908 08BUFTN1 138 25909 08BUFTN1 345 I TR	24962 06PIERC2 345 25981 08FOSTER 345 I	104.6	98.9	521.9	493.3	499.0
25908 08BUFTN1 138 25909 08BUFTN1 345 I TR	** Base Case **	100.4	94.9	437.9	413.8	436.0
27005 11GHENT 345 27014 11W FRNK 345 I LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	130.9	100.0	1032.4	789.2	789.0
27015 11W LEXN 345 27153 11W LEXN 138 I TR	27004 11BRWN N 345 27015 11W LEXN 345 I	103.26	85.00	493.6	406.3	478.0
27019 11BLUE L 161 29248 20BLIT C 161 I LN	24952 06CLIFTY 345 27013 11TRIMBL 345 I	103.1	86.5	246.5	206.7	239.0
27075 11CARROL 138 27112 11LOCKPO 138 I LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	151.2	117.9	204.2	159.2	135.0
27091 11FFRT E 138 27140 11SHADRA 138 I LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	142.6	109.9	192.5	148.4	135.0
27092 11GHENT 138 27120 11MIDWAY 138 I LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	111.2	82.6	194.7	144.6	175.0
27099 11HARDBG 138 27100 11HARDN 138 I LN	11HARDN 345' TO BUS '11BRWN N 345 11SMITH 345' TO BUS '11HARDN 345 11HARDN 345' TO BUS '11HARDN 138	110.8	94.8	279.2	238.9	252.0
27112 11LOCKPO 138 27140 11SHADRA 138 I LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	147.4	114.3	199.0	154.2	135.0
27113 11LOUDON 138 29202 20AVON 138 I LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	141.5	104.3	406.2	299.5	287.0
27113 11LOUDON 138 29202 20AVON 138 I LN	** Base Case **	121.1	95.7	300.3	237.3	248.0
27120 11MIDWAY 138 27153 11W LEXN 138 I LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	103.4	76.0	180.9	132.9	175.0
27137 11RODBRN 138 27336 11SHARKE 138 I LN	20SPURLK 345' TO BUS '20AVON 345 20AVON 345' TO BUS '20AVON 138	104.0	77.3	100.9	75.0	97.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow	delta	
2483:Avon - Loudon 138 kV	Base	199.0	280.5	231.8	48.7	
2198:Blue Lick 345/161 XFMR-Baker-Broad	Cont	239.0	242.6	216.5	26.1	
9901:11BLUE L 161 20BLIT C 161 I for lo	Cont	239.0	249.0	211.5	37.5	
9902:11BLUE L 161 20BLIT C 161 I for lo	Cont	239.0	243.6	214.8	28.8	
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	512.3	484.2	28.1	

Table 6. Results after adding Option 4 to the transmission system

Limiting Circuit	Contin.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	24962 06PIERC2 345 25981 08FOSTER 345 1	101.4	96.3	506.2	480.4	499.0
27006 11HARDN 345 27100 11HARDN 138 2 TR	11HARDN 345' TO BUS '11BRWN N 345 11SMITH 345' TO BUS '11HARDN 345 11HARDN 345' TO BUS '11HARDN 138	108.2	92.8	435.0	372.9	402.0
27014 11W FRNK 345 27151 11W FRNK 138 1 TR	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	102.85	85.96	491.6	410.9	478.0
27015 11W LEXN 345 27153 11W LEXN 138 1 TR	27004 11BRWN N 345 27015 11W LEXN 345 1	108.56	88.08	518.9	421	478.0
27051 11ADAMS 138 27148 11TYRONE 138 1 LN	27064 11BRWN N 138 27148 11TYRONE 138 1	116.1	87.9	112.7	85.3	97.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	140.1	106.9	189.2	144.3	135.0
27085 11ETOWN 138 27124 11NELSON 138 1 LN	27004 11BRWN N 345 27006 11HARDN 345 1	107.2	79.2	160.9	118.8	150.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	'11GHENT 345' TO BUS '11W FRNK 345' '11W FRNK 345' TO BUS '11W FRNK 138'	131.7	99.0	177.8	133.7	135.0
27092 11GHENT 138 27120 11MIDWAY 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	118.5	87.1	207.3	152.5	175.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	27014 11W FRNK 345 27151 11W FRNK 138 1	136.4	103.3	184.2	139.4	135.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	138.2	99.2	396.6	284.6	287.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	** Base Case **	114.9	89.9	284.9	222.9	248.0
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	110.6	80.5	193.5	140.9	175.0
27137 11RODBRN 138 27336 11SHARKE 138 1 LN	20SPURLK 345' TO BUS '20AVON 345 20AVON 345' TO BUS '20AVON 138	100.4	72.6	97.4	70.4	97.0
27148 11TYRONE 138 27151 11W FRNK 138 1 LN	11W LEXN 345' TO BUS '11BRWN N 345 11GHENT 345' TO BUS '11W LEXN 345 11W LEXN 345' TO BUS '11W LEXN 138	112.9	78.5	248.3	172.7	220.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow	delta	
2483:Avon - Loudon 138 kV	Base	199.0	265.0	217.0		48
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	496.5	471.1		25.4

Attachment A – Trimble Co. #2 study results (100% output) with Dynergy unit in LGEE at zero output and option 4 upgrades installed

Option 4 - 100% of Trimble Co. #2 (750 MW) dispatched to LGEE

Remaining overloads after option 4 implemented

Limiting Circuit	Contin. Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	24962 06PIERC2 345 25981 08FOSTER 345 1	100.8	95.7	503.0	477.5	499.0
27006 11HARDN 345 27100 11HARDN 138 2 TR	C113-T3	107.2	91.5	430.9	367.7	402.0
27014 11W FRNK 345 27151 11W FRNK 138 1 TR	C114-T3	111.0	88.8	530.5	424.6	478.0
27015 11W LEXN 345 27153 11W LEXN 138 1 TR	27004 11BRWN N 345 27015 11W LEXN 345 1	115.1	91.7	550.1	438.4	478.0
27051 11ADAMS 138 27148 11TYRONE 138 1 LN	27064 11BRWN N 138 27148 11TYRONE 138 1	120.3	90.8	116.7	88.1	97.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	C115-T3	142.5	108.2	192.4	146.1	135.0
27085 11ETOWN 138 27124 11NELSON 138 1 LN	27004 11BRWN N 345 27006 11HARDN 345 1	107.5	79.2	161.3	118.9	150.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	C115-T3	134.0	100.3	180.9	135.4	135.0
27092 11GHENT 138 27120 11MIDWAY 138 1 LN	C114-T3	123.4	89.6	216.0	156.8	175.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	C115-T3	138.7	104.6	187.3	141.2	135.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	C114-T3	100.1	71.3	306.0	215.9	303.0
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN	C114-T3	115.3	82.9	201.8	145.2	175.0
27148 11TYRONE 138 27151 11W FRNK 138 1 LN	C114-T3	116.3	79.9	255.8	175.7	220.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow		
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	493.4	468.3		

Note: The Buffington 345/138 XFMR for the outage of Pierce/Foster 345 has a flow of 514.5 MVA (103.1%) in the base case without option 4 upgrades and without Trimble Co. #2 turned on. Since the flow on this transformer is less with Trimble Co. #2 turned on and the upgrades for option 4 installed, MISO will ignore this constraint.

The Loudon (LGEE) to Avon (EKPC) tie constraint will need to be mitigated prior to this service being accepted. For this study, it was assumed a 3% reactor was installed at Avon, and the section of line containing 795 ACSR conductor was replaced with 954 ACSR conductor, to raise this line rating to alleviate constraints.

Attachment B – Trimble Co. #2 study results (75% output) with Dynergy unit in LGEE at zero output and option 4 upgrades installed

Option 4 - 75% of Trimble Co. #2 (562 MW) dispatched to LGEE

Remaining overloads after option 4 implemented

Limiting Circuit	Contin.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
27006 11HARDN 345 27100 11HARDN 138 2 TR	C113-T3	102.9	91.5	413.8	367.7	402.0
27014 11W FRNK 345 27151 11W FRNK 138 1 TR	C114-T3	104.2	88.8	498.1	424.6	478.0
27015 11W LEXN 345 27153 11W LEXN 138 1 TR	27004 11BRWN N 345 27015 11W LEXN 345 1	109.1	91.7	521.4	438.4	478.0
27051 11ADAMS 138 27148 11TYRONE 138 1 LN	27064 11BRWN N 138 27148 11TYRONE 138 1	111.9	90.8	108.6	88.1	97.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	C115-T3	132.6	108.2	179.0	146.1	135.0
27085 11ETOWN 138 27124 11NELSON 138 1 LN	27004 11BRWN N 345 27006 11HARDN 345 1	100.4	79.2	150.6	118.9	150.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	C115-T3	124.2	100.3	167.7	135.4	135.0
27092 11GHENT 138 27120 11MIDWAY 138 1 LN	C114-T3	112.7	89.6	197.3	156.8	175.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	C115-T3	128.9	104.6	174.0	141.2	135.0
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN	C114-T3	105.3	82.9	184.3	145.2	175.0
27148 11TYRONE 138 27151 11W FRNK 138 1 LN	C114-T3	104.9	79.9	230.9	175.7	220.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow		
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	487.2	468.3		

Note: The Buffington 345/138 XFMR for the outage of Pierce/Foster 345 has a flow of 514.5 MVA (103.1%) in the base case without option 4 upgrades and without Trimble Co. #2 turned on. Since the flow on this transformer is less with Trimble Co. #2 turned on and the upgrades for option 4 installed, MISO will ignore this constraint.

The Loudon (LGEE) to Avon (EKPC) tie constraint will need to be mitigated prior to this service being accepted. For this study, it was assumed a 3% reactor was installed at Avon, and the section of line containing 795 ACSR conductor was replaced with 954 ACSR conductor, to raise this line rating to alleviate constraints.

Attachment C – Trimble Co. #2 study results (75% output dispatched to LGEE) with Dynergy unit in LGEE at zero output and without upgrades installed.

Limiting Circuit	Contin.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
24952 06CLIFTY 345 24953 06CLIFTY 138 1A TR	24952 06CLIFTY 345 24953 06CLIFTY 138 1B	101.7	87.0	196.4	167.9	193.0
24952 06CLIFTY 345 24953 06CLIFTY 138 1B TR	C133-T3	113.6	96.5	176.1	149.6	155.0
24953 06CLIFTY 138 27075 11CARROL 138 1 LN	27092 11GHENT 138 27123 11NAS 138 1	102.9	89.0	216.1	186.8	210.0
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	24962 06PIERC2 345 25981 08FOSTER 345 1	104.8	98.3	522.7	490.5	499.0
25908 08BUFTN1 138 25909 08BUFTN1 345 1 TR	** Base Case **	100.2	94.0	437.0	409.9	436.0
27007 11MIDDLT 345 27119 11MIDDLT 138 1 TR	24952 06CLIFTY 345 27013 11TRIMBL 345 1	105.1	90.0	502.6	430.3	478.0
27007 11MIDDLT 345 27119 11MIDDLT 138 2 TR	27007 11MIDDLT 345 27119 11MIDDLT 138 1	109.6	103.1	523.8	493.0	478.0
27007 11MIDDLT 345 27119 11MIDDLT 138 3 TR	24952 06CLIFTY 345 27013 11TRIMBL 345 1	100.2	85.8	479.0	410.2	478.0
27015 11W LEXN 345 27153 11W LEXN 138 1 TR	27004 11BRWN N 345 27015 11W LEXN 345 1	111.0	94.9	530.8	453.4	478.0
27019 11BLUE L 161 27003 11BLUELI 345 1 TR	24952 06CLIFTY 345 27013 11TRIMBL 345 1	116.2	92.9	320.8	256.4	276.0
27019 11BLUE L 161 27003 11BLUELI 345 1 TR	** Base Case **	107.7	94.6	258.4	226.9	240.0
27019 11BLUE L 161 29248 20BLIT C 161 1 LN	24952 06CLIFTY 345 27013 11TRIMBL 345 1	131.2	104.5	313.5	249.7	239.0
27019 11BLUE L 161 29248 20BLIT C 161 1 LN	** Base Case **	105.4	92.4	251.8	220.8	239.0
27053 11AMERI 138 27097 11HAEFLI 138 1 LN	27004 11BRWN N 345 27015 11W LEXN 345 1	132.2	94.2	247.2	176.2	187.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	27005 11GHENT 345 27014 11W FRNK 345 1	140.0	115.8	189.0	156.4	135.0
27086 11FARM T 138 27336 11SHARKE 138 1 LN	C87-T3	105.1	82.0	101.9	79.5	97.0
27090 11FLEMIN 138 27157 11WEDONI 138 1 LN	C87-T3	104.5	95.0	187.0	170.1	179.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	27005 11GHENT 345 27014 11W FRNK 345 1	131.7	107.8	177.9	145.6	135.0
27091 11FFRT E 138 27148 11TYRONE 138 1 LN	C114-T3	120.6	88.0	267.7	195.3	222.0
27091 11FFRT E 138 27151 11W FRNK 138 1 LN	C114-T3	112.0	93.0	339.3	281.7	303.0
27092 11GHENT 138 27120 11MIDWAY 138 1 LN	C114-T3	124.3	99.8	217.6	174.7	175.0
27092 11GHENT 138 27128 11OC TAP 138 1 LN	C114-T3	110.7	96.1	306.6	266.1	277.0
27099 11HARDBG 138 27100 11HARDN 138 1 LN	C113-T3	110.9	95.9	279.4	241.8	252.0
27105 11KENTON 138 27157 11WEDONI 138 1 LN	C87-T3	107.7	98.2	192.7	175.7	179.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	27005 11GHENT 345 27014 11W FRNK 345 1	136.3	112.2	184.0	151.4	135.0

27113 11LOUDON 138 29202 20AVON 138 1 LN	C114-T3	147.0	112.7	421.9	323.5	287.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	** Base Case **	126.5	103.5	313.8	256.8	248.0
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN	C114-T3	116.9	93.2	204.7	163.2	175.0
27126 11OHIO C 138 27141 11SHREWS 138 1 LN	C114-T3	105.7	93.8	174.4	154.7	165.0
27132 11PISGAH 138 27153 11W LEXN 138 1 LN	27004 11BRWN N 345 27015 11W LEXN 345 1	112.8	72.9	183.9	118.8	163.0
27137 11RODBRN 138 27336 11SHARKE 138 1 LN	C87-T3	113.6	89.6	110.2	86.9	97.0

Attachment C – cont.

FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow
2483:Avon - Loudon 138 kV	Base	199.0	299.3	250.8
2198:Blue Lick 345/161 XFMR-Baker-Broad	Cont	239.0	264.2	236.1
2196:Blue Lick 345/161 XFMR	Base	239.0	251.3	222.9
9901:11BLUE_L_161_20BLIT_C_161_1 for lo	Cont	239.0	308.1	251.0
9902:11BLUE_L_161_20BLIT_C_161_1 for lo	Cont	239.0	273.0	243.1
2096:11BLUE L 161 20BLIT C 161 1	Base	239.0	251.3	222.9
65048:Buffington 345/138 Pierce-Foster 3	Cont	474.0	513.1	481.1
70084:Ghent-Owen County Tap 138 flo Ghen	Cont	277.0	283.4	259.7

Attachment D – Trimble Co. #2 study results (75% output dispatched to LGEE) with Dynergy unit in LGEE at zero output and with only 345kV upgrades installed.

Note: 345kV upgrades include a new line from Mill Creek to Hardin County, and looping Trimble County into the existing Ghent to Speed 345kV line.

Limiting Circuit	Contin.Description	% Load Post Trans	% Load Pre Trans	Post Trans Cont Flow	Pre Trans Cont Flow	Rating
27006 11HARDN 345 27100 11HARDN 138 2 TR	C113-T3	103.6	92.6	416.4	372.2	402.0
27015 11W LEXN 345 27153 11W LEXN 138 1 TR	27004 11BRWN N 345 27015 11W LEXN 345 1	105.1	88.3	502.5	422.1	478.0
27019 11BLUE L 161 29248 20BLIT C 161 1 LN	27006 11HARDN 345 27008 11MIL CK 345 O3	100.5	89.5	240.3	213.9	239.0
27053 11AMERI 138 27097 11HAEFLI 138 1 LN	27004 11BRWN N 345 27015 11W LEXN 345 1	112.9	77.6	211.2	145.1	187.0
27075 11CARROL 138 27112 11LOCKPO 138 1 LN	27005 11GHENT 345 27014 11W FRNK 345 1	130.2	108.5	175.8	146.4	135.0
27085 11ETOWN 138 27100 11HARDN 138 1 LN	27004 11BRWN N 345 27006 11HARDN 345 1	105.4	90.0	265.7	226.7	252.0
27085 11ETOWN 138 27100 11HARDN 138 1 LN	** Base Case **	112.7	99.9	230.9	204.7	205.0
27085 11ETOWN 138 27124 11NELSON 138 1 LN	C111-T3	100.1	83.3	150.2	125.0	150.0
27091 11FFRT E 138 27140 11SHADRA 138 1 LN	C115-T3	122.0	100.5	164.7	135.6	135.0
27091 11FFRT E 138 27151 11W FRNK 138 1 LN	C114-T3	101.6	84.3	308.0	255.6	303.0
27092 11GHENT 138 27120 11MIDWAY 138 1 LN	C114-T3	110.1	88.4	192.7	154.8	175.0
27092 11GHENT 138 27128 11OC TAP 138 1 LN	C114-T3	102.9	89.8	285.0	248.9	277.0
27097 11HAEFLI 138 27149 11VILEY 138 1 LN	27097 11HAEFLI 138 27153 11W LEXN 138 1	103.6	95.3	261.0	240.2	252.0
27097 11HAEFLI 138 27153 11W LEXN 138 1 LN	27149 11VILEY 138 27153 11W LEXN 138 1	103.8	96.1	290.6	269.0	280.0
27112 11LOCKPO 138 27140 11SHADRA 138 1 LN	C115-T3	126.5	104.8	170.8	141.5	135.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	C114-T3	128.1	102.1	367.7	293.1	287.0
27113 11LOUDON 138 29202 20AVON 138 1 LN	** Base Case **	110.0	92.0	272.7	228.2	248.0
27120 11MIDWAY 138 27153 11W LEXN 138 1 LN	C114-T3	102.9	81.8	180.0	143.1	175.0
27149 11VILEY 138 27153 11W LEXN 138 1 LN	27097 11HAEFLI 138 27153 11W LEXN 138 1	105.1	97.4	294.4	272.6	280.0
FGATE ID/NAME	TYPE	Rating	Post Trans Fgate Flow	Pre Trans Fgate Flow		
2483:Avon - Loudon 138 kV	Base	199.0	260.7	222.1		



Facility Study Report

*Project F012 (MISO OASIS #75052130)
750 MW LGEE. TrimbleCty to LGEE*

Prepared By

**Engineering Department
Midwest ISO
701 City Center Dr.
Carmel, IN 46032**

July 15, 2003

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1. Introduction

2. List of Assumptions

3. Construction Cost and Schedule

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ATTACHMENT 2 – Line Cost Estimates From LGEE

ATTACHMENT 3 – Line Schedules From LGEE

Executive Summary

A facility study request for transmission service in the amount of 750 MW from a generating power plant in Trimble County, KY in LGEE to LGEE was made to Midwest ISO. The MISO Transmission Service Request Number for this request is 75052130. This project is also known as Project F012. MISO has coordinated the Delivery Facility Study (the "Study") for this project and the results of the study are presented in this report.

The earlier system impact study on the delivery of power from this generator (see system impact study report on project A024 for request # 75052130 posted on MISO OASIS) has revealed that there were multiple system deficiencies. Four facility upgrade options were identified to alleviate system network problems. After further review, LGEE Transmission chose Option #4 as the preferred option. Facility upgrades related to this option have been included in this report.

The facility upgrades related to Option #4 were further split into facilities to be included in the generation interconnection study and in the delivery study. Looping of the Ghent – Speed 345 KV line through the Trimble 345 KV substation will be included as part of the generation interconnection request. The remaining facility upgrades are addressed in this delivery service request.

The total cost of upgrades/additions required for delivery of the proposed generation to LGEE has been estimated to be \$65,523,351 in 2003 dollars. This estimate does not include the looping of the Ghent – Speed 345 KV line through the Trimble 345 KV substation, but it assumes that the work is being completed under the generation interconnection request.

None of the costs identified in this report are eligible for credits.

The study has identified the key events and the schedule for those events in order to achieve a start date of January 1, 2007. The lead-time for line work related to looping of the Speed – Ghent 345 KV line through Trimble 345 KV substation has been identified as one of the longest, and must start around October 1, 2003 in order to meet the deadline. This is discussed in more detail in the generation interconnection report. A schedule of key tasks for the transmission owners for the other upgrades/installations has been prepared and included in this report.

1. Introduction

A facility study request for transmission service in the amount of 750 MW from a generating power plant in Trimble County, KY in LGEE to LGEE was made to Midwest ISO. The MISO Transmission Service Request Number for this request is 75052130. This project is also known as Project F012. MISO has coordinated the Delivery Facility Study (the "Study") for this project and the results of the study are presented in this report.

An earlier system impact study on the delivery of power from this generator (see system impact study report on project A024 for request # 75052130 posted on MISO OASIS) has revealed that there were multiple system deficiencies. Four facility upgrade options were identified to alleviate system network problems. After further review, LGEE Transmission chose Option #4 as the preferred option.

The facility upgrades related to option 4 are given below –

- Loop the existing Ghent (LGEE)-Speed (CIN) 345 kV line through the Trimble County substation. (covered in the generation interconnection study)
- Construct a 345kV line from Mill Creek to Hardin County
- Construct a 138kV line from West Lexington to Higby Mill
- Construct a 138 kV line from West Frankfort to Tyrone
- Re-conductor the 138kV line from Ghent to Owen County Tap
- Re-conductor the 138kV line from Hardin County to Etown
- Open the 69kV tie from Shelby County (EKPC) to Shelby County Tap (LGEE)

The above upgrades do not alleviate all the system overload problems. Below is a list of the remaining overloaded facilities after the implementation of option 4 along with the LGEE identified mitigation rationale:

Bus Name		Bus Name		New Ratings	Comments
11HARDN 345	TO	11HARDN 138	2	450/478	This is a new transformer scheduled to be installed in 2005.
11W FRNK 345	TO	11W FRNK 138	1	448/515	Transformer CT ratio will be reset and the low-side breaker will be replaced. Costs have been provided for this.
11W LEXN 345	TO	11W LEXN 138	1	448/478	Ratings are unchanged. The critical contingency is not valid per LGEE planning criteria.
11ADAMS 138	TO	11TYRONE 138	1	119/119	Ratings have been revised as listed.

11CARROL 138	TO	11LOCKPO 138	1	191/191	The operating limit of the conductor has been increased, and the cost to replace 600A disconnects at Carrollton have been provided.
11ETOWN 138	TO	11NELSON 138	1	202/224	The operating limit of the conductor has been increased.
11FFRT E 138	TO	11SHADRA 138	1	191/191	The operating limit of the conductor has been increased.
11GHENT 138	TO	11MIDWAY 138	1	202/224	The operating limit of the conductor has been increased.
11LOCKPO 138	TO	11SHADRA 138	1	224/224	The operating limit of the conductor has been increased.
11LOUDON 138	TO	20AVON 138	1	224/277	Ratings are unchanged. A joint study with EKPC related to the Gilbert #3 unit addition has identified installation of a 4% reactor at Avon as the solution.
11MIDWAY 138	TO	11W LEXN 138	1	202/224	The operating limit of the conductor has been increased.
11TYRONE 138	TO	11W FRNK 138	1	224/277	Conductor size of this future line has been increased.

The facility study was split into two separate studies. One related to the generation interconnection request and the other one related to the delivery request. This report covers the facility study related to the delivery request.

The looping of Ghent-Speed 345 KV line through the Trimble Co. 345 KV substation was included in the generator interconnection study, since it is the only facility required to satisfy generation interconnection criteria. The remaining facility upgrades have been addressed as part of this delivery request #75052130.

2. Assumptions

- **Start date**
The start date for this service is January 1, 2007.
- **Testing Period**
As informed by the developer, the testing period will be 6-months. All the electrical work on the transmission owners system must be ready by July 1, 2006.
- **Dollar conversion from one year to another**

All dollar figures are year end 2003 dollars. Dollar conversion rate for LG&E Energy from one year to the other has been assumed to be = 3.3% per year

- **Substation Equipment Procurement and Construction**
Procurement of substation equipment and substation construction will start 12 months before the generator in-service date.
- **10% Markup**
A 10% cost markup has been applied to all estimates.

3. Construction Cost and Schedule

For detailed substation estimates, see Attachment 1.
For detailed line estimates, see Attachment 2.
For detailed line schedules, see Attachment 3.

4. Summary of Total Cost and Schedule

Task	Cost in 2003 Dollars	Cost in 2007 Dollars
Mill Creek 345 kV Terminal Addition	\$515,874	\$587,415
Mill Creek to Hardin Co 345 kV line	\$46,558,308	\$53,014,965
Hardin Co 345 kV Terminal Addition	\$398,666	\$453,953
Tyrone 138 kV Terminal Addition	\$442,790	\$504,196
Tyrone to West Frankfort 138 kV line	\$6,261,750	\$7,130,123
West Frankfort 138 kV Terminal Addition	\$783,156	\$891,763
Higby Mill 138 kV Terminal Addition	\$234,502	\$267,022
Higby Mill to West Lexington 138 kV line	\$1,713,640	\$1,951,286
West Lexington 138 kV Terminal Addition	\$276,763	\$315,144
Reconductor Ghent to Owen Co 138 kV line	\$1,847,476	\$2,103,682
Elizabethtown 138 kV Terminal Addition	\$13,252	\$15,090
Reconductor Elizabethtown to Hardin Co 138	\$488,586	\$556,343
Carrollton Terminal Upgrade	\$31,920	\$36,347
Total	\$59,566,683	\$67,827,327
10% Markup	\$5,956,668	\$6,782,733
Grand Total	\$65,523,351	\$74,610,060

The generator requires that the work on the TO side related only to looping the Ghent-Speed 345 kV line through the Trimble County substation to be completed 6 months before the commercial operation date of January 1, 2007. All the transmission work related to the delivery request is not required until the beginning of the network service period (presently identified as January 1, 2007). Based on the individual schedules for tasks at the substations and the line work that has been presented in Section 3 of this report, the following schedule for key tasks has been prepared.

Start Date	Task/Item
30-Jun-03	Mill Creek - Hardin County Engineering Design
12-Jan-04	Mill Creek - Hardin County Right-of-Way work
5-Mar-04	Tyrone - West Frankfort Engineering Design
15-Oct-04	Tyrone - West Frankfort Right-of-Way work

30-May-05	Mill Creek - Hardin County Material Acquisition
30-May-05	Mill Creek - Hardin County Line Construction
1-Jul-05	Order all substation materials
1-Jul-05	Substation Construction Work
22-Jul-05	Tyrone - West Frankfort Material Acquisition
3-Mar-06	Tyrone - West Frankfort Line Construction

5. Review and Analysis of Delivery Evaluation Study

The purpose of this review and analysis is to adequately address all the concerns that were raised in the system impact study and establish that the new facility upgrades will work and will not deteriorate the system.

The Option 4 facilities detailed in the cost estimates above along with the subsequent modeling information provided by the TO (as well as those in Generation Interconnection Facility Report G218) were found to mitigate all constraints identified in the system impact study A024 and did not create any new limitations on the system.

6. Conclusions

The total cost of upgrades/additions required for delivery of the proposed generation to LGEE has been estimated to be \$65,523,351 in 2003 dollars. This estimate does not include the looping of the Ghent – Speed 345 KV line through the Trimble 345 KV substation, but it assumes that the work is being completed under the generation interconnection request.

None of the costs identified in this report are eligible for credits.

The study has identified the key events and the schedule for those events in order to achieve a start date of January 1, 2007. The lead-time for line work related to looping of the Speed – Ghent 345 KV line through the Trimble 345 KV substation has been identified as one of the longest, and must start around October 1, 2003 in order to meet the deadline. This is discussed in more detail in the generation interconnection report. A schedule of key tasks for the transmission owners for the other upgrades/installations has been prepared and included in this report.

Attachment 1 – Substation Cost Estimates From LGEE

See File “From LGEE - Substation Estimates and Drawings.tif”

Attachment 2 – Line Cost Estimates From LGEE

See File “From LGEE - Line Estimates.doc”

Attachment 3 – Line Schedules From LGEE

See File “TyroneWFrank.pdf”

See File “MillCreekHardinCounty.doc”

Midwest ISO (2004-11)

Final Prior Outage Report

Trimble County Generation Prior Outage Study Supplement to Facility Study F012

MISO

INTRODUCTION

TECHNICAL

Models

Event Definition

Performance Assessment

CONCLUSION

RESULTS SUMMARY

Sorted by FCITC:

Sorted by Prior Outage Facility:

RAW RESULTS

Without LGEE CBM Scenario:

With LGEE CBM Scenario:

INTRODUCTION

The Midwest ISO (MISO) requires that generation interconnection evaluation studies include an assessment of simultaneously occurring multiple contingencies to identify constraints requiring mitigation by the Customer. These contingencies are commonly known as overlapping “N-1-1” or double “N-2” contingencies. This action is consistent with MISO’s efforts to comply with NERC Planning Standard S3 of Section I regarding system adequacy and the security of electric transmission systems.

This additional study supplements the F012 transmission service facility study for the 750 MW coal-fired unit at Trimble County in LGEE’s control area (OASIS #75052130). The Customer’s obligations to mitigate identified constraints through system upgrades and/or operating restrictions are defined herein. This study should not be confused with operating studies used to define operating guides. Operating guides will be established shortly before the commercial operation of the generator and may be more or less restrictive (limitations may only be more restrictive if these further restrictions are imposed pro rata on all local generation). MISO’s Transmission System Operations Group is tasked with this responsibility.

TECHNICAL

Models

The model used for this study was the 2007 Summer peak model developed during the Delivery Study portion of the Facility Study F012, however, some topology and ratings updates were applied.

Event Definition

See Tables 1 & 2 below for the prior outage facilities and next contingency elements, respectively. All Trimble County 345 kV substation outlets have been chosen as the prior outage facilities and all branches within two buses of the Trimble County 345 kV bus have been selected as the next contingency elements.

Table 1

Code	Prior Outages
A	Trimble - Clifty 345 kV
B	Trimble - Speed 345 kV
C	Trimble - Ghent 345 kV
D	Trimble - Middleton 345 kV
E	Trimble - Buckner 345 kV
F	Trimble 345/138 kV Transformer

Table 2

Code	Next Contingencies
1	Trimble - Clifty 345 kV
2	Trimble - Speed 345 kV
3	Trimble - Ghent 345 kV
4	Trimble - Middleton 345 kV
5	Trimble - Buckner 345 kV
6	Trimble 345/138 kV Transformer
7	Clifty 345/138 kV Transformer 1A Clifty 345/138 kV Transformer 1B Clifty - M. Fort 138 kV Clifty - Carrol 138 kV Clifty - NorthS 138 kV
9	Clifty - Jeferson 345 kV
10	Clifty - Dearborn Ckt 1 345 kV
11	Clifty - Dearborn Ckt 2 345 kV
12	Clifty - Pierce Ckt 1 345 kV
13	Clifty - Pierce Ckt 2 345 kV
14	Speed - Ramsey 345 kV
15	Speed 345/138 kV Transformer
16	Ghent - Batesville 345 kV
17	Ghent - W Frankfort 345 kV
18	Ghent - W Lexington 345 kV
19	Ghent 345/138 kV Transformer 1
20	Ghent 345/138 kV Transformer 2
21	Middleton - Blue Lick 345 kV
22	Middleton - Mill Creek 345 kV
23	Middleton - Buckner 345 kV
24	Middleton 345/138 kV Transformer 1
25	Middleton 345/138 kV Transformer 2
26	Middleton 345/138 kV Transformer 3
27	Trimble - Centrf 138 kV

Performance Assessment

System adequacy was assessed based on load and generation levels set forth by the region's reliability standards.

Adequacy: Steady-state power flow analyses were completed for each of the defined event(s) and results compared to applicable operating criteria regarding facility loading. The need for mitigation is identified for event(s) where criteria are violated.

CONCLUSION

Either system upgrades are necessary to mitigate the constraints in the Results tables or an operating restriction is placed on Trimble County generation. The operating restriction will be developed such that in the event of an outage of one of the facilities in Table 1 or Table 2 above, actions will be taken to negate the effect on the system of the proposed 750 MW unit at Trimble County, up to the levels identified in the tables below. The exact actions and/or levels of reduction will be determined by MISO's Transmission System Operations Group shortly before the commercial operation of the generator and may be more or less restrictive than the levels indicated in the Results tables (limitations may only be more restrictive if these further restrictions are imposed pro rata on all local generation). Therefore, the FCITC values and unit output levels in these Results tables should be used as an indicator of possible future restrictions, not the actual restrictions themselves.

RESULTS SUMMARY

Sorted by FCITC:

FCITC of 750 MW unit under prior outage conditions	Contingency	Monitored Facility	Rating	TDF
0	A17	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.11%
0	A17	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.53%
0	A18	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.52%
0	A27	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.00%
0	A6	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.00%
0	B17	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.84%
0	B18	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.07%
0	C17	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.59%
0	D17	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.87%
0	D18	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.05%
0	D23	25386 08SPEED 345 25497 08SPEED 138 1	526.0	9.17%
0	D23	27076 11CENTRF 138 27147 11TRIMBL 138 1	215.0	4.48%
0	D23	25497 08SPEED 138 27125 11NORTHS 138 1	287.0	5.93%
0	D23	27013 11TRIMBL 345 27147 11TRIMBL 138 1	258.0	4.57%
0	D5	25386 08SPEED 345 25497 08SPEED 138 1	526.0	9.17%
0	D5	27076 11CENTRF 138 27147 11TRIMBL 138 1	215.0	4.48%
0	D5	25497 08SPEED 138 27125 11NORTHS 138 1	287.0	5.95%
0	D5	27013 11TRIMBL 345 27147 11TRIMBL 138 1	258.0	4.57%
0	E17	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.87%
0	E18	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.05%
0	F17	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.83%
0	F18	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.04%
0	F24	27007 11MIDDLT 345 27119 11MIDDLT 138 3	515.0	2.72%
0	F24	27007 11MIDDLT 345 27119 11MIDDLT 138 2	515.0	2.68%
0	F25	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	2.80%
0	F25	27007 11MIDDLT 345 27119 11MIDDLT 138 3	515.0	2.65%

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0	F26	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	2.81%
16	D17	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.85%
16	E17	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.85%
63	F17	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.81%
73	B17	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.83%
90	A3	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.56%
90	A17	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.55%
101	C17	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.57%
162	B26	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.15%
164	D17	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.84%
165	E17	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.83%
213	F17	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.80%
223	B17	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.81%
250	F26	27007 11MIDDLT 345 27119 11MIDDLT 138 2	515.0	2.64%
255	A17	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.53%
256	B25	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.12%
264	C17	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.56%
287	C26	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.24%
298	A26	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	4.56%
311	D23	25501 08GALAGH 138 27131 11P WEST 138 1	382.0	4.37%
314	D5	25501 08GALAGH 138 27131 11P WEST 138 1	382.0	4.40%
363	A25	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	4.55%
366	D18	25386 08SPEED 345 25497 08SPEED 138 1	526.0	5.27%
373	E18	25386 08SPEED 345 25497 08SPEED 138 1	526.0	5.25%
374	D18	27113 11LOUDON 138 29202 20AVON 138 1	287.0	6.83%
374	E18	27113 11LOUDON 138 29202 20AVON 138 1	287.0	6.81%
377	C25	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.21%
397	D27	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.84%
397	D6	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.84%
402	A4	25386 08SPEED 345 25497 08SPEED 138 1	526.0	8.47%
403	F23	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.84%
404	E27	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.83%

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404	E6	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.83%
405	A23	25386 08SPEED	345 25497 08SPEED	138 1	526.0	8.47%
406	A5	25386 08SPEED	345 25497 08SPEED	138 1	526.0	8.45%
438	F18	27113 11LOUDON	138 29202 20AVON	138 1	287.0	6.73%
452	B18	27113 11LOUDON	138 29202 20AVON	138 1	287.0	6.72%
455	C18	27113 11LOUDON	138 29202 20AVON	138 1	287.0	7.21%
470	D7	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.61%
473	C4	25386 08SPEED	345 25497 08SPEED	138 1	526.0	6.20%
477	E7	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.61%
477	C23	25386 08SPEED	345 25497 08SPEED	138 1	526.0	6.20%
478	C5	25386 08SPEED	345 25497 08SPEED	138 1	526.0	6.21%
596	A17	27081 11DAY-WA	138 27123 11NAS	138 1	207.0	2.72%
613	E15	27007 11MIDDLT	345 27013 11TRIMBL	345 2	1207.0	20.25%
613	D24	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.60%
616	D15	27007 11MIDDLT	345 27338 11BUCKNR	345 1	1207.0	20.25%
620	E24	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.60%
620	D15	27013 11TRIMBL	345 27338 11BUCKNR	345 1	1207.0	20.28%
629	D26	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.61%
635	D25	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.60%
637	E26	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.59%
641	E25	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.60%
644	A18	27113 11LOUDON	138 29202 20AVON	138 1	287.0	5.11%
658	A17	27081 11DAY-WA	138 27083 11DW CRN	138 1	197.0	2.72%
662	A24	27007 11MIDDLT	345 27119 11MIDDLT	138 3	515.0	4.41%
663	D17	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.85%
670	E17	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.85%
688	B24	27007 11MIDDLT	345 27119 11MIDDLT	138 3	515.0	3.04%
700	D10	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.79%
702	D16	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.55%
708	E10	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.77%
708	E16	25386 08SPEED	345 25497 08SPEED	138 1	526.0	4.55%
746	D21	25386 08SPEED	345 25497 08SPEED	138 1	526.0	5.00%

Sorted by Prior Outage Facility:

Prior Outage FCITC	Next Outage	Limiting Element	Rating	TDF
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TRIMBLE - CLIFTY 345 kV

0	Ghent-W Frankfort 345 kV	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.11%
0	Ghent-W Frankfort 345 kV	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.53%
0	Ghent-W Lexington 345 kV	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.52%
0	Trimble-Centrf 138 kV	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.00%
0	Trimble 345/138 kV Transformer	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.00%
90	Trimble-Ghent 345 kV	27161 11AIKEN 69.0 27253 11MIDDLT69.0 1	143.0	1.56%
90	Ghent-W Frankfort 345 kV	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.55%
255	Ghent-W Frankfort 345 kV	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.53%
298	Middleton 345/138 kV Transformer 3	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	4.56%
363	Middleton 345/138 kV Transformer 2	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	4.55%
402	Trimble-Middleton 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	8.47%
405	Middleton-Buckner 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	8.47%
406	Trimble-Buckner 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	8.45%
596	Ghent-W Frankfort 345 kV	27081 11DAY-WA 138 27123 11NAS 138 1	207.0	2.72%
644	Ghent-W Lexington 345 kV	27113 11LOUDON 138 29202 20AVON 138 1	287.0	5.11%
658	Ghent-W Frankfort 345 kV	27081 11DAY-WA 138 27083 11DW CRN 138 1	197.0	2.72%
662	Middleton 345/138 kV Transformer 1	27007 11MIDDLT 345 27119 11MIDDLT 138 3	515.0	4.41%

TRIMBLE - SPEED 345 kV

0	Ghent-W Frankfort 345 kV	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.84%
0	Ghent-W Lexington 345 kV	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.07%
73	Ghent-W Frankfort 345 kV	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.83%
162	Middleton 345/138 kV Transformer 3	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.15%
223	Ghent-W Frankfort 345 kV	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.81%
256	Middleton 345/138 kV Transformer 2	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.12%
452	Ghent-W Lexington 345 kV	27113 11LOUDON 138 29202 20AVON 138 1	287.0	6.72%
688	Middleton 345/138 kV Transformer 1	27007 11MIDDLT 345 27119 11MIDDLT 138 3	515.0	3.04%

TRIMBLE - GHENT 345 kV

0	Ghent-W Frankfort 345 kV	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.59%
101	Ghent-W Frankfort 345 kV	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.57%
264	Ghent-W Frankfort 345 kV	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.56%
455	Ghent-W Lexington 345 kV	27113 11LOUDON 138 29202 20AVON 138 1	287.0	7.21%
477	Middleton-Buckner 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	6.20%
377	Middleton 345/138 kV Transformer 2	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.21%
287	Middleton 345/138 kV Transformer 3	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	3.24%
473	Trimble-Middleton 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	6.20%
478	Trimble-Buckner 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	6.21%

TRIMBLE - MIDDLETON 345 kV

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0	Ghent - W Frankfort 345 kV	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.87%
0	Ghent - W Lexington 345 kV	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.05%
0	Middleton - Buckner 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	9.17%
0	Middleton - Buckner 345 kV	27076 11CENTRF 138 27147 11TRIMBL 138 1	215.0	4.48%
0	Middleton - Buckner 345 kV	25497 08SPEED 138 27125 11NORTHS 138 1	287.0	5.93%
0	Middleton - Buckner 345 kV	27013 11TRIMBL 345 27147 11TRIMBL 138 1	258.0	4.57%
0	Trimble - Buckner 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	9.17%
0	Trimble - Buckner 345 kV	27076 11CENTRF 138 27147 11TRIMBL 138 1	215.0	4.48%
0	Trimble - Buckner 345 kV	25497 08SPEED 138 27125 11NORTHS 138 1	287.0	5.95%
0	Trimble - Buckner 345 kV	27013 11TRIMBL 345 27147 11TRIMBL 138 1	258.0	4.57%
16	Ghent - W Frankfort 345 kV	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.85%
164	Ghent - W Frankfort 345 kV	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.84%
311	Middleton - Buckner 345 kV	25501 08GALAGH 138 27131 11P WEST 138 1	382.0	4.37%
314	Trimble - Buckner 345 kV	25501 08GALAGH 138 27131 11P WEST 138 1	382.0	4.40%
366	Ghent - W Lexington 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	5.27%
374	Ghent - W Lexington 345 kV	27113 11LOUDON 138 29202 20AVON 138 1	287.0	6.83%
397	Trimble - Centrf 138 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.84%
397	Trimble 345/138 kV Transformer	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.84%
470	Clifty 345/138 kV Transformer 1A Clifty 345/138 kV Transformer 1B Clifty - M. Fort 138 kV Clifty - Carrol 138 kV Clifty - NorthS 138 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.61%
613	Middleton 345/138 kV Transformer 1	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.60%
616	Speed 345/138 kV Transformer	27007 11MIDDLT 345 27338 11BUCKNR 345 1	1207.0	20.25%

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620	Speed 345/138 kV Transformer	27013 11TRIMBL 345 27338 11BUCKNR 345 1	1207.0	20.28%
629	Middleton 345/138 kV Transformer 3	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.61%
635	Middleton 345/138 kV Transformer 2	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.60%
663	Ghent - W Frankfort 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.85%
700	Clifty - Dearborn Ckt 1 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.79%
702	Ghent - Batesville 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.55%
746	Middleton - Blue Lick 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	5.00%

TRIMBLE - BUCKNER 345 kV

0	Ghent - W Frankfort 345 kV	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.87%
0	Ghent - W Lexington 345 kV	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.05%
16	Ghent - W Frankfort 345 kV	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.85%
165	Ghent - W Frankfort 345 kV	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.83%
373	Ghent - W Lexington 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	5.25%
374	Ghent - W Lexington 345 kV	27113 11LOUDON 138 29202 20AVON 138 1	287.0	6.81%
404	Trimble - Centrf 138 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.83%
404	Trimble 345/138 kV Transformer	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.83%
477	Clifty 345/138 kV Transformer 1A Clifty 345/138 kV Transformer 1B Clifty - M. Fort 138 kV Clifty - Carrol 138 kV Clifty - NorthS 138 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.61%
613	Speed 345/138 kV Transformer	27007 11MIDDLT 345 27013 11TRIMBL 345 2	1207.0	20.25%
620	Middleton 345/138 kV Transformer 1	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.60%

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637	Middleton 345/138 kV Transformer 3	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.59%
641	Middleton 345/138 kV Transformer 2	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.60%
670	Ghent - W Frankfort 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.85%
708	Clifty - Dearborn Ckt 1 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.77%
708	Ghent - Batesville 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.55%

TRIMBLE 345/138 kV TRANSFORMER

0	Ghent - W Frankfort 345 kV	27075 11CARROL 138 27112 11LOCKPO 138 1	135.0	3.83%
0	Ghent - W Lexington 345 kV	27051 11ADAMS 138 27148 11TYRONE 138 1	97.0	1.04%
0	Middleton 345/138 kV Transformer 1	27007 11MIDDLT 345 27119 11MIDDLT 138 3	515.0	2.72%
0	Middleton 345/138 kV Transformer 1	27007 11MIDDLT 345 27119 11MIDDLT 138 2	515.0	2.68%
0	Middleton 345/138 kV Transformer 2	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	2.80%
0	Middleton 345/138 kV Transformer 2	27007 11MIDDLT 345 27119 11MIDDLT 138 3	515.0	2.65%
0	Middleton 345/138 kV Transformer 3	27007 11MIDDLT 345 27119 11MIDDLT 138 1	515.0	2.81%
63	Ghent - W Frankfort 345 kV	27112 11LOCKPO 138 27140 11SHADRA 138 1	135.0	3.81%
213	Ghent - W Frankfort 345 kV	27091 11FFRT E 138 27140 11SHADRA 138 1	135.0	3.80%
250	Middleton 345/138 kV Transformer 3	27007 11MIDDLT 345 27119 11MIDDLT 138 2	515.0	2.64%
403	Middleton - Buckner 345 kV	25386 08SPEED 345 25497 08SPEED 138 1	526.0	4.84%
438	Ghent - W Lexington 345 kV	27113 11LOUDON 138 29202 20AVON 138 1	287.0	6.73%

RAW RESULTS

Without LGEE CBM Scenario:

**	From bus	** **	To bus	**	PreShift Flow	PostShift Flow	Rating	PostShift Loading%	Contingency	TDF	FCITC w/ all units on (2157 MW)
	CKT TYP										
25386	08SPEED	345 25497	08SPEED	138 1	691.4	759.6	526.0	144.4	D23	9.09%	-2569
25386	08SPEED	345 25497	08SPEED	138 1	691.4	759.6	526.0	144.4	D5	9.09%	-2569
27051	11ADAMS	138 27148	11TYRONE	138 1	116.1	125.1	97.0	129.0	A18	1.20%	-2342
27076	11CENTRF	138 27147	11TRIMBL	138 1	263.1	296.1	215.0	137.7	D23	4.40%	-1843
27076	11CENTRF	138 27147	11TRIMBL	138 1	263.1	296.1	215.0	137.7	D5	4.40%	-1843
25497	08SPEED	138 27125	11NORTHS	138 1	345.2	389.3	287.0	135.6	D5	5.88%	-1740
25497	08SPEED	138 27125	11NORTHS	138 1	345.1	389.2	287.0	135.6	D23	5.88%	-1738
27007	11MIDDLT	345 27119	11MIDDLT	138 1	539.5	559.9	515.0	108.7	F26	2.72%	-1651
27007	11MIDDLT	345 27119	11MIDDLT	138 1	536.4	556.6	515.0	108.1	F25	2.69%	-1545
27007	11MIDDLT	345 27119	11MIDDLT	138 3	523.0	542.7	515.0	105.4	F24	2.63%	-1055
27013	11TRIMBL	345 27147	11TRIMBL	138 1	268.4	302.0	258.0	117.1	D23	4.48%	-982
27013	11TRIMBL	345 27147	11TRIMBL	138 1	268.3	302.0	258.0	117.1	D5	4.49%	-979
27007	11MIDDLT	345 27119	11MIDDLT	138 2	513.3	532.7	515.0	103.4	F24	2.59%	-684
27007	11MIDDLT	345 27119	11MIDDLT	138 3	511.3	530.6	515.0	103.0	F25	2.57%	-606
27161	11AIKEN	69.0 27253	11MIDDLT	69.0 1	140.5	151.8	143.0	106.2	A3	1.51%	-584
27007	11MIDDLT	345 27119	11MIDDLT	138 1	503.7	537.3	515.0	104.3	A26	4.48%	-498
27007	11MIDDLT	345 27119	11MIDDLT	138 1	506.7	529.5	515.0	102.8	B26	3.04%	-477
27007	11MIDDLT	345 27119	11MIDDLT	138 1	500.9	534.3	515.0	103.8	A25	4.45%	-433

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27007	11MIDDLT	345	27119	11MIDDLT	138	1	503.8	526.5	515.0	102.2	B25	3.03%	-380
25386	08SPEED	345	25497	08SPEED	138	1	492.4	555.0	526.0	105.5	A4	8.35%	-347
27007	11MIDDLT	345	27119	11MIDDLT	138	2	504.8	523.8	515.0	101.7	F26	2.53%	-347
25386	08SPEED	345	25497	08SPEED	138	1	492.2	554.7	526.0	105.5	A23	8.33%	-344
25386	08SPEED	345	25497	08SPEED	138	1	492.1	554.6	526.0	105.4	A5	8.33%	-343
27075	11CARROL	138	27112	11LOCKPO	138	1	119.6	145.7	135.0	108.0	D17	3.48%	-307
27075	11CARROL	138	27112	11LOCKPO	138	1	119.6	145.7	135.0	107.9	E17	3.48%	-307
27007	11MIDDLT	345	27119	11MIDDLT	138	1	500.8	524.2	515.0	101.8	C26	3.12%	-295
27075	11CARROL	138	27112	11LOCKPO	138	1	117.9	143.7	135.0	106.4	F17	3.44%	-253
27075	11CARROL	138	27112	11LOCKPO	138	1	117.5	143.4	135.0	106.2	B17	3.45%	-243
27007	11MIDDLT	345	27119	11MIDDLT	138	1	497.9	521.3	515.0	101.2	C25	3.12%	-202
27075	11CARROL	138	27112	11LOCKPO	138	1	117.2	141.3	135.0	104.6	C17	3.21%	-196
27112	11LOCKPO	138	27140	11SHADRA	138	1	114.9	140.9	135.0	104.3	D17	3.47%	-170
27112	11LOCKPO	138	27140	11SHADRA	138	1	114.9	140.9	135.0	104.3	E17	3.47%	-170
25386	08SPEED	345	25497	08SPEED	138	1	497.0	533.6	526.0	101.4	D27	4.88%	-156
25386	08SPEED	345	25497	08SPEED	138	1	497.0	533.6	526.0	101.4	D6	4.88%	-156
27075	11CARROL	138	27112	11LOCKPO	138	1	116.4	139.8	135.0	103.6	A17	3.12%	-154
25386	08SPEED	345	25497	08SPEED	138	1	496.8	533.3	526.0	101.4	F23	4.87%	-150
25386	08SPEED	345	25497	08SPEED	138	1	496.7	533.2	526.0	101.4	E27	4.87%	-148
25386	08SPEED	345	25497	08SPEED	138	1	496.7	533.2	526.0	101.4	E6	4.87%	-148
25386	08SPEED	345	25497	08SPEED	138	1	494.4	533.6	526.0	101.4	D18	5.23%	-145
25386	08SPEED	345	25497	08SPEED	138	1	494.1	533.3	526.0	101.4	E18	5.23%	-140
27081	11DAY-WA	138	27123	11NAS	138	1	192.3	210.2	207.0	101.5	A17	2.39%	-134

Supplement to Facility Study F012

27007	11MIDDLT	345	27119	11MIDDLT	138	3	488.1	520.6	515.0	101.1	A24	4.33%	-129
27112	11LOCKPO	138	27140	11SHADRA	138	1	113.2	138.8	135.0	102.8	F17	3.41%	-111
27112	11LOCKPO	138	27140	11SHADRA	138	1	112.8	138.6	135.0	102.7	B17	3.44%	-105
25386	08SPEED	345	25497	08SPEED	138	1	484.5	530.0	526.0	100.8	C4	6.07%	-66
27081	11DAY-WA	138	27083	11DW CRN	138	1	180.7	198.5	197.0	100.8	A17	2.37%	-63
25386	08SPEED	345	25497	08SPEED	138	1	484.3	529.7	526.0	100.7	C23	6.05%	-61
25386	08SPEED	345	25497	08SPEED	138	1	484.2	529.6	526.0	100.7	C5	6.05%	-59
27112	11LOCKPO	138	27140	11SHADRA	138	1	112.5	136.4	135.0	101.1	C17	3.19%	-44
25386	08SPEED	345	25497	08SPEED	138	1	493.8	528.0	526.0	100.4	D7	4.56%	-44
25386	08SPEED	345	25497	08SPEED	138	1	493.5	527.6	526.0	100.3	E7	4.55%	-35
27091	11FFRT E	138	27140	11SHADRA	138	1	109.1	135.1	135.0	100.1	D17	3.47%	-3
27091	11FFRT E	138	27140	11SHADRA	138	1	109.1	135.1	135.0	100.1	E17	3.47%	-3

With LGEE CBM Scenario:

**	From bus	** **	To bus	**	PreShift Flow	PostShift Flow	Rating	PostShift Loading%	Contingency	TDF	FCITC w/ all units on (2157 MW)
	CKT	TYP									
25386	08SPEED	345 25497	08SPEED	138 1	711.0	779.8	526.0	148.3	D5	9.17%	-2767
25386	08SPEED	345 25497	08SPEED	138 1	710.9	779.7	526.0	148.2	D23	9.17%	-2766
27051	11ADAMS	138 27148	11TYRONE	138 1	116.0	123.9	97.0	127.8	D18	1.05%	-2554
27051	11ADAMS	138 27148	11TYRONE	138 1	116.0	123.9	97.0	127.8	E18	1.05%	-2554
27051	11ADAMS	138 27148	11TYRONE	138 1	115.5	123.5	97.0	127.4	B18	1.07%	-2484
27051	11ADAMS	138 27148	11TYRONE	138 1	115.0	122.8	97.0	126.6	F18	1.04%	-2481
27076	11CENTRF	138 27147	11TRIMBL	138 1	272.8	306.4	215.0	142.5	D23	4.48%	-2040
27076	11CENTRF	138 27147	11TRIMBL	138 1	272.7	306.3	215.0	142.5	D5	4.48%	-2038
25497	08SPEED	138 27125	11NORTHS	138 1	363.0	407.5	287.0	142.0	D23	5.93%	-2031
25497	08SPEED	138 27125	11NORTHS	138 1	363.0	407.6	287.0	142.0	D5	5.95%	-2028
27051	11ADAMS	138 27148	11TYRONE	138 1	115.9	127.3	97.0	131.2	A18	1.52%	-1993
27007	11MIDDLT	345 27119	11MIDDLT	138 1	543.5	564.6	515.0	109.6	F26	2.81%	-1763
27007	11MIDDLT	345 27119	11MIDDLT	138 1	540.3	561.3	515.0	109.0	F25	2.80%	-1654
27161	11AIKEN	69.0 27253	11MIDDLT69.0	1	147.9	155.4	143.0	108.7	A27	1.00%	-1240
27161	11AIKEN	69.0 27253	11MIDDLT69.0	1	147.9	155.4	143.0	108.7	A6	1.00%	-1240
27013	11TRIMBL	345 27147	11TRIMBL	138 1	278.2	312.5	258.0	121.1	D23	4.57%	-1192
27013	11TRIMBL	345 27147	11TRIMBL	138 1	278.2	312.5	258.0	121.1	D5	4.57%	-1192
27007	11MIDDLT	345 27119	11MIDDLT	138 3	526.8	547.2	515.0	106.2	F24	2.72%	-1184

Supplement to Facility Study F012

27161	11AIKEN	69.0	27253	11MIDDLT	69.0	1	146.4	154.7	143.0	108.2	A17	1.11%	-1057
27075	11CARROL	138	27112	11LOCKPO	138	1	139.2	168.2	135.0	124.6	D17	3.87%	-859
27075	11CARROL	138	27112	11LOCKPO	138	1	139.2	168.2	135.0	124.6	E17	3.87%	-859
27007	11MIDDLT	345	27119	11MIDDLT	138	2	517.0	537.1	515.0	104.3	F24	2.68%	-825
27075	11CARROL	138	27112	11LOCKPO	138	1	137.4	166.1	135.0	123.0	F17	3.83%	-813
27075	11CARROL	138	27112	11LOCKPO	138	1	137.0	165.8	135.0	122.8	B17	3.84%	-802
27075	11CARROL	138	27112	11LOCKPO	138	1	136.7	163.2	135.0	120.9	A17	3.53%	-798
27075	11CARROL	138	27112	11LOCKPO	138	1	136.2	163.1	135.0	120.8	C17	3.59%	-783
27007	11MIDDLT	345	27119	11MIDDLT	138	3	515.1	535.0	515.0	103.9	F25	2.65%	-754
27112	11LOCKPO	138	27140	11SHADRA	138	1	134.4	163.3	135.0	121.0	D17	3.85%	-734
27112	11LOCKPO	138	27140	11SHADRA	138	1	134.4	163.3	135.0	121.0	E17	3.85%	-734
27112	11LOCKPO	138	27140	11SHADRA	138	1	132.6	161.2	135.0	119.4	F17	3.81%	-687
27112	11LOCKPO	138	27140	11SHADRA	138	1	132.2	160.9	135.0	119.2	B17	3.83%	-677
27161	11AIKEN	69.0	27253	11MIDDLT	69.0	1	141.6	153.3	143.0	107.2	A3	1.56%	-660
27112	11LOCKPO	138	27140	11SHADRA	138	1	131.8	158.4	135.0	117.3	A17	3.55%	-660
27112	11LOCKPO	138	27140	11SHADRA	138	1	131.4	158.2	135.0	117.2	C17	3.57%	-649
27007	11MIDDLT	345	27119	11MIDDLT	138	1	509.9	533.5	515.0	103.6	B26	3.15%	-588
27091	11FFRT	E	138	27140	11SHADRA	138	1	128.7	157.5	135.0	D17	3.84%	-586
27091	11FFRT	E	138	27140	11SHADRA	138	1	128.7	157.4	135.0	E17	3.83%	-585
27091	11FFRT	E	138	27140	11SHADRA	138	1	126.9	155.4	135.0	F17	3.80%	-537
27091	11FFRT	E	138	27140	11SHADRA	138	1	126.5	155.1	135.0	B17	3.81%	-527
27007	11MIDDLT	345	27119	11MIDDLT	138	2	508.4	528.2	515.0	102.6	F26	2.64%	-500
27091	11FFRT	E	138	27140	11SHADRA	138	1	126.0	152.5	135.0	A17	3.53%	-495

Supplement to Facility Study F012

27007	11MIDDLT	345	27119	11MIDDLT	138	1	507.0	530.4	515.0	103.0	B25	3.12%	-494
27091	11FFRT E	138	27140	11SHADRA	138	1	125.6	152.3	135.0	112.8	C17	3.56%	-486
27007	11MIDDLT	345	27119	11MIDDLT	138	1	505.7	530.0	515.0	102.9	C26	3.24%	-463
27007	11MIDDLT	345	27119	11MIDDLT	138	1	501.4	535.6	515.0	104.0	A26	4.56%	-452
25501	08GALAGH	138	27131	11P WEST	138	1	368.4	401.2	382.0	105.0	D23	4.37%	-439
25501	08GALAGH	138	27131	11P WEST	138	1	368.2	401.2	382.0	105.0	D5	4.40%	-436
27007	11MIDDLT	345	27119	11MIDDLT	138	1	498.5	532.6	515.0	103.4	A25	4.55%	-387
25386	08SPEED	345	25497	08SPEED	138	1	506.7	546.2	526.0	103.8	D18	5.27%	-384
25386	08SPEED	345	25497	08SPEED	138	1	506.4	545.8	526.0	103.8	E18	5.25%	-377
27113	11LOUDON	138	29202	20AVON	138	1	261.5	312.7	287.0	109.0	D18	6.83%	-376
27113	11LOUDON	138	29202	20AVON	138	1	261.5	312.6	287.0	108.9	E18	6.81%	-376
27007	11MIDDLT	345	27119	11MIDDLT	138	1	502.9	527.0	515.0	102.3	C25	3.21%	-373
25386	08SPEED	345	25497	08SPEED	138	1	506.8	543.1	526.0	103.3	D27	4.84%	-353
25386	08SPEED	345	25497	08SPEED	138	1	506.8	543.1	526.0	103.3	D6	4.84%	-353
25386	08SPEED	345	25497	08SPEED	138	1	492.0	555.5	526.0	105.6	A4	8.47%	-348
25386	08SPEED	345	25497	08SPEED	138	1	506.5	542.8	526.0	103.2	F23	4.84%	-347
25386	08SPEED	345	25497	08SPEED	138	1	506.5	542.7	526.0	103.2	E27	4.83%	-346
25386	08SPEED	345	25497	08SPEED	138	1	506.5	542.7	526.0	103.2	E6	4.83%	-346
25386	08SPEED	345	25497	08SPEED	138	1	491.7	555.2	526.0	105.5	A23	8.47%	-345
25386	08SPEED	345	25497	08SPEED	138	1	491.7	555.1	526.0	105.5	A5	8.45%	-344
27113	11LOUDON	138	29202	20AVON	138	1	257.5	308.0	287.0	107.3	F18	6.73%	-312
27113	11LOUDON	138	29202	20AVON	138	1	256.6	307.0	287.0	107.0	B18	6.72%	-298
27113	11LOUDON	138	29202	20AVON	138	1	254.2	308.3	287.0	107.4	C18	7.21%	-295

Supplement to Facility Study F012

25386	08SPEED	345	25497	08SPEED	138	1	504.3	538.9	526.0	102.5	D7	4.61%	-280
25386	08SPEED	345	25497	08SPEED	138	1	496.7	543.2	526.0	103.3	C4	6.20%	-277
25386	08SPEED	345	25497	08SPEED	138	1	504.0	538.6	526.0	102.4	E7	4.61%	-273
25386	08SPEED	345	25497	08SPEED	138	1	496.4	542.9	526.0	103.2	C23	6.20%	-273
25386	08SPEED	345	25497	08SPEED	138	1	496.3	542.9	526.0	103.2	C5	6.21%	-272
27081	11DAY-WA	138	27123	11NAS	138	1	190.8	211.2	207.0	102.0	A17	2.72%	-154
27007	11MIDDLT	345	27013	11TRIMBL	345	2	1082.9	1234.8	1207.0	102.3	E15	20.25%	-137
25386	08SPEED	345	25497	08SPEED	138	1	497.8	532.3	526.0	101.2	D24	4.60%	-137
27007	11MIDDLT	345	27338	11BUCKNR	345	1	1082.3	1234.2	1207.0	102.3	D15	20.25%	-134
25386	08SPEED	345	25497	08SPEED	138	1	497.5	532.0	526.0	101.1	E24	4.60%	-130
27013	11TRIMBL	345	27338	11BUCKNR	345	1	1081.2	1233.3	1207.0	102.2	D15	20.28%	-130
25386	08SPEED	345	25497	08SPEED	138	1	497.0	531.6	526.0	101.1	D26	4.61%	-121
25386	08SPEED	345	25497	08SPEED	138	1	496.8	531.3	526.0	101.0	D25	4.60%	-115
25386	08SPEED	345	25497	08SPEED	138	1	496.8	531.2	526.0	101.0	E26	4.59%	-113
25386	08SPEED	345	25497	08SPEED	138	1	496.5	531.0	526.0	100.9	E25	4.60%	-109
27113	11LOUDON	138	29202	20AVON	138	1	254.1	292.4	287.0	101.9	A18	5.11%	-106
27081	11DAY-WA	138	27083	11DW CRN	138	1	179.1	199.5	197.0	101.2	A17	2.72%	-92
27007	11MIDDLT	345	27119	11MIDDLT	138	3	485.8	518.9	515.0	100.8	A24	4.41%	-88
25386	08SPEED	345	25497	08SPEED	138	1	493.8	530.2	526.0	100.8	D17	4.85%	-87
25386	08SPEED	345	25497	08SPEED	138	1	493.5	529.9	526.0	100.7	E17	4.85%	-80
27007	11MIDDLT	345	27119	11MIDDLT	138	3	494.1	516.9	515.0	100.4	B24	3.04%	-62
25386	08SPEED	345	25497	08SPEED	138	1	492.5	528.4	526.0	100.4	D10	4.79%	-50
25386	08SPEED	345	25497	08SPEED	138	1	494.1	528.2	526.0	100.4	D16	4.55%	-48

Supplement to Facility Study F012

25386	08SPEED	345	25497	08SPEED	138	1	492.2	528.0	526.0	100.4	E10	4.77%	-42
25386	08SPEED	345	25497	08SPEED	138	1	493.8	527.9	526.0	100.4	E16	4.55%	-42
25386	08SPEED	345	25497	08SPEED	138	1	488.7	526.2	526.0	100.0	D21	5.00%	-4

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*System Impact Study (MISO Project Code: A091)
For MISO OASIS Reservation #75230122
For Firm Network Service*

****Updated September 10th, 2004****

Final SIS Report (MISO Project Code: A091)

1.0 Introduction

Illinois Municipal Electric Agency (IMEA) has requested a system impact study for the MISO OASIS request 75230122, which is a long-term, firm, network transmission service request to serve loads within the IP control area. Resources in the LGE control area are to be used to serve the requested capacity of 91 MW. The requested period is from 01/01/2007 to 01/01/2020. The principal objective of this study is to identify the constraints limiting the above transmission service request for the specified time period.

2.0 Models Used for Study

The chosen base case models were modified to reflect the most current modeling information and the applicable transfer data for the selected study period based on the queue priority. MISO summer peak models for 2007 and 2009 were used for the study. Generators were dispatched based on information from the surrounding transmission companies.

The monthly and yearly firm, confirmed reservations were included in the models. There are no study reservations with a prior queue time that had a significant effect on this transaction. Because of this, no study reservations were included in the study. In order to review a worst case situation, a scenario with select counter-flows removed was also studied. The counter-flows removed for this study were: 2-51MW requests IP-AEP, 4-53MW requests IP-AEP, and 1-12MW request SIGE-OVEC.

To account for LGE's planning criteria of any single branch outage in conjunction with a unit outage, an n-1 analysis was done on three separate models. Each model had one of the following base case conditions: outage of the Brown 3 unit, outage of the Cane Run 6 unit, and outage of the Mill Creek 4 unit. In all cases, the replacement power was imported to LGE from CIN and NIPS.

Trimble County unit #2 (facility study in progress) has been included in all studies at 562 MW (75% capacity) due to the fact that the requested reservation is sourced from that unit. Upgrades/additions associated with the unit have been included in the model. These system upgrades were found to be necessary when TC unit #2 is generating at 100% capacity (750 MW), as well as at 75% (562 MW) capacity serving LGE native load. Any outcome of this study will be dependent upon those upgrades being completed by the start of this service.

Other than the TC unit #2 mentioned above, all existing and planned generation at Trimble County was turned on and generating at PMAX for this study. This includes one existing 495 MW unit, two existing 152 MW CT's, and four planned 152 MW CT's.

3.0 Contingencies and Flowgates

The MISO contingency and flowgate lists were used for the flowgate and contingency analyses. These include MAPP/MAIN contingencies and flowgates as well. Also, the outage of any single branch in any control area was analyzed. A 3% TDF cutoff was used for the OTDF flowgates and branch overloads. The cutoff TDF for PTDF flowgates was at 5%. A 2% TDF cutoff was used to screen violations on non-MISO MAPP facilities. Branch loadings were monitored using Rate A for normal conditions and Rate B, the emergency rating, under contingencies.

4.0 Study Methodology

The study approach involves an n-1, AC contingency analysis and a flowgate analysis that examine the contingency and flowgate violations for the requested transfer.

The requested network service is to serve 91 MW of load in IP from a new 750 MW coal plant in Trimble County. Given below are the scenarios and models used for the evaluation. The limiting facilities are listed in the constraint summary tables.

Source: 91 MW transfer amount is sourced from the 750 MW Trimble County Unit #2
Sink: Available IP generation based on a merit order dispatch

Models:

- 1) & 5) 2007 & 2009 Base Case
- 2) & 6) 2007 & 2009 Base with the outage of Brown 3
- 3) & 7) 2007 & 2009 Base with the outage of Cane Run 6
- 4) & 8) 2007 & 2009 Base with the outage of Mill Creek 4

Scenarios:

- A) All monthly and yearly firm, confirmed reservations
- B) All monthly and yearly firm, confirmed reservations and selected counter-flows removed

5.0 Network Study Results

No overloads or limiting constraints over the TDF cutoff were identified in either of the two scenarios in any of the eight models. For informational purposes, see the table below for constraints under the TDF cutoff.

Model-Scenario	TDF	Constrained Facility	Contingency Description	CA	ATC	Existing Rating	Comments
All	1.10%	BUFFINGTON 138/345 Trans.	PIERCE – FOSTER 345	CIN	0	454	Under TDF
All	2.60%	11HARDN 138/345 Trans. 1	11HARDN 138/345 Trans. 2	LGEE	0	316	Under TDF
5-B,6-B,7-A,7-B	2.20%	MIDDLTN 138/345 Trans. 1	MIDDLTN 138/345 Trans. 3	LGEE	0	515	Under TDF
7-A,7-B,8-A,8-B	1.40%	MIDDLTN – 3842 T 138	BLUELI 345/138 Trans. BLUELI – MIDDLT 345	LGEE	0	287	Under TDF

6.0 Flow based Study Results

MISO's flow based process is limited to calculating AFC's for the next 36 months into the future. Because the requested start date of this service is 01/01/2007, no flow based results will be analyzed.

7.0 Conclusion

No constraints were found in the network study of the years 2007 and 2009. Therefore, MISO recommends that this request be accepted, conditional upon completion of the upgrades listed below that were identified in the impact study A024 and facility study F012, the completion of a prior outage study as part of facility study F012, and upon receipt of the long-term transaction specification sheets.

- Loop the existing Ghent (LGEE)-Speed (CIN) 345 kV line through the Trimble County substation
- Construct a 345kV line from Mill Creek to Hardin County
- Construct a 138kV line from West Lexington to Higby Mill
- Construct a 138 kV line from West Frankfort to Tyrone
- Re-conductor the 138kV line from Ghent to Owen County Tap
- Re-conductor the 138kV line from Hardin County to Etown
- Open the 69kV tie from Shelby County (EKPC) to Shelby County Tap (LGEE)
- Reset transformer CT ratio and replace low-side breaker at W Frankfort
- Replace 600A disconnects at Carrollton



*System Impact Study (MISO Project Code: A099)
For MISO OASIS Reservation #75293633
For Firm Point-to-Point Service*

****Updated September 10th, 2004****

Final SIS Report (MISO Project Code: A099)

1.0 Introduction

Indiana Municipal Power Agency (IMPA) has requested a system impact study for the MISO OASIS request 75293633, which is a long-term, firm, point-to-point transmission service request to serve loads within the CIN control area. Resources in the LGEE control area are to be used to serve the requested capacity of 97 MW. The requested period is from 01/01/2008 to 01/01/2027. The principal objective of this study is to identify the constraints limiting the above transmission service request for the specified time period.

2.0 Models Used for Study

The chosen base case models were modified to reflect the most current modeling information and the applicable transfer data for the selected study period based on the queue priority. MISO summer peak models for 2007 and 2009 were used for the study. Generators were dispatched based on information from the surrounding transmission companies.

The monthly and yearly firm, confirmed reservations were included in the models. Study reservations with a prior queue time that had a significant effect on this transaction were included. The only request of this type is a study request for 91 MW from LGEE-IP.

In order to review a worst case situation, a scenario with select counter-flows removed was also studied. The counter-flows removed for this study were: 2-51MW requests IP-AEP, 4-53MW requests IP-AEP, and 1-12MW request SIGE-OVEC.

To account for LGE's planning criteria of any single branch outage in conjunction with a unit outage, an n-1 analysis was done on three additional models. Each model had one of the following base case conditions: outage of the Brown 3 unit, outage of the Cane Run 6 unit, and outage of the Mill Creek 4 unit. With the outage of the Brown 3 unit, the replacement power was imported to LGEE from CIN & NIPS. With the outages of Cane Run 6 and Mill Creek 4, the replacement power was imported to LGEE from TVA.

Trimble County unit #2 (facility study in progress) has been included in all studies at 562 MW (75% capacity) due to the fact that the requested reservation is sourced from that unit. Upgrades/additions associated with the unit have been included in the model. These system upgrades were found to be necessary when TC unit #2 is generating at 100% capacity (750 MW), as well as at 75% (562 MW) capacity serving LGEE native load. Any outcome of this study will be dependent upon those upgrades being completed by the start of this service.

Other than the TC unit #2 mentioned above, all existing and planned generation at Trimble County was turned on and generating at PMAX for this study. This includes one existing 495 MW unit, two existing 152 MW CT's, and four planned 152 MW CT's.

3.0 Contingencies and Flowgates

The MISO contingency and flowgate lists were used for the flowgate and contingency analyses. These include MAPP/MAIN contingencies and flowgates as well. Also, the outage of any single branch in any control area was analyzed. A 3% TDF cutoff was used for the OTDF flowgates and branch overloads. The cutoff TDF for PTFDF flowgates was at 5%. A 2% TDF cutoff was used to screen violations on non-

MISO MAPP facilities. Branch loadings were monitored using Rate A for normal conditions and Rate B, the emergency rating, under contingencies.

4.0 CBM and TRM

Cinergy's CBM requirement was modeled for this study. Cinergy unit Gibson 5 (630 MW) was taken offline and the power was imported from the interconnected control areas in the following portions: AEP, 256 MW; AMRN, 119 MW; DPL, 40 MW; EKPC, 20 MW; HE, 13 MW; IPL, 32 MW; LGEE, 71 MW; NIPS, 36 MW; OVEC, 23 MW; and SIGE, 20.

TRM was modeled in the n-1 study according to the latest information that the MISO has for each control area (0 TRM for both LGEE and CIN). In the analysis of flowgates, the TRM was built into the flowgate ratings.

5.0 Study Methodology

The study approach involves an n-1, AC contingency analysis and a flowgate analysis that examine the contingency and flowgate violations for the requested transfer.

The requested point-to-point service is to serve 97 MW of load in CIN from a new 750 MW coal plant in Trimble County. Given below are the scenarios and models used for the evaluation. The limiting facilities are listed in the constraint summary tables.

Source: 97 MW transfer amount is sourced from the 750 MW Trimble County Unit #2

Sink: All CIN generation except for base loaded units

Models:

- 1) & 5) 2007 & 2009 Base Case
- 2) & 6) 2007 & 2009 Base with the outage of Brown 3
- 3) & 7) 2007 & 2009 Base with the outage of Cane Run 6
- 4) & 8) 2007 & 2009 Base with the outage of Mill Creek 4

Scenarios:

- A) All monthly and yearly firm confirmed reservations
- B) All monthly and yearly firm confirmed reservations and selected counter-flows removed
- C) All monthly and yearly firm confirmed reservations, and Cinergy CBM modeled
- D) All monthly and yearly firm confirmed reservations, selected counter-flows removed, and Cinergy CBM modeled

6.0 Network Study Results

Summary of Constraints:

Model-Scenario	TDF	Constrained Facility	Contingency Description	CA	ATC	Existing Rating	Comments
All 2007 Models	3.6-3.9%	BUFFINGTON 138/345 Trans.	PIERCE – FOSTER 345	CIN	0	454	Flowgate**
All 2009 Models	3.0-3.2%	BUFFINGTON 138/345 Trans.	PIERCE – FOSTER 345	CIN	0	454	Flowgate**

**A 2nd 345/138 kV transformer is to be installed at the Buffington substation, which will mitigate the overload on the existing transformer, thereby removing this flowgate as a constraint to this transfer.

For informational purposes, see the table below for constraints under the TDF cutoff.

Model-Scenario	TDF	Constrained Facility	Contingency Description	CA	ATC	Existing Rating	Comments
All 2009 Models	1.6%	11HARDN 138/345 Trans. 1	11HARDN 138/345 Trans. 2	LGEE	0	316	Under TDF
3-C,3-D,All 2009	2.8%	MIDDLTN 138/345 Trans. 1	MIDDLTN 138/345 Trans. 3	LGEE	0	515	Under TDF
All 2009 Models	1.6%	MIDDLTN – 3842 T 138	BLUELI 345/138 Trans. BLUELI – MIDDLET 345	LGEE	0	287	Under TDF

7.0 Flow based Study Results

MISO's flow based process is limited to calculating AFC's for the next 36 months into the future. Because the requested start date of this service is 01/01/2008, no flow based results will be analyzed.

8.0 Conclusion

No valid constraints were found in the network study of the years 2007 and 2009. Therefore, MISO recommends that this request be accepted, conditional upon completion of the upgrades listed below that were identified in the impact study A024 and facility study F012, the installation of a 2nd 345/138 kV transformer at the Buffington substation, the completion of a prior outage study as part of facility study F012, and upon receipt of the long-term transaction specification sheets.

- Loop the existing Ghent (LGEE)-Speed (CIN) 345 kV line through the Trimble County substation
- Construct a 345kV line from Mill Creek to Hardin County
- Construct a 138kV line from West Lexington to Higby Mill
- Construct a 138 kV line from West Frankfort to Tyrone
- Re-conductor the 138kV line from Ghent to Owen County Tap
- Re-conductor the 138kV line from Hardin County to Etown
- Open the 69kV tie from Shelby County (EKPC) to Shelby County Tap (LGEE)
- Reset transformer CT ratio and replace low-side breaker at W Frankfort
- Replace 600A disconnects at Carrollton