

**LOUISVILLE GAS AND ELECTRIC COMPANY  
KENTUCKY UTILITIES COMPANY**

**CASE NO. 2005-00142**

**CASE NO. 2005-00154**

**CASE NO. 2005-00155**

**Response to Commission Staff's First Data Request  
Dated: June 30, 2005**

**Question No. 18**

**Responding Witness: Michael G. Toll**

Q-18. Explain how the MISO loadflow and stability studies ensure compliance with ECAR and LG&E/KU reliability criteria.

A-18. Please see the attached documents provided by the MISO.

**MISO’s response to LGEE/KPSC Q# 18-20**

**Question #18 - Explain how the MISO loadflow and stability studies ensure compliance with ECAR and LGEE/KU reliability criteria.**

**MISO Response -**

**LG&E Energy Reliability Criteria  
((From FERC Form No. 715 dated April 1, 2005))**

Contingencies	System Limits or Impacts		
	Thermal Limits	Voltage Limits	Loss of Demand Or Curtailed Firm Transfers
No Contingencies	Normal	Normal	No
A Outage of a generator, transmission circuit or transformer.	Emergency	Contingency	No
B Outage of two generators.	Emergency	Contingency	No
B Outage of a generator and a transmission circuit.	Emergency	Contingency	No
B Outage of a generator and a transformer.	Emergency	Contingency	No
C Outage of two transmission circuits.	Emergency	Contingency	Yes
C Outage of a transmission circuit and a transformer.	Emergency	Contingency	Yes
C Outage of two transformers.	Emergency	Contingency	Yes
D Outage of a bus section.	Emergency	Contingency	Yes
E Outage of a breaker.	Emergency	Contingency	Yes
F Outage of a double circuit towerline.	Emergency	Contingency	Yes
G Outage of a generator, transmission circuit, transformer or bus section.	Emergency	Contingency	Yes

A – N-1 analysis on all generators, circuits, and transformers within the STUDY area (defined as MISO and MISO-adjacent control areas)

B – First, this study addressed the scenario which is generally considered to be the worst case by removing the Brown 3 unit from the base case and then considering N-1 scenarios as described in “A”. These assumptions were validated in subsequent studies A091 and A099 dated September 10<sup>th</sup>, 2004 (see APPENDIX A) wherein additional scenarios were analyzed by performing N-1 analysis on two separate cases: an outage of the Mill Creek 4 unit and an outage of the Cane Run 6 unit. Also, these studies incorporated each transmission owners CBM margins in the flowgate analysis to ensure adequate capacity in the event of loss of generation. Both subsequent studies utilized the 2007 model that was analyzed in A024 as well as a newer 2009 model for all scenarios. Neither study found additional constraints.

C – This was analyzed in the portion of the generation interconnection (GI) study that evaluates potential cascading outages. Additionally, multiple worst case scenarios

were analyzed in the prior outage study that was performed as a supplement to Facility Study F012. This supplemental report has been enclosed as Appendix B – Trimble County Generation Prior Outage Study – A supplement to Facility Study F012 Dated November 2004)

- D – Worst case scenarios were analyzed as part of the stability analysis in the GI study. Furthermore, the LG&E 345 kV system utilizes breaker and a half or “ring bus” design and, as a result, a bus fault results in no more than one element out a time. Therefore, a bus fault on the 345 kV system is encompassed within other contingency analysis’ performed.
  - E – Analyzed in the Delivery and GI studies via the N-1 analysis, utilization of the ECAR contingency lists, and the stability analysis.
  - F – Evaluated via the inclusion of the ECAR contingency lists in applicable studies.
  - G – Selected severe contingencies were analyzed (i.e. 3 phase faults, stuck breaker)
- Note: While not every scenario involving the above can be rigorously analyzed in the Delivery and GI study process, they are evaluated in the MISO Expansion Planning process. Also, the utilization of the various reliability margins (i.e. TRM and CBM) for the control areas involved ensures compliance with applicable criteria.

**APPENDIX A**

1. Final SIS Report for A099
2. Final SIS Report for A091



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

**\*\*Updated September 10<sup>th</sup>, 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 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 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 2<sup>nd</sup> 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 – MIDDLT 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 2<sup>nd</sup> 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





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

**\*\*Updated September 10<sup>th</sup>, 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

**APPENDIX B**

**Trimble County Generation Prior Outage Study – A supplement to Facility  
Study F012 Dated November 2004**

# Midwest ISO (2004-11)

---

*Final Prior Outage Report*

## **Trimble County Generation Prior Outage Study Supplement to Facility Study F012**

---

The logo for the Midwest Independent System Operator (MISO) is displayed in a bold, italicized, sans-serif font. The letters are black with a white outline, and the entire logo is underlined with a double-line effect.

**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.



Supplement to Facility Study F012

## 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.

## Supplement to Facility Study F012

**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%

## Supplement to Facility Study F012

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%

## Supplement to Facility Study F012

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%

Supplement to Facility Study F012

**Sorted by Prior Outage Facility:**

Prior Outage FCITC	Next Outage	Limiting Element	Rating	TDF
<b>TRIMBLE - CLIFTY 345 kV</b>				
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%

Supplement to Facility Study F012

**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**



Supplement to Facility Study F012

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%

Supplement to Facility Study F012

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 - Centif 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%

Supplement to Facility Study F012

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	Cliffy - 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%

Supplement to Facility Study F012

RAW RESULTS

Without LGEE CBM Scenario:

** From bus	** ** ** To bus	** ** ** CKT TYP	PreShift Flow	PostShift Flow	Rating	PostShift Loading%	Contingency	TDF	FCITC w/ all units on (2157 MW)
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

Supplement to Facility Study F012

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	E17	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

Supplement to Facility Study F012

With LGEE CBM Scenario:

** From bus	** ** ** To bus	** ** ** CKT TYP	Preshift Flow	PostShift Flow	Rating	PostShift Loading%	Contingency	TDF	FCITC w/ all units on (2157 MW)
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 11MIDDLT69.0 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 11MIDDLT69.0 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	116.6	D17	3.84%	-586
27091	11FFRT E 138 27140 11SHADRA 138 1	128.7	157.4	135.0	116.6	E17	3.83%	-585
27091	11FFRT E 138 27140 11SHADRA 138 1	126.9	155.4	135.0	115.1	F17	3.80%	-537
27091	11FFRT E 138 27140 11SHADRA 138 1	126.5	155.1	135.0	114.9	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	112.9	A17	3.53%	-495



Supplement to Facility Study F012

27007	11MIDDLT	345	27119	11MIDDLT	138	1	507.0	530.4	515.0	103.0	E25	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

###



**LOUISVILLE GAS AND ELECTRIC COMPANY  
KENTUCKY UTILITIES COMPANY**

**CASE NO. 2005-00142**

**CASE NO. 2005-00154**

**CASE NO. 2005-00155**

**Response to Commission Staff's First Data Request  
Dated: June 30, 2005**

**Question No. 19**

**Responding Witness: Michael G. Toll**

- Q-19. Provide support for the assertion that the same facilities required for 100 percent delivery of the Trimble #2 generating plant to LG&E/KU are required for 75 percent delivery of the Trimble #2 generating plant to LG&E/KU, including the critical contingencies that each project addresses.
- A-19. Please see the attached documents provided by the MISO.

**Question #19 - Provide support for the assertion that the same facilities required for 100% delivery of TC2 to LG&E/KU are required for 75% delivery of TC2 to LG&E/KU including the critical contingencies that each project address**

**MISO Response**

The limiting circuits shown below are constraints to Trimble County Unit 2 at both the 75% and the 100% level. As shown, all three of the new facilities are required to mitigate all of the overloads.

Constraints and Mitigation with TC2 at 75% to LG&E										
Limiting Circuit				Contingency		Mitigated By				
27137	11RODBRN	138	27336	11SHARKE	138	1	C87-T3	A		
27126	11OHIO	C	138	27141	11SHREWS	138	1	C113-T3	A	
27091	11FFRT	E	138	27151	11W FRNK	138	1	C114-T3	C	
27091	11FFRT	E	138	27148	11TYRONE	138	1	C114-T3	C,A	
27086	11FARM	T	138	27336	11SHARKE	138	1	C87-T3	C,A	
27019	11BLUE	L	161	29248	20BLIT	C	161	1	Clify to Trimble 345 kV	A,B
27019	11BLUE	L	161	27003	11BLUELI	345	1	Clify to Trimble 345 kV	A,B	
27007	11MIDDLT	345	27119	11MIDDLT	138	3	Middletown 345/138 kV Trans. #1	B		
27007	11MIDDLT	345	27119	11MIDDLT	138	2	Middletown 345/138 kV Trans. #1	B		
27007	11MIDDLT	345	27119	11MIDDLT	138	1	Clify to Trimble 345 kV	A		
24953	06CLIFTY	138	27075	11CARROL	138	1	Ghent to NAS 138 kV	A,B		
24952	06CLIFTY	345	24953	06CLIFTY	138	1B	C133-T3	B		
24952	06CLIFTY	345	24953	06CLIFTY	138	1A	Clify 345/138 kV Trans.	A,B		

Line A = Mill Creek to Hardin County 345 KV Line (Case No. 2005-00142)  
Line B = Trimble County to Indiana 345 KV Line (Case No. 2005-00155)  
Line C = West Frankfort to Tyrone 138 KV Line (Case No. 2005-00154)



**LOUISVILLE GAS AND ELECTRIC COMPANY  
KENTUCKY UTILITIES COMPANY**

**CASE NO. 2005-00142**

**CASE NO. 2005-00154**

**CASE NO. 2005-00155**

**Response to Commission Staff's First Data Request  
Dated: June 30, 2005**

**Question No. 20**

**Responding Witness: Michael G. Toll**

- Q-20. Provide load flow plots for the base case and for each of the four options evaluated.
- A-20. Please see the attached documents provided by the MISO.



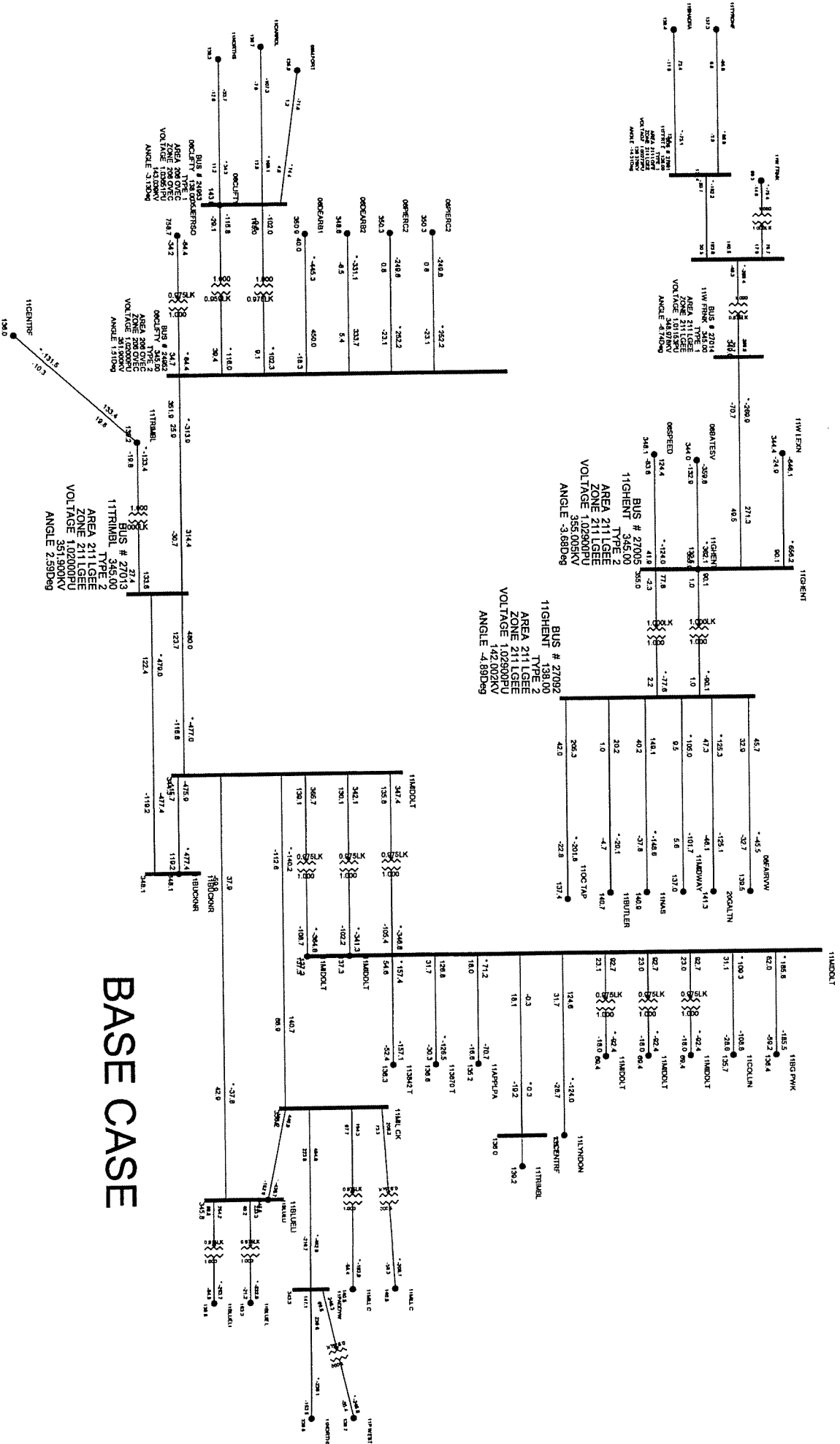
**Question #20 - Provide loadflow plots for the base case and for each of the four (4) options evaluated.**

**MISO Response -**

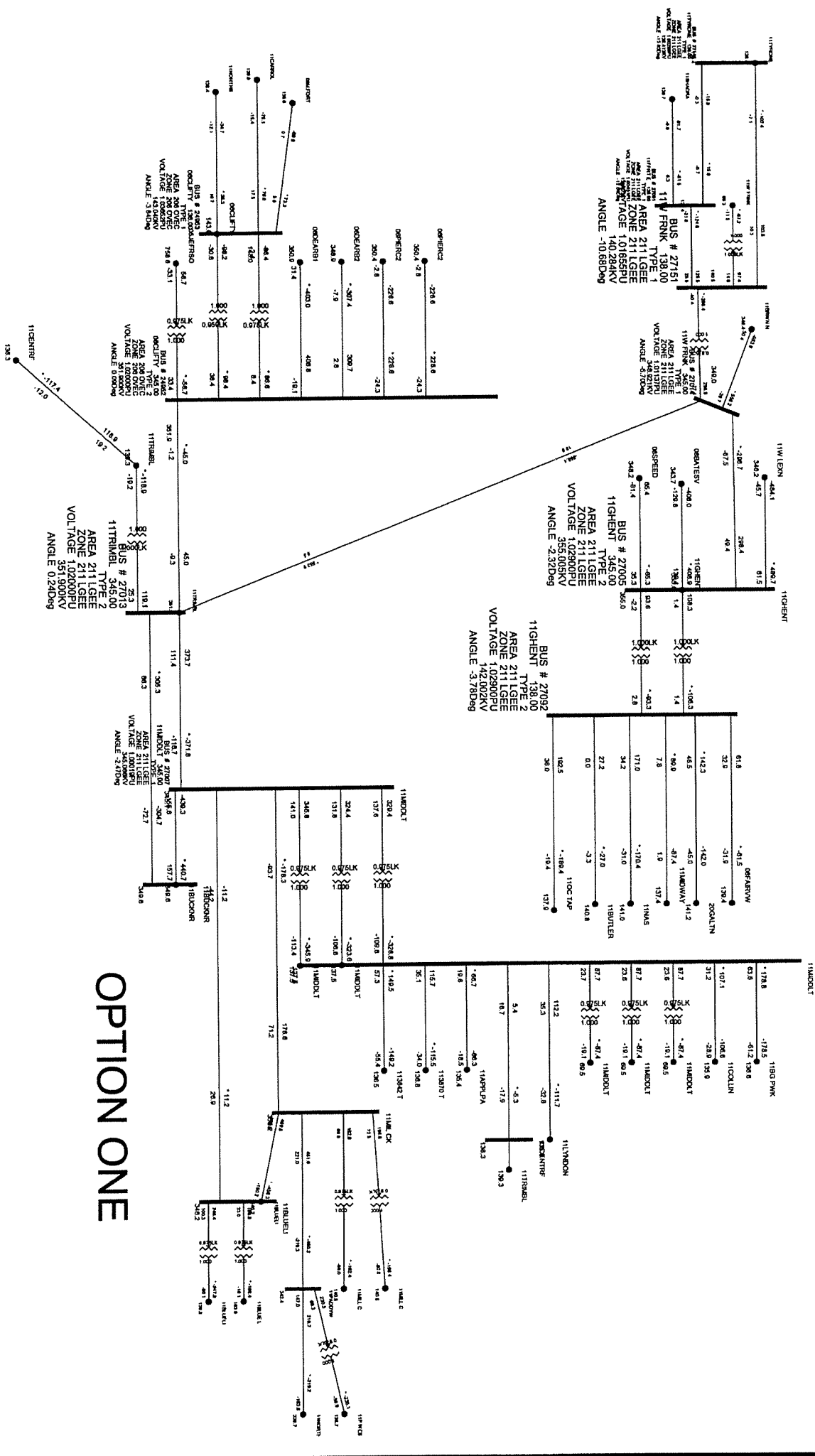
Loadflow plots for the base case and for each of the four (4) options evaluated have been included as APPENDIX C.

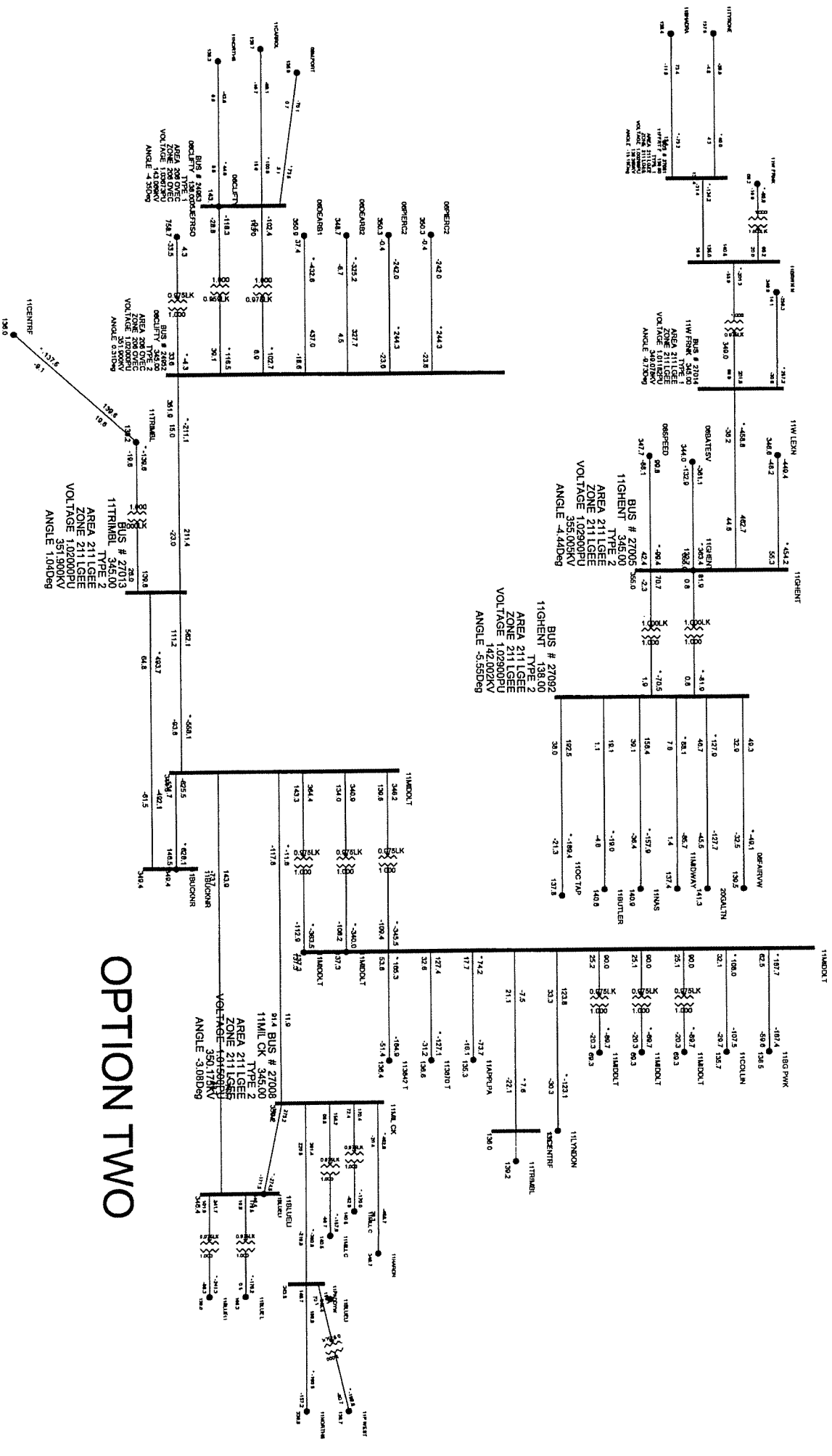
## **APPENDIX C**

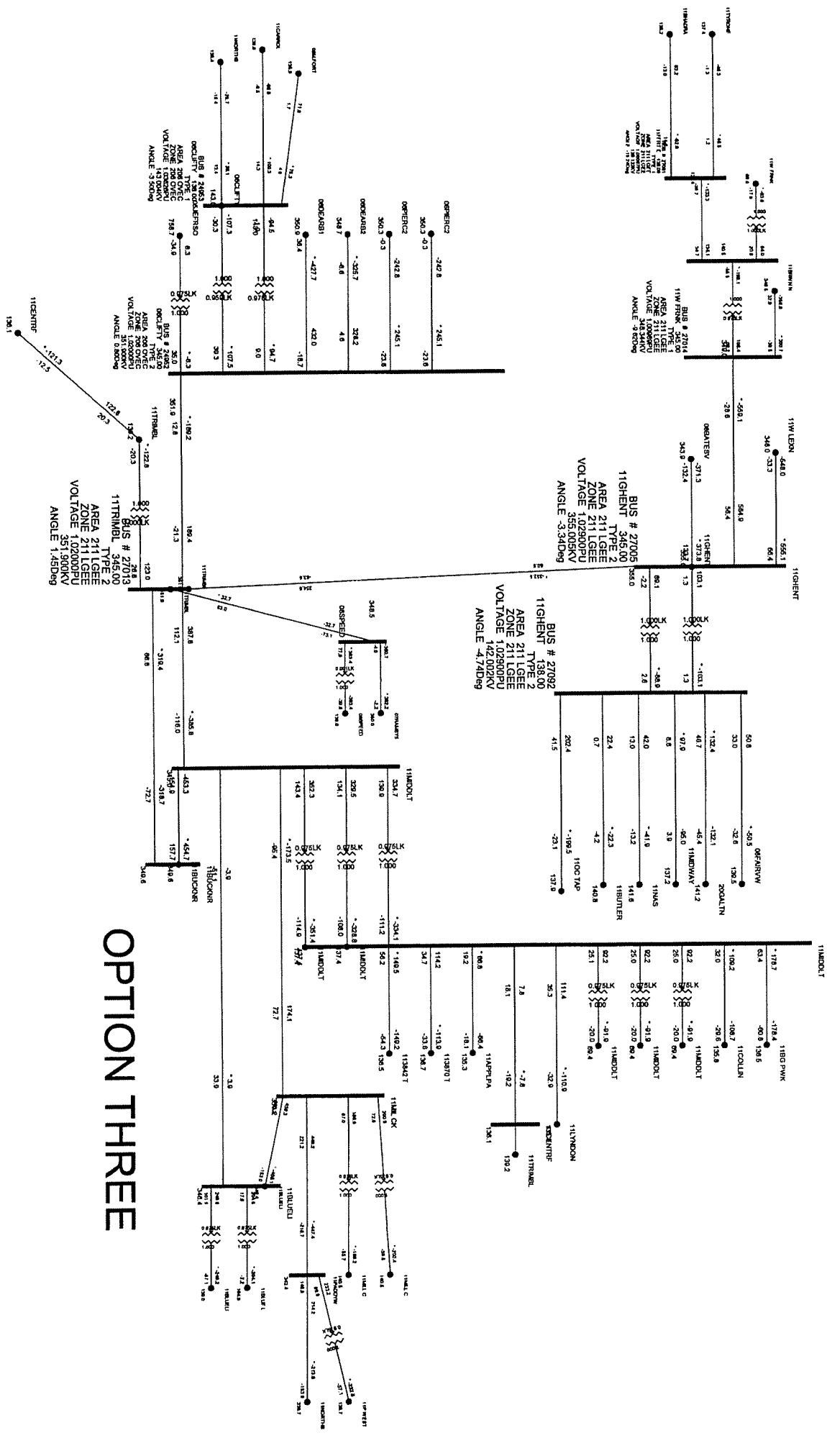
### **Loadflow One-line diagrams**



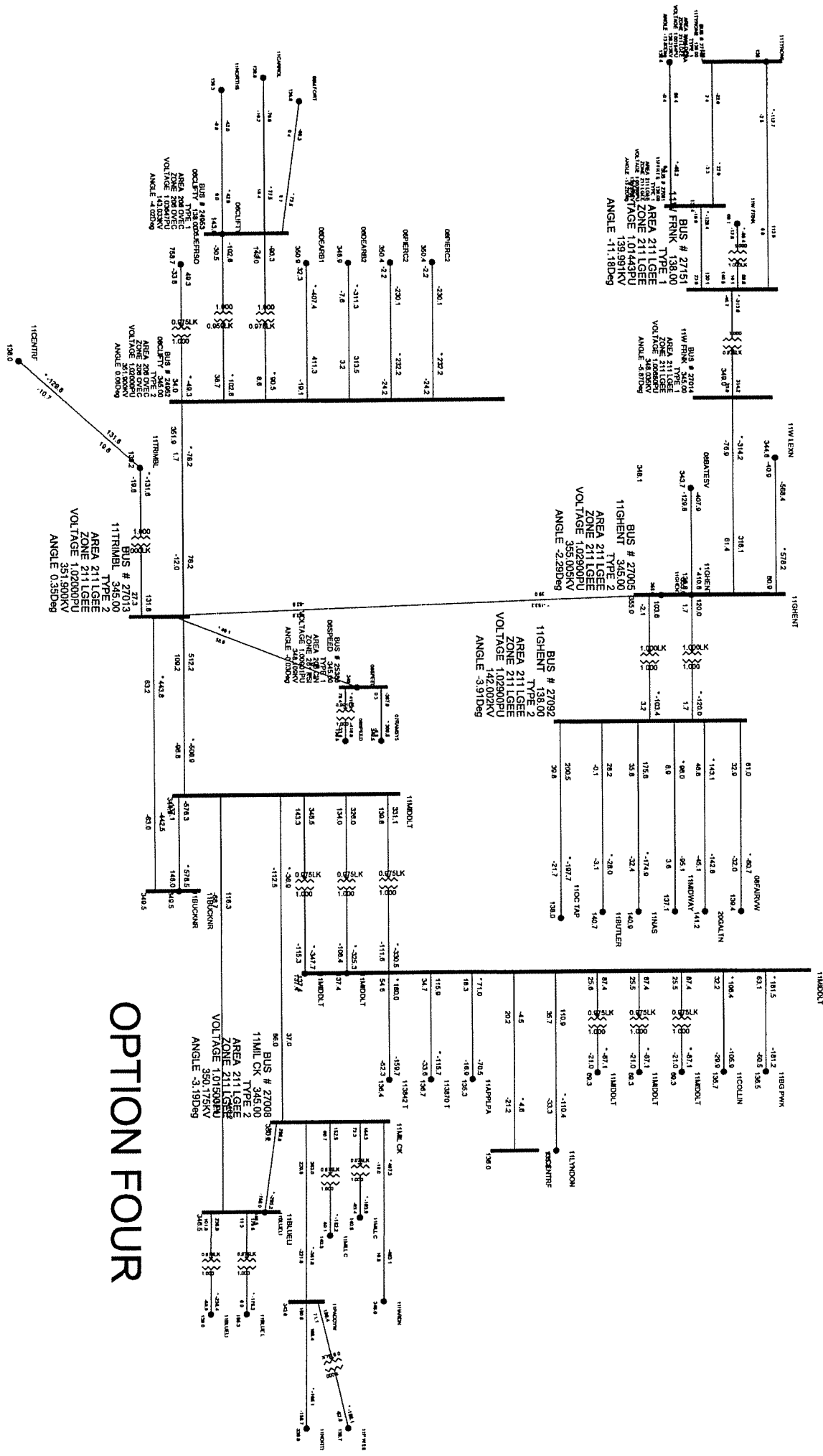
### BASE CASE







# OPTION THREE



# OPTION FOUR