Project TI-04-1103 and TI-06-0223

Interconnection System Impact Study

Eastern Plains Transmission Project
Reduced System

Performance Analysis of
Electrical Systems Required to Deliver
1000 MW, 1700 MW and 2400 MW
Generation to Tri-State Load

TRI-STATE
Generation and Transmission
Association, Inc.

Report Revision 4.9

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Executive Summary

This study was performed in response to Tri-State Merchant's request for Interconnection of generation at Holcomb, near Garden City, Kansas, and Lamar Energy Center (LEC). The table below is a summary copy of the revised interconnection request, as posted on Tri-State's OATT-Oasis Transmission Interconnection Request queue.

Tri-State Generation and Transmission Association, Inc.

INTERCONNECTION REQUEST QUEUE

UPDATED 09/07/2007

Request Number	Date Received	Method of Request	POR / POD	LOCATION COUNTY STATE	Service Type	MW Capacity	Inservice Date	Revised In Service Date	Status / Comments
TI-04-1103	11/3/2004 9/7/2007	Letter Update Letter	Rolling Hills Switchyard 345/500 kV	Holcomb, Kansas	Network Resource	700 MW Coal	12/31/2009	4/1/2013	IR System Impact Study Phase
TI-04-1103	11/3/2004 9/7/2007	Letter Update Letter	Rolling Hills Switchyard 345/500 kV	Holcomb, Kansas	Network Resource Increase	100 MW	6/1/2011	4/1/2012	IR System Impact Study Phase
TI-06-0223	2/23/2006 9/7/2007	Letter Update Letter	Rolling Hills Switchyard 345/500 kV	Holcomb, Kansas	Network Resource Increase	200 MW Coal (reduction)	6/1/2011	4/1/2012	IR System Impact Study Phase
TI-06-0223	2/23/2006	Letter	Lamar ENGY CTR 345/500 kV	Prowers, Colorado	Network Resource	600 MW Coal	6/1/2020		IC Feasibility Study Phase

This report identifies expected impacts of the Interconnection Request (IR), designated TI-04-1103 and TI-06-0223, received by Tri-State Generation and Transmission Association, Inc. (Tri-State) in the Tri-State interconnection request queue, and also summarizes Tri-State's development and analysis of the expected future load serving capability of the Eastern Plains Transmission Project (EPTP).

The requested generation interconnections were modeled in transient stability and power flow analysis models for evaluation of transient voltage stability, thermal performance, and impact on the interconnected transmission system by EPTP system infrastructure additions. In addition to the requested generation, proxy generation of an additional 800 MW was modeled to serve load out into the distant future. This was done to identify the expected requirements for future Rights of Way (ROW) and ensure that facility additions developed for this IR could be expanded economically to serve additional load and generation in the future.

Sixteen different project alternatives were evaluated by performing transient stability analysis to determine the minimum EPTP system configuration that would accommodate interconnection of the generation specified in the revised interconnection request. This revised interconnection request reduced the level of generation at Holcomb, Kansas from 1200 MW to 1000 MW, though studies had been performed with as much as 1400 MW, in accordance with recent Holcomb unit capacity estimates.

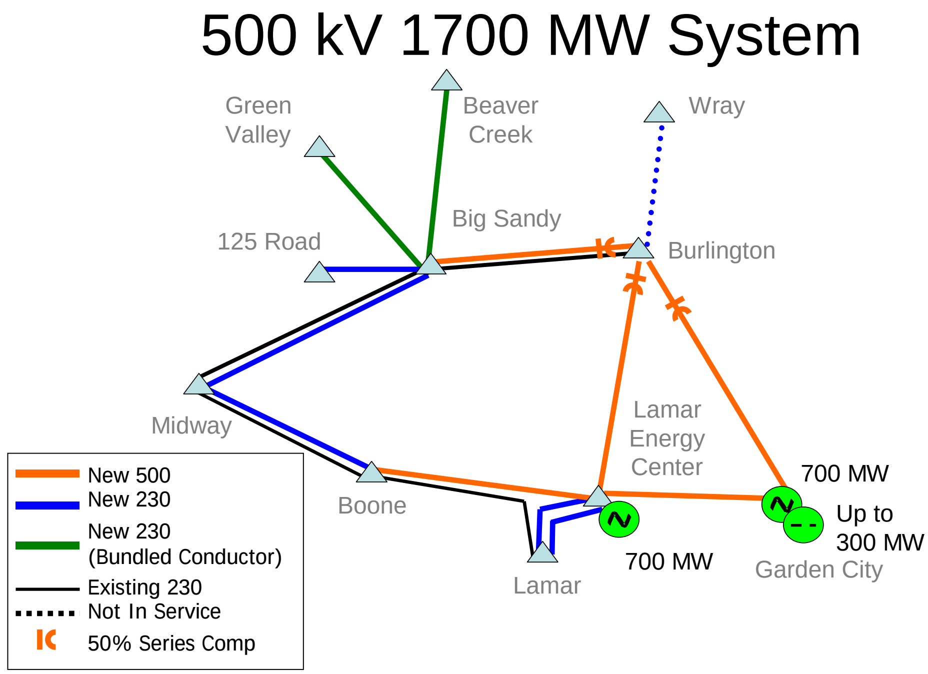
Transient stability results were used to determine the scope of the required bulk EPTP system. Minimal configurations determined in the stability analysis were used in the power flow analysis. This system was used to analyze the power flow impacts of the IR and proxy generation to the interconnected system through system normal and single contingency analysis. Through this analysis, voltage stability and thermal loading impacts were identified, as well as associated mitigation measures, in accordance with Western Electricity Coordinating Council (WECC) guidelines and procedures.

No apparent voltage stability problems could be seen with the proposed EPTP system described herein. However, several thermal loading issues are anticipated due to the impact of proposed generation supplying expected Tri-State load. A list of these loading issues and their mitigation measures can be found in the report body and its appendices.

The EPTP system may be developed in accordance with the three minimal 500/230 kV systems proposed herein for generation levels from 1000 MW to 2400 MW (depicted in Diagrams 1-3 below). Alternatively, the sizing of transformers and other facilities appears to be affected by system configuration, so it may be economical to expand the transmission system earlier than that required for anticipated generation. Additional studies are being performed to evaluate costs and benefits of transmission expansion timing scenarios.

Except for dynamic voltage stability analyses performed, the analysis which is summarized herein did not directly address voltage criteria. Additional studies are being performed to evaluate reactive power requirements along the path of the proposed EPTP system, to assess the voltage performance of the system.

Below is a diagram of the transmission system that would be required to deliver 1700 MW generation from the IR-specified interconnection points to loads on Tri-State's network. The diagram shows several substation locations on the primary bulk system, including Lamar Energy Center, Burlington, Big Sandy and Midway, which Tri-State planning envisions eventually being interconnected with 500 kV facilities. The system for 1700 MW has two 500 kV lines connecting Holcomb generation at Rolling Hills to Burlington and Lamar Energy Center. Other 500 kV lines must be constructed from Lamar Energy Center to Burlington, and Burlington to Big Sandy. In addition, transmission is required from Lamar Energy Center to Boone and on to Midway for stability purposes. Initially, this can be operated at 230 kV, but will be constructed for eventual conversion to 500 kV operation. Lastly, the required system must include a connection from Midway to Big Sandy when the initial level of generation is added at Lamar Energy Center as proposed in the IR. This also can be initially operated at 230 kV, but will require conversion to 500 kV operation with a subsequent level of generation addition at Lamar Energy Center.



As shown in the diagram the LEC – Boone line section is to be operated at 500 kV the Boone – Midway – Big Sandy sections are to be operated at 230 kV. This configuration is acceptable for the generation at Holcomb and LEC shown in the above diagram. If, in the future, a different point of interconnection is requested for generation associated with TI-06-0223B, the best configuration might be somewhat different and restudy would be required.

This configuration is the minimal system that will reliably deliver the proposed generation to expected Tri-State load. Other more extensive configurations may be developed in response to other interconnection requests.

The following table shows the estimated costs for the EPTP system and associated upgrades described herein:

Table 1: EPTP System Estimated Costs

1000 MW Configuration	($000)
EPTP Transmission Lines	$ 1,026,300
EPTP Substations	$ 495,187
System Upgrades	$ 16,953
Total 1000 MW EPTP System Estimated Costs:	$ 1,538,440
1700 MW Configuration	
EPTP Transmission Lines	$ 151,000
EPTP Substations	$ 50,000
System Upgrades	$ 30,575
Total 1700 MW EPTP System Estimated Costs:	$ 231,575
2400 MW Configuration	
EPTP Transmission Lines	$ 60,500
EPTP Substations	$ 8,730[1]
System Upgrades	$ 64,026
Total 2400 MW EPTP System Estimated Costs:	$ 133,256
Total EPTP Estimated Costs:	$ 1,903,271

See Appendices G through J for EPTP cost detail. Tri-State's share of system upgrade costs will be lower than shown above due to other utilities' participation. Most elements owned by other utilities will be upgraded under network service agreements. Some elements may be parallel facility impacts not covered under network service. For upgrades to parallel facilities due to through flow, the affected utilities may bear a portion of the affected costs. Other utilities may have different capacity margin requirements than those assumed here. The System Upgrades shown include those upgrades found in the Colorado Long Range Transmission Planning Group (CLRTPG) study which appear to be significantly impacted by EPTP.

[1] There may be additional breakers needed at LEC in this configuration that were not included in the costs shown here.

Introduction

Previous studies for the Eastern Plains Transmission Project (EPTP) have established required infrastructure additions needed to deliver up to 2800 MW generation from sites in southwest Kansas and southeast Colorado to Tri-State load throughout eastern Colorado. The minimal system previously defined consisted of adding over 800 miles of 500 kV and 230 kV transmission lines to the existing system.

Recently, Tri-State's load forecast was revised in conjunction with development of its Least-Cost Resource Plan (LCP). It became apparent that Tri-State would most likely require additional resources prior to the scheduled in-service date of Holcomb generation, located near Garden City, Kansas. Soon after the LCP was issued, Tri-State Merchant issued an RFP for an additional 250 MW of intermediate-class generation to be in-service in 2009 or 2010. With this added generation, the need for generating capacity in 2012 decreased, leading Tri-State to delay construction of one of its planned Holcomb units.

With decreased initial generation at Holcomb, the minimal EPTP system was reevaluated. First, it was thought that anticipated reductions in generating capacity at Holcomb might allow EPTP system operation at 345 kV. A 345 kV system was developed that would deliver up to 1000 MW Holcomb generation to load. Dynamic system performance criteria dictated that extensive system additions would be required to operate reliably at 345 kV, and the 345 kV system additions required to interconnect proposed generation to the system would cost at least as much as an equivalent 500 kV system. It was also seen that the required 345 kV system would not be able to deliver power at rates much higher than the initial 1000 MW generation, whereas the 500 kV system built to deliver 1000 MW could deliver much more and would have a smaller footprint – fewer line miles would be required with 500 kV operation. Most notably, a "diagonal" from Lamar Energy Center to Big Sandy appeared to be required with the reduced 345 kV system, but not with the reduced 500 kV system. Because of load growth beyond the 2012 timeframe, and because the recent high number of interconnection study requests gave an indication that future growth was inevitable, the limited 345 kV system configurations were abandoned in favor of a more flexible, expandable 500 kV system.

Previous studies had also shown that dynamic stability considerations were the limiting performance criteria to the geographically expansive EPTP system, so reevaluation of the 500 kV system began with stability studies. The results of these stability studies are summarized in a separate report. The following analysis starts with the recommendations from the stability analysis, and evaluates the power flow performance of the reduced EPTP transmission system, and also provides an assessment of expected impacts on the surrounding system.

Cases

The base case used in study case development was the WECC 2015HS case. Modifications to the case included some modifications made during 2004-2006 Colorado Long Range Transmission Planning Study efforts, and other adjustments based on previous EPTP analysis performed by Tri-State and Utility System Efficiencies (USE).

This study examined and compared three cases, representing three generation scenarios and associated load levels. Case topologies differ in voltage level and status of lines and transformers. To model power supply from proposed generation to expected load, Tri-State load was increased to match added generating capacity in each case, as shown in Table 1 below.

Table 1
Case Summary

Case	Generation at Holcomb, KS	Generation at Lamar Energy Center, CO	Case Loads, scaled at expected growth rates
1000 MW	1000 MW	0	estimated 2015 loads
1700 MW	1000 MW	700 MW	2015 loads plus 700 MW
2400 MW	1000 MW	1400 MW	2015 loads plus 1400 MW

The 1000MWEPTP01 case had 1000 MW of added generation at Holcomb, and increased Tri-State loads. The bulk infrastructure found in previous stability studies for the 1000 MW generation level was modeled in this case.

The 1700MWEPTP01 case was developed from the 1000MWEPTP01 case by adding 700 MW of generation at the Energy Center (aka LEC), and scaling Tri-State loads at expected growth rates to an additional 700 MW. Additional bulk infrastructure was modeled in this case, as found in previous stability studies.

The 2400MWEPTP01 case was developed from the 1700MWEPTP01 case by adding 700 MW more generation at the Lamar Energy Center (LEC), and scaling Tri-State loads at expected growth rates to an additional 700 MW. Additional bulk infrastructure was modeled in this case, as found in previous stability studies.

Only Tri-State load and EPTP topology was changed from case to case, and element loading that was seen to significantly increase from case to case was taken to indicate through-flow from Tri-State generation to Tri-State load, and thus could indicate a need for some measure of mitigation on significantly impacted elements. So that impacts on neighboring systems would be more apparent, other utility loads in these cases were not increased along with Tri-State load. Therefore, element loadings may be higher than study results indicate because non-Tri-State load will certainly increase to some extent along with Tri-State load.

In each of these cases, differences between generation increases and load increases (attributable to load adjustments and losses), were made up by adjusting other generation. Load modeled in the three scenario cases is described in Appendix F: Load and Generation Tables.

The starting topologies of the three cases are shown in the following diagrams:

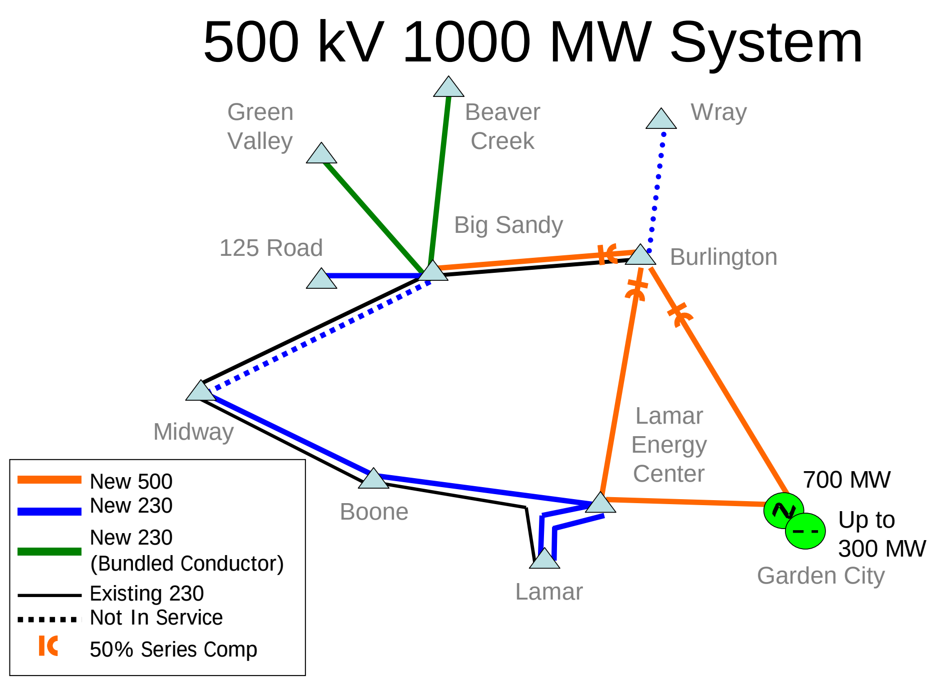


Diagram 1: Minimum System for 1000 MW of Proposed Generation

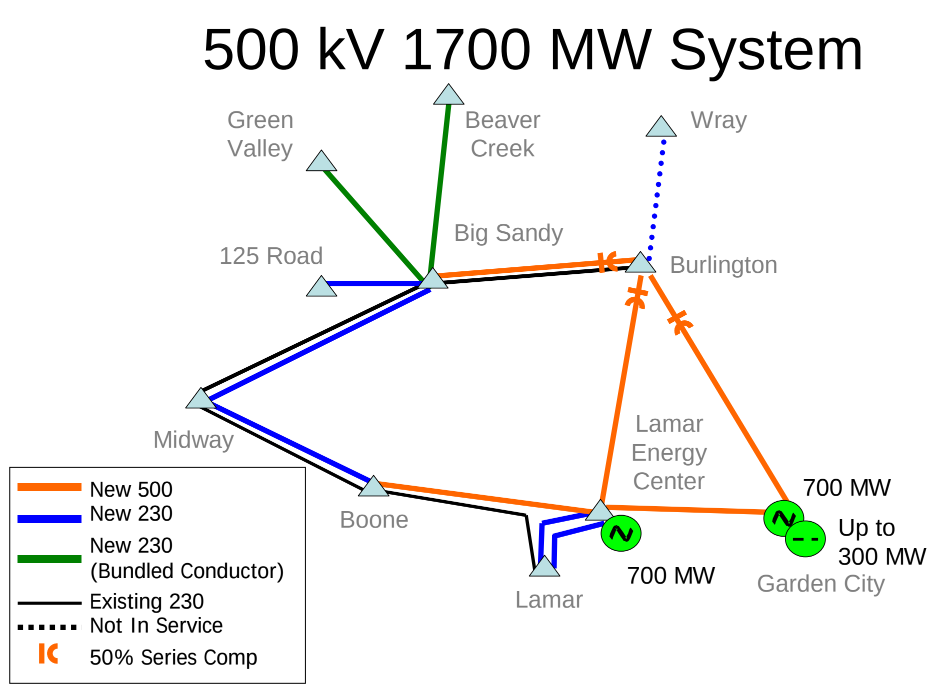


Diagram 2: Minimum System for 1700 MW of Proposed Generation

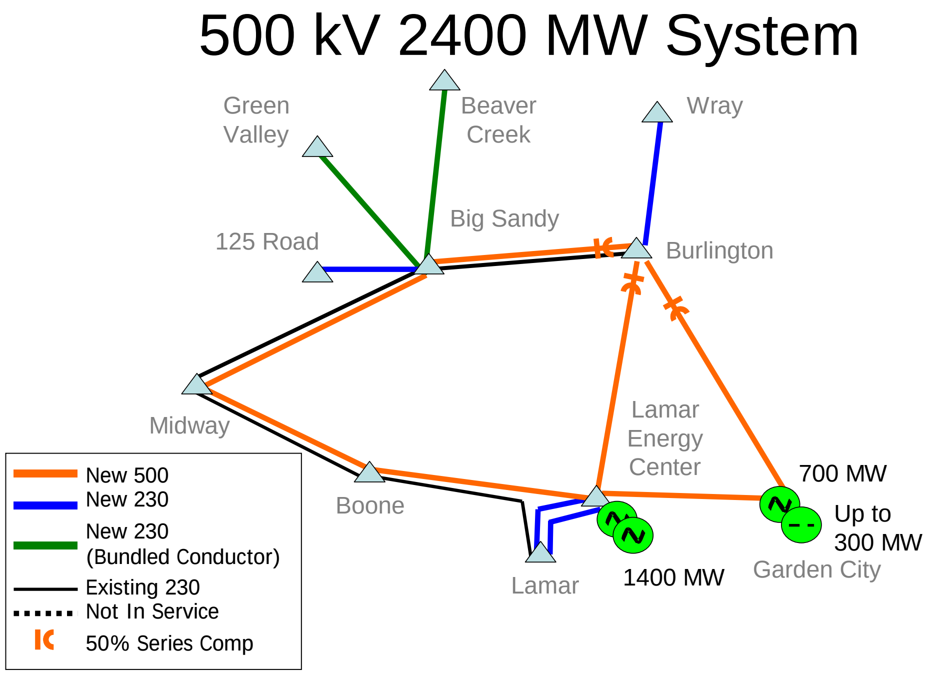


Diagram 3: Minimum System for 2400 MW of Proposed Generation

Criteria

For this study, voltage collapse conditions were examined to determine additional infrastructure requirements, and loading constraints were monitored for criteria violations. Voltage performance will be analyzed in later studies.

Under system normal conditions, loading on transmission lines should not exceed 80 percent of continuous ratings, and transformer loadings must not exceed 100 percent of maximum nameplate ratings. For system normal analyses, adjustments were allowed during solution, including shunt capacitor switching, LTC tap adjustments, area interchanges and phase shifter adjustments.

Tri-State's criteria limiting system normal line loading to 80 percent applies only to those transmission lines entirely owned by Tri-State. For lines owned by other entities, loading above this 80% limit was noted, but no facility upgrades were considered necessary until the loading reached 100% of their continuous ratings.

Under single contingency conditions, transmission lines and transformers must not exceed 100 percent of their continuous ratings for loading. System adjustments during solution were not allowed, including shunt capacitor switching, LTC tap adjustments, area interchanges and phase shifter adjustments. This criteria is enforced so that conditions immediately following outages would be examined, before automatic control devices have time to respond.

Study Method

The three cases described above were compared to determine loading issues in each case and how significant they were from case to case.

First, conditions in any of the cases that caused a voltage collapse were identified. These conditions would indicate a deficiency in system infrastructure.

Following this, system normal conditions were examined to identify transmission lines or transformers with loading criteria violations as defined above. See Appendix A for diagrams of system normal power flows for all three cases. Loadings on these elements were compared across the three cases to identify elements with significantly increasing loading issues from case to case under system normal conditions.

Next, single contingency analysis was run using all single element transmission line and transformer outages in area 70 and 73, or Colorado and Eastern Wyoming. These conditions were examined to identify the largest overloads on the transmission lines and transformers in the same areas. Again, the loading on these elements was compared across the three cases to identify the elements with significantly increasing loading issues.

Loading on any element that was seen to significantly increase from case to case was taken to be due to through flow from Tri-State generation to Tri-State load. These critical increases in through-flow that would result in thermal criteria violations are mitigated with the system upgrades identified below. Only these loading issues were considered critical to identify and alleviate.

Results

Appendix A shows that no voltage collapse conditions exist for any of the three cases, indicating that the infrastructure found in stability studies is adequate to deliver the projected generation. This does not indicate that loading (or voltage) issues do not exist; only that additional bulk transmission is not needed from a voltage collapse standpoint.

System Normal

The system is subject to system normal conditions on a continuous basis, so mitigating system normal issues is a high priority. Appendix B shows the elements that loaded above criteria in system normal conditions in the three cases. Note the list of elements whose loading does not increase significantly over the three cases versus the list of elements whose loading does increase.

Elements that had significant loading issues under system normal conditions in this study are listed below. Note that transmission lines owned by other entities are included in the System Normal Summary in Appendix B, but are not listed below if they are loaded under 100 percent of their rating for system normal conditions (see Criteria above).

The Del Camino Tap – Foster 115 kV line loads above 80% of its 130 MVA rating in the 2400MWEPTP01 case. Contingency results from the 1700MWEPTP01 case indicate the overload appeared at this level, and from the 2400MWEPTP01 case indicate a required upgraded capacity greater than 233 MVA. This line is owned by Tri-State.

The Flyhorse – Monument 115 kV line loads to 100% of its 135.6 MVA rating in the 2400MWEPTP01 case. Contingency results from the 1700MWEPTP01 case indicate an overload appeared at this level, and from the 2400MWEPTP01 case indicate a required upgraded capacity greater than 185 MVA.

The Hooper Tap – San Luis Valley 69 kV line loads above 80% of its 50 MVA rating in the 1700MWEPTP01 case. The system normal loading in the 2400MWEPTP01 case indicates a required upgraded capacity greater than 56 MVA. This line is part of the San Luis Valley REA load serving system, a member of Tri-State.

The Walsenburg 115/69 kV transformer loads above 100% of its 37 MVA rating in the 2400MWEPTP01 case. This transformer is part of the San Isabel REA load serving system, a Member of Tri-State. Contingency results from the 1700MWEPTP01 case indicate an overload appeared at this level, and from the 2400MWEPTP01 case indicate a required upgraded capacity greater than 47 MVA.

The Weld – Whitney – Windsor Tap – Windsor 115 kV lines load above 80% of their respective ratings in the 1700MWEPTP01 case and above 100% in the 2400MWEPTP01 case. The cause and aggravating factor of this overload is expected increasing load level at Windsor 115 kV. Contingency results from the 1700MWEPTP01 case indicate an overload appeared at the load level in this case, and from the 2400MWEPTP case the following capacity upgrades will likely be required:

- Weld (LM) – Whitney 115 kV loads to 174.7% of its 210 MVA rating. Rating above 367 MVA needed.
- Whitney – Windsor Tap 115 kV loads to 185.7% of its 165.7 MVA rating. Rating above 308 MVA needed.
- Windsor – Windsor Tap 115 kV loads to 175.5% of its 120 MVA rating. Rating above 211 MVA needed.

Single Contingency

Appendix C contains a comparison of the 1000MWEPTP01 case with the 1700MWEPTP01 case in terms of single contingency results. Four reports are shown there: (1) a list of overloaded elements whose loading does not increase significantly between the two cases, (2) a list of overloaded elements whose loading does increase, (3) a list of elements that overload in the 1000MWEPTP01 case only, and (4) a list of elements that overload in the 1700MWEPTP01 case only. Elements that overloaded in one case only but were not significant are also shown on the "Not More Severe" report.

Appendix D contains a comparison of the 1700MWEPTP01 case with the 2400MWEPTP01 case in terms of single contingency results. Four reports are shown there: (1) a list of overloaded elements whose loading does not increase significantly between the two cases, (2) a list of overloaded elements whose loading does increase, (3) a list of elements that overload in the 1700MWEPTP01 case only, and (4) a list of elements that overload in the 2400MWEPTP01 case only. Elements that overloaded in one case only but were not significant are also shown on the "Not More Severe" report.

The resulting list of required upgrades is shown in Appendix E. This list contains facilities that require an upgrade due to increasing Tri-State generation flowing to increasing Tri-State loads, in both system normal conditions and under single contingency conditions.

Conclusions and Recommendations

Tri-State's load forecast was revised and additional power sources are being considered, delaying plans for one of the anticipated Holcomb generating units. With decreased initial generation at Holcomb, the minimal EPTP system was reevaluated.

The possibility arose that the anticipated reductions in generating capacity at Holcomb might allow EPTP system operation at 345 kV. A 345 kV system was developed that would deliver up to 1000 MW Holcomb generation to load. The results of that analysis are contained in the report titled "Minimal 345 kV System for Delivery of 1000 MW from Holcomb". From these study results, because of load growth beyond the 2012 timeframe, and because the recent high number of interconnection study requests gave an indication that future growth was inevitable, the limited 345 kV system configurations were abandoned in favor of a more flexible, expandable 500 kV system.

Previous studies had also shown that dynamic stability considerations were the limiting performance criteria to the geographically expansive EPTP system, so the reevaluation of the 500 kV system began with stability studies. The results of these stability studies are summarized in the report titled "Eastern Plains Transmission Project Configurations Transient Stability Assessment".

This power flow study started with the recommendations from the stability analysis, and evaluated the power flow performance of the reduced EPTP transmission system, and also provided an assessment of expected impacts on the surrounding system.

From the results of this study, no new EPTP transmission infrastructure is required beyond the EPTP system proposed in the three diagrams above. However several facility upgrades are needed to satisfy thermal loading criteria. Below is a list of the required upgrades for each level of requested generation.

To mitigate the observed loading issues on facilities owned by entities other than Tri-State, coordination will be required between Tri-State and the affected entities to mitigate impacts, in accordance with Western Electricity Coordinating Council (WECC) guidelines and procedures.

List of Required Upgrades

The following elements require a capacity upgrade at the 1000 MW level of generation and the EPTP infrastructure shown in Diagram 1 above. The maximum flow out of all of the cases for each element and its rating are shown in parentheses.

Tri-State and Member Facilities

- The 125Road 230/115 kV transformer (111.8% of its 200 MVA rating)
- The Big Sandy – Burlington 230 kV line (145.9% of its 281 MVA rating)[2]

Western's Facilities

- The Stegall 230/115 kV transformer (117.2% of its 100 MVA rating)[3]

Colorado Springs Utilities' Facilities

- The Cottonwood – Kettle Creek 115 kV line (166.1% of its 132.9 MVA rating)

The following elements require a capacity upgrade at the 1700MW level of generation and the EPTP infrastructure shown in Diagram 2 above. The maximum flow out of all of the cases for each element and its rating are shown in parentheses.

Tri-State and Member Facilities

- The Big Sandy 500/230 kV transformers #1 and #2 (112.2% each of their 598 MVA ratings)[4]
- The Bonny Creek – Burlington 115 kV line (114.1% of its 140 MVA rating)[5]
- The Bonny Creek – South Fork 115 kV line (109.7% of its 140 MVA rating)[4]
- The Boone 500/230 kV transformers #1 and #2 (104.8% each of their 450 MVA ratings)[6]

[2] The loading on this line is reduced with the system designed to deliver 2400 MW of generation due to the addition of the Big Sandy - Midway 500 kV line.
[3] This transformer overloaded for the outage of the higher rated, parallel transformer. This condition exists currently.
[4] The loading on these transformers is alleviated with the system designed to deliver 2400 MW of generation due to the voltage change of the Big Sandy – Midway line from 230 kV to 500 kV, as well as the addition of the Burlington – Wray 230 kV line.
[5] The loading on these lines is alleviated with the system designed to deliver 2400 MW of generation due to the addition of the Burlington – Wray 230 kV line.

- The Dacono – Erie Switch 115 kV line (156.4% of its 166.1 MVA rating)
- The Del Camino Tap – Foster 115 kV line (178.8% of its 130 MVA rating)
- The Fuller 230/115 kV transformer (127.5% of its 100 MVA rating)
- The Hooper Tap – San Luis Valley 69 kV line (89.4% of its 50 MVA rating, system normal)
- The Two Buttes – Walsh 69 kV line (127.4% of its 33.9 MVA rating)
- The Walsenburg 115/69 kV transformer (125% of its 37 MVA rating)
- The Weld (LM) – Whitney 115 kV line (174.7% of its 210 MVA rating)
- The Whitney – Windsor Tap 115 kV line (185.7% of its 165.7 MVA rating)
- The Windsor – Windsor Tap 115 kV line (175.5% of its 120 MVA rating)

PSCo's Facilities

- The Coors Recycling – Ft. Lupton 115 kV line (132.5% of its 218.7 MVA rating)
- The Coors Recycling – Fulton (TS) 115 kV line (126.7% of its 218.7 MVA rating)
- The Daniels Park 345/230 kV transformers #1, #2, and #3 (108.8% each of their 560 MVA ratings)
- The Daniels Park – Prairie 230 kV line (115.1% of its 665 MVA rating)
- The Ft. Lupton 230/115 kV transformers #1 and #2 (115.6% each of their 280 MVA ratings)
- The Greenwood – Monaco 230 kV line (124.2% of its 439 MVA rating)
- The Lafayette – Valmont 115 kV line (173.7% of its 239 MVA rating)
- The Leetsdale – Monaco 230 kV line (116.5% of its 439 MVA rating)
- The Weld (PS) 230/115 kV transformer (131.6% of its 350 MVA rating)

Western's Facilities

- The Airport – Boyd 115 kV line (174.9% of its 236 MVA rating)
- The Airport – Windsor Tap 115 kV line (168.5% of its 165.7 MVA rating)
- The Weld (LM) 230/115 kV transformer (132.2% of its 350 MVA rating)

Colorado Springs Utilities' Facilities

- The Flyhorse – Monument 115 kV line (136.1% of its 135.6 MVA rating)
- The Fountain – RD Nixon 115 kV line (106.7% of its 162.2 MVA rating)

The following elements require a capacity upgrade at the 2400MW level of generation and the EPTP infrastructure shown in Diagram 3 above. The maximum flow out of all of the cases for each element and its rating are shown in parentheses.

Tri-State and Member Facilities

- The Cheney Tap – Two Buttes 69 kV line (107.8% of its 33.9 MVA rating)
- The Comanche – Stem Beach 115 kV line (100.9% of its 232 MVA rating)
- The Dacono – Rinn Valley 115 kV line (117.9% of its 166.1 MVA rating)
- The Del Camino – Foster (TS) 115 kV line (125.2% of its 130 MVA rating)
- The Erie Switch 115/230 kV transformer (102.2% of its 250 MVA rating)
- The Garnet Mesa Tap – Hotchkiss 115 kV line (100% of its 95 MVA rating)
- The Granada Tap – Holly Tap 69 kV line (101.7% of its 55 MVA rating)

[6] The loading on these transformers is alleviated with the system designed to deliver 2400 MW of generation due to the voltage change of the Boone – Midway line from 230 kV to 500 kV.

- The Granada Tap – Willow Creek 69 kV line (116.2% of its 55 MVA rating)
- The Midway 500/230 kV transformers #1 and #2 (112.1% each of their 598 MVA ratings)
- The San Luis Valley 230/115 kV transformers #1 and #2 (103% each of their 150 MVA ratings)
    - Tri-State/PSCo jointly owned facility

<u>PSCo's Facilities</u>

- The Buckley – Smoky Hill 230 kV line (104.1% of its 435 MVA rating)
- The Buckley – Tolgate 230 kV line (104.1% of its 435 MVA rating)
- The Daniels Park – Greenwood 230 kV line (109.9% of its 665 MVA rating)
- The Lafayette – Parkway 115 kV line (116.2% of its 247 MVA rating)
- The Leetsdale 230/115 kV transformer (104.4% of its 280 MVA rating)
- The Leetsdale – Monroe (PS) 230 kV line (112.6% of its 398.4 MVA rating)
- The Midway (PS) 345/230 kV transformer (104.3% of its 560 MVA rating)
- The Monument – Palmer 115 kV line (113.5% of its 134.8 MVA rating)
    - CSU/PSCo each own part of this line
- The Waterton 345/230 kV transformer (104.4% of its 560 MVA rating)

<u>Platte River Power Authority Facilities</u>

- The Boyd 230/115 kV transformers #1 and #2 (107.3% each of their 184 MVA ratings)
- The Laporte 230/115 kV transformer (106.1% of its 184 MVA rating)
- The Longmont NW – Meadow 115 kV line (106.1% of its 110.2 MVA rating)
- The Longs Peak – Ft. St. Vrain 230 kV line (105.1% of its 377.7 MVA rating)

<u>Western's Facilities</u>

- The Brighton (Western) – Sand Creek 115 kV line (119.6% of its 85.1 MVA rating)[7]
- The Curecanti – South Canal 115 kV line (103.3% of its 120 MVA rating)
- The Fordham – Longmont NW 115 kV line (127.9% of its 109 MVA rating)
- The Kersey Tap – Prospect 115 kV line (100.1% of its 109 MVA rating)
- The Midway (BR) – West Cañon 230 kV line (103.9% of its 239 MVA rating)

<u>Colorado Springs Utilities' Facilities</u>

- The Atmel Sub – Drake N 115 kV line (102.6% of its 129 MVA rating)
- The Atmel Sub – Kelker E 115 kV line (100.1% of its 159 MVA rating)
- The Birdsale – Templeton 115 kV line (100.5% of its 79 MVA rating)
- The Briargate – Cottonwood S 115 kV line (102.2% of its 200 MVA rating)
- The Briargate – Kettle Creek 115 kV line (101.3% of its 159 MVA rating)
- The Flyhorse – Kettle Creek 115 kV line (116.1% of its 159 MVA rating)
- The Kelker 230/115 kV transformers #1(S->E) and #2(N->W) (105.5% each of their 350 MVA ratings)
- The Midway (BR) – RD Nixon 230 kV line (117.9% of its 483.6 MVA rating)

<u>Aquila's Facilities</u>

- The Portland – West Station 115 kV line (113.4% of its 99 MVA rating)

[7] This facility is part of the Beaver Creek – Erie line rebuild project, and has an expected rating of 220 MVA.

A separate transformer sizing study is needed to verify all EPTP transformer sizes. Also, a separate voltage criteria study is needed to assess the voltage performance of the EPTP system.

The difference in transformer sizes indicates that there are potential system benefits to having the entire 2400 MW EPTP system in service with the 1000 MW level of generation. Additional analysis is required to determine the most beneficial initial system configuration.

The requested in service dates of the proposed generation found in Tri-State's Interconnection Request queue appear possible to meet. However, a formal determination of this will appear in the facility study.

The following table shows the estimated costs for the EPTP system and associated upgrades described herein:

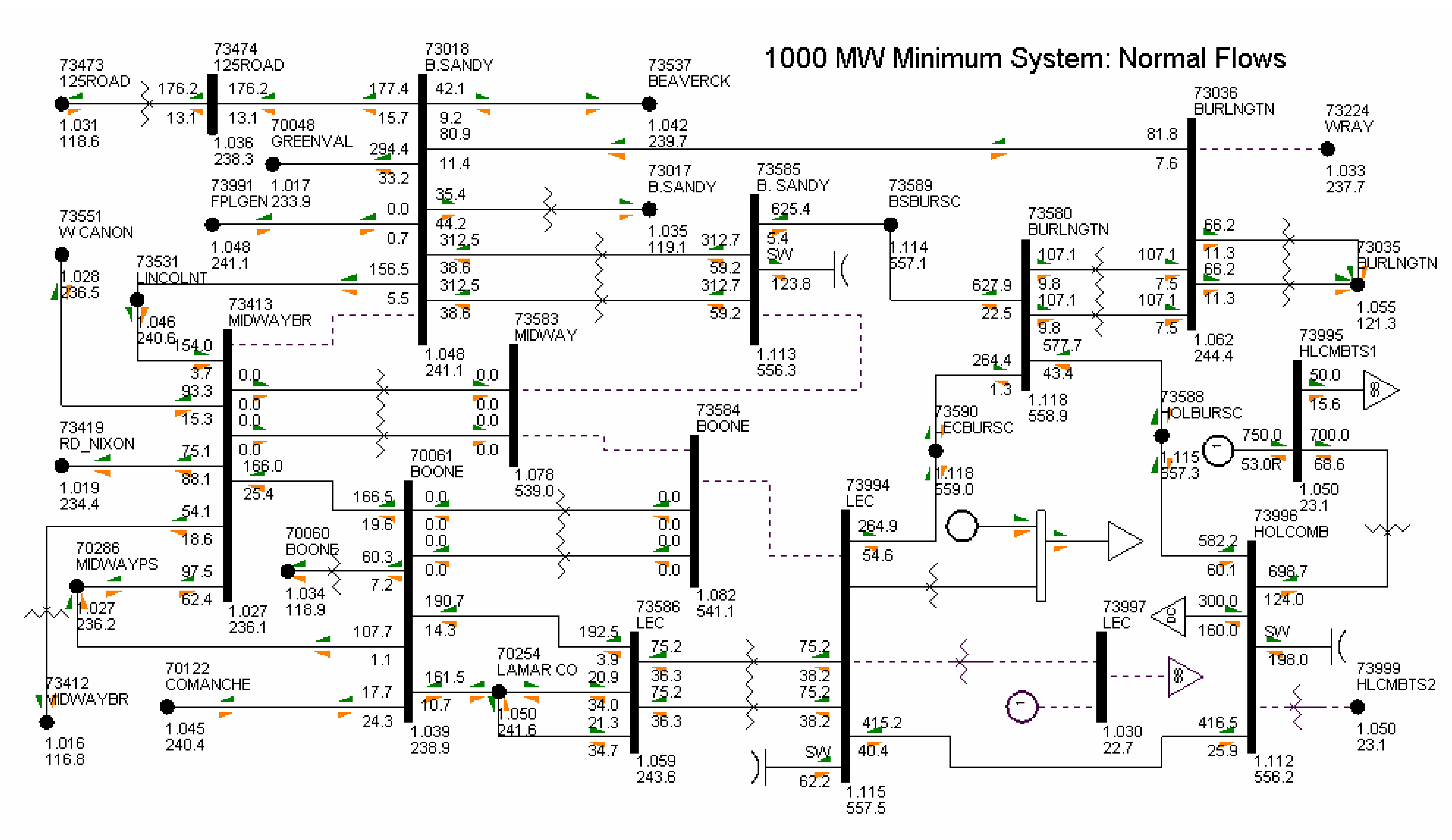
Table 1: EPTP System Estimated Costs

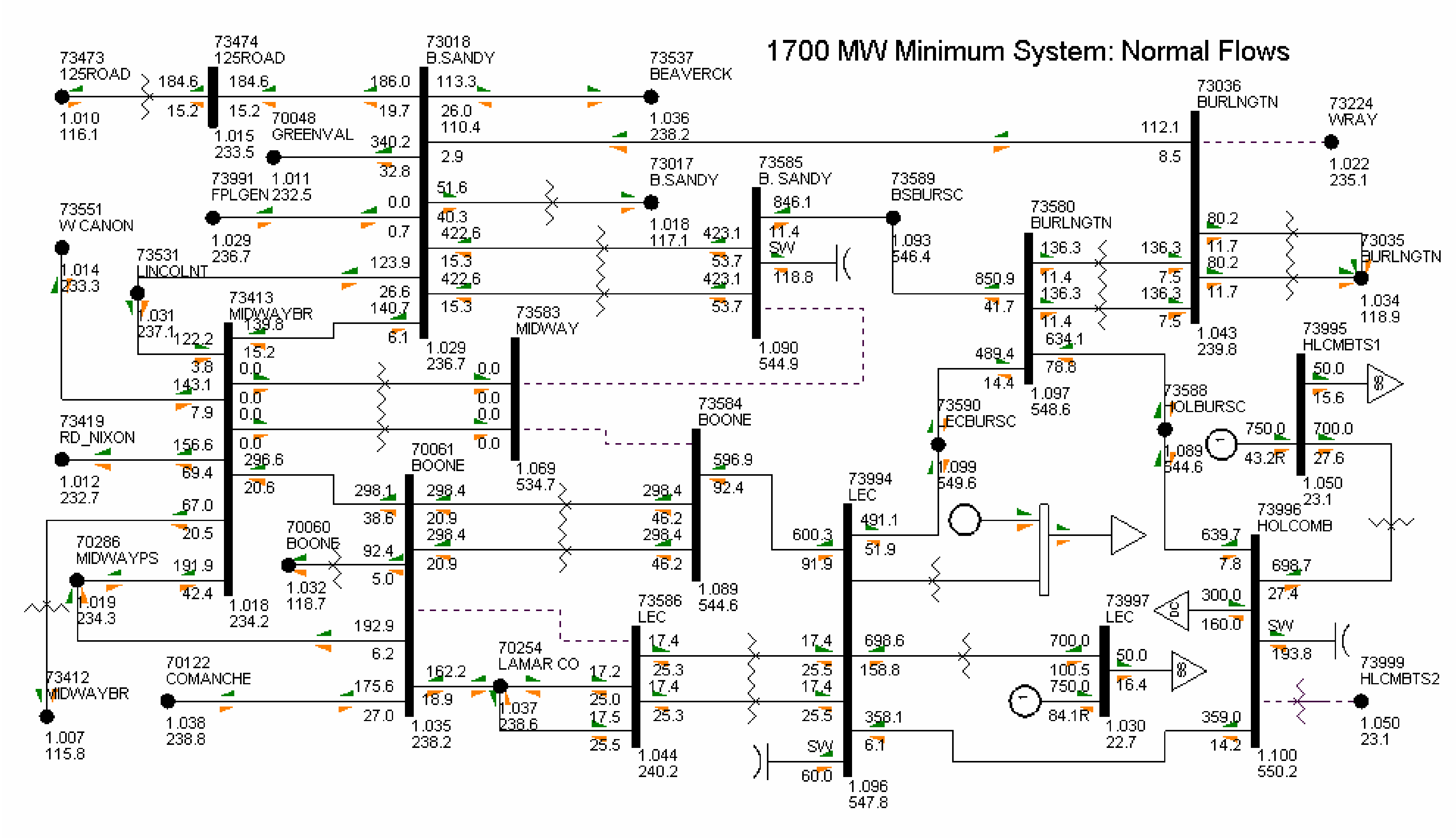
1000 MW Configuration	($000)
EPTP Transmission Lines	$ 1,026,300
EPTP Substations	$ 495,187
System Upgrades	$ 16,953
Total 1000 MW EPTP System Estimated Costs:	$ 1,538,440
1700 MW Configuration	
EPTP Transmission Lines	$ 151,000
EPTP Substations	$ 50,000
System Upgrades	$ 30,575
Total 1700 MW EPTP System Estimated Costs:	$ 231,575
2400 MW Configuration	
EPTP Transmission Lines	$ 60,500
EPTP Substations	$ 8,730[8]
System Upgrades	$ 64,026
Total 2400 MW EPTP System Estimated Costs:	$ 133,256
Total EPTP Estimated Costs:	$ 1,903,271

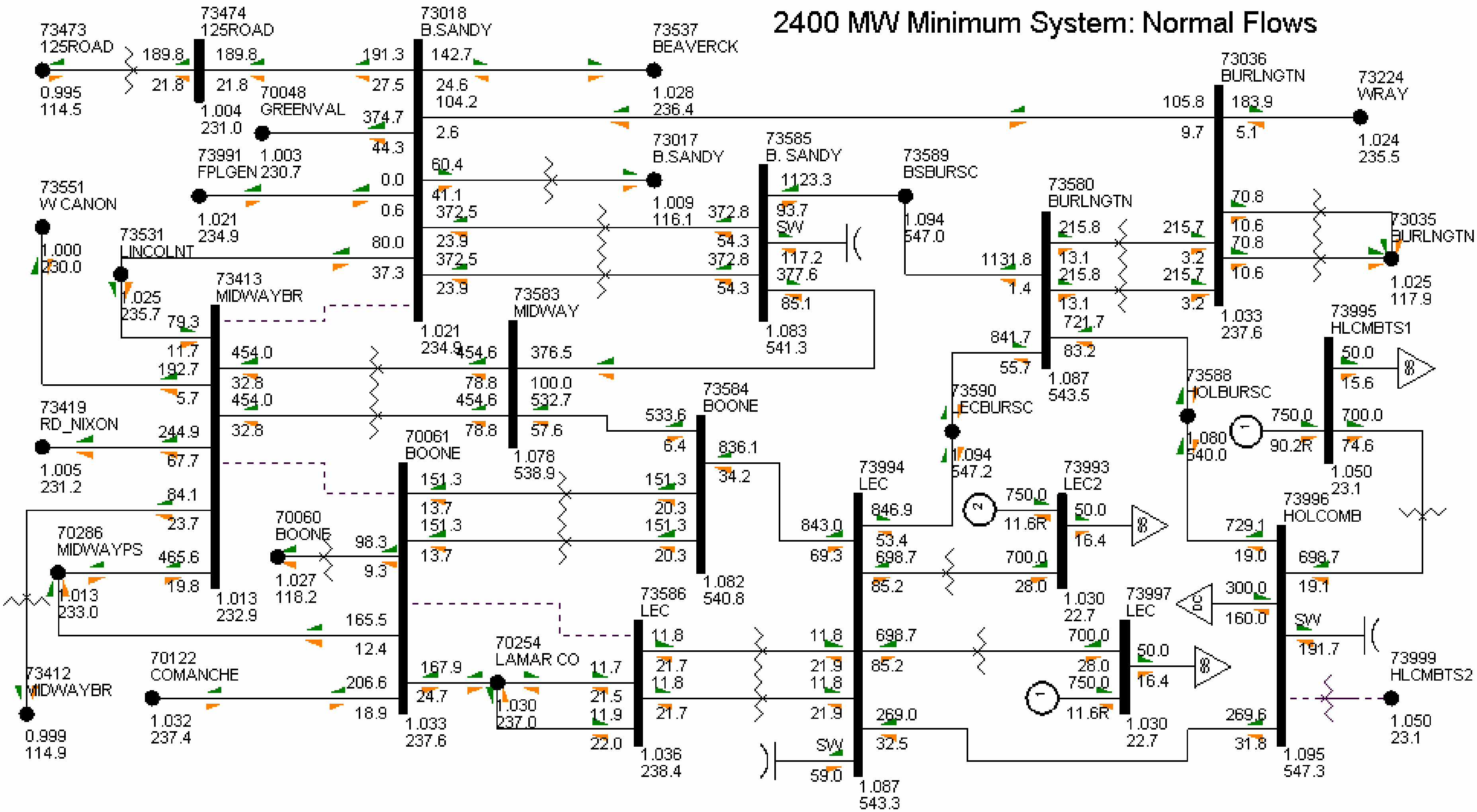
See Appendices G through J for EPTP cost detail. Tri-State's share of system upgrade costs will be lower than shown above due to other utilities' participation. Most elements owned by other utilities will be upgraded under network service agreements. Some elements may be parallel facility impacts not covered under network service. For upgrades to parallel facilities due to through flow, the affected utilities may bear a portion of the affected costs. Other utilities may have different capacity margin requirements than those assumed here. The System Upgrades shown include those upgrades found in the Colorado Long Range Transmission Planning Group (CLRTPG) study which appear to be significantly impacted by EPTP.

[8] There may be additional breakers needed at LEC in this configuration that were not included in the costs shown here.

Appendix A: System Normal Flows


1000 MW Minimum System: Normal Flows
73473 125ROAD
73474 125ROAD
73018 B.SANDY
73537 BEAVERCK
70048 GREENVAL
73991 FPLGEN
73017 B.SANDY
73585 B. SANDY
73589 BSBURSC
73036 BURLNGTN
73224 WRAY
73551 W CANON
73531 LINCOLNT
73413 MIDWAYBR
73583 MIDWAY
73580 BURLNGTN
73035 BURLNGTN
73995 HLCMBTS1
73588 HOLBURSC
73590 ECBURSC
73584 BOONE
73419 RD_NIXON
70061 BOONE
73994 LEC
73996 HOLCOMB
70060 BOONE
70286 MIDWAYPS
73586 LEC
73997 LEC
70254 LAMAR CO
70122 COMANCHE
73412 MIDWAYBR
73999 HLCMBTS2


1700 MW Minimum System: Normal Flows
73473 125ROAD
73474 125ROAD
73018 B.SANDY
73537 BEAVERCK
73036 BURLNGTN
73224 WRAY
70048 GREENVAL
73991 FPLGEN
73017 B.SANDY
73585 B. SANDY
73589 BSBURSC
73580 BURLNGTN
73035 BURLNGTN
73551 W CANON
73531 LINCOLNT
73413 MIDWAYBR
73583 MIDWAY
73995 HLCMBTS1
73588 HOLBURSC
73590 ECBURSC
73419 RD_NIXON
73584 BOONE
70061 BOONE
73994 LEC
73996 HOLCOMB
70286 MIDWAYPS
70060 BOONE
73586 LEC
73997 LEC
70254 LAMAR CO
73412 MIDWAYBR
70122 COMANCHE
73999 HLCMBTS2


2400 MW Minimum System: Normal Flows
73473 125ROAD
73474 125ROAD
73018 B.SANDY
73537 BEAVERCK
73036 BURLNGTN
73224 WRAY
70048 GREENVAL
73991 FPLGEN
73017 B.SANDY
73585 B. SANDY
73589 BSBURSC
73580 BURLNGTN
73035 BURLNGTN
73551 W CANON
73531 LINCOLNT
73413 MIDWAYBR
73583 MIDWAY
73995 HLCMBTS1
73588 HOLBURSC
73590 ECBURSC
73584 BOONE
73419 RD_NIXON
70061 BOONE
73994 LEC
73993 LEC2
73996 HOLCOMB
70060 BOONE
70286 MIDWAYPS
73586 LEC
73997 LEC
73999 HLCMBTS2
70254 LAMAR CO
73412 MIDWAYBR
70122 COMANCHE

Appendix B: Voltage Collapse Conditions

*System *DNS* Conditions*

Case Name *1000MWEPTP01*
Contingency

*** NO DNS CONDITIONS ***

System *DNS* Conditions

Case Name *1700MWEPTP01*

Contingency

*** NO DNS CONDITIONS ***

System *DNS* Conditions

Case Name *2400MWEPTP01*
Contingency

*** NO DNS CONDITIONS ***

Appendix C: System Normal Loading

Not More Severe Loading Report: System Normal

Case 1 System Case Name *1000MWEPTP01*
Case 2 System Case Name *1700MWEPTP01*
Case 3 System Case Name *2400MWEPTP01*

From Bus Name	To Bus Name	Circuit	Rating (MVA)	Case 1 System Max Of Percent	Case 2 System Max Of Percent	Case 3 System Max Of Percent
ALCOVA 115	FREMONT 115	1	80	79.4	79.5	79.8
ARAPAHOA 115	SHERIDAN 115	1	159	89	89.5	90.4
BARRLAKE 230	GREENVAL 230	1	435	75.2	78.9	83.1
CALIFOR1 115	NORTH542 115	1	150	79.6	79.2	78.7
CURECANT 230	MORROWPT 230	1	182	88.1	87.9	88.1
FOUNTAIN 115	RD_NIXON 115	1	162.2	76.1	81.1	85.9
GREELEY 115	WELD PS 115	1	186.6	79.5	80.6	82.7
QUAKER2 115	QUAKERTP 115	1	86	79.4	81	83.2
SIDNEY 230	SIDNEYDC 230	1	240	85.2	84.3	83.7
STONMOOR69.0	W.STATON69.0	1	35	96.8	97.8	98.6

More Severe Loading Report: System Normal

Case 1 System Case Name *1000MWEPTP01*
Case 2 System Case Name *1700MWEPTP01*
Case 3 System Case Name *2400MWEPTP01*

From Bus Name	To Bus Name	Circuit	Rating (MVA)	Case 1 System Max Of Percent	Case 2 System Max Of Percent	Case 3 System Max Of Percent
COORSREC 115	FTLUPTON 115	1	218.7	75.4	85.6	97.5
COORSREC 115	FULTONTS 115	1	218.7	69.8	79.8	91.7
CTTNWD N 115	KETTLECK 115	1	132.9	55.6	77	98.9
DEL CTAP 115	FOSTERTS 115	1	130	22.8	48.7	80.9
FLYHORSE 115	KETTLECK 115	1	159	32.8	58.4	85.3
FLYHORSE 115	MONUMENT 115	1	135.6	38.4	68.5	100
GREENWD 230	MONACO12 230	1	439	62.4	76.6	90.1
HOOPERTP69.0	SAN LUIS69.0	1	50	77.7	83.9	89.4
LEETSDAL 230	MONACO12 230	1	439	54.8	69.1	82.6
MIDWAYBR 230	W CANON 230	1	239	38.5	58.9	79.7
WALSENBG69.0	WALSENBG 115	1	37	77.7	95.3	111.5
WELD LM 115	WHITNEY 115	1	210	67.8	86.7	109
WHITNEY 115	WINDSORT 115	1	165.7	53.1	76.6	104
WINDSOR 115	WINDSORT 115	1	120	58.1	97.7	146.2

Appendix D: Single Contingency Analysis – 1000 MW vs. 1700 MW

Not More Severe Loading Report

Case 1 System Case Name *1000MWEPTP01*
Case 2 System Case Name *1700MWEPTP01*

From Bus Name	To Bus Name	Circuit	Case 1 System Max Of Percent	Rating (MVA)	Count	Case 2 System Max Of Percent	Rating (MVA)	Count
ALMSA TM69.0	ALMSA TM 115	1	103	25	2	103.9	25	3
ARAPAHOB 115	ARAPAHOE 230	1	100	280	1	100.9	280	1
BENFRNCH69.0	BIG BEN 69.0	1	99.9	42	1	100.1	42	1
CAMEO 69.0	CAMEO 100	1	103.7	66.7	3	102.5	66.7	4
FLAMGORG69.0	FLAMGORG 138	1	122.4	19	5	122.6	19	5
GRANDJCT69.0	GRANDJCT 115	1	106.4	42	2	108	42	2
GREELEY 46.0	GREELEY 115	2	104.3	33.3	1	106	33.3	1
HAYDEN 138	HAYDEN 230	1	98	150	1	101.4	150	1
HAYDEN 138	HAYDEN 230	2	97.6	150	1	101	150	1
LOOKOUT 69.0	LOOKOUT1 230	1	102.8	100	1	102.7	100	1
MOSCA 69.0	SAN LUIS69.0	1	107.8	23.9	1	110.4	23.9	1
NSS1 69.0	NSS2 69.0	1	124.3	107	1	124.3	107	1
NSS1 69.0	WYODAK 69.0	1	115.6	107	1	115.6	107	1
NSS2 69.0	WYODAK 69.0	1	124.3	107	2	124.3	107	2
SIDNEY 115	SIDNEY 230	1	100	167	1	98.5	167	3

More Severe Loading Report

Case 1 System Case Name *1000MWEPTP01*
Case 2 System Case Name *1700MWEPTP01*

From Bus Name	To Bus Name	Circuit	Case 1 System Max Of Percent	Rating (MVA)	Count	Case 2 System Max Of Percent	Rating (MVA)	Count
125ROAD 115	125ROAD 230	1	103.6	200	1	110.1	200	2
B.SANDY 230	BURLNGTN 230	1	130.2	281	2	145.9	281	2
BONNY CK 115	BURLNGTN 115	1	95.4	140	2	114.1	140	2
CTTNWD N 115	KETTLECK 115	1	102.8	132.9	1	134	132.9	2
STEGALL 115	STEGALL 230	1	106.4	100	1	112.4	100	1
WELD LM 115	WHITNEY 115	1	97.2	210	1	131.9	210	10

System Unique Loading Report

Case Name: *1000MWEPTP01*
as compared to: *1700MWEPTP01*

From Bus	To Bus	Circuit	Most Severe Contingency	Rating (MVA)	Max Percent	Count
SIDNEY 115	SIDNEY 230	1	N.YUMA 230-SIDNEY 230 CIRCUIT 1	167	100	1

*The Sidney 230/115 kV transformer has a 65ºC rise rating of 187 MVA. It’s loaded to 98.5% of its 167 MVA rating in the 1700MWEPTP01 case.

System Unique Loading Report

Case Name: *1700MWEPTP01*
as compared to: *1000MWEPTP01*

From Bus	To Bus	Circuit	Most Severe Contingency	Rating (MVA)	Max Percent	Count
AIRPORT 115	BOYD 115	1	WELD LM 115-WHITNEY 115 CIRCUIT 1	236	122.8	1
AIRPORT 115	WINDSORT 115	1	WELD LM 115-WHITNEY 115 CIRCUIT 1	165.7	113.7	1
B. SANDY 500	B.SANDY 230	1	B. SANDY 500-B.SANDY 230 CIRCUIT 2	598	112.2	1
B. SANDY 500	B.SANDY 230	2	B. SANDY 500-B.SANDY 230 CIRCUIT 1	598	112.2	1
BONNY CK 115	BURLNGTN 115	1	B. SANDY 500-BSBURSC 500 CIRCUIT 1	140	114.1	2
BONNY CK 115	SO. FORK 115	1	B. SANDY 500-BSBURSC 500 CIRCUIT 1	140	109.7	2
BOONE 230	BOONE 500	1	BOONE 230-BOONE 500 CIRCUIT 2	450	104.8	3
BOONE 230	BOONE 500	2	BOONE 230-BOONE 500 CIRCUIT 1	450	104.8	3
COORSREC 115	FTLUPTON 115	1	LAFAYETT 115-VALMONT 115 CIRCUIT 1	218.7	112.1	1
COORSREC 115	FULTONTS 115	1	LAFAYETT 115-VALMONT 115 CIRCUIT 1	218.7	106.3	1
DACONO 115	ERIE SW 115	1	DEL CTAP 115-FOSTERTS 115 CIRCUIT 1	166.1	104.9	1
DANIELPK 230	DANIELPK 345	1	DANIELPK 230-DANIELPK 345 CIRCUIT 2	560	99.9	2
DANIELPK 230	DANIELPK 345	2	DANIELPK 230-DANIELPK 345 CIRCUIT 1	560	99.9	2
DANIELPK 230	DANIELPK 345	3	DANIELPK 230-DANIELPK 345 CIRCUIT 1	560	99.9	2
DANIELPK 230	PRAIRIE 230	1	DANIELPK 230-GREENWD 230 CIRCUIT 1	665	102.5	1
DEL CTAP 115	FOSTERTS 115	1	DACONO 115-ERIE SW 115 CIRCUIT 1	130	127.8	1
FLYHORSE 115	MONUMENT 115	1	125ROAD 230-B.SANDY 230 CIRCUIT 1	135.6	99.6	2
FOUNTAIN 115	RD_NIXON 115	1	KELKER N 230-KELKER W 115 CIRCUIT 1	162.2	100.3	2
FTLUPTON 115	FTLUPTON 230	1	FTLUPTON 115-FTLUPTON 230 CIRCUIT 2	280	100.2	1
FTLUPTON 115	FTLUPTON 230	2	FTLUPTON 115-FTLUPTON 230 CIRCUIT 1	280	100.2	1
FULLER 115	FULLER 230	1	125ROAD 230-B.SANDY 230 CIRCUIT 1	100	104.1	2

Case Name: *1700MWEPTP01*
as compared to: *1000MWEPTP01*

From Bus	To Bus	Circuit	Most Severe Contingency	Rating (MVA)	Max Percent	Count
GREENWD 230	MONACO12 230	1	BUCKLEY2 230-SMOKYHIL 230 CIRCUIT 1	439	109.1	3
HAYDEN 138	HAYDEN 230	1	HAYDEN 138-HAYDEN 230 CIRCUIT 2	150	101.4	1
HAYDEN 138	HAYDEN 230	2	HAYDEN 138-HAYDEN 230 CIRCUIT 1	150	101	1
LAFAYETT 115	VALMONT 115	1	COORSREC 115-FTLUPTON 115 CIRCUIT 1	239	130.4	2
LEETSDAL 230	MONACO12 230	1	BUCKLEY2 230-SMOKYHIL 230 CIRCUIT 1	439	101.5	2
T BUTTES69.0	WALSH 69.0	1	GRAN TAP69.0-WILOW CK69.0 CIRCUIT 1	33.9	109.1	1
WALSENBG69.0	WALSENBG 115	1	COMANCHE 230-WALSENBG 230 CIRCUIT 1	37	103.3	1
WELD LM 115	WELD LM 230	1	WELD PS 115-WELD PS 230 CIRCUIT 1	350	110.4	1
WELD LM 115	WHITNEY 115	1	AIRPORT 115-BOYD 115 CIRCUIT 1	210	131.9	4
WELD PS 115	WELD PS 230	1	WELD LM 115-WELD LM 230 CIRCUIT 1	350	109.8	1
WHITNEY 115	WINDSORT 115	1	AIRPORT 115-BOYD 115 CIRCUIT 1	165.7	132.9	2
WINDSOR 115	WINDSORT 115	1	WELD LM 115-WHITNEY 115 CIRCUIT 1	120	106.5	3

*The Hayden 230/138 kV #1 and #2 transformers are loaded to 98% and 97.6%, respectively, of their 150 MVA ratings, in the 1000MWEPTP01 case. They are not significantly impacted.

*The Boone 500/230 kV transformers are not in the 1000MWEPTP01 case.

Appendix E: Single Contingency Analysis – 1700 MW vs. 2400 MW

Not More Severe Loading Report

Case 1 System Case Name *1700MWEPTP01*
Case 2 System Case Name *2400MWEPTP01*

From Bus Name	To Bus Name	Circuit	Case 1 System Max Of Percent	Rating (MVA)	Count	Case 2 System Max Of Percent	Rating (MVA)	Count
125ROAD 115	125ROAD 230	1	110.1	200	2	111.8	200	19
ALMSA TM69.0	ALMSA TM 115	1	103.9	25	3	105.6	25	5
ARAPAHOB 115	ARAPAHOE 230	1	100.9	280	1	102	280	1
BENFRNCH69.0	BIG BEN 69.0	1	100.1	42	1	100.3	42	1
CAMEO 69.0	CAMEO 100	1	102.5	66.7	4	101.8	66.7	4
FLAMGORG69.0	FLAMGORG 138	1	122.6	19	5	122.7	19	5
GRANDJCT69.0	GRANDJCT 115	1	108	42	2	109.6	42	2
GREELEY 115	WELD PS 115	1	99.2	186.6	2	102	186.6	2
GREELEY 46.0	GREELEY 115	2	106	33.3	1	108.9	33.3	1
HAYDEN 138	HAYDEN 230	1	101.4	150	1	103.3	150	1
HAYDEN 138	HAYDEN 230	2	101	150	1	102.9	150	1
LOOKOUT 69.0	LOOKOUT1 230	1	102.7	100	1	102.6	100	1
MOSCA 69.0	SAN LUIS69.0	1	110.4	23.9	1	113.5	23.9	1
NSS1 69.0	NSS2 69.0	1	124.3	107	1	124.3	107	1
NSS1 69.0	WYODAK 69.0	1	115.6	107	1	115.6	107	1
NSS2 69.0	WYODAK 69.0	1	124.3	107	2	124.3	107	2
QUAKER2 115	QUAKERTP 115	1	97.3	86	1	99.9	86	2
SIDNEY 115	SIDNEY 230	1	98.5	167	3	102.2	167	8

Case 1 System Case Name *1700MWEPTP01*
Case 2 System Case Name *2400MWEPTP01*

From Bus Name	To Bus Name	Circuit	Case 1 System Max Of Percent	Rating (MVA)	Count	Case 2 System Max Of Percent	Rating (MVA)	Count
STONMOOR69.0	W.STATON69.0	1	99.4	35	1639	101	35	1643

More Severe Loading Report

Case 1 System Case Name *1700MWEPTP01*
Case 2 System Case Name *2400MWEPTP01*

From Bus Name	To Bus Name	Circuit	Case 1 System Max Of Percent	Rating (MVA)	Count	Case 2 System Max Of Percent	Rating (MVA)	Count
AIRPORT 115	BOYD 115	1	122.8	236	1	174.9	236	2
AIRPORT 115	WINDSORT 115	1	113.7	165.7	1	168.5	165.7	2
B.SANDY 230	BURLNGTN 230	1	145.9	281	2	119.1	281	2
COORSREC 115	FTLUPTON 115	1	112.1	218.7	1	132.5	218.7	21
COORSREC 115	FULTONTS 115	1	106.3	218.7	1	126.7	218.7	3
CTTNWD N 115	KETTLECK 115	1	134	132.9	2	166.1	132.9	145
DACONO 115	ERIE SW 115	1	104.9	166.1	1	156.4	166.1	2
DANIELPK 230	DANIELPK 345	1	99.9	560	2	108.8	560	2
DANIELPK 230	DANIELPK 345	2	99.9	560	2	108.8	560	2
DANIELPK 230	DANIELPK 345	3	99.9	560	2	108.8	560	2
DANIELPK 230	PRAIRIE 230	1	102.5	665	1	115.1	665	1
DEL CTAP 115	FOSTERTS 115	1	127.8	130	1	178.8	130	4
FLYHORSE 115	MONUMENT 115	1	99.6	135.6	2	136.1	135.6	1521
FOUNTAIN 115	RD_NIXON 115	1	100.3	162.2	2	106.7	162.2	4
FTLUPTON 115	FTLUPTON 230	1	100.2	280	1	115.6	280	1
FTLUPTON 115	FTLUPTON 230	2	100.2	280	1	115.6	280	1
FULLER 115	FULLER 230	1	104.1	100	2	127.5	100	15

Case 1 System Case Name *1700MWEPTP01*
Case 2 System Case Name *2400MWEPTP01*

From Bus Name	To Bus Name	Circuit	Case 1 System Max Of Percent	Rating (MVA)	Count	Case 2 System Max Of Percent	Rating (MVA)	Count
GREENWD 230	MONACO12 230	1	109.1	439	3	124.2	439	11
LAFAYETT 115	VALMONT 115	1	130.4	239	2	173.7	239	2
LEETSDAL 230	MONACO12 230	1	101.5	439	2	116.5	439	6
STEGALL 115	STEGALL 230	1	112.4	100	1	117.2	100	1
T BUTTES69.0	WALSH 69.0	1	109.1	33.9	1	127.4	33.9	1
WALSENBG69.0	WALSENBG 115	1	103.3	37	1	125	37	1644
WELD LM 115	WELD LM 230	1	110.4	350	1	132.2	350	2
WELD LM 115	WHITNEY 115	1	131.9	210	4	174.7	210	1640
WELD PS 115	WELD PS 230	1	109.8	350	1	131.6	350	1
WHITNEY 115	WINDSORT 115	1	132.9	165.7	2	185.7	165.7	1632
WINDSOR 115	WINDSORT 115	1	106.5	120	3	175.5	120	1644

System Unique Loading Report

Case Name: 2400MWEPTP01
as compared to: 1700MWEPTP01

From Bus	To Bus	Circuit	Most Severe Contingency	Rating (MVA)	Max Percent	Count
ATMELSUB 115	DRAKE N 115	1	DRAKE 7 13.8-DRAKE N 115 CIRCUIT 1	129	102.6	1
ATMELSUB 115	KELKER E 115	1	DRAKE 7 13.8-DRAKE N 115 CIRCUIT 1	159	100.1	1
BIRDSALE 115	TEMPLTON 115	1	DRAKE N 115-FAIRVWCS 115 CIRCUIT 1	79	100.5	1
BOYD 115	BOYD 230	1	WELD LM 115-WHITNEY 115 CIRCUIT 1	184	107.3	1
BOYD 115	BOYD 230	2	WELD LM 115-WHITNEY 115 CIRCUIT 1	184	107.3	1
BRIARGAT 115	CTTNWD S 115	1	CTTNWD N 115-KETTLECK 115 CIRCUIT 1	200	102.2	1
BRIARGAT 115	KETTLECK 115	1	CTTNWD N 115-KETTLECK 115 CIRCUIT 1	159	101.3	1
BRIGHTNW 115	SANDCRK 115	1	ERIE SW 115-ERIE SW 230 CIRCUIT 1	85.1	119.6	2
BUCKLEY2 230	SMOKYHIL 230	1	GREENWD 230-MONACO12 230 CIRCUIT 1	435	104.1	2
BUCKLEY2 230	TOLGATE 230	1	GREENWD 230-MONACO12 230 CIRCUIT 1	435	104.1	2
CHEN TAP69.0	T BUTTES69.0	1	LAMAR CO 115-VILAS 115 CIRCUIT 1	33.9	107.8	2
COMANCHE 115	STEM BCH 115	1	COMANCHE 230-WALSENBG 230 CIRCUIT 1	232	100.9	1
CURECANT 115	SOCANAL 115	1	CURECANT 230-LOSTCANY 230 CIRCUIT 1	120	103.3	3
DACONO 115	RINNVALL 115	1	DEL CTAP 115-FOSTERTS 115 CIRCUIT 1	166.1	117.9	1
DANIELPK 230	GREENWD 230	1	DANIELPK 230-PRAIRIE 230 CIRCUIT 1	665	109.9	1
DELCAMIN 115	FOSTERTS 115	1	DACONO 115-ERIE SW 115 CIRCUIT 1	130	125.2	1
ERIE SW 115	ERIE SW 230	1	DEL CTAP 115-FOSTERTS 115 CIRCUIT 1	250	102.2	2
FLYHORSE 115	KETTLECK 115	1	DANIELPK 230-FULLER 230 CIRCUIT 1	159	116.1	10
FORDHAM 115	LNGMNTNW 115	1	DEL CTAP 115-LONGPEAK 115 CIRCUIT 1	109	127.9	1
GARNETAP 115	HOTCHKIS 115	1	GRANDJCT 345-MONTROSE 345 CIRCUIT 1	95	100	1

Case Name: *2400MWEPTP01*
as compared to: *1700MWEPTP01*

From Bus	To Bus	Circuit	Most Severe Contingency	Rating (MVA)	Max Percent	Count
GRAN TAP69.0	HOLL TAP69.0	1	LAMAR CO 115-VILAS 115 CIRCUIT 1	55	101.7	2
GRAN TAP69.0	WILOW CK69.0	1	LAMAR CO 115-VILAS 115 CIRCUIT 1	55	116.2	2
GREELEY 115	WELD PS 115	1	ROSEDALE 115-WELD PS 115 CIRCUIT 1	186.6	102	1
KELKER E 115	KELKER S 230	1	KELKER N 230-KELKER W 115 CIRCUIT 1	350	105.5	1
KELKER N 230	KELKER W 115	1	KELKER E 115-KELKER S 230 CIRCUIT 1	350	105.6	1
KERSEYTP 115	PROSPEC 115	1	BOOMERNG 115-WELD LM 115 CIRCUIT 1	109	100.1	1
LAFAYETT 115	PARKWAY 115	1	COORSREC 115-FTLUPTON 115 CIRCUIT 1	247	116.2	2
LAPORTE 115	LAPORTE 230	1	DIXON 230-RAWHIDE 230 CIRCUIT 1	184	106.1	1
LEETSDAL 115	LEETSDAL 230	1	LEETSDAL 230-MONROEPS 230 CIRCUIT 1	280	104.4	1
LEETSDAL 230	MONROEPS 230	1	DANIELPK 230-SANTEFE 230 CIRCUIT 1	398.4	112.6	3
LNGMNTNW 115	MEADOW 115	1	DEL CTAP 115-LONGPEAK 115 CIRCUIT 1	110.2	106.1	1
LONGPEAK 230	ST.VRAIN 230	1	HARMONY 230-TIMBERLN 230 CIRCUIT 1	377.7	105.1	1
MIDWAY 500	MIDWAYBR 230	1	MIDWAY 500-MIDWAYBR 230 CIRCUIT 2	598	112.1	1
MIDWAY 500	MIDWAYBR 230	2	MIDWAY 500-MIDWAYBR 230 CIRCUIT 1	598	112.1	1
MIDWAYBR 230	RD_NIXON 230	1	FRTRANGE 230-RD_NIXON 230 CIRCUIT 1	483.6	117.9	2
MIDWAYBR 230	W CANON 230	1	COMANCHE 230-WALSENBG 230 CIRCUIT 1	239	103.9	1
MIDWAYPS 230	MIDWAYPS 345	1	DANIELPK 345-G039 345 CIRCUIT 2	560	104.3	2
MONUMENT 115	PALMER 115	1	DANIELPK 230-FULLER 230 CIRCUIT 1	134.8	113.5	5
PORTLAND 115	W.STATON 115	1	MIDWAYBR 230-W CANON 230 CIRCUIT 1	99	113.4	1
QUAKER2 115	QUAKERTP 115	1	ARVADA 115-CHEROKEE 115 CIRCUIT 1	86	99.9	1
SAN LUIS 115	SAN LUIS 230	1	SAN LUIS 115-SAN LUIS 230 CIRCUIT 2	150	103	1
SAN LUIS 115	SAN LUIS 230	2	SAN LUIS 115-SAN LUIS 230 CIRCUIT 1	150	103	1
SIDNEY 115	SIDNEY 230	1	BEAVERCK 115-MESSEX 115 CIRCUIT 1	167	102.2	3

Case Name: *2400MWEPTP01*
as compared to: *1700MWEPTP01*

From Bus	To Bus	Circuit	Most Severe Contingency	Rating (MVA)	Max Percent	Count
STONMOOR69.0	W.STATON69.0	1	COMANCHE 230-WALSENBG 230 CIRCUIT 1	35	101	15
WATERTON 230	WATERTON 345	1	DANIELPK 345-G039 345 CIRCUIT 2	560	104.4	2

*The Greeley – Weld PS 115 kV line is loaded to 99.2 % of its 186.6 MVA rating in the 1700MWEPTP01 case. It is not significantly impacted.

*The Quaker2 – QuakerTap 115 kV line is loaded to 97.3% of its 86 MVA rating in the 1700MWEPTP01 case. It is not significantly impacted.

*The Sidney 230/115 kV transformer has a 65ºC rise rating of 187 MVA. It's loaded to 98.5% of its 167 MVA rating in the 1700MWEPTP01 case.

*The StoneMoor – West Station 69 kV line is loaded to 99.4% of its 35 MVA rating in the 1700MWEPTP01 case. It is not significantly impacted.

*The MidwayBR 500/230 kV transformers are not in the 1700MWEPTP01 case.

System Unique Loading Report

Case Name: *1700MWEPTP01*
as compared to: *2400MWEPTP01*

From Bus	*To Bus*	*Circuit*	*Most Severe Contingency*	*Rating (MVA)*	*Max Percent*	*Count*
B. SANDY 500	B.SANDY 230	1	B. SANDY 500-B.SANDY 230 CIRCUIT 2	598	112.2	1
B. SANDY 500	B.SANDY 230	2	B. SANDY 500-B.SANDY 230 CIRCUIT 1	598	112.2	1
BONNY CK 115	BURLNGTN 115	1	B. SANDY 500-BSBURSC 500 CIRCUIT 1	140	114.1	2
BONNY CK 115	SO. FORK 115	1	B. SANDY 500-BSBURSC 500 CIRCUIT 1	140	109.7	2
BOONE 230	BOONE 500	1	BOONE 230-BOONE 500 CIRCUIT 2	450	104.8	3
BOONE 230	BOONE 500	2	BOONE 230-BOONE 500 CIRCUIT 1	450	104.8	3

Appendix F: Load and Generation Tables

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000			1700			2400	
	Generation Level:		1000 MW			1700 MW			2400 MW	
	Load Level:		2015HE			2015 + 700			2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr		MW	MVAr		MW	MVAr
12009	BERNARDO	"TS"	4.6	-0.3		5.5	-0.4		6.3	-0.4
12010	BLACKLAK	"TS"	9.8	3.2		11.2	3.7		12.3	4
12013	BLUEWATR	"TS"	7.3	2.4		8.4	2.7		9.2	3
12018	CINIZA	"TS"	1.3	0.4		1.4	0.5		1.5	0.5
12021	CLAYTON	"TS"	10.3	-1.8		13.8	-2.4		17.1	-3
12022	COYOTE_J	"TS"	16.1	5.3		16.9	5.6		17.5	5.8
12024	CUCHILLO	"TS"	9.3	3.1		11.7	3.8		13.8	4.5
12025	DEMINGPG	"TS"	12.3	4.1		13.7	4.5		14.8	4.9
12026	DEMINGPG	"TS"	1.7	0.6		1.9	0.6		2.1	0.7
12029	GALLUPPG	"TS"	10.1	1.7		11.8	2		13.1	2.2
12031	GALLUPPG	"TS"	4.9	1.6		5.8	1.9		6.5	2.1
12034	GRANTS	"TS"	15.5	5.1		17.8	5.9		19.7	6.5
12037	HERNANDZ	"TS"	49.3	16.2		57.4	18.9		64.4	21.2
12039	HOLLYWOD	"TS"	18.7	5		21.3	5.7		23.4	6.3
12041	HOT_SPRG	"TS"	3	0.9		3.1	0.9		3.2	1
12042	LA_JARA	"TS"	5.4	0.9		6.7	1.1		7.8	1.3
12046	MORIARTY	"TS"	33.3	10.9		40.8	13.4		47.4	15.6
12049	MPC	"TS"	15.7	5.2		16.8	5.5		17.6	5.8
12052	PAGUATE	"TS"	7.2	2.4		8.3	2.7		9.2	3
12055	PDPLAYAS	"TS"	17.3	5.7		21	6.9		24.3	8
12064	ROWE	"TS"	8.7	1.6		10.2	1.9		11.6	2.1
12069	SMITHLAK	"TS"	8.3	2.7		9.7	3.2		10.8	3.6
12070	SNYSIDRO	"TS"	4.5	1.1		5.3	1.3		6	1.4
12072	SOCORROP	"TS"	21.4	6.6		25.2	7.8		28.6	8.8
12074	SOCORROP	"TS"	8.3	2.7		9.7	3.2		10.9	3.6
12076	SPRINGER	"TS"	8.7	2.4		9.6	2.7		10.3	2.9
12078	STORRIE	"TS"	7.5	1.7		9.3	2.1		10.9	2.5
12080	TAOS	"TS"	45.4	14.9		50.7	16.7		55.1	18.1
12084	TAYLOR_P	"TS"	1.4	0.1		1.5	0.1		1.7	0.1
12087	WILLARD	"TS"	11.5	3.8		16	5.3		20.6	6.8
12088	WILLARD	"TS"	10.2	3.3		10.9	3.6		11.5	3.8
12090	YORKCANY	"TS"	0	0		0	0		0	0
12098	ENRON NM	"TS"	11.8	3.7		12.6	4		13.2	4.2
12104	ESTANCIA	"TS"	9.2	3		11.3	3.7		13.1	4.3
13011	RUIDOSO	"TS"	8.8	2.9		11.4	3.8		13.9	4.6
70028	ANSEL TS	"TS"	5.1	1.7		5.4	1.8		5.7	1.9
70047	BARRLAKE	"TS"	11.5	3.8		17.4	5.7		23.8	7.8

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000		1700		2400	
	Generation Level:		1000 MW		1700 MW		2400 MW	
	Load Level:		2015HE		2015 + 700		2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr	MW	MVAr	MW	MVAr
70055	BNAVST	"TS"	18.5	6.1	22.7	7.5	26.4	8.7
70068	BURROCYN	“TS”	30	9.9	30.1	9.9	30.2	9.9
70086	CANONCTY	“TS”	3.4	1.1	4.3	1.4	5.1	1.7
70090	CARMEL	“TS”	16.8	5.5	17.9	5.9	18.8	6.2
70092	CENTER	“TS”	18.3	6	19.5	6.4	20.4	6.7
70102	CHENEY	“TS”	6.2	2	6.7	2.2	7.1	2.3
70127	COORSREC	“TS”	6.5	2.1	6.5	2.1	6.4	2.1
70129	CREEDE	“TS”	2.5	0.8	2.7	0.9	2.8	0.9
70161	EADS	“TS”	0.9	0.3	0.9	0.3	1	0.3
70178	FOWLER	“TS”	0.8	0.3	0.9	0.3	0.9	0.3
70184	FT HOLLY	“TS”	5.6	1.9	6.1	2	6.5	2.1
70191	FTLUPTON	“TS”	22.8	7.5	32.7	10.7	42.7	14
70194	FULTONTS	“TS”	44.4	14.6	66.8	22	90.7	29.8
70204	GRANADA	“TS”	5.6	1.9	6.1	2	6.5	2.1
70221	HILANDSL	“TS”	3.4	1.1	3.6	1.2	3.8	1.2
70222	HILLTOP	“TS”	4.4	1.4	4.7	1.6	5	1.7
70229	HOOPER	“TS”	7.3	2.4	7.8	2.6	8.2	2.7
70234	HUDSON	“TS”	12.5	4.1	15.7	5.2	18.6	6.1
70243	LA SECPA	“TS”	8	2.6	11.3	3.7	14.6	4.8
70245	LAGARITA	“TS”	7.3	2.4	7.8	2.6	8.2	2.7
70275	MANZANOL	“TS”	2.9	1	3.2	1	3.3	1.1
70289	MOFFAT	“TS”	3.7	1.2	4	1.3	4.2	1.4
70304	OTEROTP	“TS”	2	0.6	2.6	0.9	3.2	1.1
70307	P.VALLEY	“TS”	86.7	28.5	128.7	42.3	172.6	56.7
70321	PINONCYN	“TS”	1.8	0.6	1.8	0.6	1.8	0.6
70322	PLAINVW	“TS”	6.6	2.2	6.6	2.2	6.6	2.2
70325	PLAZA	“TS”	3.7	1.2	3.9	1.3	4.1	1.3
70329	PORTLAND	“TS”	1.1	0.4	1.4	0.5	1.6	0.5
70333	PROWERS	“TS”	0.9	0.3	0.9	0.3	1	0.3
70335	PUEBLO-W	“TS”	36.4	12	39.6	13	42.3	13.9
70362	RIVERDAL	“TS”	43.8	14.4	66.4	21.8	90.5	29.7
70373	S.ACACIO	“TS”	2.4	0.8	2.6	0.8	2.7	0.9
70383	SFORKSL	“TS”	2.5	0.8	2.7	0.9	2.8	0.9
70394	SMELTER	“TS”	3.7	1.2	4.7	1.5	5.7	1.9
70404	SPRNGFLD	“TS”	0	0	0	0	0	0
70411	STANLEY	“TS”	10.1	3.3	10.7	3.5	11.3	3.7
70412	STEM BCH	“TS”	39.7	13	40.4	13.3	41	13.5

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000			1700			2400	
	Generation Level:		1000 MW			1700 MW			2400 MW	
	Load Level:		2015HE			2015 + 700			2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr		MW	MVAr		MW	MVAr
70414	STOCKADE	“TS”	2.4	0.8		2.6	0.8		2.7	0.9
70425	T BUTTES	“TS”	6.6	2.2		7.1	2.3		7.5	2.5
70434	TWNLAKES	“TS”	1.1	0.4		1.4	0.5		1.7	0.5
70457	WALSENBG	“TS”	18.7	6.1		22.3	7.3		25.5	8.4
70458	WALSENBG	“TS”	32.6	10.7		32.6	10.7		32.6	10.7
70460	WALSH	“TS”	6.6	2.2		7.1	2.3		7.5	2.5
70477	ZINZER	"TS"	2.4	0.8		2.6	0.8		2.7	0.9
70507	MEARSJCT	"TS"	0	0		0	0		0.1	0
70529	JLGREEN	"TS"	24.5	8		33.6	11		42.5	14
70544	ISABELLE	"TS"	23	7.5		34.5	11.4		46.8	15.4
70577	ISABELLE	"TS"	0	0		0	0		0	0
70578	ISABELLE	"TS"	0	0		0	0		0	0
70579	ISABELLE	"TS"	0	0		0	0		0	0
70583	ELIZABTH	"IR"	14.7	4.8		20.1	6.6		25.4	8.3
70585	KIOWA	"IR"	10	3.3		13.7	4.5		17.3	5.7
70590	RMEC	"TS"	14.7	4.8		20.9	6.9		27.2	8.9
70604	PARKWAY	"TS"	24	7.9		33.4	11		42.7	14
70605	HENRYLAK	"TS"	13.3	4.4		20.1	6.6		27.4	9
70607	BROMLEY	"TS"	35.3	11.6		50.9	16.7		66.8	22
70610	REUNION	"TS"	13.8	4.5		20.9	6.9		28.5	9.4
70612	PRARIE	"TS"	24.6	8.1		33.7	11.1		42.5	14
70702	CO GRN W	"TS"	0	0		0	0		0	0
73002	CO GRN W	"TS"	56.2	18.5		72.6	23.9		87.8	28.9
73003	AKRON	"TS"	4.3	1.4		4.6	1.5		4.8	1.6
73004	ALCOVA	"TS"	2.7	0.9		3.2	1		3.6	1.2
73005	ALVIN	"TS"	12.6	4.2		12.4	4.1		12.2	4
73006	ANTON	"TS"	4.5	1.5		4.8	1.6		5.1	1.7
73007	ARAPASUB	"TS"	5.9	1.9		6.2	2		6.5	2.1
73010	ARICKARE	"TS"	2.3	0.8		2.5	0.8		2.7	0.9
73019	BASIN	"TS"	9.2	3		10	3.3		10.7	3.5
73023	BIJOUTAP	"TS"	8.4	2.7		8.8	2.9		9.1	3
73024	BLKHLWTP	"TS"	6.6	2.2		8.2	2.7		9.6	3.2
73025	BONNY CK	"TS"	5.8	1.9		6.1	2		6.4	2.1
73028	BOYSEN	"TS"	0.1	0		0.1	0		0.1	0
73029	BRIDGEPT	"TS"	6.9	2.3		7.3	2.4		7.7	2.5
73030	BRIGHTNW	"TS"	17.1	5.6		25.9	8.5		35.3	11.6
73031	BRUSHTAP	"TS"	4.7	1.6		5	1.7		5.3	1.7

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000			1700			2400	
	Generation Level:		1000 MW			1700 MW			2400 MW	
	Load Level:		2015HE			2015 + 700			2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr		MW	MVAr		MW	MVAr
73037	BUSHNELL	"TS"	3.1	1		3.3	1.1		3.4	1.1
73039	CARTERLK	"TS"	3.4	1.1		4.5	1.5		5.4	1.8
73040	CARTERMT	"TS"	11.1	3.6		12.5	4.1		13.6	4.5
73042	CASPERLM	"TS"	5.4	1.8		6.2	2		6.9	2.3
73043	CHEYENNE	"TS"	0.6	0.2		0.7	0.2		0.7	0.2
73046	DALTON	"TS"	17	5.6		18.2	6		19.1	6.3
73049	DELCAMIN	"TS"	7.1	2.3		8	2.6		8.6	2.8
73050	DERBYHIL	"TS"	0	0		0	0		0	0
73053	ECKLEY	"TS"	20.5	6.7		22	7.2		23.3	7.6
73055	FOSTERTS	"TS"	26.9	8.8		43.5	14.3		62.2	20.4
73059	FLEMING	"TS"	1.4	0.4		1.3	0.4		1.3	0.4
73061	FRASER	"TS"	14.1	4.6		17.1	5.6		19.8	6.5
73063	FRENCHCK	"TS"	10.8	3.6		10.6	3.5		10.4	3.4
73064	GARLAND	"TS"	1.4	0.5		1.7	0.5		1.9	0.6
73065	GARY	"TS"	1.2	0.4		1.3	0.4		1.4	0.5
73067	GERING	"TS"	18.4	6		19.3	6.3		20	6.6
73069	GLENDO	"TS"	0.7	0.2		0.7	0.2		0.8	0.3
73072	GOREPASS	"TS"	5.7	1.9		6.8	2.2		7.8	2.5
73080	HAXTUN	"TS"	5.8	1.9		5.6	1.9		5.5	1.8
73081	HDOME	"TS"	12.4	4.1		13.9	4.6		15.2	5
73083	HELL CK	"TS"	5.7	1.9		6.1	2		6.3	2.1
73088	HOYT	"TS"	2.9	1		3.1	1		3.2	1.1
73089	HRSTHTAP	"TS"	0	0		0	0		0	0
73090	HYGIENE	"TS"	9.6	3.2		12.4	4.1		15	4.9
73091	IDALIA	"TS"	13.6	4.5		14.6	4.8		15.4	5.1
73092	JACINTO	"TS"	14	4.6		14.8	4.9		15.4	5.1
73093	JIMREADY	"TS"	1.2	0.4		1.4	0.5		1.6	0.5
73094	JOES	"TS"	11.2	3.7		12.1	4		12.8	4.2
73095	KERSEYTP	"TS"	9.6	3.2		12.3	4.1		14.8	4.9
73096	KIMBALL	"TS"	6.3	2.1		6.5	2.1		6.7	2.2
73098	KODAK	"TS"	35.9	11.8		34.6	11.4		33.6	11
73103	L.MEADOW	"TS"	2.1	0.7		2.3	0.7		2.4	0.8
73104	LAGRANGE	"TS"	5	1.6		5.8	1.9		6.5	2.1
73105	LAPORTE	"TS"	0	0		0	0		0	0
73107	LAR.RIVR	"TS"	16.6	5.4		18	5.9		19.2	6.3
73109	LARAMIE	"TS"	0.3	0.1		0.3	0.1		0.3	0.1
73110	LIBERTY	"TS"	7.5	2.5		8	2.6		8.5	2.8

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000			1700			2400	
	Generation Level:		1000 MW			1700 MW			2400 MW	
	Load Level:		2015HE			2015 + 700			2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr		MW	MVAr		MW	MVAr
73112	LINGLE	"TS"	3	1		3.3	1.1		3.6	1.2
73114	LONETREE	"TS"	13.4	4.4		17.2	5.6		20.6	6.8
73117	LOST CK	"TS"	2.5	0.8		2.7	0.9		2.8	0.9
73123	LOVELL	"TS"	4.1	1.3		4.3	1.4		4.5	1.5
73126	LYMAN	"TS"	10	3.3		10.9	3.6		11.6	3.8
73127	LYONS	"TS"	0.2	0.1		0.2	0.1		0.2	0.1
73128	MAY	"TS"	3.8	1.3		4.2	1.4		4.5	1.5
73131	MCGREW	"TS"	9.6	3.1		10.3	3.4		10.9	3.6
73132	MCKENZIE	"TS"	4.9	1.6		5.9	2		6.9	2.3
73134	MED BOW	"TS"	2.3	0.8		2.5	0.8		2.7	0.9
73136	MESSEX	"TS"	2.3	0.7		2.4	0.8		2.5	0.8
73137	MIRACLEM	"TS"	0.2	0.1		0.2	0.1		0.3	0.1
73139	MYERS	"TS"	6.5	2.1		7.2	2.4		7.7	2.5
73145	NUNN	"TS"	0.9	0.3		1.1	0.4		1.3	0.4
73147	ORCHARD	"TS"	10.2	3.4		10.9	3.6		11.4	3.8
73151	PILOT BU	"TS"	28	9.2		32.7	10.7		36.7	12.1
73152	PINEBLUF	"TS"	9.5	3.1		10.5	3.4		11.3	3.7
73153	PODOLAK	"TS"	11.2	3.7		12	4		12.6	4.2
73156	POUDRE	"TS"	0	0		0	0		0	0
73157	POWELLTP	"TS"	0.6	0.2		0.7	0.2		0.8	0.3
73159	PROSPVAL	"TS"	7	2.3		7.5	2.5		7.8	2.6
73161	QUALLS	"TS"	4.5	1.5		4.8	1.6		5	1.6
73162	RADERVIL	"TS"	0.1	0		0.1	0		0.1	0
73163	RALSTON	"TS"	3.5	1.2		4.1	1.4		4.6	1.5
73166	REDWILLW	"TS"	6.6	2.2		6.4	2.1		6.3	2.1
73169	REDWILLW	"TS"	13.8	4.5		18	5.9		22	7.2
73171	ROCKMTCM	"TS"	17.7	5.8		20	6.6		21.9	7.2
73172	ROCKPRTP	"TS"	12.8	4.2		15	4.9		16.9	5.5
73174	SAGEBRSH	"TS"	3.8	1.2		4	1.3		4.2	1.4
73175	SANDHILL	"TS"	13.1	4.3		14.2	4.7		15	4.9
73176	SEMINOE	"TS"	0	0		0	0		0	0
73178	SENTINEL	"TS"	14.8	4.9		16.3	5.4		17.6	5.8
73179	SIDNEY	"TS"	7.5	2.5		7.8	2.6		8.1	2.7
73184	SMOKYHLW	"TS"	19.2	6.3		20.3	6.7		21.1	6.9
73185	SO. FORK	"TS"	2.9	0.9		3.1	1		3.3	1.1
73191	STERLING	"TS"	19.6	6.5		19.4	6.4		19.2	6.3
73194	SWOODROW	"TS"	1.1	0.4		1.2	0.4		1.3	0.4

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000			1700			2400	
	Generation Level:		1000 MW			1700 MW			2400 MW	
	Load Level:		2015HE			2015 + 700			2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr		MW	MVAr		MW	MVAr
73201	TIMNTHTP	"TS"	0	0		0	0		0	0
73202	TORRNGTN	"TS"	8.1	2.7		9.5	3.1		10.6	3.5
73203	TRILBY	"TS"	15.1	5		19.4	6.4		23.4	7.7
73205	TROWBRDG	"TS"	7.2	2.4		8	2.6		8.6	2.8
73207	WAANIBE	"TS"	9.5	3.1		10.1	3.3		10.5	3.4
73208	WAGES	"TS"	16.4	5.4		16	5.3		15.8	5.2
73210	WAUNETA	"TS"	14.2	4.7		13.9	4.6		13.7	4.5
73213	WIGGINS	"TS"	5.7	1.9		6	2		6.3	2.1
73214	WILDCAT	"TS"	3.2	1.1		3.4	1.1		3.5	1.2
73216	WINDRIVR	"TS"	14.3	4.7		16.7	5.5		18.8	6.2
73218	WINDSOR	"TS"	64.8	21.3		106.9	35.1		155.1	51
73219	WINDYGAP	"TS"	12	3.9		14.5	4.8		16.7	5.5
73221	WOODROW	"TS"	1.3	0.4		1.3	0.4		1.4	0.5
73230	YUMA	"TS"	27.8	9.1		29.9	9.8		31.6	10.4
73235	MASONVIL	"TS"	7.8	2.6		10	3.3		12	4
73236	GREENWOD	"TS"	6	2		6.4	2.1		6.8	2.2
73298	BELLEVTP	"TS"	2.9	1		3.7	1.2		4.5	1.5
73301	BLUVALTP	"TS"	0.7	0.2		0.9	0.3		1	0.3
73310	FME	"TS"	0	0		0	0		0	0
73318	LIMON	"TS"	21.9	7.2		26.4	8.7		30.3	10
73325	RIPPLE	"TS"	9.7	3.2		12.5	4.1		15	4.9
73326	ROBB	"TS"	5.9	1.9		6.3	2.1		6.7	2.2
73327	TROUBLE	"TS"	2.2	0.7		2.7	0.9		3.1	1
73331	WRAYWAPA	"TS"	6.4	2.1		6.8	2.2		7.2	2.4
73336	ERVAYBAS	"TS"	0.9	0.3		1.1	0.4		1.3	0.4
73340	NAHNEJEN	"TS"	8.7	2.9		9.3	3.1		9.8	3.2
73359	LIMESTON	"TS"	7.7	2.5		8.1	2.7		8.5	2.8
73368	GUERNRRL	"TS"	0	0		0	0		0	0
73371	BETHELLM	"TS"	4.3	1.4		4.6	1.5		4.9	1.6
73372	OTIS LM	"TS"	9	2.9		9.6	3.2		10.2	3.3
73374	VERNONLM	"TS"	9.5	3.1		10.2	3.4		10.8	3.6
73378	FMN	"TS"	4.6	1.5		4.9	1.6		5.1	1.7
73400	EMIL AND	"TS"	25.7	8.4		35	11.5		44	14.5
73402	FALCONMV	"TS"	11.8	3.9		14.2	4.7		16.3	5.4
73405	GEESEN	"TS"	5.8	1.9		7.8	2.6		9.9	3.2
73414	MONUMENT	"TS"	13.1	4.3		17.9	5.9		22.7	7.4
73416	RANCHO	"TS"	5.7	1.9		6.9	2.3		7.9	2.6

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000			1700			2400	
	Generation Level:		1000 MW			1700 MW			2400 MW	
	Load Level:		2015HE			2015 + 700			2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr		MW	MVAr		MW	MVAr
73421	STETSON	"TS"	10.1	3.3		13.5	4.4		16.9	5.5
73431	PEYTON	"TS"	0	0		0	0		0	0
73445	GRESHAM	"TS"	5.8	1.9		8	2.6		10.3	3.4
73450	GRESHAM	"TS"	3.7	1.2		5.1	1.7		6.4	2.1
73451	GRESHAM	"TS"	1.7	0.6		2.3	0.8		2.9	1
73452	BLACKFOR	"TS"	6.6	2.2		9.2	3		11.8	3.9
73456	BLACKFOR	"TS"	5.3	1.7		7.3	2.4		9.2	3
73457	PALMRDIV	"TS"	6.3	2.1		8.7	2.9		11.1	3.6
73457	PALMRDIV	"TS"	11.4	3.7		15.7	5.2		20	6.6
73458	APPLTREE	"TS"	2.8	0.9		4.4	1.4		6.1	2
73459	APPLTREE	"TS"	3.3	1.1		4.5	1.5		5.7	1.9
73460	BLK SQMV	"TS"	6.1	2		8.3	2.7		10.5	3.5
73460	BLK SQMV	"TS"	19.6	6.4		26.8	8.8		33.8	11.1
73463	PADDOCK	"TS"	12.3	4.1		16.7	5.5		20.9	6.9
73464	ADENA	"TS"	2.3	0.7		2.4	0.8		2.5	0.8
73469	WAVER PV	"TS"	16.6	5.5		20.9	6.9		24.9	8.2
73473	WAVER PV	"TS"	4.9	1.6		6.7	2.2		8.5	2.8
73476	FORESTLK	"TS"	5.1	1.7		6.7	2.2		8.2	2.7
73478	GALIEN	"TS"	11.4	3.7		11.9	3.9		12.4	4.1
73479	HARISBRG	"TS"	3.5	1.1		3.9	1.3		4.3	1.4
73485	BURL KC	"TS"	11.6	3.8		12.3	4		12.8	4.2
73501	BURL KC	"TS"	40.6	13.4		59.6	19.6		79.2	26
73502	DACONO	"TS"	28.2	9.3		39.7	13.1		51.3	16.8
73503	ERIE TAP	"TS"	18.9	6.2		38.5	12.7		65.5	21.5
73534	MEETSETP	"TS"	1.2	0.4		1.4	0.4		1.5	0.5
73553	BOXELDER	"TS"	9.4	3.1		12.1	4		14.6	4.8
73554	BOOMERNG	"TS"	20	6.6		43.8	14.4		78.6	25.8
73555	BRACEWEL	"TS"	15.3	5		16.3	5.4		17.1	5.6
73556	WAGONWHL	"TS"	4	1.3		5.2	1.7		6.3	2.1
79002	AXIAL	"TS"	15.2	5		17.5	5.8		19.5	6.4
79011	CAHONE	"TS"	5.4	1.8		6.5	2.1		7.4	2.4
79012	CORTEZ	"TS"	8.7	2.9		10.2	3.4		11.5	3.8
79020	CURECANT	"TS"	0.5	0.2		0.7	0.2		0.8	0.3
79042	HOTCHKIS	"TS"	10	3.3		12.6	4.1		15	4.9
79044	LOSTCANY	"TS"	0	0		0	0		0	0
79046	MEEKER	"TS"	4.7	1.5		5.9	1.9		6.9	2.3
79052	NUCLA	"TS"	6.7	2.2		8.4	2.8		10	3.3

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

	Case:		1000			1700			2400	
	Generation Level:		1000 MW			1700 MW			2400 MW	
	Load Level:		2015HE			2015 + 700			2015 + 1400	
BusNo	BusName	Load_ID	MW	MVAr		MW	MVAr		MW	MVAr
79056	RIFLE CU	"TS"	0	0		0	0		0	0
79073	BLUEDOOR	"TS"	7.3	2.4		8.4	2.8		9.4	3.1
79074	E.CORTEZ	"TS"	9.1	3		10.5	3.5		11.8	3.9
79075	EMPIRETS	"TS"	6.8	2.2		8.1	2.7		9.3	3
79076	AM EAST	"TS"	8.7	2.9		6	2		4.5	1.5
79077	BAYFIELD	"TS"	19.1	6.3		25.2	8.3		30.9	10.2
79078	BODO	"TS"	64.7	21.3		82.2	27		98.3	32.3
79079	BULLOCK	"TS"	22.5	7.4		27	8.9		31	10.2
79080	CASCADEL	"TS"	12.1	4		13	4.3		13.7	4.5
79081	CRSTBUTT	"TS"	11.2	3.7		12.7	4.2		14	4.6
79082	HAPPYCAN	"TS"	20.9	6.9		26.4	8.7		31.3	10.3
79083	JUANITA	"TS"	33.7	11.1		37.4	12.3		40.5	13.3
79084	LAKECITY	"TS"	3.5	1.2		4	1.3		4.5	1.5
79085	NORTHMSA	"TS"	4.2	1.4		5.3	1.7		6.3	2.1
79086	PAGOSA	"TS"	19.2	6.3		25.8	8.5		32.1	10.6
79088	ROCKWOOD	"TS"	15.3	5		20.5	6.7		25.5	8.4
79089	SHENDOAH	"TS"	5.2	1.7		7	2.3		8.7	2.9
79090	SKITO	"TS"	5.4	1.8		6.2	2		6.8	2.2
79099	FLOR.RIV	"TS"	34.9	11.5		23.9	7.9		18.1	5.9
79103	GARNET M	"TS"	16.1	5.3		20.4	6.7		24.3	8
79108	HOVENWEP	"TS"	8.7	2.9		9.1	3		9.4	3.1
79110	MAIN CO	"TS"	3.9	1.3		4.1	1.3		4.2	1.4
79111	MANCOSTP	"TS"	3.2	1.1		3.8	1.3		4.3	1.4
79118	Y.JACK W	"TS"	5.8	1.9		6.1	2		6.2	2.1
79120	MOQUI C	"TS"	5.8	1.9		6.1	2		6.2	2.1
79121	SANDCANY	"TS"	8.7	2.9		9.1	3		9.4	3.1
79188	TELLURID	"TS"	12.5	4.1		15.6	5.1		18.4	6.1
79189	SUNSH SM	"TS"	2.2	0.7		2.8	0.9		3.3	1.1
79191	COYOTE_G	"TS"	0.9	0.3		1	0.3		1.1	0.4
79192	SOCANAL	"TS"	19.1	6.3		24.2	7.9		28.8	9.5
79262	CEMNT CK	"TS"	1.6	0.5		2	0.6		2.3	0.8
79309	W.RV.CTY	"TS"	2.6	0.9		3.2	1		3.7	1.2
79312	Ca	"TS"	80	26.3		80	26.3		80	26.3
79350	Cb	"TS"	80.7	26.5		80.7	26.5		80.7	26.5
99901	POUDRE	"TS"	6.5	2.1		8.2	2.7		9.7	3.2
99902	DERBYHIL	"TS"	5.6	1.8		7.1	2.3		8.4	2.8

Table F-1 is continued on the next page

Table F-1
Loads used in the Three Generation Scenarios

Load Totals

	(MW)	2015HE		2015 + 700		2015 + 1400
	Total Load	3181		3860		4544
	Increase			680		683

Table F-2
Generator Schedules for 1000MW Case

						PowerFlow Data:		
					TSGT			Whole
					Net	Gen.Aux.Power		Generator
Bus	Bus	SS	Unit		Generator	MW	MVAr	Gross
Number	Name	ID	ID	Description	Schedule	(ID = "SS")	(Pf = 0.95)	Schedule
73129	MBPP-1	1	1	Laramie River 2	196.0	42.8	11.5	585.0
73130	MBPP-2	1	1	Laramie River 3	196.0	42.8	11.5	585.0
79015	CRAIG 1	1	1	Craig 1	98.0	23.2	7.2	446.0
79016	CRAIG 2	1	1	Craig 2	98.0	23.2	7.2	446.0
79017	CRAIG 3	1	1	Craig 3	375.0	25.0	8.3	400.0
73995	SANDSAGE	1	1	Holcomb 1	700.0	50.0	15.6	750.0
73997	LEC	1	1	LEC 1	0.0	0.0	0.0	0.0
73993	LEC2	1	2	LEC 2	0.0	0.0	0.0	0.0
79158	NUCLA 1	1	1	Nucla 1	12.0	2.0	0.6	14.0
79159	NUCLA 2	1	1	Nucla 2	12.0	2.0	0.6	14.0
79160	NUCLA 3	1	1	Nucla 3	12.0	2.0	0.6	14.0
79161	NUCLA 4	1	1	Nucla 4	63.0	4.0	1.2	69.0
12058	PEGS1	1	1	Escalante (PEGS)	246.0	23.0	7.2	269.0
10320	SJUAN_G3	1	1	San Juan 3	38.0	2.5	0.8	544.0
16518	SPR GEN3	1	1	Springerville 3	400.0	30.0	9.4	430.0
79251	RIFLE1	1	1	Rifle steam	0.0	0.0	0.0	0.0
79251	RIFLE1	2	2	Rifle GT1	0.0	0.0	0.0	0.0
79252	RIFLE2	1	3	Rifle GT2	0.0	0.0	0.0	0.0
79252	RIFLE2	2	4	Rifle GT3	0.0	0.0	0.0	0.0
73302	BRLNGTN1	1	1	Burlington 1	0.0	0.0	0.0	0.0
73303	BRLNGTN2	1	1	Burlington 2	0.0	0.0	0.0	0.0
70565	BARRLAK1	1	1	Knutson 1	0.0	0.0	0.0	0.0
70566	BARRLAK2	1	1	Knutson 2	0.0	0.0	0.0	0.0
73532	LINCOLN1	1	1	Limon 1	0.0	0.0	0.0	0.0
73533	LINCOLN2	1	1	Limon 2	0.0	0.0	0.0	0.0
12094	PYRMD12	1	1	Pyramid1	0.0	0.0	0.0	0.0
12094	PYRMD12	2	2	Pyramid2	0.0	0.0	0.0	0.0
12095	PYRMD34	1	1	Pyramid3	0.0	0.0	0.0	0.0
12095	PYRMD34	2	2	Pyramid4	0.0	0.0	0.0	0.0
60086	BRIDGER1	1	1	Bridger 1	0.0	30.0	21.0	520.0

Table F-3
Generator Schedules for 1700MW Case

						PowerFlow Data:		
					TSGT			Whole
					Net	Gen.Aux.Power		Generator
Bus Number	Bus Name	SS ID	Unit ID	Description	Generator Schedule	MW (ID = "SS")	MVAr (Pf = 0.95)	Gross Schedule
73129	MBPP-1	1	1	Laramie River 2	196.0	42.8	11.5	585.0
73130	MBPP-2	1	1	Laramie River 3	196.0	42.8	11.5	585.0
79015	CRAIG 1	1	1	Craig 1	98.0	23.2	7.2	446.0
79016	CRAIG 2	1	1	Craig 2	98.0	23.2	7.2	446.0
79017	CRAIG 3	1	1	Craig 3	375.0	25.0	8.3	400.0
73995	SANDSAGE	1	1	Holcomb 1	700.0	50.0	15.6	750.0
73997	LEC	1	1	LEC 1	700.0	50.0	16.4	750.0
73993	LEC2	1	2	LEC 2	0.0	0.0	0.0	0.0
79158	NUCLA 1	1	1	Nucla 1	12.0	2.0	0.6	14.0
79159	NUCLA 2	1	1	Nucla 2	12.0	2.0	0.6	14.0
79160	NUCLA 3	1	1	Nucla 3	12.0	2.0	0.6	14.0
79161	NUCLA 4	1	1	Nucla 4	63.0	4.0	1.2	69.0
12058	PEGS1	1	1	Escalante (PEGS)	246.0	23.0	7.2	269.0
10320	SJUAN_G3	1	1	San Juan 3	38.0	2.5	0.8	544.0
16518	SPR GEN3	1	1	Springerville 3	400.0	30.0	9.4	430.0
79251	RIFLE1	1	1	Rifle steam	0.0	0.0	0.0	0.0
79251	RIFLE1	2	2	Rifle GT1	0.0	0.0	0.0	0.0
79252	RIFLE2	1	3	Rifle GT2	0.0	0.0	0.0	0.0
79252	RIFLE2	2	4	Rifle GT3	0.0	0.0	0.0	0.0
73302	BRLNGTN1	1	1	Burlington 1	0.0	0.0	0.0	0.0
73303	BRLNGTN2	1	1	Burlington 2	0.0	0.0	0.0	0.0
70565	BARRLAK1	1	1	Knutson 1	0.0	0.0	0.0	0.0
70566	BARRLAK2	1	1	Knutson 2	0.0	0.0	0.0	0.0
73532	LINCOLN1	1	1	Limon 1	0.0	0.0	0.0	0.0
73533	LINCOLN2	1	1	Limon 2	0.0	0.0	0.0	0.0
12094	PYRMD12	1	1	Pyramid1	0.0	0.0	0.0	0.0
12094	PYRMD12	2	2	Pyramid2	0.0	0.0	0.0	0.0
12095	PYRMD34	1	1	Pyramid3	0.0	0.0	0.0	0.0
12095	PYRMD34	2	2	Pyramid4	0.0	0.0	0.0	0.0
60086	BRIDGER1	1	1	Bridger 1	0.0	30.0	21.0	460.0

Table F-4
Generator Schedules for 2400MW Case

						PowerFlow Data:		
					TSGT			Whole
					Net	Gen.Aux.Power		Generator
Bus Number	Bus Name	SS ID	Unit ID	Description	Generator Schedule	MW (ID = "SS")	MVAr (Pf = 0.95)	Gross Schedule
73129	MBPP-1	1	1	Laramie River 2	196.0	42.8	11.5	585.0
73130	MBPP-2	1	1	Laramie River 3	196.0	42.8	11.5	585.0
79015	CRAIG 1	1	1	Craig 1	98.0	23.2	7.2	446.0
79016	CRAIG 2	1	1	Craig 2	98.0	23.2	7.2	446.0
79017	CRAIG 3	1	1	Craig 3	375.0	25.0	8.3	400.0
73995	SANDSAGE	1	1	Holcomb 1	700.0	50.0	15.6	750.0
73997	LEC	1	1	LEC 1	700.0	50.0	16.4	750.0
73993	LEC2	1	2	LEC 2	700.0	50.0	16.4	750.0
79158	NUCLA 1	1	1	Nucla 1	12.0	2.0	0.6	14.0
79159	NUCLA 2	1	1	Nucla 2	12.0	2.0	0.6	14.0
79160	NUCLA 3	1	1	Nucla 3	12.0	2.0	0.6	14.0
79161	NUCLA 4	1	1	Nucla 4	63.0	4.0	1.2	69.0
12058	PEGS1	1	1	Escalante (PEGS)	246.0	23.0	7.2	269.0
10320	SJUAN_G3	1	1	San Juan 3	38.0	2.5	0.8	544.0
16518	SPR GEN3	1	1	Springerville 3	400.0	30.0	9.4	430.0
79251	RIFLE1	1	1	Rifle steam	0.0	0.0	0.0	0.0
79251	RIFLE1	2	2	Rifle GT1	0.0	0.0	0.0	0.0
79252	RIFLE2	1	3	Rifle GT2	0.0	0.0	0.0	0.0
79252	RIFLE2	2	4	Rifle GT3	0.0	0.0	0.0	0.0
73302	BRLNGTN1	1	1	Burlington 1	0.0	0.0	0.0	0.0
73303	BRLNGTN2	1	1	Burlington 2	0.0	0.0	0.0	0.0
70565	BARRLAK1	1	1	Knutson 1	0.0	0.0	0.0	0.0
70566	BARRLAK2	1	1	Knutson 2	0.0	0.0	0.0	0.0
73532	LINCOLN1	1	1	Limon 1	0.0	0.0	0.0	0.0
73533	LINCOLN2	1	1	Limon 2	0.0	0.0	0.0	0.0
12094	PYRMD12	1	1	Pyramid1	0.0	0.0	0.0	0.0
12094	PYRMD12	2	2	Pyramid2	0.0	0.0	0.0	0.0
12095	PYRMD34	1	1	Pyramid3	0.0	0.0	0.0	0.0
12095	PYRMD34	2	2	Pyramid4	0.0	0.0	0.0	0.0
60086	BRIDGER1	1	1	Bridger 1	0.0	30.0	21.0	520.0

Appendix G: Facility Upgrade Unit Costs

The cost estimates for the EPTP infrastructure found in Appendices H through J, as well as for the existing facility upgrade costs found in Appendix H, are based on Tri-State's Draft Ten Year Capital Construction Budget, dated October 8, 2007.

The existing facility upgrade costs found in Appendices I and J are based on the following unit cost table.

Table G-1: Unit Cost Assumptions for Existing Facility Upgrades

Facility	Unit Cost ($000)	Unit
	(2008 $)	
230 kV line uprate	115	mile
230 kV line reconductor	185	mile
115 kV line uprate	75	mile
115 kV line reconductor	160	mile
69 kV line uprate	35	mile
69 kV line reconductor	110	mile
345/230 kV, 560 MVA transformer	2896	each
230/115 kV, 100 MVA transformer	975	each
230/115 kV, 150 MVA transformer	1167	each
230/115 kV, 200 MVA transformer	1471	each
230/115 kV, 250 MVA transformer	1663	each
230/115 kV, 300 MVA transformer	1896	each
230/115 kV, 350 MVA transformer	2081	each
115/69 kV, 75 MVA transformer	568	each

Appendix H: 1000 MW EPTP System Cost Estimates

Table H-1: 1000 MW EPTP System Estimated Costs

PROJECT TITLE	($000)	COMMENTS
Transmission Lines		
BIG SANDY- BURLINGTON NEW 500 KV LINE	$ 115,000	79 MI; 3 COND BUNDLE OF TWD 1272 ACSR; INCL FIBER IN OPGW
BIG-SANDY - BURLINGTON 230 KV LINE UPRATE	$ 7,500	REPLACE CT @ BIG SANDY; UPRATE CONDUCTOR TO 100˚ C
BIG SANDY- GREEN VALLEY 345/230 KV LINE	$ 71,300	93 MI; 2 COND BUNDLE OF 1272 ACSR OPGW INCL FIBER;
BIG SANDY- ROAD 125 KV 230 KV LINE	$ 13,300	26 MI;1272 ACSR OPGW INCL FIB
BIG SANDY - STORY 345/230 KV LINE	$ 80,000	72 MI; 2 COND BUNDLE OF 1272 ACSR OPGW INCL FIB
BOONE- LEC 500 KV LINE	$ 142,500	115 MI; 3 COND BUNDLE OF TWD 1272 ACSR; INCL FIBER IN OPGW
BOONE-MIDWAY 500 KV LINE	$ 63,700	38 MI;3 COND BUNDLE OF TWD 1272 ACSR; INCL FIBER IN OPGW
BURLINGTON- LEC 500 KV LINE	$ 124,000	86 MI; 3 COND BUNDLE OF TWD 1272 ACSR; INCL FIBER IN OPGW
BURLINGTON- ROLLING HILLS 500 KV LINE	$ 217,000	167 MI;3 COND BUNDLE OF TWD 1272 ACSR; INCL FIBER IN OPGW
LAMAR-LEC 230 KV LINE #1	$ 17,500	19 MI;1272 ACSR OPGW INCL FIBER;
LAMAR-LEC 230 KV LINE #2	$ 17,500	19 MI;1272 ACSR OHGW INCL FIBER;
LEC- ROLLING HILLS 500 KV LINE	$ 157,000	90 MI;3 COND BUNDLE OF TWD 1272 ACSR; INCL FIBER IN OPGW
(SUBTOTAL)	$1,026,300	

Table H-1 continued on next page

Table H-1: 1000 MW EPTP System Estimated Costs (cont.)

PROJECT TITLE	($000)	COMMENTS
Substations		
BIG SANDY SUB: (2) 500/230 KV, 900 MVA XFMR	$ 61,359	10/01/07 SUBSTATION COST ESTIMATE
BOONE SUB: (2) 500/230 KV, 700 MVA XFMR	$ 58,692	10/01/07 SUBSTATION COST ESTIMATE
BURLINGTON SUB: (1) 500/230 KV, 900 MVA XFMR	$ 87,297	10/01/07 SUBSTATION COST ESTIMATE
GREEN VALLEY (XCEL) SUB: 230 KV ADD	$ 4,541	10/01/07 SUBSTATION COST ESTIMATE
LAMAR 2ND 230/115 KV, 167 MVA XFMR ADD	$ 5,530	EST INCL (1) 230 KV BKR & (1) 115 KV BKR
LAMAR 230/115 KV, 167 MVA XFMR REPL	$ 1,600	
LAMAR (TS) SUB 230 KV BKR ADD	$ 7,513	10/01/07 SUBSTATION COST ESTIMATE
LEC SUB; (1) 500/230 KV, 600 MVA XFMR	$ 52,575	10/01/07 SUBSTATION COST ESTIMATE
MIDWAY (TS) SUB: (2) 500/230 KV, 1000 MVA XFMRS	$ 63,489	10/01/07 SUBSTATION COST ESTIMATE
MIDWAY (non-TS) SUB: 230 KV BKR ADD	$ 16,600	EST INCL (3) 230KV BKR; (2) 0.5 MI 230KV INTERSUBSTATION TIE-LINES
ROAD 125 SUB: 230/115 KV, 300 MVA XFMR	$ 10,062	10/01/07 SUBSTATION COST ESTIMATE
ROLLING HILLS 500 KV SWITCH STATION	$ 38,500	10/01/07 SUBSTATION COST ESTIMATE
ROLLING HILLS HVDC STATION	$ 84,054	10/01/07 SUBSTATION COST ESTIMATE
STORY SUB: 230 KV BKR ADD	$ 3,375	10/01/07 SUBSTATION COST ESTIMATE
(SUBTOTAL)	$ 495,187	

Table H-1 continued on next page

Table H-1: 1000 MW EPTP System Estimated Costs (cont.)

PROJECT TITLE	($000)	COMMENTS
1000 MW System Upgrades[9]		
AIRPORT TAP - DOT TAP 115 KV LINE REBUILD	$ 1,721	NETWORK PROJECT WITH AQUILA; 7.9 MI
BOONE- DOT TAP 115 KV LINE RECOND	$ 659	NETWORK PROJECT WITH AQUILA; 3.0 MI
COTTONWOOD - KETTLE CREEK 115 KV LINE UPRATE	$ 300	UPRATING OF EXISTING LINE, NETWORK PROJECT WITH CSU
FT. LUPTON SECOND 230/115 KV XFMR 280 MVA	$ 3,470	REPLACE WITH NETWORK PROJECT WITH PSCO
KELKER WEST - ROCK ISLAND 115 KV LINE RECOND	$ 465	NETWORK PROJECT WITH CSU; 4.6 MI TO 159 MVA
KELKER EAST-TEMPLETON 115 KV LINE RECOND	$ 750	NETWORK PROJECT WITH CSU; 7.4 MI TO 159 MVA
LAFAYETTE - VALMONT 115 KV LINE UPRATE	$ 2,968	NETWORK PROJECT WITH PSCO; 7.6 MI
MIDWAY (USBR) 230/115 KV XFMR REPLACEMENT	$ 3,000	REPLACE WITH 167 MVA; NETWORK PROJECT WITH WESTERN
PORTLAND - WEST STATION 115 KV LINE UPRATE	$ 150	NETWORK PROJECT WITH AQUILA; 20.0 MI
WELD 230/115 KV XFMR REPLACEMENT	$ 3,470	NETWORK PROJECT WITH PSCO, WESTERN
Total 1000 MW System Upgrade Costs	$16,953	
Total 1000 MW EPTP System Estimated Costs	$1,538,440	

[9] All of the listed Upgrade projects, with the exception of the Cottonwood – Kettle Creek 115 kV line uprate project, were identified and estimated in the Colorado Long Range Transmission Planning Group study, dated July 2006.

Appendix I: 1700 MW EPTP System Cost Estimates

Table I-1: 1700 MW EPTP System Estimated Costs

PROJECT TITLE	($000)	COMMENTS
Transmission Lines		
BIG SANDY- MIDWAY 500 KV LINE	$ 151,000	95 MI;3 COND BUNDLE OF TWD 1272 ACSR; INCL FIB
(SUBTOTAL)	$ 151,000	

Table I-1 continued on next page

Table I-1: 1700 MW EPTP System Estimated Costs (cont.)

PROJECT TITLE	($000)	COMMENTS
Substations		
CPP UNIT#1 LEC SWITCHSTATION ADD	$ 50,000	2-500 KV BKR;
(SUBTOTAL)	$ 50,000	

Table I-1 continued on next page

Table I-1: 1700 MW EPTP System Estimated Costs (cont)

Facility	Miles	Rating	Units	%	New Rating	Growth Factor	Cost ($000)	Notes
						1.5		
Tri-State and Member Facilities								
The Dacono – Erie Switch 115 kV line	4.4	166.1	MVA	156.4%	259.8	389.7	$ 968	
The Del Camino Tap – Foster 115 kV line	2	130	MVA	178.8%	232.4	348.7	$ 440	
The Fuller 230/115 kV transformer	n/a	100	MVA	127.5%	127.5	191.3	$ 975	Cost for 2nd 100
The Weld (LM) – Whitney 115 kV line	5.4	210	MVA	174.7%	366.9	550.3	$ 1,188	Poudre/Western line
The Whitney – Windsor Tap 115 kV line	2.8	165.7	MVA	185.7%	307.7	461.6	$ 616	
The Windsor – Windsor Tap 115 kV line	2.6	120	MVA	175.5%	210.6	315.9	$ 572	
PSCo's Facilities								
The Coors Recycling – Ft. Lupton 115 kV line	1.9	218.7	MVA	132.5%	289.8	434.7	$ 418	
The Coors Recycling – Fulton (TS) 115 kV line	1.8	218.7	MVA	126.7%	277.1	415.6	$ 396	
The Daniels Park 345/230 kV transformers #1, #2, and #3	n/a	560	MVA	108.8%	609.3	913.9	$ 5,792	Cost for (2) 560
The Daniels Park – Prairie 230 kV line	3.6	665	MVA	115.1%	765.4	1148.1	$ 1,008	
The Ft. Lupton 230/115 kV transformers #1 and #2	n/a	280	MVA	115.6%	323.7	485.5	$ 3,792	Cost for (2) 280
The Greenwood – Monaco 230 kV line	2.1	439	MVA	124.2%	545.2	817.9	$ 588	
The Lafayette – Valmont 115 kV line	7.6	239	MVA	173.7%	415.1	622.7	$ 1,672	
The Leetsdale – Monaco 230 kV line	6.9	439	MVA	116.5%	511.4	767.2	$ 3,192	0.5 miles of UG
The Weld (PS) 230/115 kV transformer	n/a	350	MVA	131.6%	460.6	690.9	$ 2,081	Cost for 3rd 350
Western's Facilities								
The Airport – Boyd 115 kV line	5.4	236	MVA	174.9%	412.8	619.1	$ 1,188	
The Airport – Windsor Tap 115 kV line	4.9	165.7	MVA	168.5%	279.2	418.8	$ 1,078	
The Weld (LM) 230/115 kV transformer	n/a	350	MVA	132.2%	462.7	694.1	$ 2,081	Cost for 4th 350

Table I-1 Continued on next page

Table I-1: 1700 MW EPTP System Estimated Costs (cont)

Facility	Miles	Rating	Units	%	New Rating	Growth Factor	Cost ($000)	Notes
Colorado Springs Utilities' Facilities								
The Flyhorse – Monument 115 kV line	5.5	135.6	MVA	136.1%	184.6	276.8	$ 1,210	
The Fountain – RD Nixon 115 kV line	6	162.2	MVA	106.7%	173.1	259.6	$ 1,320	
Total Upgrade Cost 1700 MW System:							$ 30,575	
Total 1700 MW EPTP System Estimated Costs							$ 231,575	

Appendix J: 2400 MW EPTP System Cost Estimates

Table J-1: 2400 MW EPTP System Estimated Costs

PROJECT TITLE	($000)	COMMENTS
Transmission Lines		
BURLINGTON- WRAY 230 KV LINE	$ 27,500	60 MI;1272 ACSR OPGW INCL FIBER;
GREEN VALLEY-BCE TP (2) 230 KV LINE	$ 33,000	10 MI;1272 ACSR OPGW INCL FIB;
(SUBTOTAL)	$ 60,500	

Table J-1 continued on next page

Table J-1: 2400 MW EPTP System Estimated Costs (cont.)

PROJECT TITLE	($000)	COMMENTS
Substations[10]		
GREEN VALLEY TAP SUB:230 KV ADD	$ 3,500	10/01/07 SUBSTATION COST ESTIMATE
WRAY SUB: 230 KV BKR ADD	$ 5,230	10/01/07 SUBSTATION COST ESTIMATE
(SUBTOTAL)	$ 8,730	

Table J-1 continued on next page

[10] There may be additional breakers needed at LEC in this configuration that were not included in the costs shown here.

Table J-1: 2400 MW EPTP System Estimated Costs (cont)

Facility	Miles	Rating	Units	%	New Rating	Growth Factor	Cost ($000)	Notes
						1.5		
Tri-State and Member Facilities								
The Comanche – Stem Beach 115 kV line	12	232	MVA	100.9%	234.1	351.1	$ 2,640	
The Dacono – Rinn Valley 115 kV line	4.2	166.1	MVA	117.9%	195.8	293.7	$ 924	
The Del Camino – Foster (TS) 115 kV line	3	130	MVA	125.2%	162.8	244.1	$ 660	
The Erie Switch 230/115 kV transformer	n/a	250	MVA	102.2%	255.5	383.3	$ 1,663	Cost for 2nd 250
The Garnet Mesa Tap – Hotchkiss 115 kV line	12	95	MVA	100%	95	142.5	$ 2,640	
The San Luis Valley 230/115 kV transformers #1 and #2	n/a	150	MVA	103%	154.5	231.8	$ 2,334	Tri-State/PSCo jointly owned facility; Cost for (2) 150
PSCo's Facilities								
The Buckley – Smoky Hill 230 kV line	5.5	435	MVA	104.1%	452.8	679.3	$ 1,540	
The Buckley – Tolgate 230 kV line	3.4	435	MVA	104.1%	452.8	679.3	$ 952	
The Daniels Park – Greenwood 230 kV line	8.1	665	MVA	109.9%	730.8	1096.3	$ 2,268	
The Lafayette – Parkway 115 kV line	5.4	247	MVA	116.2%	287	430.5	$ 1,188	
The Leetsdale 230/115 kV transformer	n/a	280	MVA	104.4%	292.3	438.5	$ 1,896	Cost for 2nd 280
The Leetsdale – Monroe (PS) 230 kV line	1.8	398.4	MVA	112.6%	448.6	672.9	$ 504	
The Midway (PS) 345/230 kV transformer	n/a	560	MVA	104.3%	584.1	876.1	$ 2,896	Cost for 2nd 560
The Monument – Palmer 115 kV line	6.6	134.8	MVA	113.5%	153	229.5	$ 1,452	CSU/PSCo each own part of this line
The Waterton 345/230 kV transformer	n/a	560	MVA	104.4%	584.6	877	$ 2,896	Cost for 2nd 560
Platte River Power Authority Facilities								
The Boyd 230/115 kV transformers #1 and #2	n/a	184	MVA	107.3%	197.4	296.1	$ 2,942	Cost for (2) 184
The Laporte 230/115 kV transformer	n/a	184	MVA	106.1%	195.2	292.8	$ 1,471	Cost for 2nd 184
The Longmont NW – Meadow 115 kV line	2.7	110.2	MVA	106.1%	116.9	175.4	$ 594	
The Longs Peak – Ft. St. Vrain 230 kV line	9.8	377.7	MVA	105.1%	397	595.4	$ 2,744	

Table J-1 continued on next page

Table J1: 2400 MW EPTP System Estimated Costs (cont)

Facility	Miles	Rating	Units	%	New Rating	Growth Factor	Cost ($000)	Notes
Western's Facilities								
The Curecanti – South Canal 115 kV line	14.2	120	MVA	103.3%	124	185.9	$ 3,124	
The Fordham – Longmont NW 115 kV line	1.2	109	MVA	127.9%	139.4	209.1	$ 264	Western/PRPA owned
The Kersey Tap – Prospect 115 kV line	7.9	109	MVA	100.1%	109.1	163.7	$ 1,738	
The Midway (BR) – West Cañon 230 kV line	41.3	239	MVA	103.9%	248.3	372.5	$ 11,564	
Colorado Springs Utilities' Facilities								
The Atmel Sub – Drake N 115 kV line	1.8	129	MVA	102.6%	132.4	198.5	$ 396	
The Atmel Sub – Kelker E 115 kV line	3.7	159	MVA	100.1%	159.2	238.7	$ 814	
The Birdsale – Templton 115 kV line	2	79	MVA	100.5%	79.4	119.1	$ 440	
The Briargate – Cottonwood S 115 kV line	3.8	200	MVA	102.2%	204.4	306.6	$ 836	
The Briargate – Kettle Creek 115 kV line	5.1	159	MVA	101.3%	161.1	241.6	$ 1,122	
The Flyhorse – Kettle Creek 115 kV line	5	159	MVA	116.1%	184.6	276.9	$ 1,100	
The Kelker 230/115 kV transformers #1(S->E) and #2(N->W)	n/a	350	MVA	105.5%	369.3	553.9	$ 4,162	Cost for (2) 350
The Midway (BR) – RD Nixon 230 kV line	5.4	483.6	MVA	117.9%	570.2	855.2	$ 1,512	
Aquila's Facilities								
The Portland – West Station 115 kV line	12.5	99	MVA	113.4%	112.3	168.4	$ 2,750	
Total Upgrade Cost 2400 MW System:							$ 64,026	
Total 2400 MW EPTP System Estimated Costs							$ 133,256	