Initial Study / Proposed Mitigated Negative Declaration

Subtransmission Project (STP)

Riverside, California

TECHNICAL APPENDIX A

69 KV SUBTRANSMISSION NETWORK REPORT
REVIEW OF EXISTING SYSTEMS (8/2007)

Riverside Public Utilities
3901 Orange Street
Riverside, California 92501

February 2009

69 kV SUBTRANSMISSION NETWORK REPORT

CITY OF RIVERSIDE

REVIEW OF EXISTING SYSTEM

AUGUST 2007

ADDENDUM NO.1 – AUGUST 2008

PREPARED BY: Lyle E. Hill, P.E.

WATER ENERGY LIFE

CITY OF RIVERSIDE

PUBLIC UTILITIES

1. EXECUTIVE SUMMARY

Riverside Public Utilities (RPU) operates a network of 69,000 volt (69 kV) subtransmission lines that delivery electric energy to substations for distribution to customers within the City of Riverside via 4 and 12 kV feeders. RPU staff uses planning criteria, approved by RPU management, to determine the strength of the subtransmission system to withstand unforeseen outages. These criteria are consistent with industry-accepted good utility practice.

A network study examined the state of the existing RPU subtransmission system and compared the results to the planning criteria. Projected peak summer loads of 2009 were modeled, along with maximum RPU local generation on-line, as well as minimum levels of local generation on-line. Single and double subtransmission line-out contingencies were then modeled.

Results of the network study indicate the following:

1. The existing subtransmission network does not meet the planning criteria for either single or double contingencies.
2. Short term need - determine the need for automatic equipment that would interrupt customer load during contingency conditions, in order to protect overloaded subtransmission lines.
3. Long term need - determine what subtransmission line reinforcements are needed to again meet the planning criteria.

These needs will be addressed in a separate report.

2. BACKGROUND

The City of Riverside provides electric service to the residents and businesses within the city limits via a network of 69 / 33 kV subtransmission lines, distribution substations and radial 4 and 12 kV feeders. The subtransmission network consists of 24 lines that serve 14 substations.

RPU uses planning criteria that were approved in 1992 in order to plan for additions to the subtransmission network and maintain reliability. The criteria include standards to be met by the network for single-line outages and also double-line outages, and are partially summarized below:

1. Base case loading shall not exceed 100% of rated conductor ampacity.
2. Single line-out contingencies shall not result in conductor loading above 110%.
3. Double line-out contingencies shall not result in conductor loading above 125%. For common-mode outages, this limit is reduced to

110%. A common-mode outage is one that involves two lines supported by a common structure, such as a single wood pole.
4. The criteria include voltage drop limits for single and double line-out contingencies. The double contingency limit is no more than a 7.8% drop in voltage from the base case level.

The criteria indicate that for unlikely contingencies, such as a double line-out, that remedial action schemes be relied upon in order to protect utility equipment. These actions can include: 1) manual load dropping, 2) use of thermal relays and/or 3) use of undervoltage relays.

The most recent additions to the RPU 69 kV network occurred in:

1996 with the completion of the Vista-Freeman 69 kV line, the seventh source line from SCE's Vista Substation,

2002 with the addition of Springs Generating Station, which did not include 69 kV network changes, and

2006 with the completion of the Riverside Energy Resource Center (RERC), which was connected to the network by looping the Mountain View – Riverside 69 kV line into the RERC switchyard.

In addition to these projects, RPU has also been pursuing a new transmission interconnection with Southern California Edison (SCE). This effort, known as the Riverside Transmission Reliability Project (RTRP) has been in progress for a number of years.

3. ASSUMPTIONS

The subtransmission network was modeled using Aspen Power Flow software and the existing 69 and 33 kV line configurations. The loading was forecasted at each 69 kV substation bus and totaled 601 MW, representing a 616 MW demand at Vista Substation, accounting for network losses. See Table 5 for a listing of individual substation loads. This system demand is forecasted for approximately the year 2009, assuming normal weather conditions. Adverse weather conditions could result in this load occurring sooner than 2009. Winter 2009 is when RTRP is expected to be operational. Therefore, the results of this study should represent the heaviest loading conditions expected for normal weather conditions, prior to the completion of new 69 kV lines which are a part of RTRP.

The existing RPU network is connected to Vista Substation via seven 69 kV subtransmission lines. Energy delivery from the high-voltage transmission system to the City is delivered through 230-69 kV transformers at Vista, with a combined capacity limit of 557 MW. Therefore, it was assumed that for "minimum generation" cases, just enough RPU local generation (RERC) would be on-line so that the capacity limit at Vista would not be exceeded by the 601 MWs of substation load plus the network losses.

Maximum generation cases assumed that both RERC units were on-line (48 MW each) and the four Springs units were on-line (9 MW each). The units were operated at a fixed generator bus voltage, within the reactive limits of each of the units (RERC 15 MVAR each, Springs 7.5 MVAR each). The Vista 69 kV bus was also fixed at 68.0 kV, per SCEs published bus voltage schedule. This voltage was maintained using reactive sources and transformer tap changers at Vista.

4. SUMMARY OF RESULTS

In addition to the base case, with all lines in service, the study included four scenarios:

Scenario 1 – maximum generation levels with all RERC and Springs units on at full load. Take out one line at a time and report overloads and low voltage conditions.

1. Maximum line loading was 134% of rated ampacity on the Hunter – University 69 kV line. There is one additional case with a loading above 125%.
2. There were no low voltage conditions.

See Table 1 for a complete listing of results and Appendix A for power flow cases for Scenario 1 and all other scenarios.

Scenario 2 – minimum generation levels, with RERC at 62 MW total and all Springs units off-line. Take out one line at a time and report overloads and low voltage conditions.

1. Maximum line loading was 165% of rated ampacity on the Hunter – University 69 kV line. There are four additional cases with a loading above 125%.
2. There were no low voltage conditions.

See Table 2 for a complete listing of results.

Scenario 3 – maximum generation levels with all RERC and Springs units on at full load. Take out two lines at a time and report overloads and low voltage conditions.

1. Maximum line loading was 177% of rated ampacity on the Freeman – Orangecrest 69 kV line. Note that this most severe case is a common-mode outage. There are 24 additional cases with a loading above 125%.
2. University, La Colina, Springs and Orangecrest Substations experienced approximately a 20% voltage drop as the worst low voltage condition, with two additional low voltage cases.

See Table 3 for a complete listing of results.

Scenario 4 – minimum generation levels, with RERC at 62 MW total and all Springs units off-line. Take out two lines at a time and report overloads and low voltage conditions.

1. For one double line-out case, a common-mode outage case, the power flow model did not converge. This indicates a severe outcome if the

outage were to actually occur: high conductor loading, low voltage, and probable uncontrolled load shedding.
2. There were an additional 33 cases with line loading above 125% and three cases where low voltage would result.

5. CONCLUSIONS AND RECOMMENDATIONS

The existing RPU 69 kV network does not meet the approved planning criteria for single, as well as double contingencies. Additional subtransmission lines need to be constructed in order to reliably meet the criteria.

Capital additions are normally made to satisfy single-contingency criteria violations. The criteria also indicate that a double contingency that occurs at peak load conditions (an unlikely event) that violates the loading limits should be addressed with a remedial action scheme. The fact that the study shows that not only double contingencies but also some single contingences exceed 125% indicates the importance of making capital additions as soon as possible. Until this can happen, some form of remedial action schemes should be planned. It is recommended that RPU Energy Delivery Engineering review the outages and loadings of Tables 1 – 4 and make a recommendation for operation until RTRP is completed.

It is further recommended that the addition of subtransmission lines be studied to determine what lines could be constructed prior to RTRP to reinforce the 69 kV network, in the event that RTRP is delayed beyond the current 2009 operating date. Once RTRP is constructed, the 69 kV network will be able to meet the RPU planning criteria.

TABLE 1

(see Table 5 for line-naming convention)

SCENARIO 1: MAXIMUM GENERATION ON RERC – 2 @ 48 MW, SPRINGS – 4 @ 9 MW PLUS ONE LINE OUT AT A TIME			
LINE OUTAGE	**LINE OVERLOAD SUMMARY**		**VOLTAGE VIOLATION SUMMARY**
	HIGHEST OVERLOAD	**ADDITIONAL OVERLOADS**	
BASE CASE			
VLC	HU – 134%	VH – 102%	
HU	VLC – 127%		
MV-RERC	RP – 122%		
VAH	VH – 121%		
PR	RERC-MV – 114%		
VH	VAH – 110%		
VR1			
RIV AUTO BK			
OCS			
MVP			
LMV	KF – 102%		
MR			
LK			
LCS			
LCU	VLC – 104%		
LCOC			
HR			
FMV			
FK	MVL – 101%		
FOC			
FR AUTO BK			
VR2			
VMV	RERC-MV – 103%		
VF	RERC-MV – 100%		
RERC-RIV			

TABLE 2

SCENARIO 2: MINIMUM GENERATION ON RERC – 1 @ 48 MW, 1 @ 14 MW, SPRINGS – OFF PLUS ONE LINE OUT AT A TIME			
LINE OUTAGE	LINE OVERLOAD SUMMARY		VOLTAGE VIOLATION SUMMARY
	HIGHEST OVERLOAD	ADDITIONAL OVERLOADS	
BASE CASE			
VLC	HU – 165%	LCU – 129% VH – 118% VAH – 114%	
HU	VLC – 157%		LA COLINA: 0.943 pu
VAH	VH – 139%	VLC – 107%	
LCU	VLC – 131%		
VH	VAH – 126%	VLC – 104%	
VR1	VH – 107%	VAH – 103%	
RI AUTO BK			
PR	HU – 102%	MV – RERC – 100%	
OCS			
MVP			
LMV	FK – 102%	HU – 101%	
MR			
LK			
LCS			
LCOC			
HR	HU – 104%		
FMV	HU – 103%		
FK	LMV – 101%		
FOC			
FR AUTO BK			
VR2	VH – 106%	VA H – 102%	
VMV	VH – 104%	PR – 102% VAH – 100% VLC – 100%	
VF	VLC – 106%	VH – 105% VAH – 101% HU – 106%	
RERC-RIV			
MV-RERC	PR – 120%	HU – 102%	

TABLE 3

SCENARIO 3: MAXIMUM GENERATION ON RERC – 2 @ 48 MW, SPRINGS – 4 @ 9 MW PLUS TWO LINES OUT AT A TIME			
LINE OUTAGES	LINE OVERLOAD SUMMARY		VOLTAGE VIOLATION SUMMARY
	HIGHEST OVERLOAD	ADDITIONAL OVERLOADS GREATER THAN 125%	
VLC + HU common	FOC – 177%	FMV – 138%	UNIVERSITY: 0.7999 pu LA COLINA: 0.8065 pu O'CREST 0.8191 pu SPRINGS: 0.8200 pu FREEMAN: 0.9244 pu
VLC + LCU common	FOC – 121%		LA COLINA: 0.9059 pu
VF + VH common	VAH – 127%		
VF + PR common	RERC MV – 136%		
VF + FMV common	LMV – 131%		
VLC + VAH	VH – 160%	HU – 127%	
VLC + VF	HU – 155%		
FOC + HU	VLC – 152%		
HU + FOC	VLC – 152%		
VF + LMV	FMV – 151%		
VLC + FOC	HU – 150%		
VMV + PR	RERC MV – 148%		
VF + HU	VLC – 147%		
VAH VR#1	VH – 146%		
VAH + VR#2	VH – 145%		
VLC + VH	VAH – 144%	HU – 128%	
MV RERC + PR	VMV – 142%		
VLC + VMV	HU – 142%		
FMV + HU	VLC – 140%		
VAH + VF	VH – 140%		
VLC + HR	HU – 139%		
VLC + HR	HU – 139%		
VAH + VMV	VH – 139%		
VLC + VR#1	HU – 135%		
VF + FMV	LMV – 131%		
VLC + OCS	HU – 130%		
VR#1 + VR #2 common	VAH – 110%		
VMV + RERC-RIV common	RP – 103%		
VF + HR common			
VAH + VH	VLC – 118%		
VAH + HR	VH – 119%		
VAH + FOC	VH – 121%		
VAH + LCU	VH – 109%		

TABLE 3, continued

VH + LCU	VLC – 106%		
VMV + VF	RERC MV – 122%		
VMV + FOC	RERC MV 106%		
VMV + VR#1	VH – 109%		
VMV + HR			
VMV + FK	RERC MV – 109%		
VMV + FMV			
VMV + LMV	FK – 102%		
VF + VR#1	VH – 109%		
VR#1 + HR	VR – 105%		
VR#1 + MVP			
VR#1 + LCU	VLC – 107%		
VR#1 + FK	LMV – 102%		
VR#1 + FMV			
FK + PR	RERC MV – 120%		
FK + FMV	LMV – 101%		
FMV + LMV	MR –113% HU – 113%		
FMV + FOC			
FMV + MV RERC	PR – 109%		
FMV + PR	RERC MV–104%		
FOC + LCOC			

TABLE 4

SCENARIO 4: MINIMUM GENERATION ON RERC – 1 @ 48 MW, 1 @ 14 MW, SPRINGS – OFF PLUS TWO LINES OUT AT A TIME			
LINE OUTAGES	LINE OVERLOAD SUMMARY		VOLTAGE VIOLATION SUMMARY
	HIGHEST OVERLOAD	ADDITIONAL OVERLOADS GREATER THAN 125%	
VLC + HU common	***DOES NOT CONVERGE***		
VLC + LCU common	FOC – 192%	FMV – 140%	FREEMAN 0.9096 KAISER 0.9142 LA COLINA 0.7698 LYNN 0.9182 O'CREST 0.7802 SPRINGS 0.7732
VF + VH common	VAH – 145%		
VF + FMV common	LMV – 135%	HU – 126%	
VR#1 + VR #2 common	VH – 131%	VAH – 126%	
VF + PR common	RERC MV – 125%		
VMV + RERC RIV common	PR – 129%		
HU + FOC	VLC – 208%		LA COLINA 0.8895 O'CREST 0.8728 SPRINGS 0.8794 UNIVERSITY 0.8835
VLC + FOC	HU – 198%	LCU – 160% VH – 126%	
VLC + VF	HU – 190%	LCU - 153% VH – 138% VAH – 133%	
VLC + VAH	VH – 186%	HU – 158%	
VF + HU	VLC – 180%		
VLC + VMV	HU – 174%	LCU – 138% VH – 135% VAH – 130%	
FMV + HU	VLC – 171%		
VLC + HR	HU – 170%	LCU – 133%	
VLC + VH	VAH – 168%	HU – 159%	
VAH + VR#1	VH – 168%		
VLC + VR#1	HU – 167%	VH – 138% VAH – 132% UL – 130%	
VLC + OCS	HU – 164%	LCU – 127%	
VAH + VR#2	VH – 166%		
VAH + VF	VH – 161%		
VAH + VMV	VH – 160%		

TABLE 4, continued

VF + LMV	FMV – 156%		
PR + MV RERC	VMV – 148%	HU – 127%	
VAH + VH	VLC – 141%		
VMV + PR	RERC MV – 140%		
VAH + FOC	VH – 139%		
VMV + VF	PR – 139%	VH – 125%	
VAH + HR	VH – 136%		
VF + FMV	LMV – 135%		
VR#1 + LCU	VLC – 135%		
VAH + LCU	VLC – 134%		
VH + LCU	VLC – 134%		
FMV + LMV	HU – 131%		KAISER 0.9268 LYNN 0.9214
VMV + VR#1	VH – 125%		
VF + HR common	HU – 119%		
VMV + FOC	PR – 106%		
VMV + HR	HU – 112%		
VMV + FK	PR – 111%		
VMV + FMV	HU – 103%		
VMV + LMV	FK – 103%		
VF + VR#1	VH – 124%		
VR#1 + HR	HR – 122%		
VR#1 + MVP	VH – 105%		
VR#1 + FK	VH – 108%		
VR#1 + FMV	VH – 106%		
FK + PR	RERC MV – 107%		
FK + FMV	LMV – 101%		
FMV + FOC			
FMV + MV RERC	HU – 108%		
FMV + PR	HU – 108%		
FOC + LCOC			

TABLE 5

FORECASTED LOADS – NORMAL WEATHER CONDITIONS			
SUBSTATION		MW	MVAR
ALUMAX		0	0
CASA BLANCA		3	0.2
FREEMAN		96	-4.8
HUNTER		52	13.5
KAISER		4	3.3
LA COLINA		56	3.9
LYNN		91	-3.6
MAGNOLIA		9	1.4
MOUNTAIN VIEW		67	9.4
ORANGECREST		60	20.4
PLAZA		38	4.6
RIVERSIDE 4 KV		11	-3.5
RIVERSIDE 12 KV		55	15.4
SPRINGS		26	1.0
UNIVERSITY		33	11.9
SUBSTATION TOTAL – AT THE 69/33 KV BUS LEVEL		**601**	**73.1**
69/33 kV LINE LOSSES	**W/ MINIMUM GENERATION**	**15.3**	**61.6**
	W/ MAXIMUM GENERATION	**12.0**	**46.6**

69/33kV SUBTRANSMISSION LINE NAMING CONVENTION		
A		ALUMAX
CB		CASA BLANCA
F		FREEMAN
H		HUNTER
K		KAISER
LV		LA COLINA
L		LYNN
M		MAGNOLIA
MV		MOUNTAIN VIEW
OC		ORANGECREST
P		PLAZA
R / RIV		RIVERSIDE
RERC		RIVERSIDE ENERGY RESOURCE CENTER
S		SPRINGS
U		UNIVERSITY
V		VISTA
EXAMPLES	VAH	VISTA - ALUMAX - HUNTER
	MVP	MOUNTAIN VIEW - PLAZA

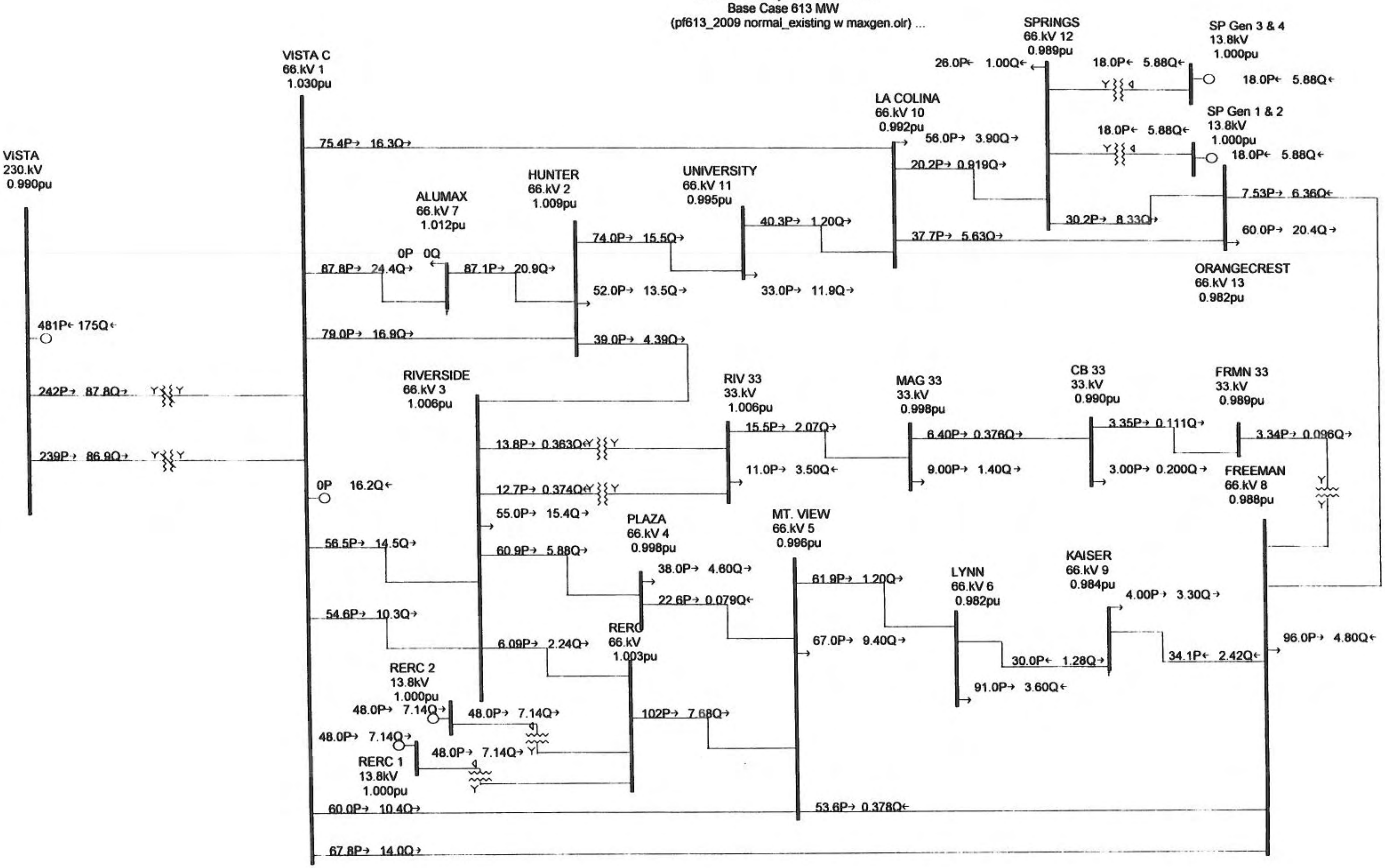
Appendix A: Power Flow Plots

Scenario	Case Description	Case Number and Plot Type
Scenario 1: Maximum Generation	Base Case	1. MW and MVAR
		2. Amps
	N-1: Most Severe Case	3. Amps
Scenario 2: Minimum Generation	Base Case	4. MW and MVAR
		5. Amps
	N-1: Most Severe Case	6. Amps
Scenario 3: Maximum Generation	Base Case	Same as Scenario 1
	N-2: Most Severe Case	7. Amps
Scenario 4: Minimum Generation	Base Case	Same as Scenario 2
	N-2: Most Severe Case	Case did not converge
	N-2: Next Most Severe Case *	8. Amps

* The next most severe case could either be 192% loading for a common-mode outage, or 208% for an unrelated double outage. The 192% case was chosen for display, as the "next most serve" case due to the greater likelihood that a common-mode outage could occur, versus an unrelated double outage.

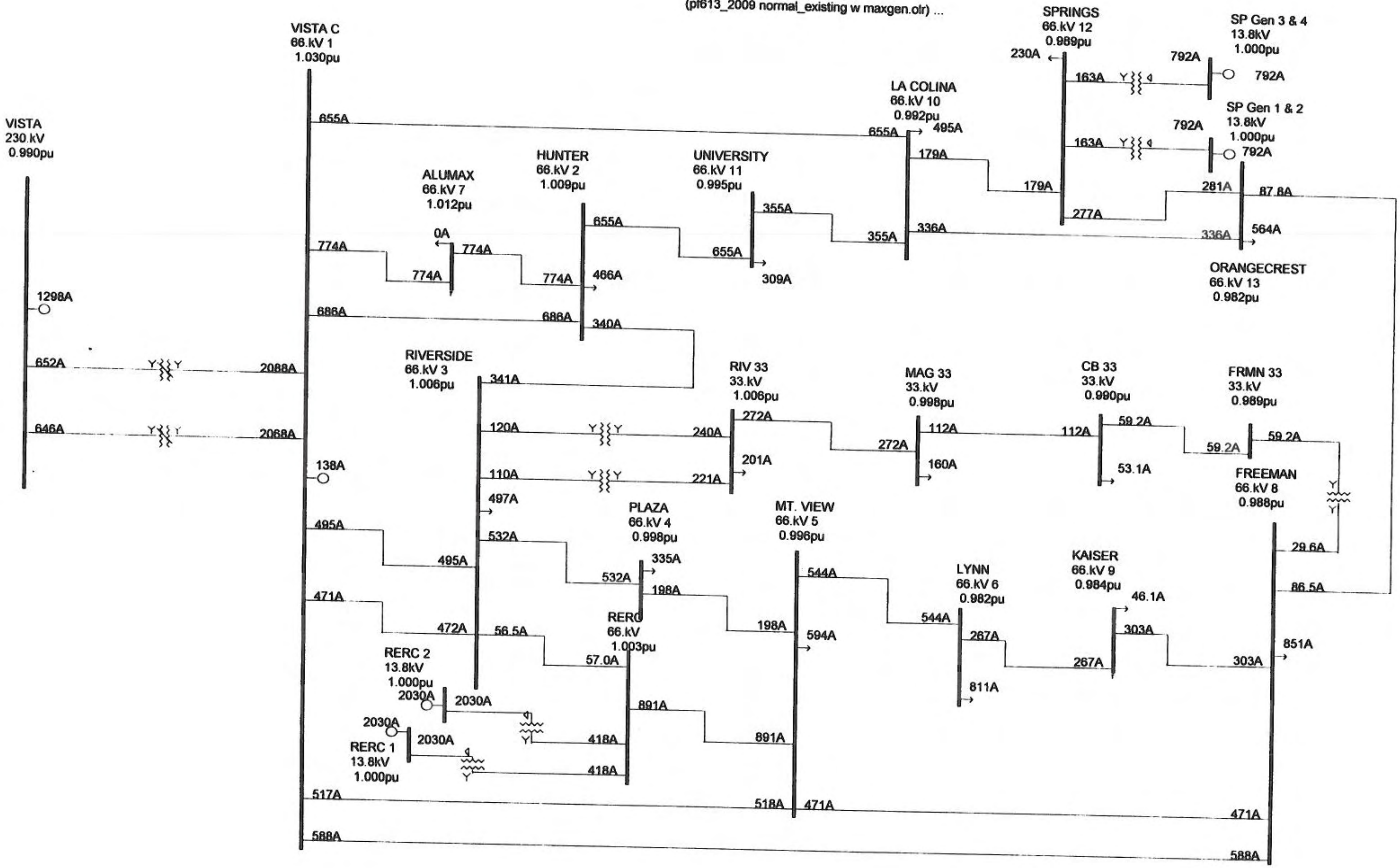
CASE 1

RPU Electric System Power Flow
Base Case 613 MW
(pf613_2009 normal_existing w maxgen.olr) ...



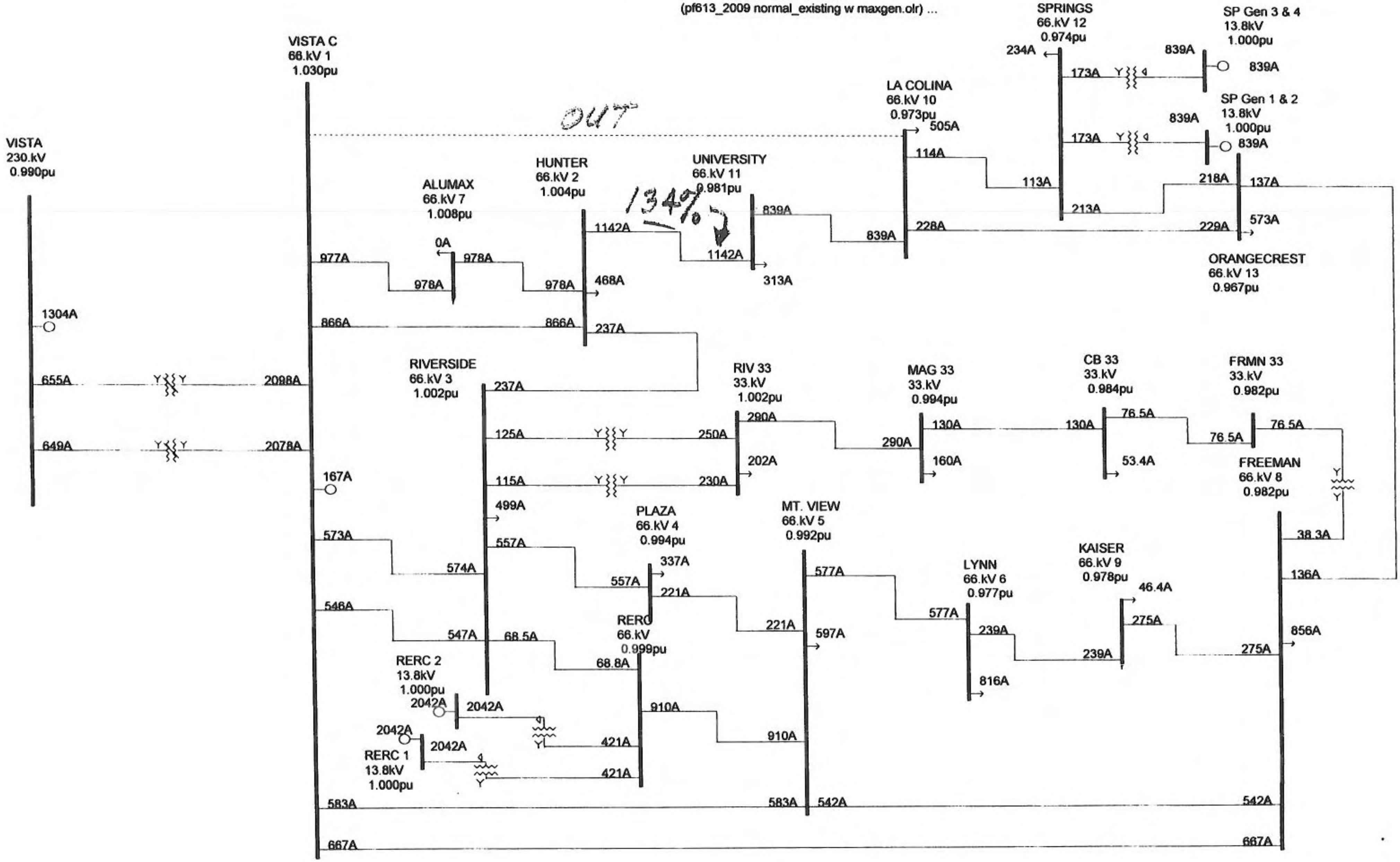
CASE 2

RPU Electric System Power Flow
Base Case 613 MW
(pf613_2009 normal_existing w maxgen.olr) ...



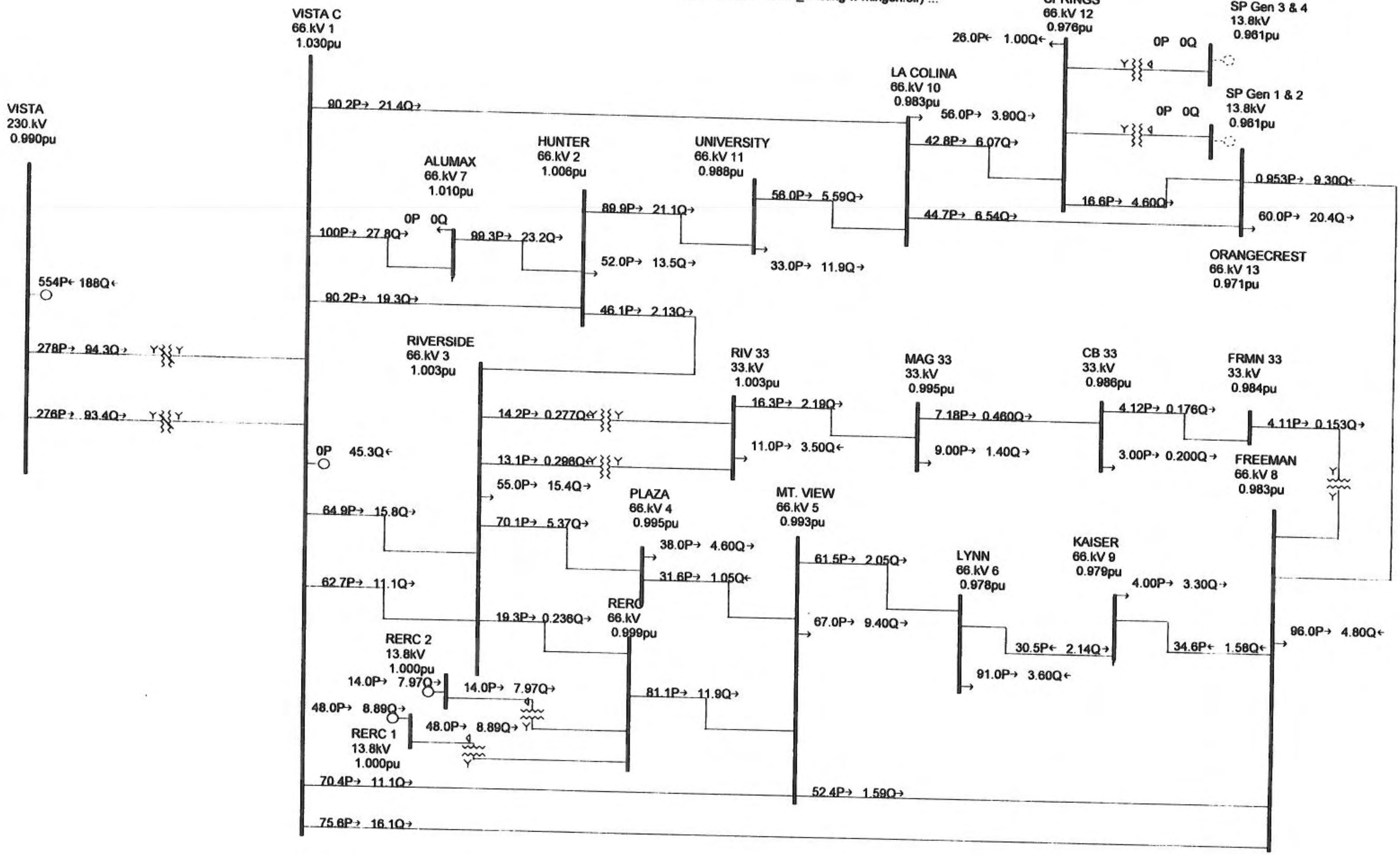
CASE 3

RPU Electric System Power Flow
Base Case 613 MW
(pf613_2009 normal_existing w maxgen.olr) ...



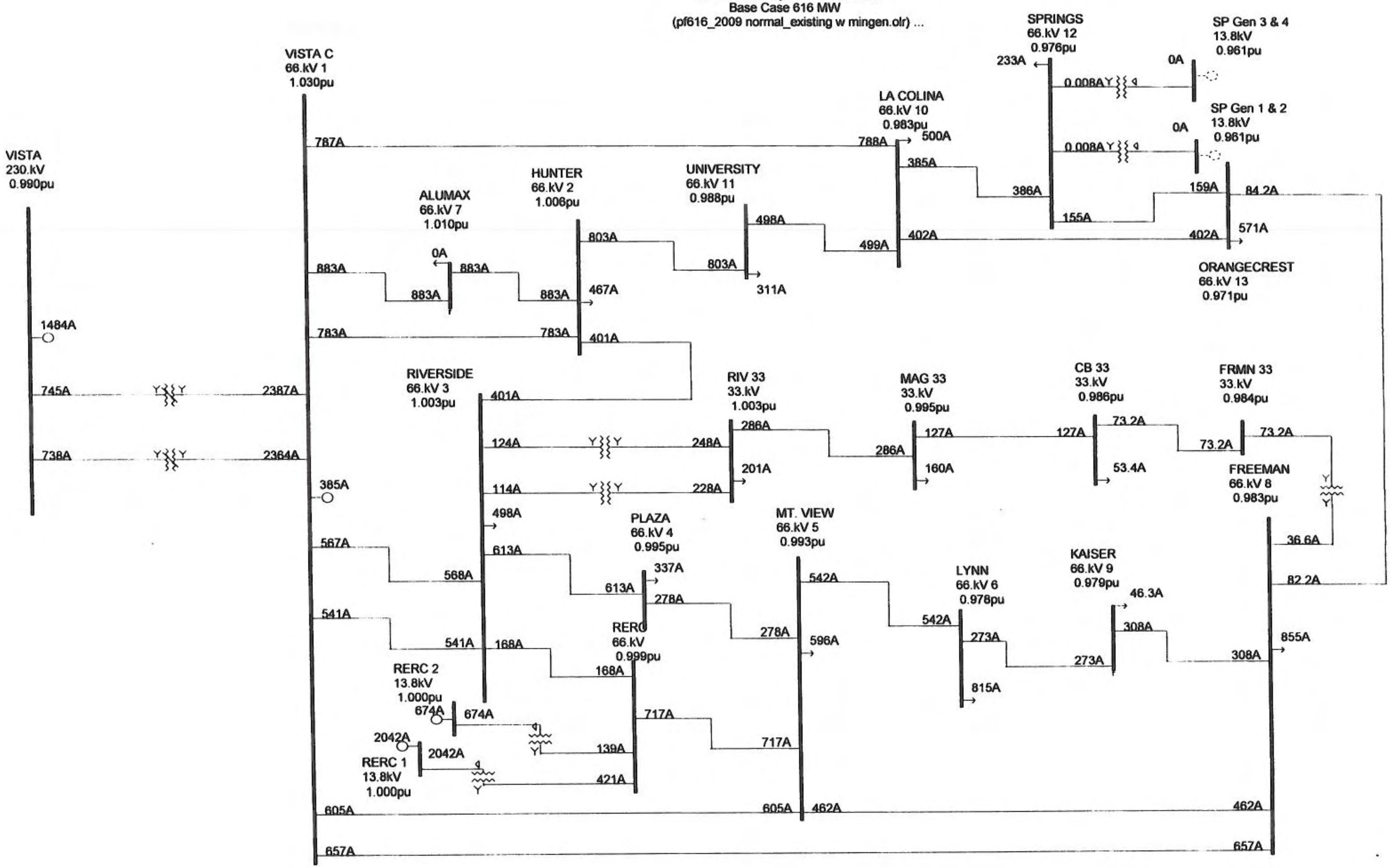
CASE 4

RPU Electric System Power Flow
Base Case 616 MW
(pf616_2009 normal_existing w mingen.olr) ...



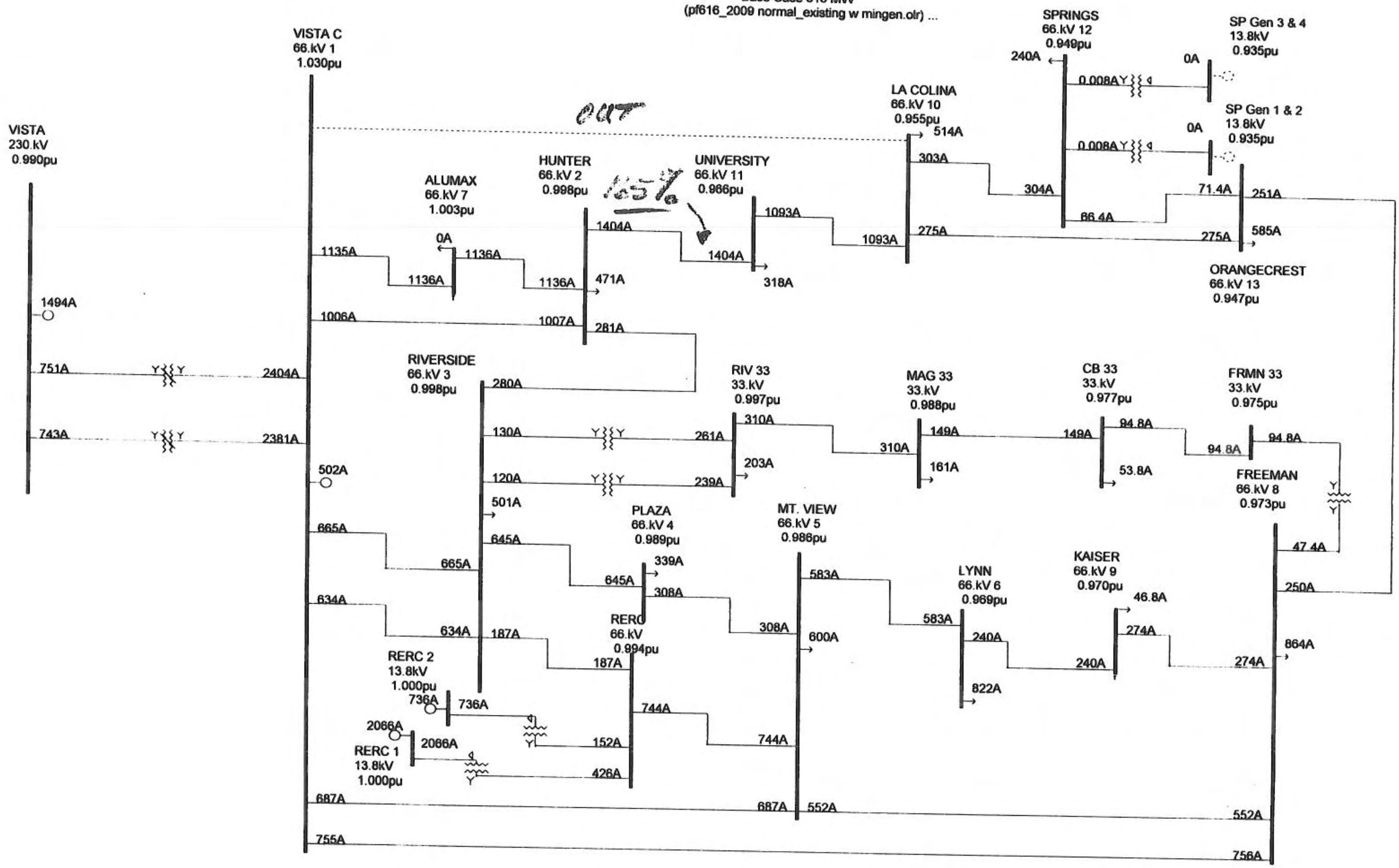
CASE 5

RPU Electric System Power Flow
Base Case 616 MW
(pf616_2009 normal_existing w mingen.olr) ...

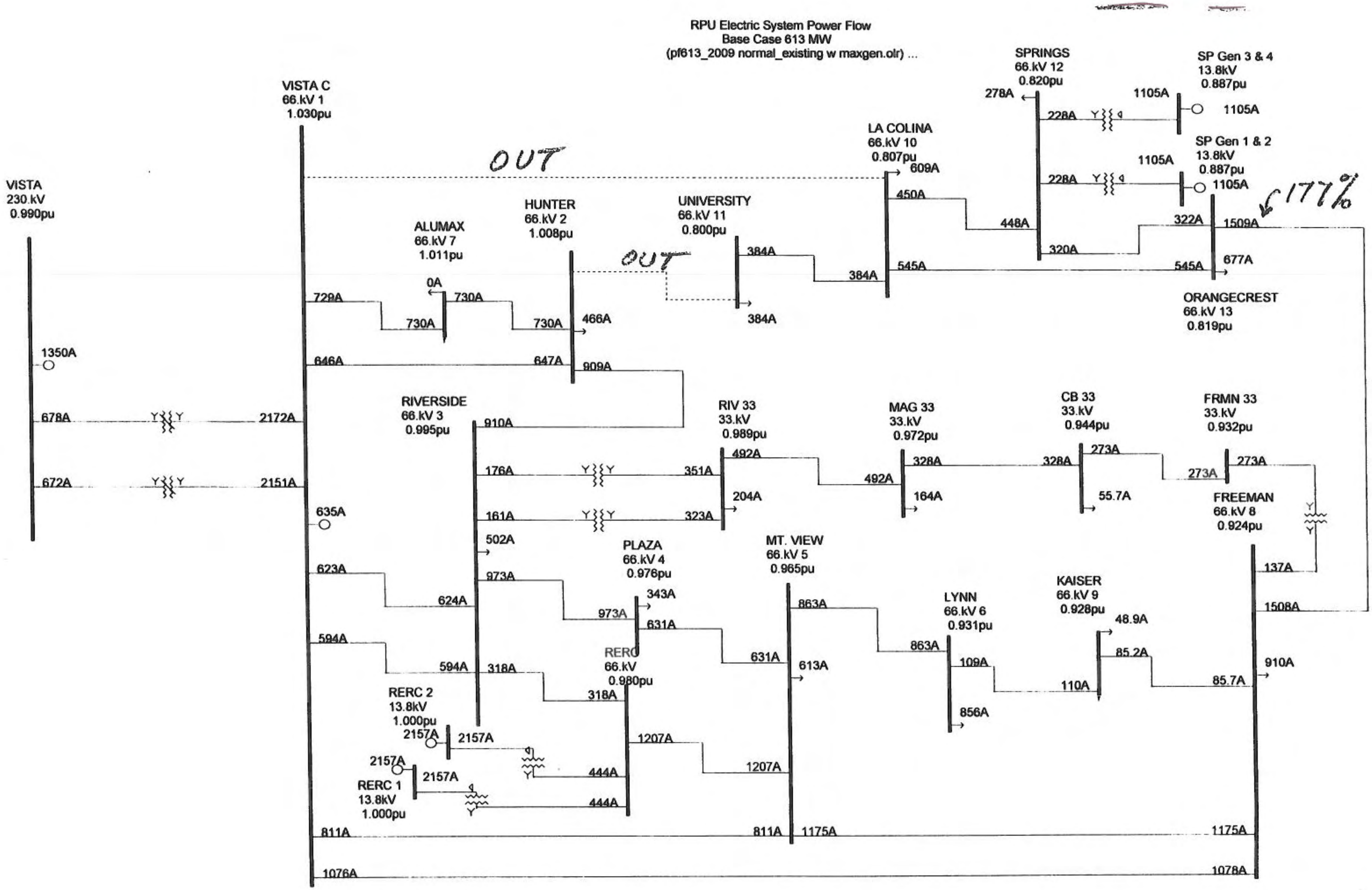


CASE 6

RPU Electric System Power Flow
Base Case 616 MW
(pf616_2009 normal_existing w mingen.olr) ...



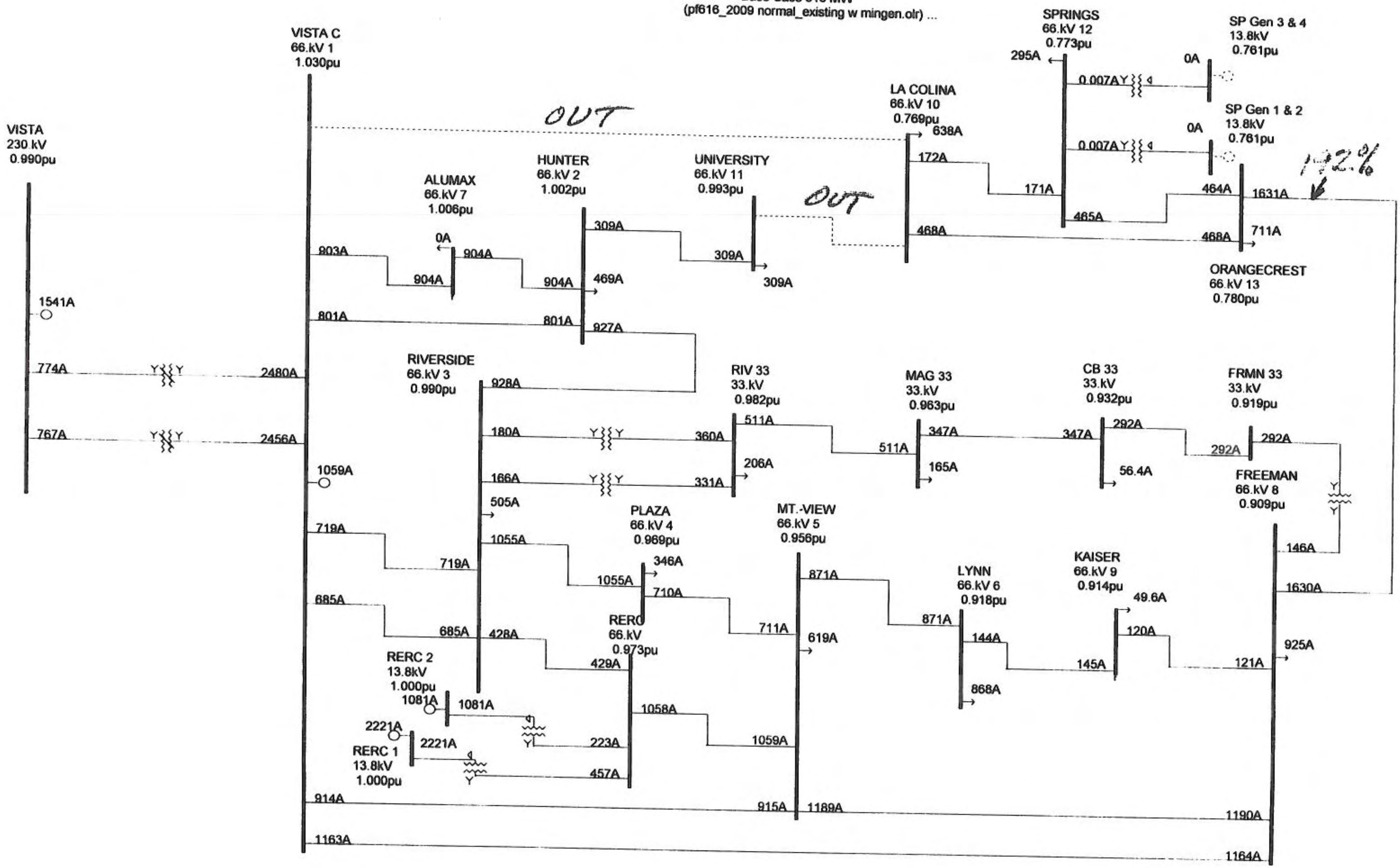
CASE 7



RPU Electric System Power Flow
Base Case 613 MW
(pf613_2009 normal_existing w maxgen.olr) ...
OUT
OUT
↙177%
VISTA 230.kV 0.990pu
1350A
678A
672A
VISTA C 66.kV 1 1.030pu
2172A
2151A
729A
646A
635A
623A
594A
811A
1076A
ALUMAX 66.kV 7 1.011pu
0A
730A
730A
HUNTER 66.kV 2 1.008pu
730A
466A
647A
909A
UNIVERSITY 66.kV 11 0.800pu
384A
384A
LA COLINA 66.kV 10 0.807pu
609A
450A
384A
545A
SPRINGS 66.kV 12 0.820pu
278A
228A
228A
448A
320A
SP Gen 3 & 4 13.8kV 0.887pu
1105A
1105A
SP Gen 1 & 2 13.8kV 0.887pu
1105A
1105A
ORANGECREST 66.kV 13 0.819pu
322A
1509A
545A
677A
RIVERSIDE 66.kV 3 0.995pu
910A
176A
161A
502A
973A
624A
594A
318A
RIV 33 33.kV 0.989pu
492A
351A
204A
323A
MAG 33 33.kV 0.972pu
492A
328A
164A
CB 33 33.kV 0.944pu
328A
273A
55.7A
FRMN 33 33.kV 0.932pu
273A
273A
FREEMAN 66.kV 8 0.924pu
137A
1508A
910A
85.7A
1175A
1078A
PLAZA 66.kV 4 0.976pu
343A
973A
631A
RERC 66.kV 0.980pu
318A
1207A
444A
444A
MT. VIEW 66.kV 5 0.965pu
863A
631A
613A
1207A
811A
1175A
LYNN 66.kV 6 0.931pu
863A
109A
856A
KAISER 66.kV 9 0.928pu
48.9A
85.2A
110A
RERC 2 13.8kV 1.000pu
2157A
2157A
RERC 1 13.8kV 1.000pu
2157A
2157A

CASE 8

RPU Electric System Power Flow
Base Case 616 MW
(pf616_2009 normal_existing w mingen.olr) ...



ADDENDUM NO. 1 – AUGUST 2008

69 kV SUBTRANSMISSION NETWORK REPORT

Addendum No. 1 was issued to cover a portion of the Riverside Public Utilities Planning Criteria not included in the original 2007 report. The Criteria indicates that double contingencies may be studied at 80% of peak loads, based on the unlikelihood of having an N-2 at peak load conditions. This assumption is supported by historical experience. Therefore, the attached table includes the results of double contingencies occurring during 80% of peak load. Note that the internal generation was assumed to be off at this time of reduced load, consistent with actual operating experience and economic realities.

Results for N-1 contingencies, taken at 100% of peak load, are included here for completeness.

The original report included results of N-2 contingencies performed at 100% of peak loads. This was done since there is the reality of such events actually occurring. System operators need to be aware of possible overloading and be prepared to take action, as required.

RIVERSIDE PUBLIC UTILITIES - EXISTING NETWORK

ELECTRICAL NETWORK STUDY RESULTS FOR N-1 AND N-2

FORECASTED PEAK LOAD OF 616 MW

MAXIMUM INTERNAL GENERATION ON-LINE FOR N-0, N-1 AND ZERO GENERATION FOR N-2 *

LINE OUTAGES	LINE OVERLOAD SUMMARY HIGHEST OVERLOAD	 ADDITIONAL OVERLOADS	VOLTAGE VIOLATION SUMMARY
Base Case (N-0)	--	--	--
N-1			
Vista - La Colina	Hunter - University - 134%		
Hunter - University	Vista - La Colina - 127%		
Mtn View - RERC	Plaza - Riverside - 122%		
Vista - Alumax - Hunter	Vista - Hunter - 121%		
Plaza - Riverside	Mtn. View - RERC - 114%		
Vista - Hunter	Vista - Alumax - Hunter - 110%		
N-2 Common Mode			
Vista - La Colina + Hunter - University (common-mode)	Freeman - Orangecrest - 197%	Plaza - Riverside - 125% Freeman - Mt. View - 124% Vista - Freeman - 111%	La Colina 0.74 per unit University 0.74 per unit Springs 0.75 per unit Orangecrest 0.76 per unit
Vista - La Colina + La Colina - University (common-mode)	Freeman - Orangecrest - 141%		La Colina 0.84 per unit Springs 0.84 per unit Orangecrest 0.85 per unit
Vista - Mt. View + RERC - Riverside (common-mode)	Plaza - Riverside - 134%		
Vista - Freeman + Vista - Hunter (common-mode)	Vista - Alumax - Hunter - 127%		
Vista - Riverside 1 + Vista - Riverside 2 (common-mode)	Vista - Hunter - 117%	Hunter - Riverside - 116% Vista - Alumax - Hunter - 112%	
Vista - Freeman + Plaza - Riverside (common-mode)	Vista - Mt. View - 111%		
N-2 Unrelated			
Vista - La Colina + Vista - Alumax - Hunter	Vista - Hunter - 161%	Hunter - University - 127%	
Vista - La Colina + Vista - Freeman	Hunter - University - 155%	La Colina - University 126%	
Vista - La Colina + Vista - Hunter	Vista - Alumax - Hunter - 145%	Hunter - University - 128%	
Vista - La Colina + Vista - Mt. View	Hunter - University - 143%		
There are an additional 17 N-2 outage cases that involve the Vista - La Colina line and one other line, resulting in the Hunter - University line being loaded to a lesser magnitude than the cases above, but still above 125%.			
Hunter - University + Freeman - Orangecrest	Vista - La Colina - 159%		
Vista - Freeman + Hunter - University	Vista - La Colina - 147%		
Vista - Mt. View + Hunter - University	Vista - La Colina - 137%		
Freeman - Mt. View + Hunter - University	Vista - La Colina - 137%		

There are an additional 17 N-2 outage cases that involve the Hunter - University line and one other line, resulting in the Vista - La Colina line being loaded to a lesser magnitude than the cases above, but still above 125%.			
Vista - Alumax - Hunter + Vista - Riverside 1	Vista - Hunter - 148%		
Vista - Alumax - Hunter + Vista - Riverside 2	Vista - Hunter - 146%		
Vista - Alumax - Hunter + Vista - Mt. View	Vista - Hunter - 141%		
Vista - Alumax Hunter + Vista - Freeman	Vista - Hunter - 140%		
Vista - Mtn. View + Mtn. View - RERC	Plaza - Riverside - 134%		
Vista - Hunter + Vista - Riverside 1	Vista - Alumax - Hunter - 133%		
Vista - Hunter + Vista - Riverside 2	Vista - Alumax - Hunter - 131%		
Vista - Mt. View + Vista - Freeman	Plaza - Riverside - 130%		
Vista - Hunter + Vista - Mt. View	Vista - Alumax - Hunter - 128%		
Vista - Hunter + Vista - Freeman	Vista - Alumax - Hunter - 127%		
Vista - Freeman + La Colina - University	Vista - La Colina - 127%		

* Note: Maximum generation could be expected at peak summer loads, as modeled in the base case and N-1 cases. Since the N-2 cases were performed at 80% of peak load, per the RPU Criteria, zero generation would be expected, based on operating history and the economics of energy supply by currently installed internal generation.