

**Xcel Energy  
Transmission Capital 5-Year Budget Submittal  
2010– 2014**

<b>Revision #:</b> 4	August 6, 2009	<b>Total Project Cost:</b> <u>Alt 1 \$ 3,280,000</u>
<b>Date Submitted:</b> 8-6-09		<u>Alt 2 \$4,114,000</u>
<b>Project Title:</b>	RifleCu 138-69 kV Transformer Replacement	
<b>Project Manager:</b>	Robb Nielsen	
<b>Planner:</b>	W. Anderson	
<b>In Service Date:</b>	May 31, 2011	
<b>Area of Work (NSP, NSPW, PSCo, CHY, SPS)</b>	PSCo	
<b>State Work Being Completed:</b>	Colorado	
<b>Project Category:</b>	LS (Transmission reliability projects that involve load shedding)	
<b>Project Priority</b>	High	
<b>Request Type (New, Carryover, Reimbursable)</b>		
<b>Project Start Date:</b>	Engineering 18 months prior to ISD	
<b>Date Submitted:</b>	August 6, 2009	
<b>Discretionary / Non Discretionary</b>	Non Discretionary	
<b>Distribution Associated Projects</b> No	None	<b>Distribution Funded Yes / No:</b> No
<b>O&amp;M Dollars Needed</b> N/A		

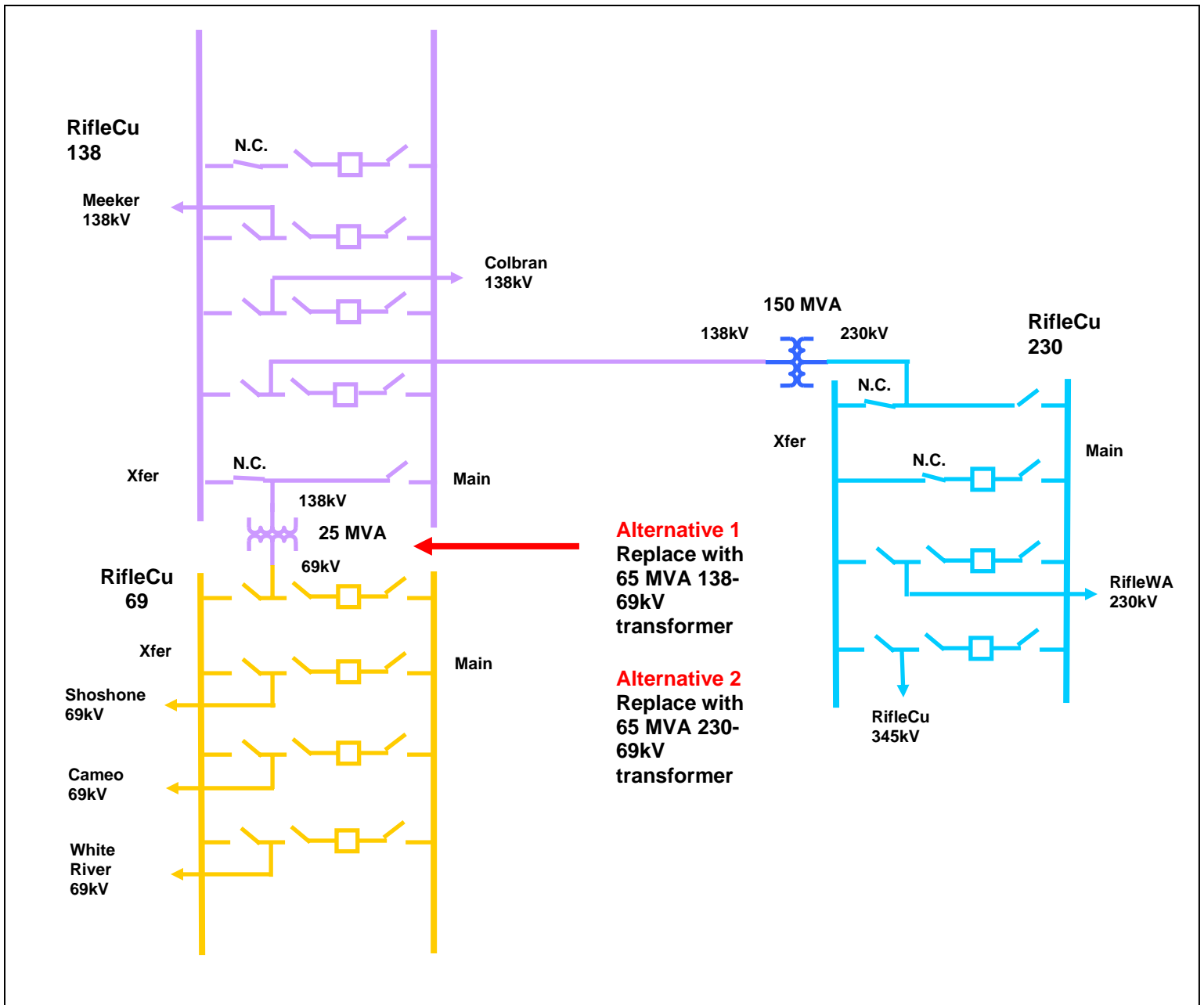
**Project Description (Board Level)**

The project consists of replacing the RifleCu PS 138-69 kV 25MVA transformer with a 65 MVA 138-69kV transformer.

**Detailed Project Description**

Replace the RifleCuPS 138-69kV 25 MVA transformer with a 138-69kV transformer rated at 65 MVA. An alternative is to replace the 25 MVA 138-69kV transformer with a 65 MVA 230-69kV transformer.

Figure No. 1 – RifleCu 138-69kV Transformer Replacement Conceptual One-Line



## Necessity Description

### A. Benchmark Case – Present System - 2009 Heavy Summer

The 2009 heavy summer case that was developed for the PSCo Capital Budget Studies was used for the evaluation of the RifleCu 138-69kV transformer. The case has a Debeque Load of 2.64 MW and 0.96 MVAR and Una Orchard Load of 15.2 MW and 5.0 MVAR. The TOT2A flow is 110 MW north-to-south with a Craig/Hayden generation of 1767 MW. The Cameo generation is 66 MW.

Scenario study cases were created to understand the impact of dispatch scenarios on the flow of the RifleCu 138-69kV transformer. Of particular interest is the impact of the retirement of the Cameo generation facility<sup>1</sup>. PSCo plans to retire this generation facility at the end of 2010 or soon thereafter. In addition, a wholesale customer of PSCo and a retail energy customer of PSCo would like to increase their demands at the Debeque and Una Orchard substations. Contingency analysis was conducted on the scenario cases, and the results are listed in Table 1 below.

Table 1. Scenario Case Summary (2009 HS)

Yr/Season	Alternative	Crg/Hay Gen	Cameo Gen	Debeque Load	Una Load	TOT1A	TOT2A (PS Sched)	TOT5	Monitored Element	Ckt	Limiting Contingency	Rating	LnFlow	%O/L	V-Cont
2009HS		1844	66	3	15	352	100	755	RIFLE CU 69.000-RIFLE CU 138.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	25.0	27.8	111.1	
2009HS		1383	66	3	15	187	100	467	RIFLE CU 69.000-RIFLE CU 138.00	T2	CAMEO 69.00-DEBEQUE 69.00-	25.0	26.7	106.8	
2009HS		1383	66	3	15	187	100	467	RIFLE CU 69.000-RIFLE CU 138.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	25.0	25.4	101.8	
2009HS		1844	0	3	15	345	100	699	RIFLE CU 69.000-RIFLE CU 138.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	25.0	33.9	<b>135.6</b>	
2009HS		1844	0	12	30	343	100	679	RIFLE CU 69.000-RIFLE CU 138.00	T2	CAMEO 69.00-DEBEQUE 69.00-	25.0	52.6	<b>210.5</b>	
2009HS		1844	0	12	30	343	100	679	RIFLE CU 69.000-RIFLE CU 138.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	25.0	40.7	<b>162.9</b>	
2009HS		1844	0	12	30	343	100	679	DEBEQUE 69.000		CAMEO 69.00-DEBEQUE 69.00-				<b>0.710</b>
2009HS		1844	0	12	30	343	100	679	UNA ORCH 69.000		CAMEO 69.00-DEBEQUE 69.00-				<b>0.723</b>
2009HS		1844	0	12	30	375	-100	851	RIFLE CU 69.000-RIFLE CU 138.00	T2	CAMEO 69.00-DEBEQUE 69.00-	25.0	53.9	<b>215.7</b>	
2009HS		1844	0	12	30	375	-100	851	DEBEQUE 69.000		CAMEO 69.00-DEBEQUE 69.00-				<b>0.723</b>
2009HS		1844	0	12	30	375	-100	851	UNA ORCH 69.000		CAMEO 69.00-DEBEQUE 69.00-				<b>0.735</b>
2009HS		1844	66	3	15	278	300	616	RIFLE CU 69.000-RIFLE CU 138.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	25.0	26.8	107.3	
2009HS		1844	66	3	15	204	500	468	RIFLE CU 69.000-RIFLE CU 138.00	T2	GRANDJCT 345.0-RIFLE_CU 345.0-1	25.0	26.7	106.8	
2009HS		1844	66	3	15	204	500	468	RIFLE CU 69.000-RIFLE CU 138.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	25.0	25.9	103.7	

The results in Table 1 show that the retirement of the Cameo generation station greatly increases the contingency flow on the RifleCu 138-69kV transformer. In addition, the study determined that as Craig/Hayden generation increases, the contingency flow across the RifleCu 138-69kV transformer increases. The study also determined that as the TOT2A south-to-north flow increases, the flow across

<sup>1</sup> The Cameo generating facility is a coal-fired plant with a maximum real power generation capability of 77 MW and a maximum reactive power generation capability of 51 MVAR.

the RifleCu 138-69kV transformer increases. The flow adjustments across TOT2A were accomplished using the San Juan and Shiprock phase shifting transformers with the El Paso Tap-Glade Tap 115kV line open. Schedules from Western-RMR and New Mexico were adjusted as needed. As expected, the increase of demand at the Debeque and Una Orchard substations increases the flow across the RifleCu 138-69kV transformer.

The highest flow across the RifleCu 138-69kV transformer occurs when the Cameo generation station is off-line, the Craig/Hayden generation is at maximum generation, the Debeque and Una Orchard load increases are represented in the case, and the TOT2A flow is 100 MW south-to-north (-100 MW). For that scenario, the contingency flow across the RifleCu 138-69kV transformer is 53.9 MVA or 216% of its 25 MVA rating. These high flows across the RifleCu 138-69kV transformer have been observed in other studies<sup>2</sup>. Allowing for load growth on the 69kV system and south-to-north power transfer increases along with inherent uncertainty in the model data, the replacement transformer should be increased to 65 MVA. Therefore, a 65 MVA 138-69kV transformer was selected to replace the existing RifleCu 25 MVA 138-69kV transformer.

#### B. Benchmark Case – Future System - 2018 Heavy Summer

To examine a future scenario case, the WECC 2018 heavy summer base case (2018 HS1A) was obtained. The case reflects the Cameo generation facility retirement. The TOT2A flow is 92 MW north-to-south with the Craig/Hayden generation at 1742 MW. The 2018 heavy summer case represents the forecasted demand in the study area in the on-peak summer of 2018. A comparison of the loads between the 2009 heavy summer case and the 2018 heavy summer case is provided in Table 2 below. The demands in Zone 708 (the study area plus areas north and east) are expected to increase from 596 MW to 708 MW, an increase of approximately 19%.

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<sup>2</sup> The Cameo Retirement and Replacement Study completed in July 2009 identified a 225% contingency overload of the 25 MVA 138-69kV transformer with the Cameo generating station removed from service.

Table 2. Demand Comparison Table Between 2009 and 2018 (on-peak summer)

		2009HS		2018HS				2009HS		2018HS	
Bus Name		Pload (MW)	Qload (MVAR)	Pload (MW)	Qload (MVAR)	Bus Name		Pload (MW)	Qload (MVAR)	Pload (MW)	Qload (MVAR)
CRAIG YV	230.00	27.3	0.7	34.5	0.9	SHOSHA&B	4.0000	0.0	0.0	0.5	0.2
CRAIG YV	230.00	2.2	0.1	2.2	0.1	UINTAH	69.000	8.3	1.6	25.6	4.9
CAMEO	69.000	0.9	0.3	1.1	0.4	UINTAH	69.000	0.3	0.1	0.6	0.1
CAMEO1	13.800	1.6	0.3	0.0	0.0	UINTAH	13.800	24.2	10.8	29.4	13.5
CAMEO2	13.800	3.0	0.5	0.0	0.0	UINTAH	13.800	9.4	3.8	11.5	4.7
CARBNDAL	115.00	6.8	-1.9	7.9	-2.1	UINTAH	13.800	0.8	0.2	1.0	0.2
<b>UNA ORCH</b>	<b>69.000</b>	<b>15.2</b>	<b>5.0</b>	<b>30.0</b>	<b>9.9</b>	UINTAH	13.800	0.0	0.0	0.0	0.0
CLIFTON	230.00	17.0	-0.9	19.9	-0.7	VINELAND	69.000	5.3	2.2	6.2	2.7
CLIFTON	230.00	11.0	-1.1	12.8	-1.1	VINELAND	69.000	-0.8	-0.3	-0.8	-0.3
<b>DEBEQUE</b>	<b>69.000</b>	<b>1.6</b>	<b>0.6</b>	<b>1.8</b>	<b>0.7</b>	MTHARRIS	138.00	9.3	0.7	11.7	0.9
<b>DEBEQUE</b>	<b>69.000</b>	<b>1.0</b>	<b>0.3</b>	<b>9.9</b>	<b>3.2</b>	MTHARRIS	138.00	0.8	0.1	0.8	0.1
<b>DEBEQUE</b>	<b>69.000</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	COOLEYMA	230.00	16.4	-1.8	15.9	-1.7
FRUITA	69.000	9.8	4.2	12.1	5.5	COOLEYMA	230.00	0.9	-0.1	0.9	-0.1
FRUITA	69.000	1.7	0.5	1.7	0.5	BASLTDST	115.00	8.3	0.6	7.1	0.5
FRUITA	69.000	0.1	0.0	0.0	0.0	BASLTDST	115.00	0.4	0.0	0.4	0.0
GLENWOOD	69.000	0.0	0.0	10.2	3.9	ASPEN PS	115.00	11.0	3.6	14.6	4.8
GLENWOOD	69.000	7.7	3.2	0.0	0.0	ASPEN PS	115.00	0.0	0.0	0.0	0.0
GLENWOOD	69.000	0.4	0.2	0.4	0.1	ASPEN PS	115.00	21.1	-3.2	17.3	-2.6
GRANDJPS	230.00	40.2	-2.4	46.8	-1.7	ASPEN PS	115.00	1.1	-0.2	1.0	-0.2
GRANDJPS	230.00	43.5	-3.5	51.1	-2.6	SNOWMASS	115.00	7.8	-1.3	6.4	-1.0
GRANDJCT	69.000	20.6	4.0	22.5	4.3	SNOWMASS	115.00	0.4	-0.1	0.4	-0.1
GRANDJCT	69.000	0.7	0.1	0.5	0.1	BEAVERCU	115.00	19.8	-2.8	18.0	-2.5
HORIZON	230.00	18.0	6.0	22.1	8.0	BEAVERCU	115.00	1.0	-0.2	1.1	-0.2
HORIZON	230.00	26.2	13.1	31.5	17.0	CRYSTLPS	115.00	10.4	3.1	9.4	2.8
ADOBE	230.00	11.7	-2.2	14.4	-2.6	CRYSTLPS	115.00	0.5	0.2	0.6	0.2
ADOBE	230.00	0.4	-0.1	0.3	-0.1	COLBRAN	138.00	6.9	2.0	6.5	1.9
MITCHLCR	69.000	0.0	0.0	10.0	2.2	COLBRAN	138.00	0.2	0.1	0.1	0.0
MITCHLCR	69.000	7.6	1.8	0.0	0.0	RIFLE CU	138.00	7.2	1.7	8.7	2.2
MITCHLCR	69.000	0.4	0.1	0.4	0.1	RIFLE CU	138.00	0.1	0.0	4.1	0.3
NEWCASTL	69.000	1.3	0.5	1.5	0.6	RIFLE CU	138.00	4.4	0.4	0.2	0.0
NEWCASTL	69.000	4.4	1.6	5.1	1.8	RIFLE CU	138.00	0.2	0.0	16.0	4.4
PARACHUT	230.00	10.5	4.1	13.6	5.6	STEAMBT	230.00	30.4	-0.8	38.5	-1.0
PARACHUT	230.00	5.3	0.6	4.9	0.6	STEAMBT	230.00	2.5	-0.1	2.5	-0.1
PARACHUT	230.00	0.3	0.0	0.3	0.0	VAIL	115.00	14.2	-2.1	12.9	-1.9
WHEELER	230.00	3.0	0.2	3.2	0.2	VAIL	115.00	0.7	-0.1	0.8	-0.1
BENCH	230.00	35.0	2.4	28.0	1.9	WOLCOTT	230.00	14.0	-8.0	13.6	-7.7
ROARNGFK	69.000	0.0	0.0	11.5	0.0	WOLCOTT	230.00	0.7	-0.4	0.8	-0.5
ROARNGFK	69.000	8.7	0.0	0.0	0.0	AVON	115.00	12.1	0.1	11.0	0.1
ROARNGFK	69.000	0.4	0.0	0.4	0.0	AVON	115.00	0.6	0.0	0.6	0.0
						<b>TOTAL for ZONE 8</b>	<b>596.1</b>		<b>708.0</b>		

The 2018HS case was modified to reflect the forecasted demand increases at Debeque (increase of 10 MW for a 12 MW total) and Una Orchard (increase of 15 MW for a 30 MW total). The Cameo generation facility is retired in the case; therefore, no modification was needed at Cameo. The Craig/Hayden generation was increased to the maximum output. The TOT2A flows were adjusted to provide additional stress to the case. The flow adjustments across TOT2A were accomplished using the San Juan and Shiprock phase shifting transformers with the El Paso Tap-Glade Tap 115kV line open. Schedules from Western-RMR and New Mexico were adjusted as needed. With the TOT2A flow at 300 MW south-to-north (-300 MW), the contingency flow across the RifleCu 138-69kV transformer increased to 56.5 MW, or 226.2% of the 25 MVA rating of the transformer. In addition, contingency voltages at Una Orchard 69kV and Debeque 69kV decreased to 0.738 p.u. and 0.726 p.u. respectively.

C. Alternative 1 – RifleCu 65 MVA 138-69kV Transformer

Alternative 1 was created to resolve the RifleCu 138-69kV contingency overload. The impedance data for an existing 65 MVA transformer<sup>3</sup> (with R=0.003300 and X=0.108700) was used. The new transformer characteristics were substituted for the RifleCu 25MVA 138-69kV transformer and contingencies were simulated. The contingency flow of the RifleCu 65 MVA 138-69kV transformer was 59.0 MVA or 78% of its 65 MVA rating. The higher flow was due to the decreased impedance of the larger transformer. Low voltages at Debeque 69kV (0.800 p.u.) and Una Orchard 69kV (0.811 p.u.) for an outage after sectionalizing of the Cameo-Debeque 69kV line (and other outages) were observed; therefore, shunt capacitor banks (three 7.5 MVAR banks) were added at the Una Orchard 69kV bus. Table 3 summarizes these results.

**Table 3 Alternative 1 (RifleCu 65 MVA, 138-69kV Transformer, 3-7.5 MVAR caps at Una)**

18HS_T-300_A1a.sav	Monitored Element	Ckt	Limiting Contingency	Rating	LnFlow	%O/L	V-Cont
	CAMEO 230.00-PARACHUT 230.00	1	CLIFTON____230.0-GRANDJCT____230.0-1	373.3	261.9	70.2	
	CAMEO 69.000-CAMEO 230.00	T5	GRANDJCT____69.00-GRANDJCT____115.0-T1	66.7	42.9	64.3	
	CAMEO 69.000-DEBEQUE 69.000	1	GRANDVLY____69.00-OILSHALE____69.00-1	55.9	45.1	80.8	
	CLIFTON 230.00-GRANDJCT 230.00	1	PARACHUT____230.0-RIFLE_PS____230.0-1	494.4	310.3	62.8	
	COLBRAN 138.00-COLBRAN 115.00	T2	CLIFTON____230.0-GRANDJCT____230.0-1	14.0	12.9	92.1	
	CURECANT 115.00-SOCANAL 115.00	1	CURECANT____230.0-NORTHFRK____230.0-1	120.0	86.3	71.9	
	CURECANT 230.00-MORROWPT 230.00	1	BLUEMESA____115.0-CURECANT____115.0-1	182.0	165.9	91.2	
	GRANDJCT 230.00-GRANDJCT 345.00	1	PARACHUT____230.0-RIFLE_PS____230.0-1	280.0	310.3	110.8	
	GRANDJCT 69.000-GRANDJCT 115.00	T1	CLIFTON____230.0-GRANDJCT____230.0-1	42.0	53.2	126.6	
	GRANDVLY 69.000-OILSHALE 69.000	1	CAMEO____69.00-DEBEQUE____69.00-1	55.9	44.4	79.4	
	OILSHALE 69.000-RIFLE CU 69.000	1	CAMEO____69.00-DEBEQUE____69.00-1	55.9	46.1	82.5	
	PARACHUT 230.00-RIFLE PS 230.00	1	CLIFTON____230.0-GRANDJCT____230.0-1	373.3	324.7	87.0	
	<b>RIFLE CU 69.000-RIFLE CU 138.00</b>	T2	CAMEO____69.00-DEBEQUE____69.00-1	65.0	<b>59.0</b>	90.8	
	RIFLE PS 230.00-RIFLE WA 230.00	1	CLIFTON____230.0-GRANDJCT____230.0-1	500.0	350.7	70.1	
	UNA ORCH 69.000-GRANDVLY 69.000	1	CAMEO____69.00-DEBEQUE____69.00-1	55.9	43.0	77.0	

<sup>3</sup> The Blackhawk 75.0 MVA 138.0-69.0 at Bus #65167 was selected.

The placement of shunt capacitors to support contingency voltages at Debeque and Una substations could have occurred at the Debeque Substation instead of the Una Substation. The shunt capacitor banks were placed at Debeque instead of Una.

**Table 4 Alternative 1 (RifleCu 65 MVA, 138-69kV Transformer, 3-7.5 MVAR caps at Debeque)**

18HS_T-300._A1b.sav						
Monitored Element	Ckt	Limiting Contingency	Rating	LnFlow	%O/L	V-Cont
CAMEO 230.00-PARACHUT 230.00	1	CLIFTON 230.0-GRANDJCT 230.0-1	373.3	261.9	70.2	
CAMEO 69.000-CAMEO 230.00	T5	GRANDJCT 69.00-GRANDJCT 115.0-T1	66.7	42.9	64.3	
CAMEO 69.000-DEBEQUE 69.000	1	GRANDVLY 69.00-OILSHALE 69.00-1	55.9	45.1	80.8	
CAMEO 69.000-DEBEQUE 69.000	1	OILSHALE 69.00-RIFLE_CU 69.00-1	55.9	45.2	80.8	
CAMEO 69.000-DEBEQUE 69.000	1	UNA_ORCH 69.00-GRANDVLY 69.00-1	55.9	45.1	80.7	
CAMEO 69.000-DEBEQUE 69.000	1	RIFLE_CU 69.00-RIFLE_CU 138.0-T2	55.9	38.1	68.2	
CLIFTON 230.00-GRANDJCT 230.00	1	PARACHUT 230.0-RIFLE_PS 230.0-1	494.4	310.3	62.8	
COLBRAN 138.00-COLBRAN 115.00	T2	CLIFTON 230.0-GRANDJCT 230.0-1	14.0	12.9	92.1	
COLBRAN 138.00-COLBRAN 115.00	T2	GRANDJCT 230.0-GRANDJCT 345.0-1	14.0	12.9	92.1	
CRAIG 230.00-CRAIG 345.00	2	CRAIG 230.0-CRAIG 345.0-1	561.0	397.3	70.8	
CRAIG 230.00-CRAIG 345.00	1	CRAIG 230.0-CRAIG 345.0-2	561.0	397.3	70.8	
CURECANT 115.00-SOCANAL 115.00	1	CURECANT 230.0-NORTHFRK 230.0-1	120.0	86.3	71.9	
CURECANT 230.00-MORROWPT 230.00	1	BLUEMESA 115.0-CURECANT 115.0-1	182.0	165.9	91.2	
GOREPASS 138.00-HAYDEN 138.00	1	GOREPASS 230.0-HAYDEN 230.0-1	135.0	120.4	89.2	
GOREPASS 230.00-HAYDEN 230.00	1	HAYDEN 230.0-FOIDELCK 230.0-1	403.2	303.2	75.2	
GRANDJCT 230.00-GRANDJCT 345.00	1	PARACHUT 230.0-RIFLE_PS 230.0-1	280.0	310.3	110.8	
GRANDJCT 69.000-GRANDJCT 115.00	T1	CLIFTON 230.0-GRANDJCT 230.0-1	42.0	53.2	126.6	
GRANDVLY 69.000-OILSHALE 69.000	1	CAMEO 69.00-DEBEQUE 69.00-1	55.9	44.4	79.4	
OILSHALE 69.000-RIFLE CU 69.000	1	CAMEO 69.00-DEBEQUE 69.00-1	55.9	46.1	82.5	
PARACHUT 230.00-RIFLE PS 230.00	1	CLIFTON 230.0-GRANDJCT 230.0-1	373.3	324.7	87.0	
<b>RIFLE CU 69.000-RIFLE CU 138.00</b>	<b>T2</b>	<b>CAMEO 69.00-DEBEQUE 69.00-1</b>	<b>65.0</b>	<b>59.0</b>	<b>90.8</b>	
RIFLE CU 69.000-RIFLE CU 138.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	65.0	57.9	89.1	
RIFLE PS 230.00-RIFLE WA 230.00	1	CLIFTON 230.0-GRANDJCT 230.0-1	500.0	350.7	70.1	
RIFLE PS 230.00-RIFLE WA 230.00	1	GRANDJCT 230.0-GRANDJCT 345.0-1	500.0	350.6	70.1	
RIFLE PS 230.00-RIFLE WA 230.00	1	CLIFTON 230.0-GRANDJPS 230.0-1	500.0	321.3	64.3	
UNA ORCH 69.000-GRANDVLY 69.000	1	CAMEO 69.00-DEBEQUE 69.00-1	55.9	43.0	77.0	

Placing the capacitors at Debeque instead of Una Orchard Substation is acceptable since adding the caps at Debeque mitigates the low voltage situation at Una Orchard Substation for an outage after sectionalizing of the Una Orchard-Debeque 69kV line. The rating of the proposed RifleCu 138-69kV transformer needs to be at least 59 MVA. Factoring in load h and uncertainty in the model data, the RifleCu 25 MVA 138-69kV transformer could be replaced with a

D. Alternative 2 – RifleCu 65 MVA 230-69kV Transformer

A second alternative was developed. This alternative consisted of replacing the RifleCu 25 MVA 138-69kV transformer with a 65 MVA 230-69kV transformer. The impedance data for an existing 65 MVA 230-69kV transformer<sup>4</sup> (with R=0.005 and X=0.1252) was used. Contingencies were conducted and the results listed in Table 5 below.

**Table 5 Alternative 2 (RifleCu 65 MVA 230-69kV Transformer, No Caps at Una)**

18HS_T-300_A2.sav						
Monitored Element	Ckt	Limiting Contingency	Rating	LnFlow	%O/L	V-Cont
CAMEO 69.000-DEBEQUE 69.000	1	UNA_ORCH 69.00-GRANDVLY 69.00-1	55.9	51.1	91.4	
COLBRAN 138.00-COLBRAN 115.00	T2	CLIFTON 230.0-GRANDJCT 230.0-1	14.0	13.1	93.5	
CRAIG 230.00-CRAIG 345.00	2	CRAIG 230.0-CRAIG 345.0-1	561.0	398.0	70.9	
CRAIG 230.00-CRAIG 345.00	1	CRAIG 230.0-CRAIG 345.0-2	561.0	398.0	70.9	
CURECANT 115.00-SOCANAL 115.00	1	CURECANT 230.0-NORTHFRK 230.0-1	120.0	86.0	71.7	
CURECANT 230.00-MORROWPT 230.00	1	BLUEMESA 115.0-CURECANT 115.0-1	182.0	165.5	90.9	
<b>DEBEQUE 69.000</b>		CAMEO 69.00-DEBEQUE 69.00-1				<b>0.809</b>
DEBEQUE 69.000		UNA_ORCH 69.00-GRANDVLY 69.00-1				0.855
GOREPASS 138.00-HAYDEN 138.00	1	GOREPASS 230.0-HAYDEN 230.0-1	135.0	120.7	89.4	
GOREPASS 230.00-HAYDEN 230.00	1	HAYDEN 230.0-FOIDELCK 230.0-1	403.2	303.7	75.3	
GRANDJCT 230.00-GRANDJCT 345.00	1	PARACHUT 230.0-RIFLE_PS 230.0-1	280.0	307.7	109.9	
GRANDJCT 69.000-GRANDJCT 115.00	T1	CLIFTON 230.0-GRANDJCT 230.0-1	42.0	55.3	131.6	
GRANDVLY 69.000		GRANDVLY 69.00-OILSHALE 69.00-1				0.829
GRANDVLY 69.000-OILSHALE 69.000	1	CAMEO 69.00-DEBEQUE 69.00-1	55.9	49.5	88.5	
OILSHALE 69.000		OILSHALE 69.00-RIFLE_CU 69.00-1				0.831
OILSHALE 69.000-RIFLE CU 69.000	1	CAMEO 69.00-DEBEQUE 69.00-1	55.9	53.3	95.3	
OILSHALE 69.000-RIFLE CU 69.000	1	CLIFTON 230.0-GRANDJCT 230.0-1	55.9	39.4	70.4	
OILSHALE 69.000-RIFLE CU 69.000	1	GRANDJCT 230.0-GRANDJCT 345.0-1	55.9	39.3	70.3	
PARACHUT 230.00-RIFLE PS 230.00	1	CLIFTON 230.0-GRANDJCT 230.0-1	373.3	326.0	87.3	
<b>RIFLE CU 69.000-RIFLE CU 230.00</b>	<b>T2</b>	<b>CAMEO 69.00-DEBEQUE 69.00-1</b>	<b>65.0</b>	<b>67.7</b>	<b>104.2</b>	
RIFLE CU 69.000-RIFLE CU 230.00	T2	RIFLE_PS 230.0-RIFLE_WA 230.0-1	65.0	63.3	97.4	
RIFLE CU 69.000-RIFLE CU 230.00	T2	HOPKINS 230.0-RIFLE_PS 230.0-1	65.0	60.5	93.1	
<b>UNA ORCH 69.000</b>		CAMEO 69.00-DEBEQUE 69.00-1				<b>0.820</b>
UNA ORCH 69.000		UNA_ORCH 69.00-GRANDVLY 69.00-1				0.827
UNA ORCH 69.000-GRANDVLY 69.000	1	CAMEO 69.00-DEBEQUE 69.00-1	55.9	46.2	82.6	

**Table 6 Alternative 2 (RifleCu 65 MVA 230-69kV Transformer, 3-7.5 MVAR caps at Una)**

18HS_T-300_A2a.sav						
Monitored Element	Ckt	Limiting Contingency	Rating	LnFlow	%O/L	V-Cont
CAMEO 69.000-DEBEQUE 69.000	1	GRANDVLY 69.00-OILSHALE 69.00-1	55.9	45.1	80.8	
COLBRAN 138.00-COLBRAN 115.00	T2	CLIFTON 230.0-GRANDJCT 230.0-1	14.0	12.9	92.0	
CRAIG 230.00-CRAIG 345.00	2	CRAIG 230.0-CRAIG 345.0-1	561.0	398.0	70.9	
CRAIG 230.00-CRAIG 345.00	1	CRAIG 230.0-CRAIG 345.0-2	561.0	398.0	70.9	
CURECANT 115.00-SOCANAL 115.00	1	CURECANT 230.0-NORTHFRK 230.0-1	120.0	86.3	71.9	
CURECANT 230.00-MORROWPT 230.00	1	BLUEMESA 115.0-CURECANT 115.0-1	182.0	166.0	91.2	

<sup>4</sup> The Calapoya 75.0 MVA 230-69 at Bus #45380 was selected.

GOREPASS	138.00-HAYDEN	138.00	1	GOREPASS	230.0-HAYDEN	230.0-1	135.0	120.7	89.4
GRANDJCT	230.00-GRANDJCT	345.00	1	PARACHUT	230.0-RIFLE_PS	230.0-1	280.0	307.8	109.9
GRANDJCT	69.000-GRANDJCT	115.00	T1	CLIFTON	230.0-GRANDJCT	230.0-1	42.0	53.6	127.6
GRANDVLY	69.000-OILSHALE	69.000	1	CAMEO	69.00-DEBEQUE	69.00-1	55.9	44.4	79.4
OILSHALE	69.000-RIFLE CU	69.000	1	CAMEO	69.00-DEBEQUE	69.00-1	55.9	46.1	82.4
PARACHUT	230.00-RIFLE PS	230.00	1	CLIFTON	230.0-GRANDJCT	230.0-1	373.3	322.0	86.3
<b>RIFLE CU</b>	<b>69.000-RIFLE CU</b>	<b>230.00</b>	T2	RIFLE_PS	230.0-RIFLE_WA	230.0-1	65.0	<b>64.8</b>	99.7
RIFLE CU	69.000-RIFLE CU	230.00	T2	CAMEO	69.00-DEBEQUE	69.00-1	65.0	62.8	96.6
RIFLE CU	69.000-RIFLE CU	230.00	T2	HOPKINS	230.0-RIFLE_PS	230.0-1	65.0	61.4	94.5
UNA ORCH	69.000-GRANDVLY	69.000	1	CAMEO	69.00-DEBEQUE	69.00-1	55.9	43.1	77.0

The RifleCu 230-69kV transformer rating needs to be at least 65 MVA.

### Alternatives and Reason for Choice

<p>Alternative 0 -</p> <p>No change.</p> <p>Alternative 1 – <b>(Please estimate this project)</b></p> <p>Replace the 25 MVA 138-69kV transformer with a 65 MVA <b>138</b>-69kV transformer.</p> <p>Alternative 2 – <b>(Please estimate this project)</b></p> <p>Replace the 25 MVA 138-69kV transformer with a 65 MVA <b>230</b>-69kV transformer</p> <p>The 138-69kV transformer contingency flow is smaller for Alternative 1 than for Alternative 2 and one could argue that the 25 MVA 138-69kV transformer could be replaced with a 70 MVA transformer instead of a 65 MVA transformer; however, that difference is due to the arbitrary choice of transformers (that were selected from the WECC base case) to represent typical 138-69kV and 230-69kV transformer impedance data. The preferred alternative will be determined after PSCo Substation Engineering has studied both alternatives.</p> <p>The transformers will have additional capacity built-in as this evaluation did not consider the PSCo transformer overload criteria that allows a load-following transformer to load to 115% of its nominal rating for two hours under emergency conditions such as a single contingency..</p>
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### Consequences of Not Doing Project

<p>The RifleCu 25 MVA 138-69kV transformer could experience contingency overloads that could require load shedding to relieve the transformer overload.</p>
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**Capital Financing Alt 1: ( AFUDC Excluded)  
(Whole Dollar Value)**

<b>Years</b>	<b>Trans Line</b>	<b>Trans / Dist Sub</b>	<b>ROW</b>	<b>Land</b>	<b>Total</b>
<b>2010</b>		\$ 50,000			\$ 50,000
<b>2011</b>		\$3,230,000			\$3,230,000
<b>2012</b>					
<b>2013</b>					
<b>2014</b>					
<b>Total</b>					
					\$3,280,000

**Capital Financing Alt 2: ( AFUDC Excluded)  
(Whole Dollar Value)**

<b>Years</b>	<b>Trans Line</b>	<b>Trans / Dist Sub</b>	<b>ROW</b>	<b>Land</b>	<b>Total</b>
<b>2010</b>		\$ 978,000			\$ 978,000
<b>2011</b>		\$3,136,000			\$3,136,000
<b>2012</b>					
<b>2013</b>					
<b>2014</b>					
<b>Total</b>					\$4,114,000