PG&E's 2023 Request Window Proposals

CAISO 2023-2024 Transmission Planning Process

September 27, 2023

Together, Building a Better California

Transmission Project Proposals Overview

Thirteen Reliability Driven Projects Seeking CAISO Approval:

North Coast/ North Bay

- Covelo 60 kV Voltage Support Project
- Calistoga 60 kV Voltage Support Project

Sacramento

- Vaca Dixon Area Reinforcement Project (Re-scope)

Greater Bay Area

- Martin - Millbrae 60kV Area Reinforcement Project

Stockton/Sierra

- Atlantic High Voltage Mitigation Project (Re-scope)
- French Camp Reinforcement Project (Conceptual)

Transmission Project Proposals Overview

Central Coast/ Los Padres

- Diablo Canyon Area 230 kV High Voltage Mitigation Project
- Crazy Horse Canyon-Salinas-Soledad #1 and #2 115 kV Line Reconductoring
- Spence 60 kV Area Transmission Reinforcement Project (Conceptual)

Greater Fresno Area

- Camden 70 kV Reinforcement Project
- Gates 230/70 kV Transformer Addition Project
- Reedley 70 kV Capacity Increase Project

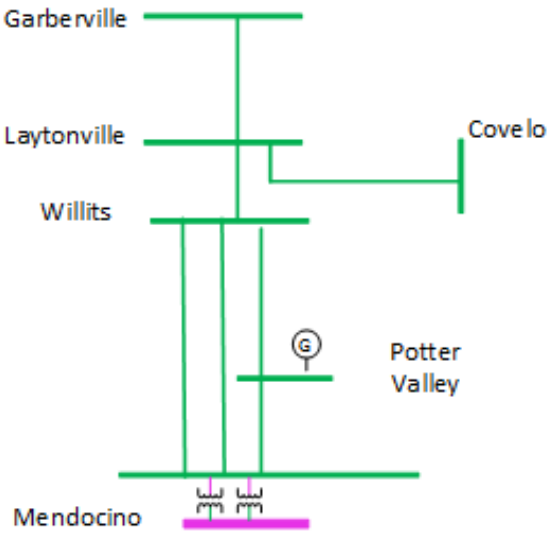
Kern

- Tejon Area Reinforcement Project (Conceptual)

COVELO 60 KV VOLTAGE SUPPORT

Area Background

- Laytonville and Covelo 60 kV Substations are in Mendocino County.
- Laytonville is located 23 miles north-west of the town of Willits and is served by the Laytonville-Willits 60 kV and Garberville-Laytonville 60 kV Lines.
- Covelo is located 14 miles north-east of the town of Laytonville and is radially served by the Laytonville – Covelo 60 kV Line.
- Upon the loss of the Laytonville-Willits 60 kV line, both Laytonville and Covelo are served from the Humboldt area via the Garberville-Laytonville 60 kV line.



Single Line Diagram for Covelo Area

Assessment Results

- **Contingency Description:**
  - P0 (Normal Conditions)
  - P1 category event that causes loss of Laytonville-Willits 60 kV line
  - P2 category event that causes loss of Mendocino-Willits- Fort Bragg 60 kV

- **Power Flow Results**

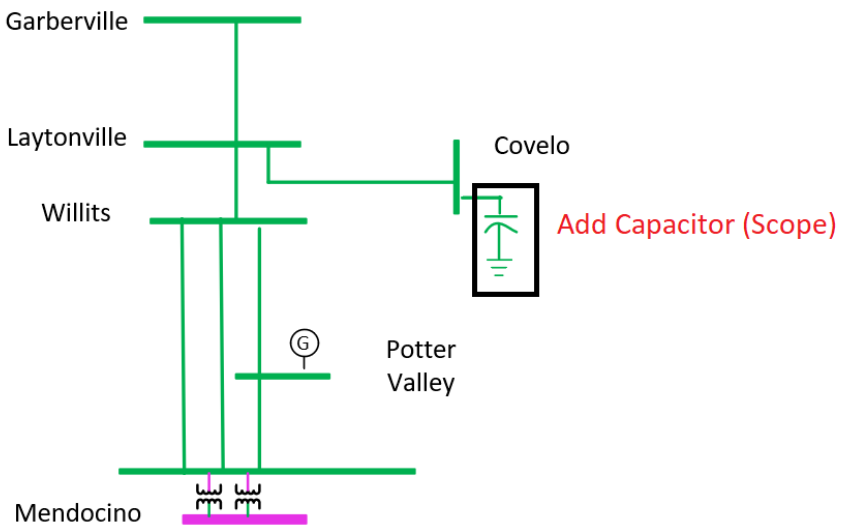
NCNB Summer Peak		Pre-Project (p.u.)			Post-Project (p.u.)	Contingency	
Facility	Rating (kV)	2025	2028	2035	2035	Category	Contingency Name
Covelo	60	0.941	0.962	0.935	1.038	P0	Basecase
Covelo	60	0.756	0.851	<0.7	1.026	P1	LAYTONVILLE-WILLITS 60KV
Covelo	60	0.925	0.979	0.899	1.005	P2	MENDOCINO-WILLITS-FORT BRAGG 60KV (MENDOCNO-WILLITSJ)
Laytonville	60	0.950	0.970	0.948	1.012	P0	Basecase
Laytonville	60	0.766	0.860	<0.7	1.019	P1	LAYTONVILLE-WILLITS 60KV

Proposed Project

- **Project Objectives:** The project objective is to mitigate the low voltage at Laytonville and Covelo Substations.
- **Preferred Scope:**

  The project scope is to install a 10 MVAR Shunt Capacitor at Covelo 60 kV Substation.

- **Proposed In-Service Date:**
  - May 2030 or earlier
- **Estimated Cost:**
  - $11.0M - $22.0M*



Proposed Single Line Diagram

*AACE Level 5 quality estimates includes a +100% contingency

Proposed Project (cont.)

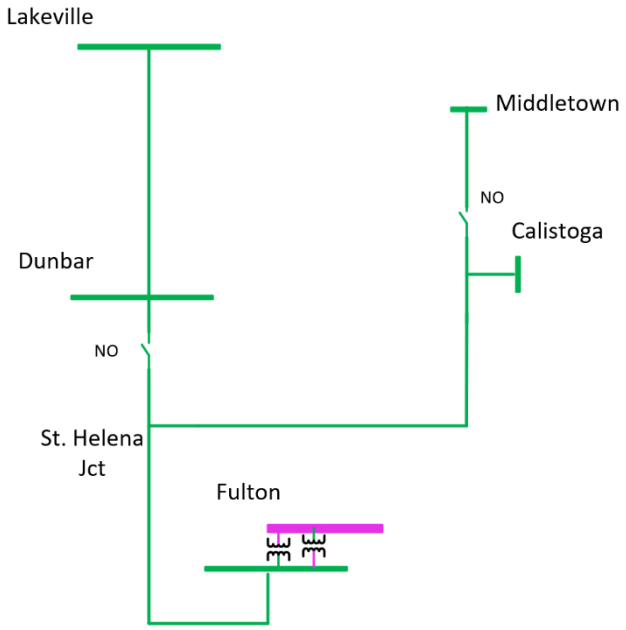
- **Other Alternatives Considered**
  - Alternative 1: Installing SVC at Covelo

  This alternative is not recommended because the cost is higher than the preferred scope.

CALISTOGA 60 KV VOLTAGE SUPPORT

Area Background

- Calistoga town is located in Napa County and is served from the Fulton – Calistoga 60 kV Line. The substation also has an alternate source from the Konocti-Middletown 60 kV Line which is normally open.
- Calistoga Substation has one transformer 4-7.0MVA. The 2035 projected total peak load for Calistoga Substation is approximately 28 MW.



Existing Single Line Diagram of Calistoga 60 kV Substation

Assessment Results

- **Contingency Description:**
  - P0 (Normal Conditions)
  - P1 category event that causes loss of Lakeville #1 60 kV line
  - P2 category event that cause loss of Fulton 115 kV section 2F
- **Power Flow Results**

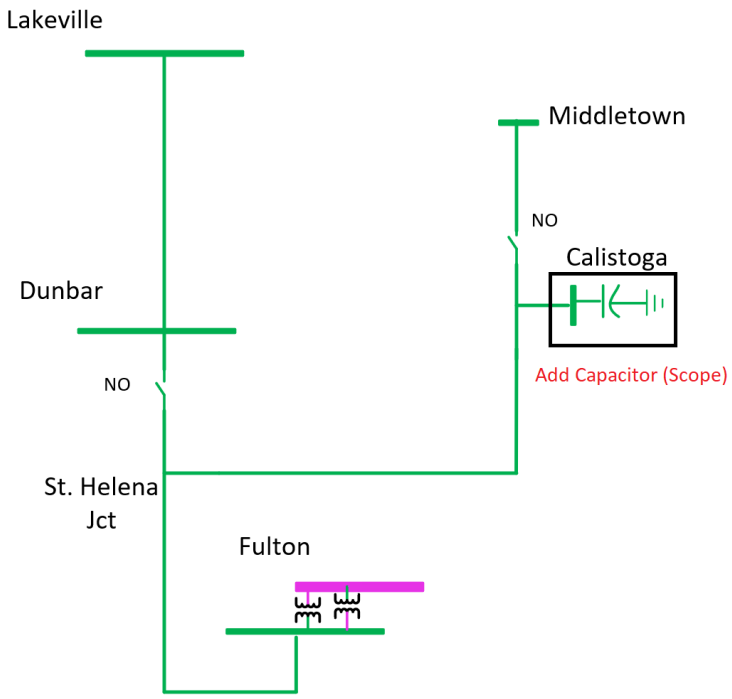
Summer Peak Area Assessment	Pre-Project			Post-Project	Contingency	
Facility	2025	2028	2035	2035	Category	Contingency Name
Calistoga 60 kV Bus	0.949	0.937	0.910	1.010	P0	Basecase
Calistoga 60 kV Bus	0.892	0.877	0.799	0.910	P1	P1-2: LAKEVILLE #1 60KV
Calistoga 60 kV Bus	0.957	0.935	0.893	0.991	P2	P2-2: FULTON 115KV SECTION 2F

Proposed Project

- **Project Objectives:** The project objective is to mitigate the low voltage at Calistoga 60 kV Substation.
- **Preferred Scope:**

  The project scope is to install a 15 MVAR Shunt Capacitor at Calistoga 60 kV Substation.

- **Proposed In-Service Date:**
  - May 2030 or earlier
- **Estimated Cost:**
  - $14.0M - $28.0M*



Proposed Single Line Diagram of Calistoga 60 kV Substation

*AACE Level 5 quality estimates includes a +100% contingency

Proposed Project (cont.)

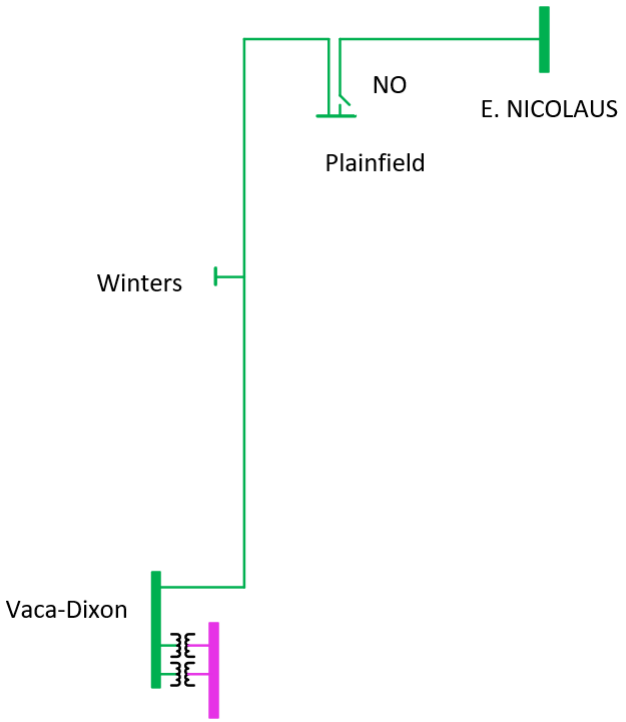
- **Other Alternatives Considered**
  - Alternative 1: Installing SVC at Calistoga

  This alternative is not recommended because the cost is higher than the preferred scope as well as space at the substation is very limited.

VACA DIXON REINFORCEMENT PROJECT (RE-SCOPE)

Area Background

- Winters and Plainfield 60 kV Substations are located in Yolo County. These substations are normally radially served from the Vaca - Plainfield 60 kV line while the source from E. Nicolaus-Plainfield 60 kV line is normally open.
- The distribution load serving capability in this pocket is currently limited due to capacity constraints on these transmission lines and the radial setup.
- There is a CAISO approved project to add a 10 MVAR capacitor at Plainfield Substation.



Single Line Diagram for Vaca-Dixon Area

Assessment Results

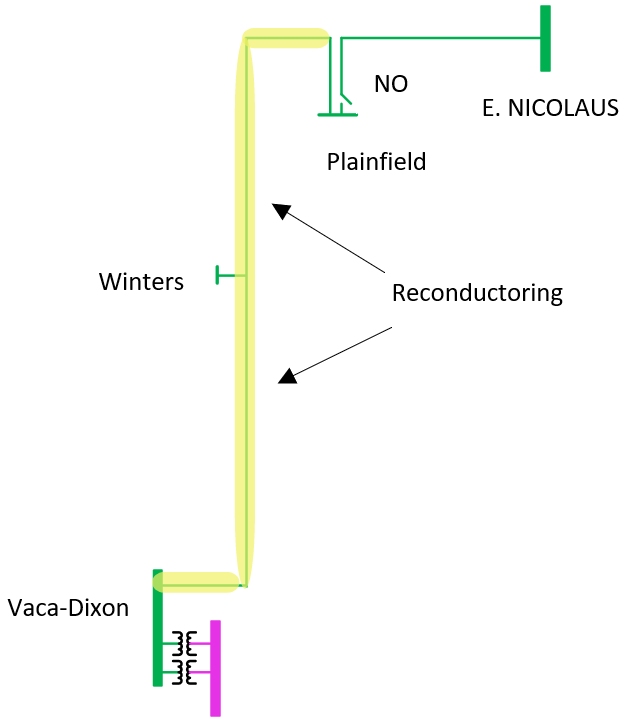
- **Contingency Description:**
  - P0 (Normal Conditions)
  - P1 category event that causes loss of Plainfield Capacitor Bank
- **Power Flow Results:**

Monitored		Pre-Project			Post-Project	Contingency	
Facility	Rating (MVA)	2025	2028	2035	2035	Category	Contingency Name
VACA-DXN WINTERS	30 (SN)	126.7%	96.7%	126.4%	51.9%	P0	Basecase
WINTERS-PLAINFIELD	25 (SN)	141.7%	104.3%	138.3%	46.8%	P0	Basecase
VACA-DXN WINTERS	30 (SN)	N/A*	89.0%	105.9%	43.1%	P1	PLAINFIELD Cap bank
WINTERS-PLAINFIELD	25(SN)	N/A*	96.9%	115.8%	37.9%	P1	PLAINFIELD Cap bank

*The Plainfield Capacitor banks will not be in-service by 2025, therefore the outage is not applicable to 2025 scenario.

Proposed Project

- **Project Objectives:** This project protects against the NERC TPL-001-5 Category P0 and P1 violations and can mitigate the observed thermal violations.
- **Preferred Scope**
  - Reconductor Vaca-Plainfield 60 kV (about 30 miles) to achieve minimum conductor rating of 635 AMPS for summer normal and 741 AMPS for summer emergency rating.
  - Upgrade any limiting components as necessary to achieve full conductor capacity.



Proposed Single Line Diagram

- **Proposed In-Service Date :** May 2030 or earlier
- **Estimated Cost :** $34M - $68M*

*AACE Level 5 quality estimates includes a +100% contingency

Alternatives

- **Other Alternatives Considered**

Alternative 1: Status Quo

This alternative is not recommended, because it does not mitigate the expected capacity constraints due to thermal overload and low voltage without having to rely on dropping or transferring customer load before/after a single contingency event.

Alternative 2: Installing 25 MW of Battery at Winters Substation and reconductoring about 22 miles Winters-Plainfield.

This alternative is not feasible due to space limitations at Winters Substation.

Alternative 3: Voltage Conversion and Reconductoring Fulton JCT-VACA 115 kV (about 12 miles) Madison-Vaca 115 kV (about 12 miles).

This alternative is not recommended because of higher cost.

Alternatives (Cont.)

- **Other Alternatives Considered**

Alternative 4: Construct a second Vaca-Plainfield line by changing existing 60kV Line to DCTL.

Introducing a new 60 kV source from Vaca Dixon have benefits for reliability. In case of an N-1 outage of one of the Vaca-Plainfield lines, the Winters and Plainfield substations can be served from the other Vaca-Plainfield line. However, due to the higher cost this alternative is not recommended.

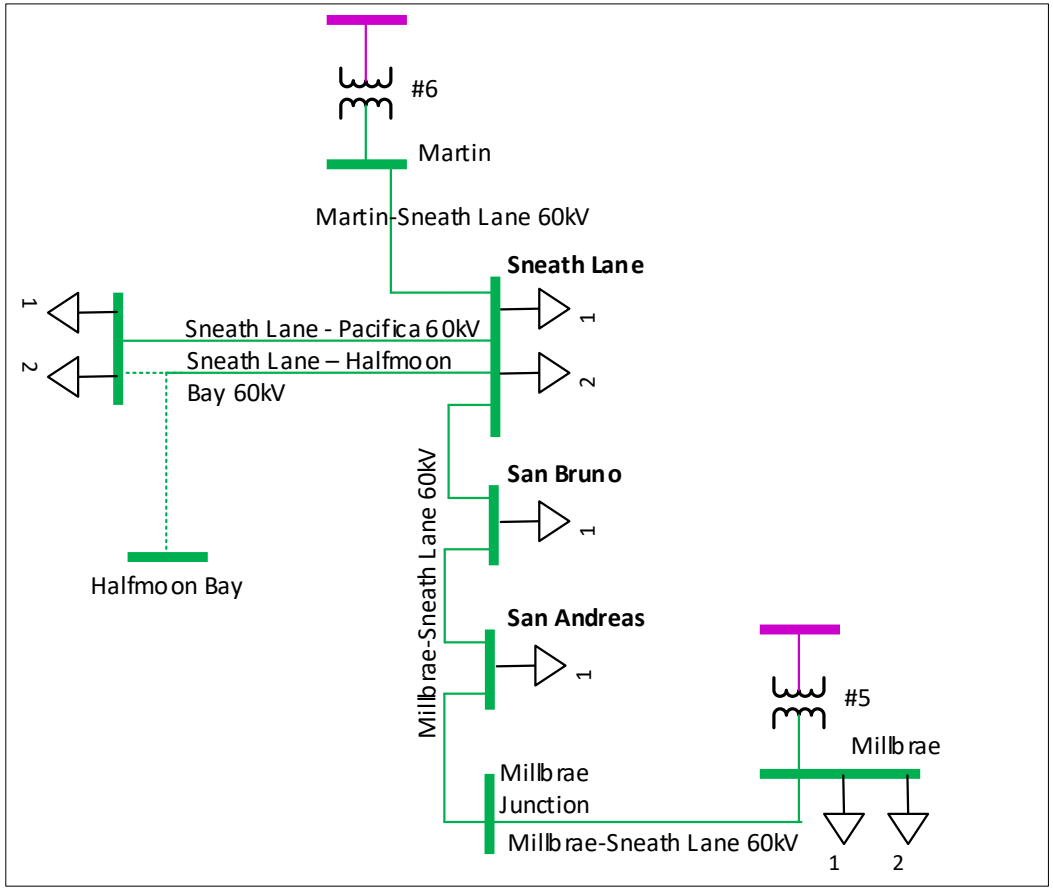
Alternative 5: Construct a second Vaca-Plainfield line by converting existing 60kV Line to 115 kV DCTL.

This item is same as alternative 4, but the voltage would be 115 kV. The cost in comparison to alternative 4 would be higher, so this alternative is not recommended.

MARTIN - MILLBRAE 60KV AREA REINFORCEMENT PROJECT

Area Background

- The Martin - Millbrae 60 kV area is located in the Peninsula and serves about 23,000 customers.
- The 60 kV pocket is served by Martin 115/60 kV Transformer Bank No. 6 and Millbrae 115/60 kV Transformer Bank No. 5.
- PG&E's Distribution Planning has projected higher load growth in the pocket and is targeting to expand the load serving capacity by upgrading the distribution banks at the Sneath Lane substation.



Martin-Millbrae Area Single Line Diagram

Assessment Results

- **Contingency Description:**
  - **P1**: Losing Martin 115/60 kV Transformer Bank No. 6 or Millbrae 115/60 kV Transformer Bank No. 5

- **Power Flow Results:**

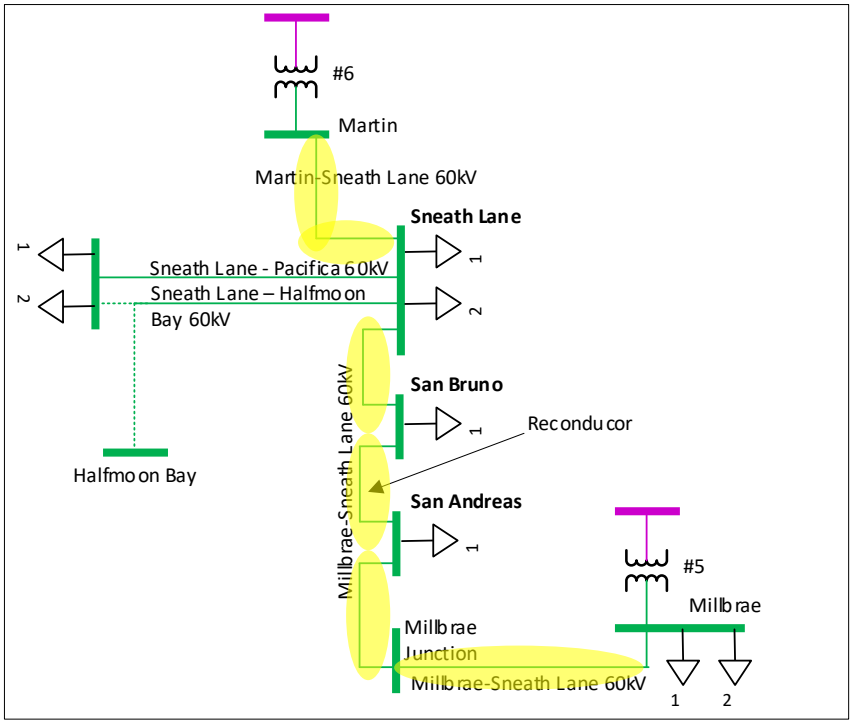
Monitored Facility		Pre-Project			Post-Project		Contingency	
Facility Name	Rating* (Amp)	2025 (%)	2028 (%)	2035 (%)	2028 (%)	2035 (%)	Category	Contingency Name
Martin – Sneath Lane 60kV line	711	113.9	123	158	70.5	90.5	P1	Millbrae Bank #5
Millbrae – Sneath Lane 60kV line (Millbrae-Millbrae Tap)	597	104	109.3	141.6	53	69.5	P1	Martin Bank #6

*Winter emergency rating

Proposed Project

- **Project Objectives:** This project protects against the NERC TPL-001-5 Category P1 violations and can mitigate the observed thermal violations.
- **Preferred Scope**

– Reconductor 7.2 miles on the Martin – Sneath Lane 60 kV Line with a larger conductor to achieve at least 1100 Amps during summer emergency conditions and 1200 Amps during winter emergency conditions.



Proposed Project Single Line Diagram

– Reconductor 2.5 miles on the Millbrae – Sneath Lane 60 kV Line with a larger conductor to achieve at least 1100 Amps during summer emergency conditions and 1200 Amps during winter emergency conditions.

– Upgrade any limiting components

Proposed Project (cont.)

- **Proposed In-Service Date**
  - May 2030 or earlier
- **Estimated Cost**
  - $20.0M - $40.0M*
- **Other Alternatives Considered**
  - Alternative 1: Status Quo

    This alternative is not recommended because it does not mitigate the NERC TPL P1 violations.
  - Alternative 2: Energy Storage

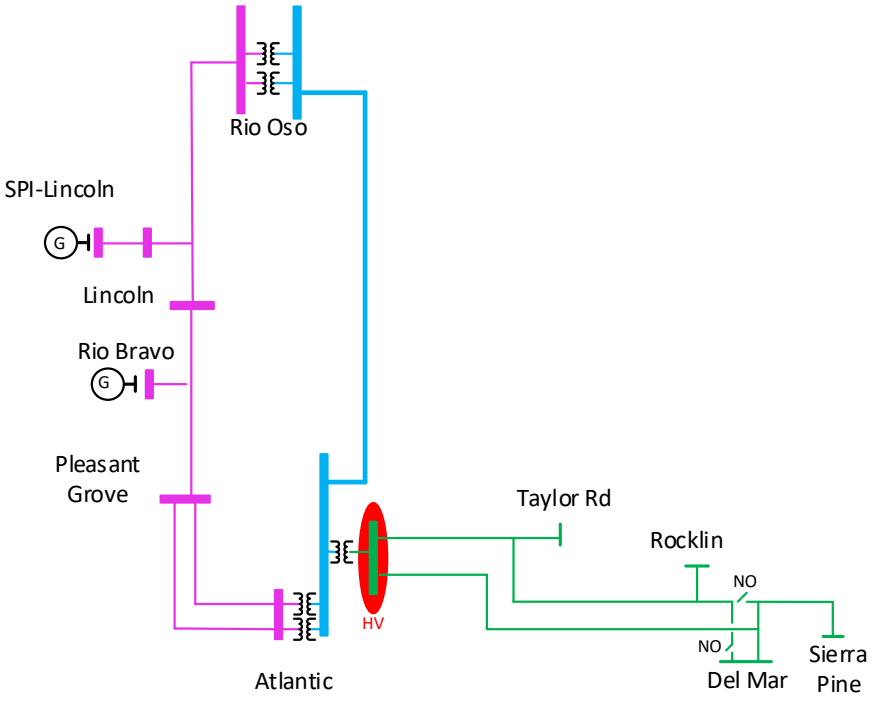
    This alternative is not recommended because the energy storage charging capability is limited by the existing line capacity and will be further limited by the future load increase.

*AACE Level 5 quality estimates includes a +100% contingency

ATLANTIC HIGH VOLTAGE MITIGATION (RE-SCOPE)

Area Background

- The Atlantic 230/60 kV transformer (3 single-phase banks plus a spare) is the main source to serve the City of Rocklin in Placer County.
- The Atlantic High Voltage mitigation project was approved by CAISO in the 2021-2022 TPP cycle
- The approved scope is to add a voltage regulator on the 3 single-phase 230/60 kV banks.
- The estimated cost of adding a voltage regulator is $7M-14M*



Single Line Diagram of the Study Area

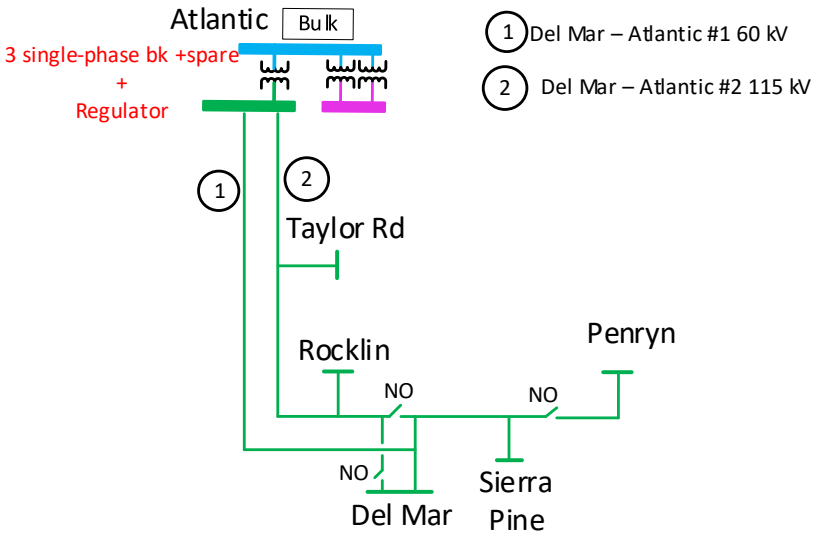
*AACE Level 5 quality estimates includes a +100% contingency

Reasons for the Proposed Re-scope

- Phase A failed in 2022 and there is no spare single-phase bank available
- The estimated cost of adding a new spare single-phase bank is $4M-8M*

Approved Scope Disadvantages:

- Limited construction window due to weak back tie
- Reliability concerns during failure of a single-phase bank. It would take 2-3 days to insert the spare phase.
- Existing scope will not improve operational flexibility and serving capability for future load growth



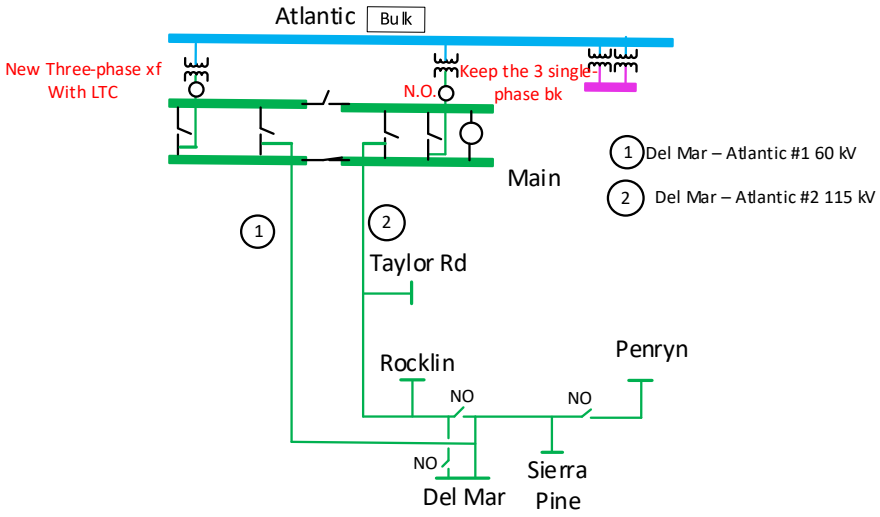
Single Line Diagram of the Existing Scope

*AACE Level 5 quality estimates includes a +100% contingency

Proposed Re-scope

Proposed Re-scope:

- Install a 200 MVA 3-phase 230/60 kV transformer with LTC
- Associated bus work at Atlantic to install the new transformer.



Single Line Diagram of the project re-scope

Estimated Cost

- $20M - $40M*

<u>Advantages:</u>

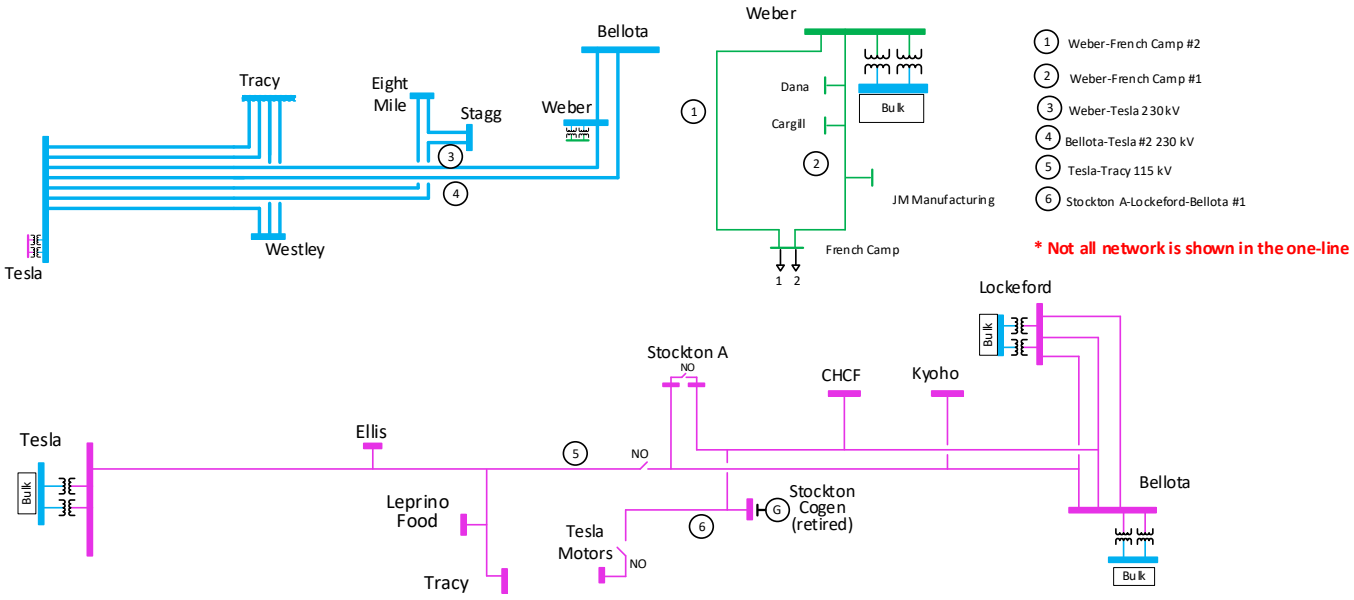
- Increase construction window and reduce customers at risk during construction.
- Improve reliability by keeping the existing three single-phase banks as backup.
- Improve operational flexibility and serving capability for future load growth.

*AACE Level 5 quality estimates includes a +100% contingency

FRENCH CAMP REINFORCEMENT PROJECT (CONCEPTUAL)

Area Background

- French Camp, Dana, Cargill, and JM Manufacturing 60 kV Substations are in a small load area in South Stockton DPA near Highway 5 and Highway 99.
- This pocket is served through Weber-French Camp #1 and #2 60 kV lines.
- There are multiple 230 kV and 115 kV lines which are close to the French Camp substation.
  - Weber-Tesla 230 kV, Bellota-Tesla #2 230 kV
  - Tesla-Tracy 115 kV, Stockton A-Lockeford-Bellota #1 115 kV



Weber Area Single Line Diagram

Area Load Forecast

- Load forecast in the 2023-2024 TPP

Substation	2025 (MW)	2025 (MVAR)	2028 (MW)	2028 (MVAR)	2035 (MW)	2035 (MVAR)
French Camp	39.06	9.78	40.07	9.99	48.94	11.90
JM Manufacturing	4.66	1.36	4.66	1.36	4.66	1.99
Cargill	2.19	0.54	2.19	0.54	2.19	1.93
Dana	0.53	0	0.53	0	0.53	0
Total	46.4	11.7	47.4	11.9	56.3	15.8

- This area is expected to experience significantly higher load growth in the planning horizon, especially given its proximity to the state's transportation corridors. PG&E Distribution Planning has received multiple load requests in this area which include EV charging, distribution center and merchandise center.
- For the South Stockton 21 kV Distribution Planning Area, load is expected to grow from 270 MW in 2023 to over 400 MW in 2035.
- Weber Substation has been the main source for serving the load in this pocket. Weber is already being utilized close to its maximum capacity with no feasibility for further expansion after the currently planned upgrades.

Assessment Results

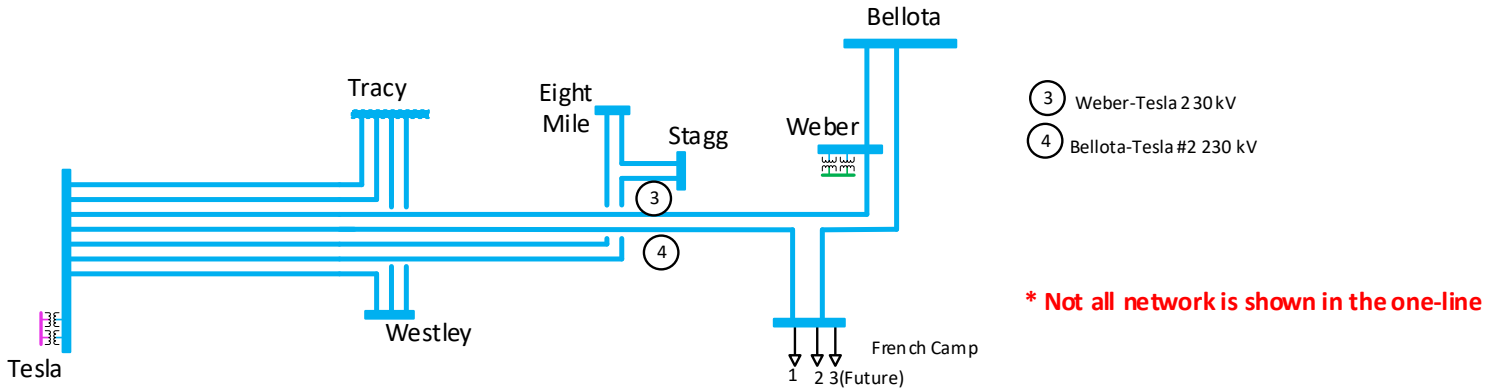
- **Contingency Description:**
  - P1-2: WEBER-FRENCH CAMP #1 60KV
  - P2-1: WEBER-FRENCH CAMP #1 60KV (WEBER016-WEBER D)
- **Power Flow Results:**

Facility	SE Rating (Amps)	2025 (%)	2028 (%)	2035 (%)	Category	Contingency Name
Weber -French Camp #2 60 kV	326	109.7	122.8	153.8	P1-2	P1-2: WEBER-FRENCH CAMP #1 60KV
Weber -French Camp #2 60 kV	326	133.7	147	181.8	P2-1	P2-1: WEBER-FRENCH CAMP #1 60KV (WEBER016-WEBER D)

- The thermal violations will be much worse considering the future load growth which hasn't been included in the study cases.

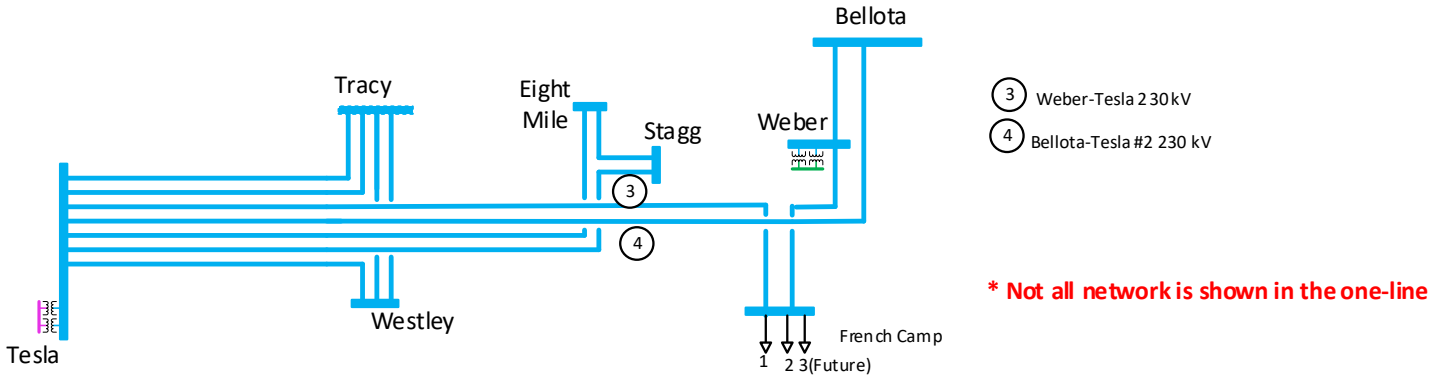
Proposed 230 kV Alternatives

- **Alternative 1:** Loop French Camp Substation into Weber-Tesla 230 kV line



Proposed Single Line Diagram (Alternative 1)

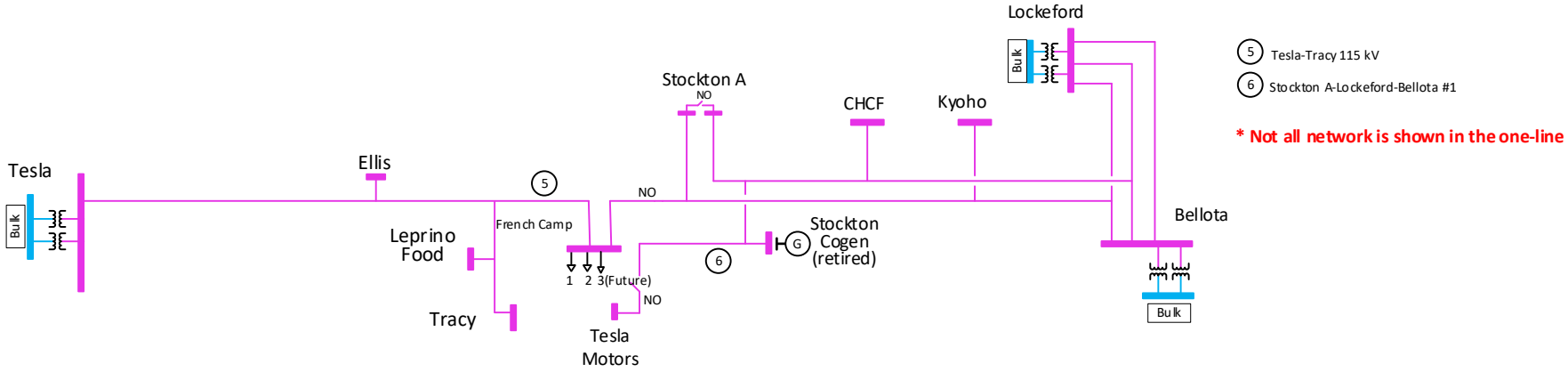
- **Alternative 2:** Loop French Camp Substation into Bellota-Tesla #2 230 kV line



Proposed Single Line Diagram (Alternative 2)

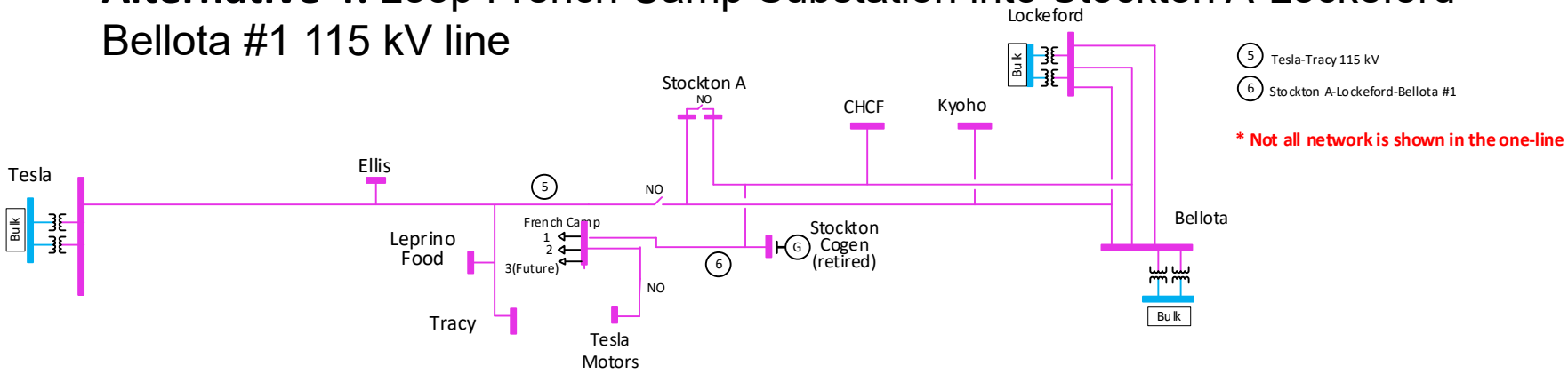
Proposed 115 kV Alternatives

- **Alternative 3:** Loop French Camp Substation into Tesla-Tracy 115 kV line



Proposed Single Line Diagram (Alternative 3)

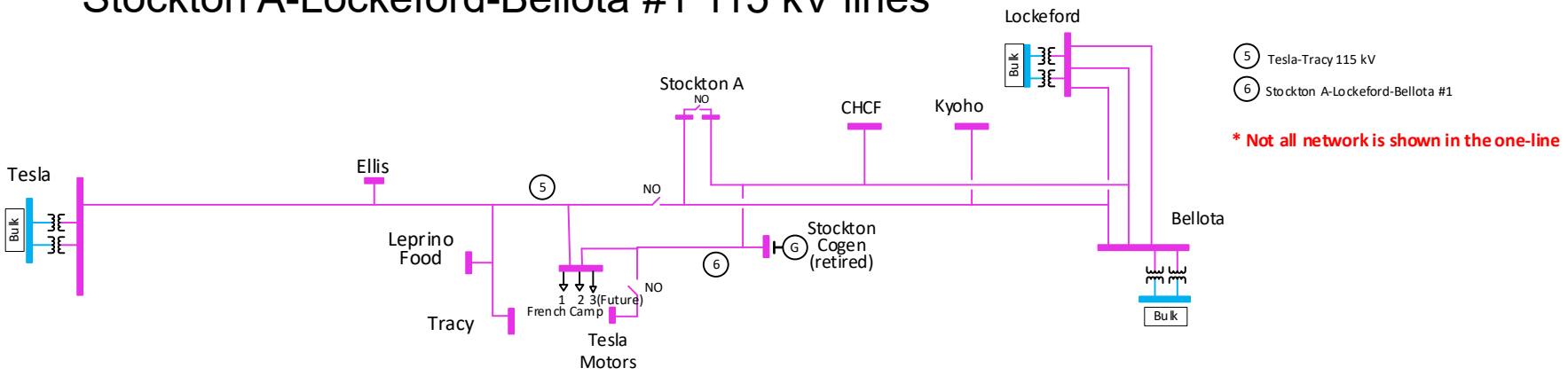
- **Alternative 4:** Loop French Camp Substation into Stockton A-Lockeford-Bellota #1 115 kV line



Proposed Single Line Diagram (Alternative 4)

Proposed 115 kV Alternatives (cont.)

- **Alternative 5:** Loop French Camp Substation into Tesla-Tracy and Stockton A-Lockeford-Bellota #1 115 kV lines



Proposed Single Line Diagram (Alternative 5)

Other Alternatives

- **Other Alternatives which are not suggested due to the limitation to serve load in long term.**
  - *Reconductor Weber-French Camp #1 and #2 60 kV lines*
  - *Install Energy Storage at French Camp 60 kV transmission substation*
    - The charging capability is limited by the existing line capacity and will be further limited by the future load increase at the French Camp Substation.

DIABLO CANYON AREA 230 KV HIGH VOLTAGE MITIGATION

Area Background

- High voltages conditions are observed in 230 kV system in the Los Padres area (San Luis Obispo County) in real time operation.
- In recent years, high voltages usually occur overnight between 2300 and 0400, when overall PG&E and local Los Padres load is low and bulk system transfers are also low.
- High voltages also tend to occur in the middle of the day during the belly of the duck when net demand is also low due to increased level of solar PV.
- Grid Operators used available voltage control measures, including simultaneously de-energizing multiple 230 kV lines in the area, 500kV line(s) to lower system voltages, and calling on assistance from neighboring entities. At times, these lines are removed from service for multiple days in a row solely for voltage control.
- Several high voltage support devices have been approved in recent TPPs but none in the Los Padres area.

Power flow Results

Voltage Results for the Preferred Alternative

Monitored Bus	Max voltage limit (kV)	Pre-Project Voltage (kV)	Post-Project Voltage (kV)
Diablo 230 kV bus	242	245.4	236.2
Morro Bay 230 kV bus	242	244.7	237.7
Mesa 230 kV bus	242	246.6	231.9

Line by Line Power flow results for the Preferred Alternative

DCPP High Voltage Scenario		Post-Project	Contingency	
Facility	Rating (MVA)	Loading %	Category	Contingency Name
Mesa 230/115 kV transformer bank 2	420(SN)	12.5	P0	Base case
Mesa 230/115 kV transformer bank 2	462(SE)	27.7	P1	Mesa 230/115 kV transformer bank 3
Mesa 230/115 kV transformer bank 3	398(SN)	13.3	P0	Base case
Mesa 230/115 kV transformer bank 3	398(SE)	32.1	P1	Mesa 230/115 kV transformer bank 2

Proposed Project

Preferred Scope:

- Install a total of 120 MVAR shunt reactor along with the existing shunt capacitors at Mesa Substation 115 kV bus. The number and size of reactor units will be either 3X40 MVAR or 4X30 MVAR. This will be determined based on power quality requirements (i.e. flicker) as well as in coordination of the LTCs on Mesa 230/115kV TBs #2 and #3. The shunt devices will regulate the voltage at Mesa 230 kV bus.

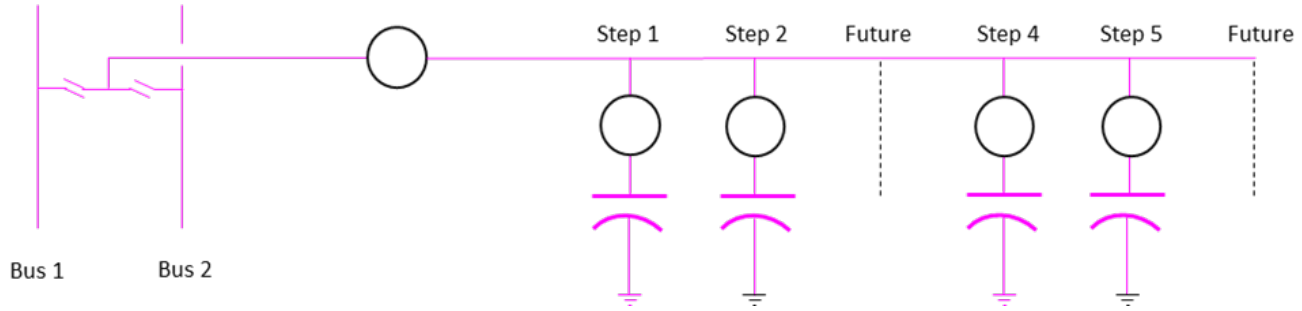
- Remove one or two of the existing 25 MVAR shunt capacitor steps.

- **Proposed In-Service Date:**
  - May 2027 or earlier
- **Estimated Cost:**
  - $35M - $70M*

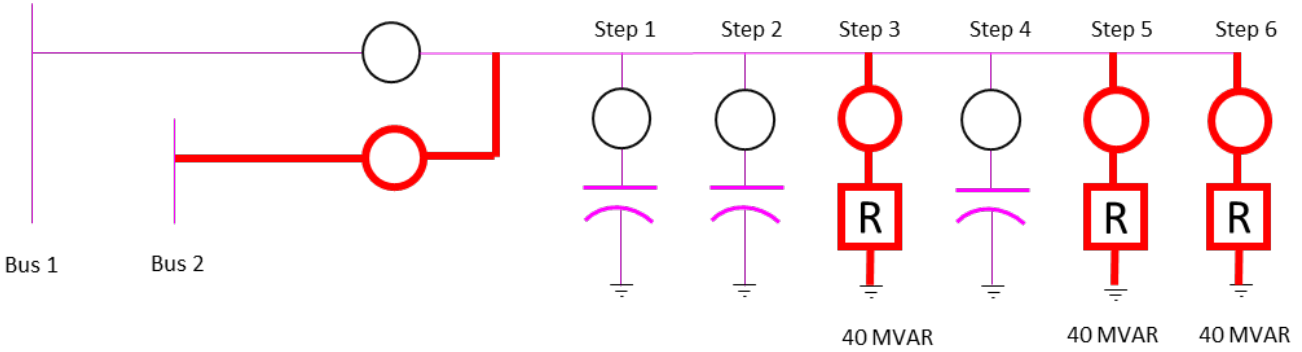
*AACE Level 5 quality estimates includes a +100% contingency

Proposed Project (Cont')

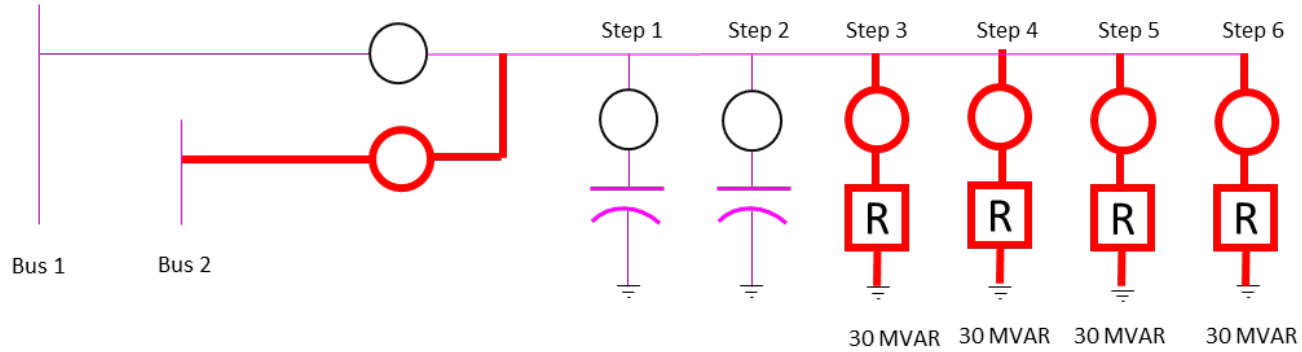
- Existing Voltage Control Devices at Mesa 115 kV Substation



- Proposed Single-line Diagram for the Preferred Alternative (3X40 MVAr Shunt Reactors)



- Proposed Single-line Diagram for the Preferred Alternative (4X30 MVAr Shunt Reactors)



Proposed Project (Cont')

Other Considered Alternatives:

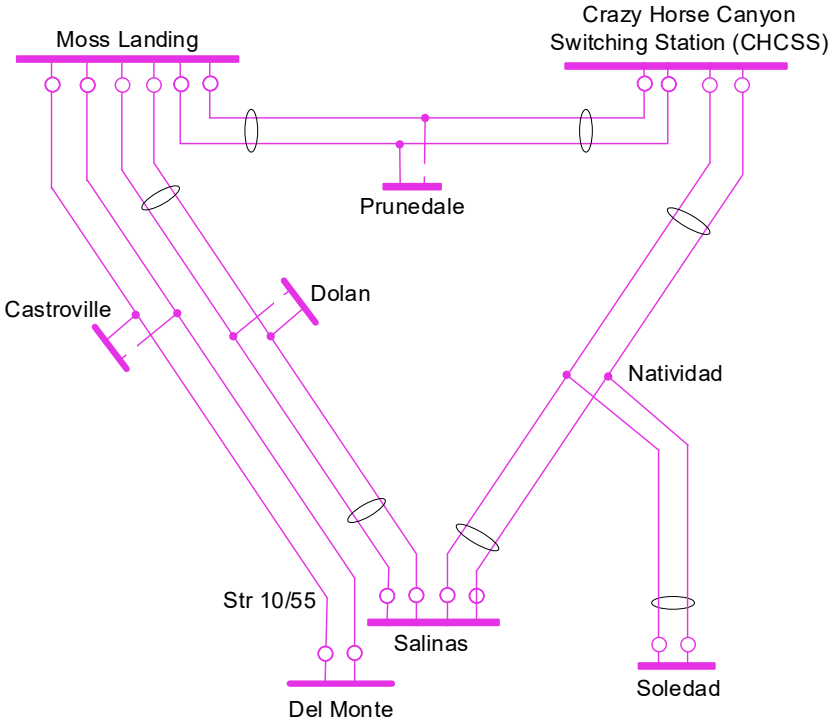
- Alternative 1: Install a 120 MVAR STATCOM at DCPP 230 kV bus.
- Alternative 2: Install a 120 MVAR STATCOM at Mesa 230 kV bus.
- Alternative 3: Install a 120 MVAR STATCOM at Morro Bay 230 kV bus.
- Alternative 4: Install a 120 MVAR STATCOM at Mesa 115 kV bus.

Study results show all the alternatives above can alleviate the high voltage issue at DCPP 230 kV bus and its neighboring buses. However, alternative 1 is not preferred due to high cost and space limitations at the substation. Alternatives 2, 3, and 4 are also not recommended due to the high costs compared to the preferred scope.

CRAZY HORSE CANYON-SALINAS-SOLEDAD #1 AND #2 115 KV LINE RECONDUCTORING

Area Background

- The Moss landing – CHCSS#1 and #2 115 kV lines, Moss landing – Salinas #1 and #2 115 kV lines, and CHCSS– Salinas – Soledad #1 and #2 115 kV lines together provide electric power to customers at Salinas, Soledad, San Benito, and Hollister substations.
- Overall load supplied by the above 115 kV system is forecasted to grow from 450 MW to 617 MW from 2025 to 2035



Existing Single Line Diagram

Assessment Results

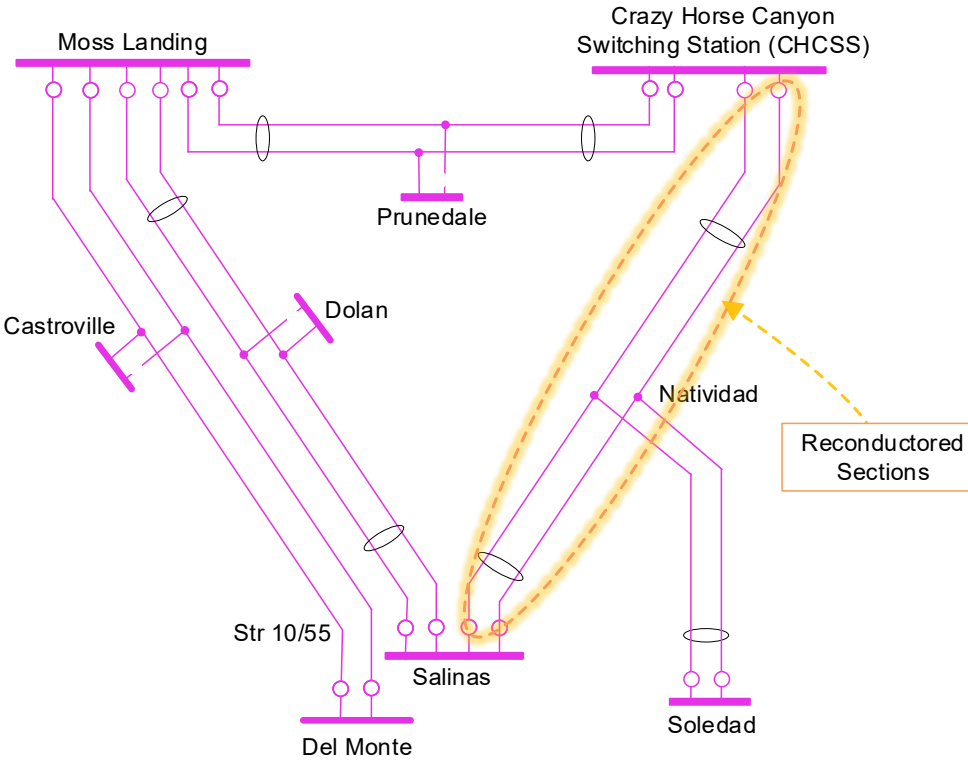
Power Flow Results:

Summer Peak		Pre-Project Loading (%)			Post-Project (%)	Contingency	
Facility	Rating (Amps)	2025	2028	2035	2035	Category	Contingency Name
CHCSS-Natividad SW 115 kV #1, #2	406	80	93	111	38	P2-1	Moss Landing-Salinas #1 open at Moss Landing end
CHCSS-Natividad SW 115 kV #1, #2	406	167	197	253	76	P7	Moss Landing-Salinas #1 & #2
Natividad SW-Salinas 115 kV #1, #2	349	155	189	263	68	P7	Moss Landing-Salinas #1 & #2
Moss Landing-Prunedale #1, #2	1310	81	91	120	120	P7	Moss Landing- Salinas #1 & #2
Prunedale-CHCSS- #1, #2	1144	89	102	132	132	P7	Moss Landing- Salinas #1 & #2
Moss Landing-Dolan #1	1144	97	109	138	138	P7	Moss Landing-CHCSS #1 & #2
Moss Landing-Dolan #2, Dolan-Salinas #1, #2	1144	87	99	126	126	P7	Moss Landing-CHCSS #1 & #2

Facility	Base	Pre-Project Voltage (pu)			Post-Project Voltage (pu)	Category	Contingency Name
	kV	2025	2028	2035	2035 *		
Hollister	115	>0.95	0.938	0.890	0.890	P1-2	CHCSS-Hollister
Hollister	115	0.898	0.875	0.816	0.816	P7	Moss Landing-Salinas #1 & #2
Gonzales	60	0.885	0.862	0.831	0.831	P7	Moss Landing-CHCSS #1 & #2
Otter	60	>0.95	0.891	0.755	0.755	P7	Moss Landing-Salinas #1 & #2

Proposed Project

- **Preferred Scope**
  - Reconductor CHCSS-Natividad section of the CHCSS-Salinas-Soledad #1 and #2 115 kV lines to achieve at least 1200 Amps under summer emergency (SE) conditions.
  - Reconductor Natividad-Salinas section of the CHCSS-Salinas-Soledad #1 and #2 115 kV lines to achieve at least 1200 Amps under SE conditions.
  - Upgrade any limiting element(s) on these line sections and associated bus connections to achieve full conductor rating.



Proposed Single-line Diagram

- **Proposed In-Service Date:** May 2030 or earlier
- **Estimated Cost:** $54M - $108M*

*AACE Level 5 quality estimates includes a +100% contingency

Proposed Project

Other Alternatives considered

- **Status Quo**

  Not recommended because it does not mitigate P2-1 or any P7 violation

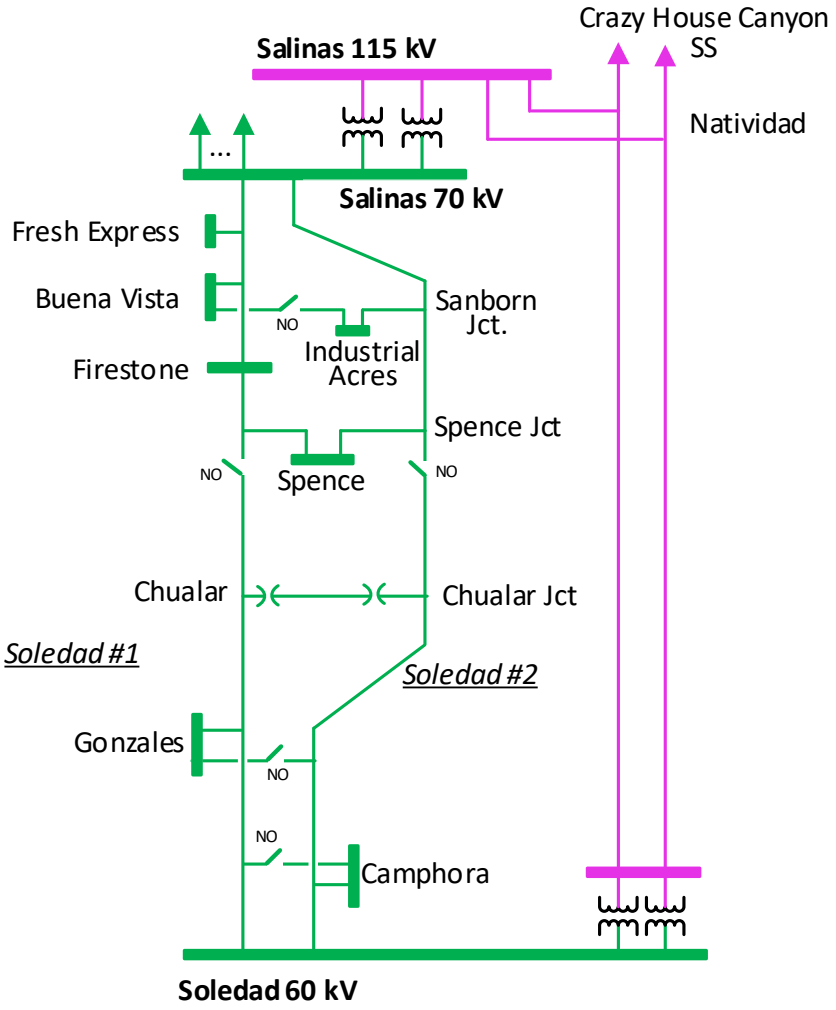
- **Loop Moss Landing- Del Monte #1 and #2 115 kV double circuits into Salinas Substation**

  Dismissed due to space constraint at Salinas station

SPENCE 60 KV AREA REINFORCEMENT PROJECT (CONCEPTUAL)

Area Background

- The Salinas-Spence 60 kV system consists of two 60 kV paths. One is the Salinas-Firestone 60 kV and Firestone-Spence 60 kV lines. The second path is the Salinas-Spence 60 kV line that passes through Sanborn Jct. and serves the Industrial Acres Substation.
- South of Spence, two 60 kV lines Soledad #1 and Soledad #2 extend toward Gonzales and eventually Soledad and are normally open at Spence.
- Major load growth has been modelled at Spence substation, which is forecasted at 23.3 MW in 2023, 50.8 MW in 2025, and 84.6 MW in 2035. This will result in P0, P1-2 and P1-3 overloads on the Salinas to Spence transmission system, as well as P1 low voltage violations.



Assessment Results

- **Power Flow Results**

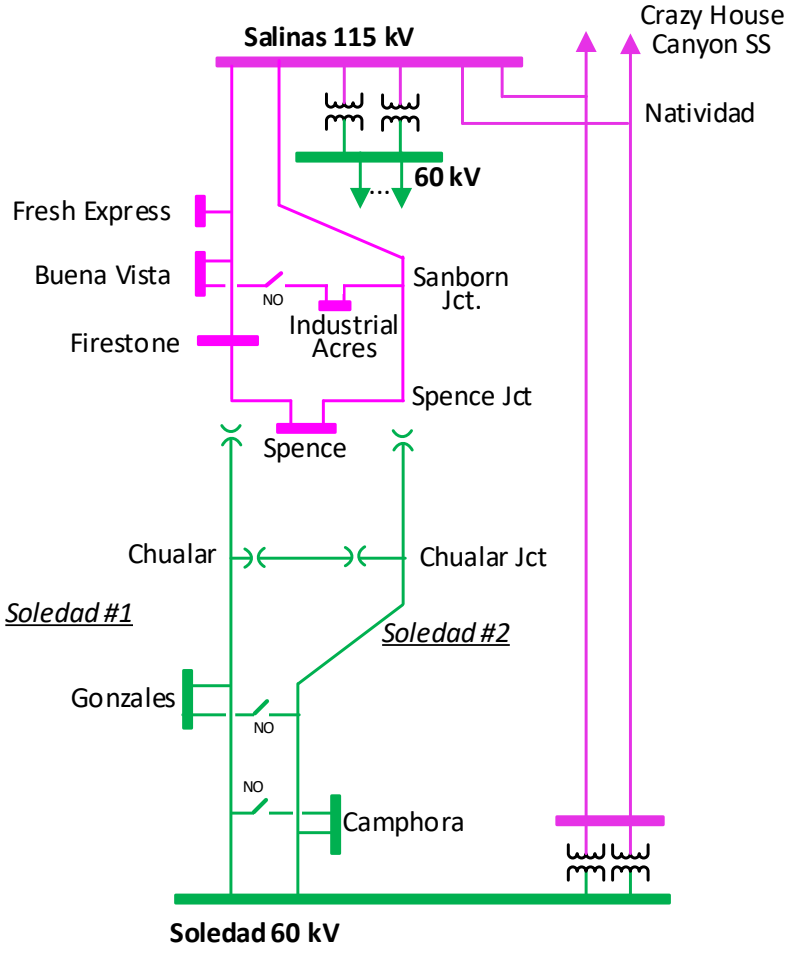
Salinas Area Summer Peak		Pre-Project Loading (%)			Contingency	
Facility	Rating *	2025	2028	2035	Category	Contingency Name
Salinas - Fresh Express Jct	703 A	104	132	147	P0	(None)
Fresh Express Jct-Buena Vista Jct	703 A	95	122	137	P0	(None)
Salinas-Fresh Express Jct	801 A	133	181	197	P1-2	Salinas-Spence
Fresh Express Jct-Buena Vista Jct	801 A	124	172	188	P1-2	Salinas-Spence
Buena Vista Jct-Firestone	350 A	165	118	122	P1-2	Salinas-Spence
Firestone-Spence	350 A	159	116	120	P1-2	Salinas-Spence
Salinas-Sanborn Jct	801 A	130	179	207	P1-2	Salinas-Firestone
Sanborn Jct-Spence Jct-Spence	350 A	169	121	125	P1-2	Salinas-Firestone
Sanborn Jct-Industrial Acres	554 A	83	85	121	P1-2	Salinas-Firestone
Salinas2-Salinas1 Bus Tie	1043 A	104	138	159	P1-3	Salinas 115/60 kV TB 3
Salinas 115/60 kV TB 2	220 MVA	76	97	125	P1-3	Salinas 115/60 kV TB 3
Salinas 115/60 kV TB 3	220 MVA	76	97	125	P1-3	Salinas 115/60 kV TB 2

Proposed Project Alternatives

This conceptual proposal explores different alternatives, and the final recommendation is pending further studies and analysis.

Alternative 1 – Salinas to Spence Voltage Conversion to 115 kV

1. Rebuild 60 kV lines Salinas-Spence, Salinas-Firestone and Firestone-Spence at 115 kV to achieve minimum rating of 1200 Amps for Salinas-Buena Vista and Salinas-Sanborn Jct section, and 800 Amps for the rest sections
2. Replace the transformer and other HV side equipment at the following substations to allow 115 kV operation;
   - ✓D stations: Industrial Acres, Spence, Buena Vista, and
   - ✓T stations: Fresh Express and Firestone
3. Terminate two lines (Salinas-Spence, Salinas-Firestone) at Salinas 115 kV and convert the Salinas to Spence system to 115 kV.

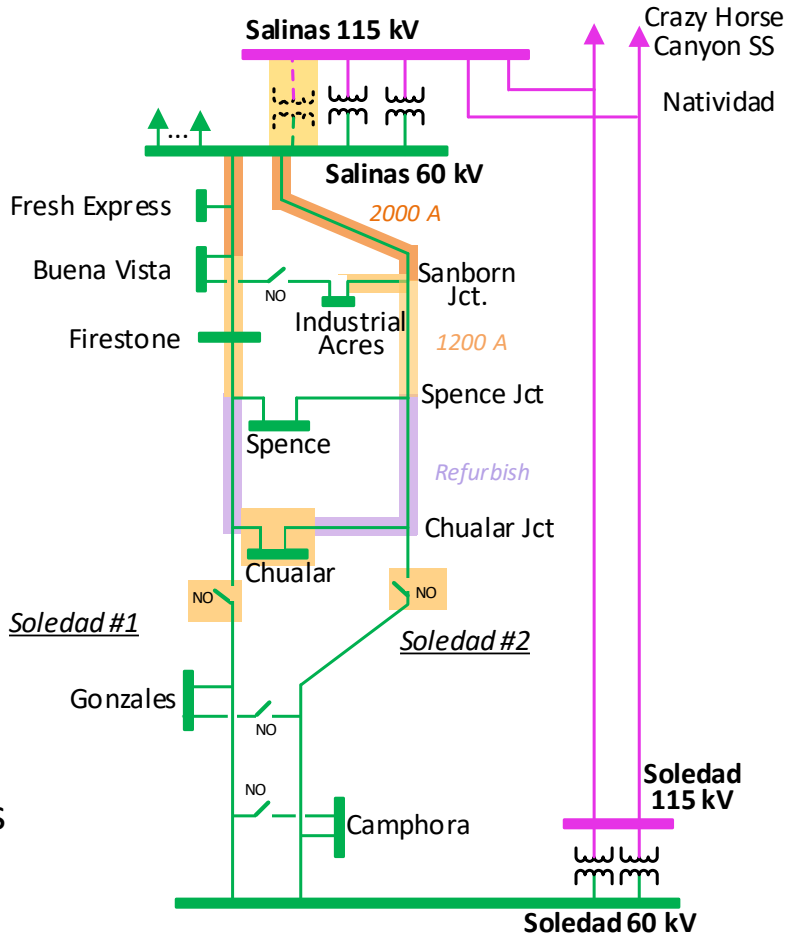


Proposed Single-line Diagram -Alternative 1

Proposed Project Alternatives (Cont.)

Alternative 2 – A New Substation near Chualar Supplied from Salinas 60 kV

1. Build a new Chualar Substation with two 30MVA distribution banks, normal supplied from Spence 60 kV via taps to two lines
2. Reconductor 60 kV line sections between Salinas and Spence to achieve
   - 1893 Amps for Salinas-Buena Vista, Salinas-Sanborn Jct
   - 1200 Amps for the rest sections including Industrial Acres-Sanborn Jct
3. Refurbish Spence-Chualar line sections as necessary, and reconductor to achieve 800 Amps rating or above when Chualar load exceeds 35 MVA level;
4. Add a third 200 MVA 115/60 kV bank at Salinas
5. Provision for 1x10 Mvar capacitor bank at Chualar 60 kV
6. Replace conductor and switches between Salinas 60 kV bus 1 and 2 to achieve a SE rating of 2000 Amps

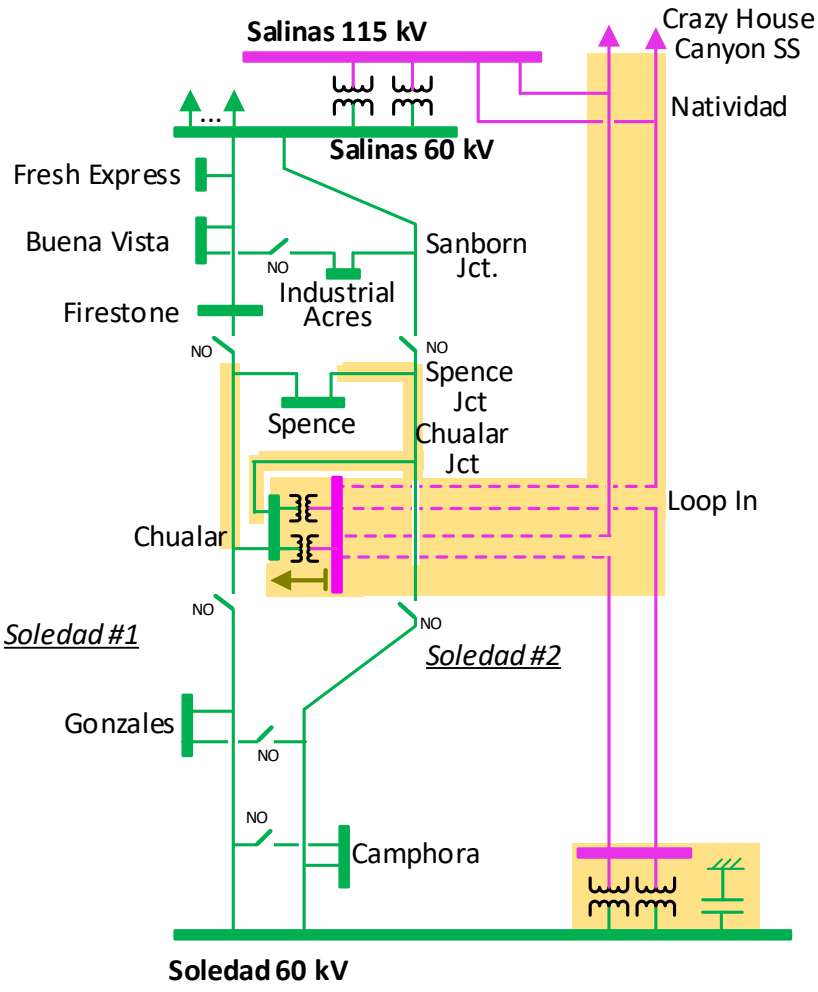


Proposed Single-line Diagram -Alternative 2

Proposed Project Alternatives(Cont.)

Alternative 3 – A 115 kV Substation near Chualar Supplied by Looping in 115 kV Lines

1. Build a new 115 kV station with two 45 MVA 115/12 kV distribution transformers
2. Loop in both 115 kV line sections from Salinas to Soledad with 1200 Amps or above conductor for the new sections;
3. Install two new 115/60 kV stepdown transformers at Chualar, 150 MVA each; terminate both Soledad #1 and #2 60 kV lines at Chualar station;
4. Supply Spence from Chualar 60 kV normally (see diagram);
5. Reconductor 60 kV line sections Chualar-Spence-Spence Jct-Chualar Jct-Chualar to achieve min 800 Amps SE ratings.
6. Reconductor both 115 kV line section from Natividad to Chualar loop-in point to achieve min 1200 Amps SE rating
7. Replace both Soledad 115/60 kV transformer with 100 MVA units with LTC, and install a 30 MVAR capacitor bank at Soledad 60 kV

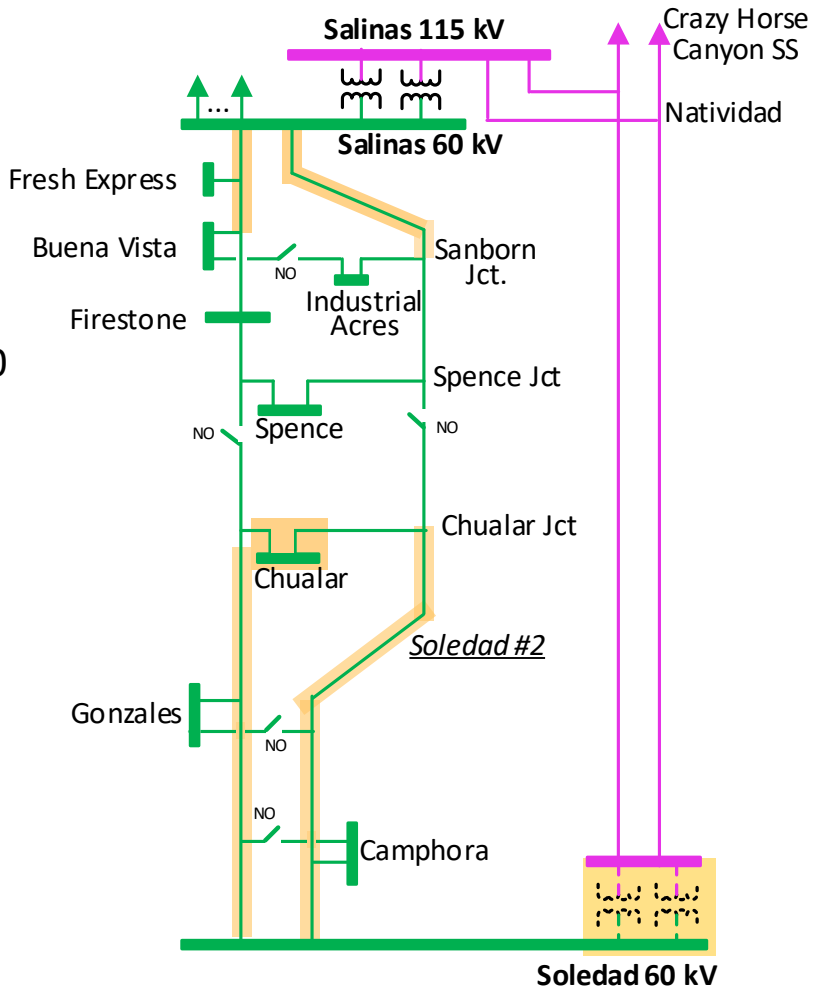


Proposed Single-line Diagram -Alternative 3

Proposed Project Alternatives(Cont.)

Alternative 4 – A New 60 kV Substation (near Chualar area) Supplied from Soledad 60 kV

1. Build a new 60 kV Substation (Chualar) with two 30 MVA distribution transformers, normally supplied from Soledad 60 kV via both 60 kV lines.
2. Replace both Soledad 115/60 transformers with 100 MVA ones including On-Load-Tap-Changers.
3. Install capacitor bank of 3x10 MVAR at Chualar 60 kV.
4. Reconductor Soledad-Chualar on Soledad line #2 and #1 to achieve min 500 Amps for Chualar-Gonzales and 800 Amps for Gonzales-Soledad.
5. Reconductor Salinas-Buena Vista Jct. and Salinas-Sanborn Jct. to achieve 1450 Amps or above SE rating. Reconductor Sanborn Jct.-Industrial Acres to achieve 960 Amps or above SE rating.
6. Replace the limiting elements (conductor and switches) between Salinas 60 kV bus 1 and bus 2 to achieve a SE rating of 2000 A.



Proposed Single-line Diagram -Alternative 4

Other Considerations

- This conceptual proposal explores different alternatives for reinforcing PG&E transmission system between Salinas and Spence to mitigate the overloads caused by the expected significant load increase near Spence and Chualar areas.

- Approximate project cost estimates are not yet available but will be ultimately provided for each alternative based on the AACE Level 5 quality estimates*.

- There is an existing CAISO approved project that is scoped to reconductor 60 kV line sections between Salinas and Spence (Sanborn Jct.-Spence, Buena Vista Jct.-Firestone-Spence Jct.-Spence) to achieve 600 Amps summer emergency rating. This project has been on hold awaiting final scope on the Salinas to Spence Area Reinforcement project. The Salinas-Firestone #1 & #2 Reconductoring project will be evaluated accordingly.

*AACE Level 5 quality estimates includes a +100% contingency

CAMDEN 70 KV REINFORCEMENT PROJECT

Area Background

- Camden Substation is in Fresno County. Camden-Kingsburg 70 kV line is the only source feeding Camden Substation.
- PG&E Transmission Operations has observed low voltage issues at Camden Substation and over 90% loading of Camden-Kingsburg 70 kV Line during peak conditions.
- PG&E Distribution Planning anticipates additional loads will be transferred to Camden Substation in the upcoming years.

Existing Single Line Diagram

Assessment Results

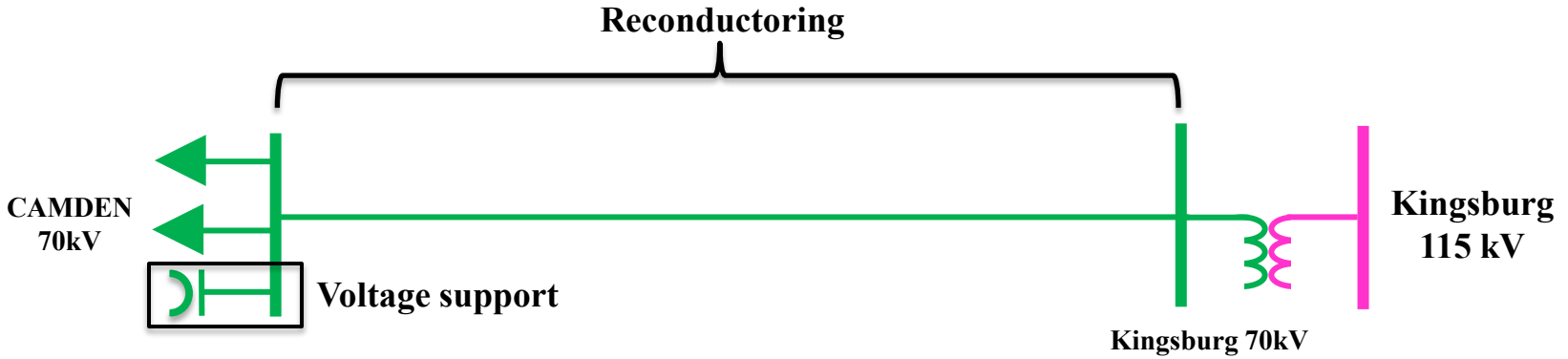
- **Contingency Description:**
  - **P0:** Normal Conditions
- **Power Flow Results:**

Fresno Peak		Pre-Project			Post-Project	Contingency	
Facility	Summer Normal Rating (MVA)	2025	2028	2035	2035	Category	Contingency Name
Camden-Kingsburg 70kV Line	41.6	134.5%	137.1%	175.3%	43.3%	P0	Normal Condition

Substation	Pre-Project Voltage (p.u.)			Post-Project Voltage (p.u.)	Contingency	
	2025	2028	2035	2035	Category	Contingency Name
Camden	0.880	0.878	0.793	0.95	P0	Normal Condition

Proposed Project

- **Project Objectives:** mitigate the low voltage at Camden 70 kV Substation and normal overload of Camden-Kingsburg 70 kV Line
- **Preferred Scope**
  - Install 30 MVAR voltage support at Camden Substation
  - Reconductor the Camden-Kingsburg 70 kV Line to achieve minimum required rating of 800 Amps under summer normal conditions (using 477-24/7 ACSS conductor preferably) and upgrade any limiting component(s) as necessary to achieve full conductor rating



Proposed Single Line Diagram

Proposed Project (cont.)

- **Proposed In-Service Date**

  May 2030 or earlier

- **Estimated Cost**

  $50M - $100M*

- **Other Alternatives Considered**

  – Alternative 1: Status Quo

  is not chosen because it does not mitigate the NERC TPL Category P0 violations.

  – Alternative 2: Energy Storage and Voltage Support

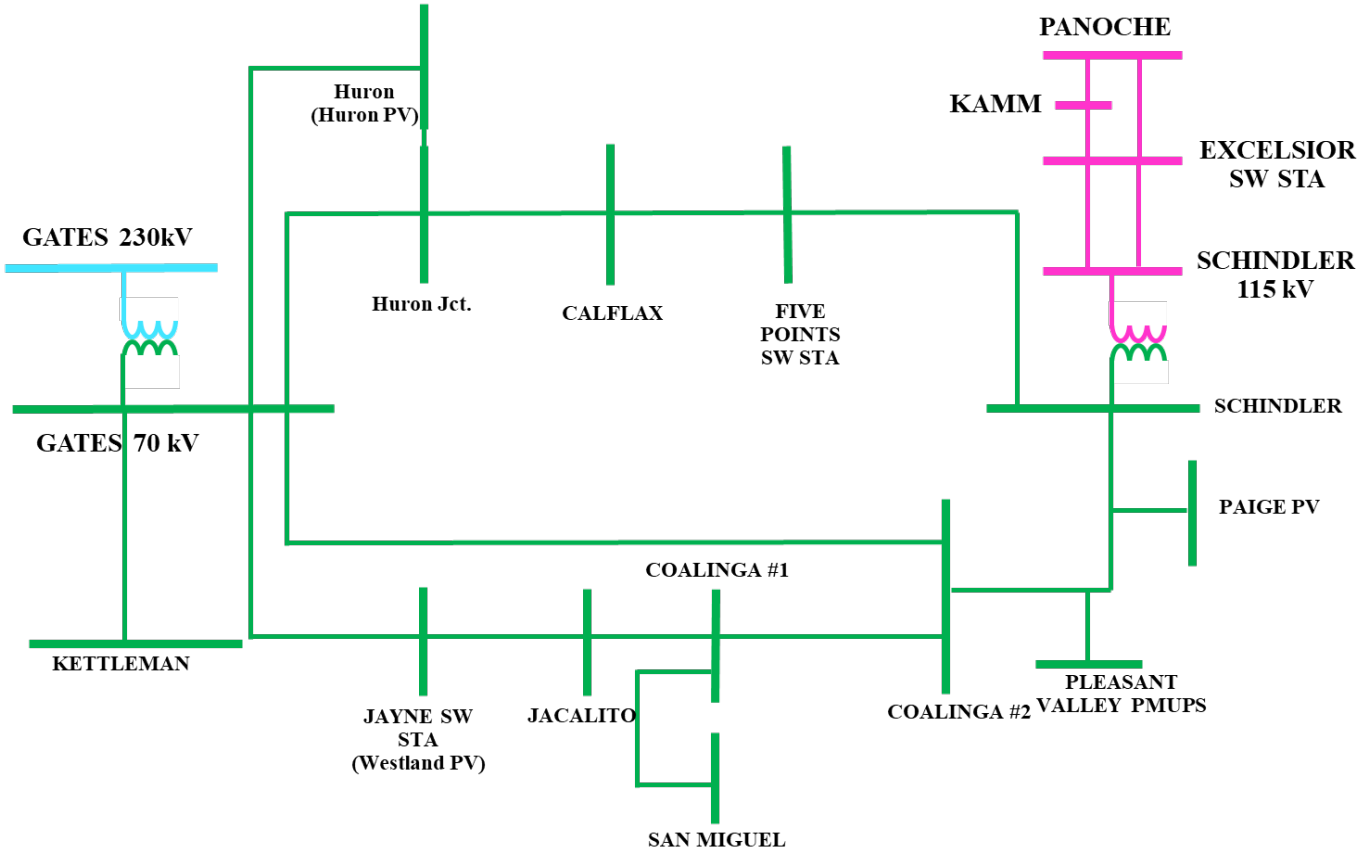
  is not recommended due to multiple reasons. First, Camden Substation has space limitations for adding both energy storage and voltage support devices. Second, the outage of energy storage will become a new NERC TPL Category P1 violation that needs to be mitigated.

*AACE Level 5 quality estimates includes a +100% contingency

GATES 230/70 KV TRANSFORMER BANK ADDITION PROJECT

Area Background

- Gates Substation is in Fresno County.
- Gates 230/70 kV Transformer Bank #5 serves as the main source feeding the local 70 kV sub-area from the bulk system.



Existing Single Line Diagram

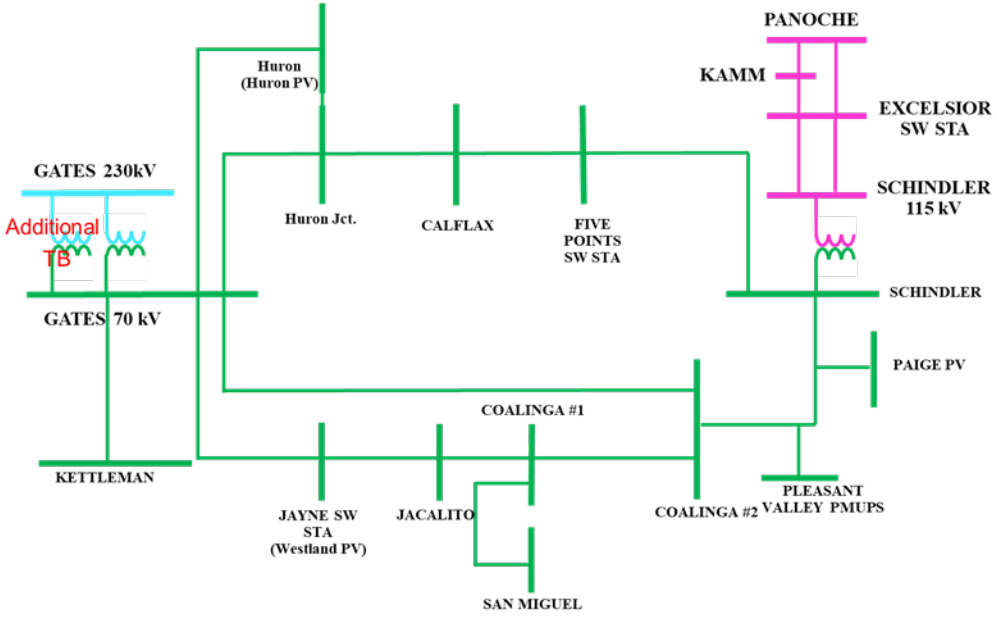
Assessment Results

- **Contingency Description:**
  - **P1:** GATES D 230/70KV TB 5
  - **P3:** CHV.COAL 9.11KV GEN UNIT 1 & GATES D 230/70KV TB 5
- **Power Flow Results:**

Fresno Peak		Pre-Project			Post-Project	Contingency	
Facility	Summer Normal Rating (MVA)	2025	2028	2035	2035	Category	Contingency Name
Schindler 115kV/70 kV Transformer Bank #1	96	117.37%	108.5%	117.32%	31.8%	P1	GATES D 230/70KV TB 5
Schindler-Coalinga #2 70kV Line (Schindler-Paige Solar Jct. section)	48.4	102.02%	93.12%	103.82%	32.8%		
Schindler-Coalinga #2 70kV Line (Paige Solar Jct.-Pleasanton Valley section)	48.4	103.43%	95.09%	104.34%	32.9%		
Schindler-Five Points SW STA 70 kV Line	52.9	122.43%	113.08%	135.24%	27.3%		
Five Points SW STA -Huron-Gates 70 kV Line (Five Points SW-Calflax section)	52.9	125.87%	116.72%	136.17%	28.0%		
San Miguel-Paso Robles 70 kV Line	41.7	87.77%	99.14%	133.33%	12.4%		

Proposed Project

- **Project Objectives:** establish Gates Substation as a stronger source to the local 70 kV Sub-area and address NERC TPL P1 thermal overload and low voltage issues
- **Preferred Scope**
  - Install additional 230/70 kV transformer bank at Gates Substation
  - Upgrade Gates 70 kV bus and any limiting components to achieve the full transformer capacity



Proposed Single Line Diagram

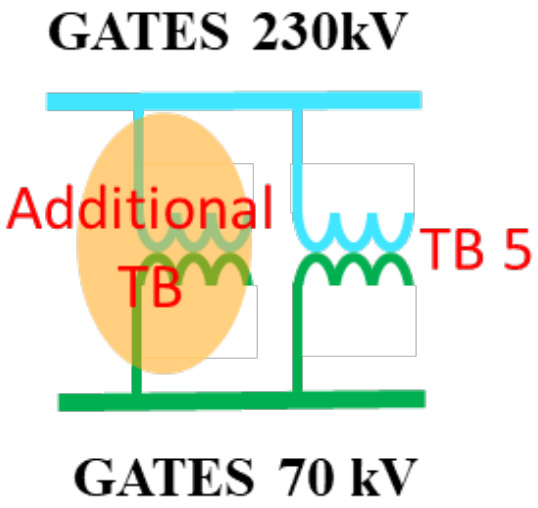
Proposed Project (cont.)

- **Proposed In-Service Date**

  May 2030

- **Estimated Cost**

  $36M - $72M*



Proposed Single Line Diagram

- **Other Alternatives Considered**
  - Alternative 1: Energy storage

    is not feasible because around 100 MW energy storage will be needed to mitigate all the identified overloads and low voltage issues and there will not be sufficient capacity to charge this size of energy storage in the charging window.
  - Alternative 2: Converting 70 kV network to 115 kV

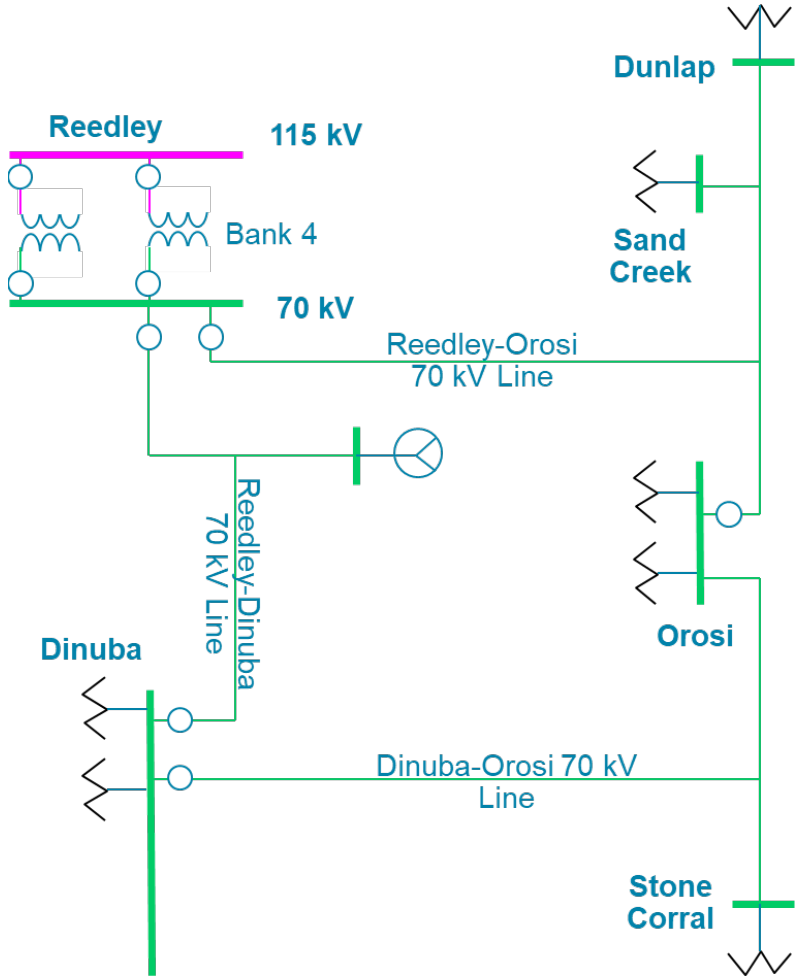
    is not as cost-effective.

*AACE Level 5 quality estimates includes a +100% contingency

REEDLEY 70 KV CAPACITY INCREASE PROJECT

Area Background

- Reedley 70 kV Sub-area is in Tulare and Fresno Counties.
- Reedley Substation provides power to the customers in this 70 kV pocket.
- The existing Reedley 70 kV Reinforcement Project will install 12 MW energy storage at Dinuba Substation.



Existing Single Line Diagram

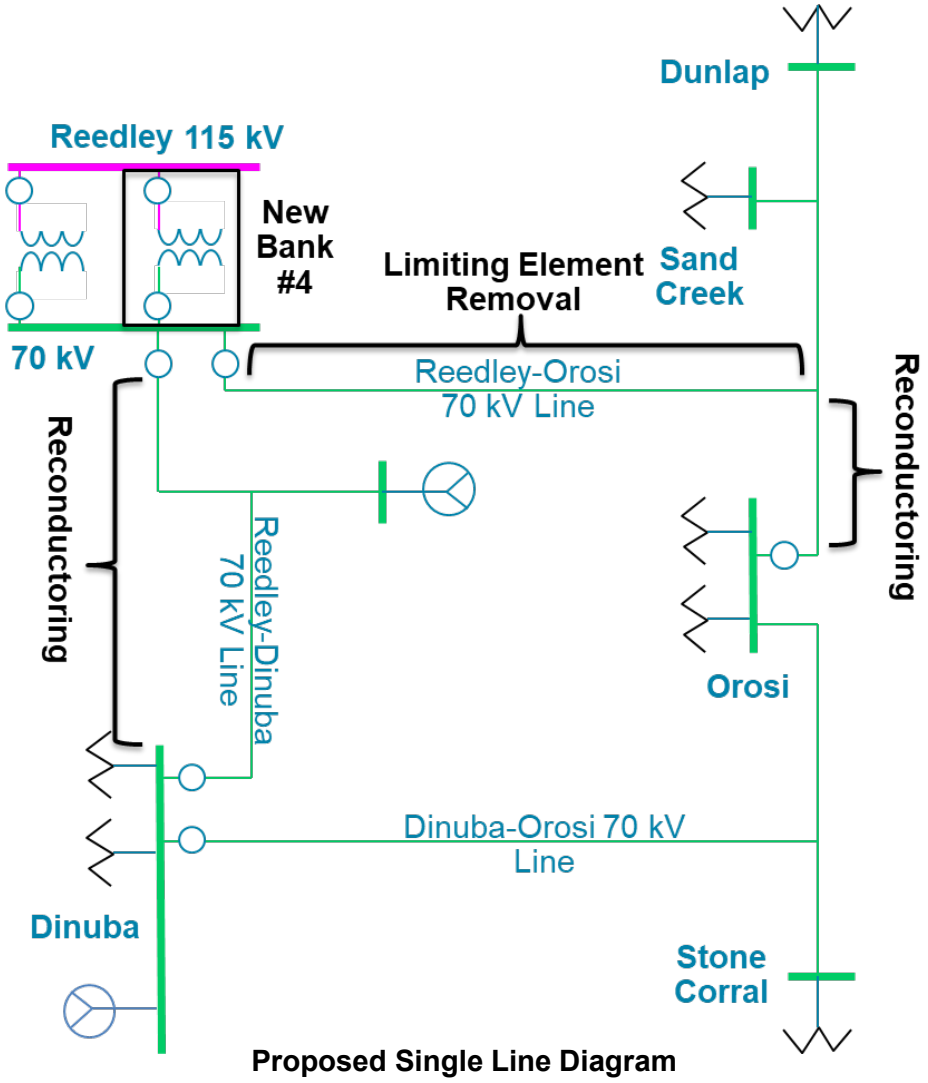
Assessment Results

- **Contingency Description:**
  - **P1:** REEDLEY-OROSI 70KV; REEDLEY-DINUBA #1 70KV; REEDLEY 115/70KV BANK #2
- **Power Flow Results:**

Fresno Peak		Pre-Project			Post-Project	Contingency	
Facility	Summer Emergency Rating (MVA)	2025	2028*	2035*	2035*	Category	Contingency Name
REEDLEY-DINUBA #1 70KV	62.3	141.2%	114.9%	128.3%	58.1%	P1	REEDLEY-OROSI 70KV
REEDLEY-OROSI 70KV (FROM REEDLEY TO DUNLAP JCT)	72.7	139.3%	112.0%	127.7%	104%**	P1	REEDLEY-DINUBA #1 70KV
REEDLEY-OROSI 70KV (FROM DUNLAP JCT TO OROSI)	62.3	148.6%	117.6%	132.1%	60.9%	P1	REEDLEY-DINUBA #1 70KV
DINUBA - OROSI 70KV (STONE CORRAL JCT TO DINUBA)	41.8	135.7%	93.8%	104.6%	105.7%**	P1	REEDLEY-DINUBA #1 70KV
REEDLEY 115/70KV TB 4	110	116.2%	105.8%	114.2%	62.1%	P1	REEDLEY 115/70KV TB 2

Proposed Project

- **Project Objectives:** Establish Reedley as a stronger power source to the local 70 kV system and address NERC TPL-001-5 P1 thermal overload issues
- **Preferred Scope**
  - Replace limiting equipment on the Reedley-Orosi 70 kV Line between Reedley and Dunlap Junction to achieve the full rating of the existing conductor.
  - Reconductor the Reedley-Orosi 70 kV Line from Dunlap Junction to Orosi Substation.
  - Reconductor the Reedley-Dinuba #1 70 kV Line.
  - Upgrade Reedley 115/70 kV transformer No. 4 to 200 MVA



Proposed Single Line Diagram

Proposed Project (cont.)

- **Proposed In-Service Date**

  May 2030 or earlier

- **Estimated Cost**

  $35M - $70M*

- **Other Alternatives Considered**
  - Alternative 1: Energy Storage

    At least 30 MW energy storage will be needed to mitigate all the identified overloads and there will not be sufficient capacity to charge the energy storage without reconductoring the transmission lines.
  - Alternative 2: Introducing 115 kV source

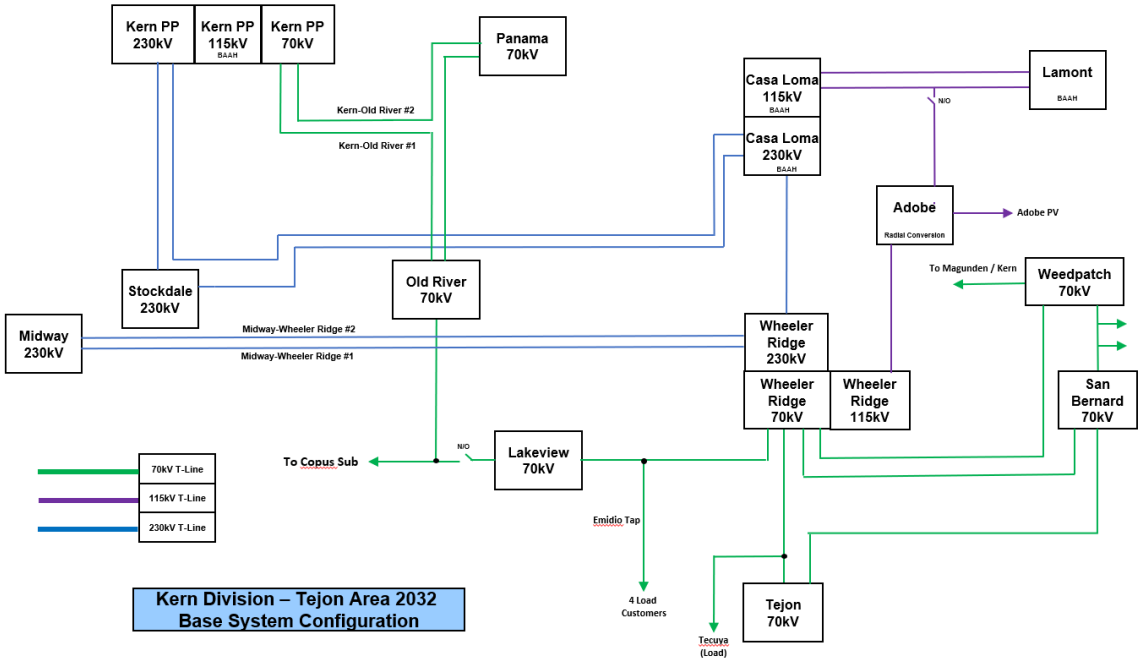
    is not as cost-effective.

*AACE Level 5 quality estimates includes a +100% contingency

TEJON AREA REINFORCEMENT PROJECT (CONCEPTUAL)

Tejon Area Background

- The Tejon Area, located near the junction of I-5 and Hwy 99 in Kern County, is primarily supplied from Wheeler Ridge Sub with a weak 70 kV back tie to Kern PP.
- This area is expected to experience significantly higher load growth in the planning horizon especially given its proximity to the state's transportation corridors. The Tejon area includes the last rest stops on Interstate-5 before customers travelling south pass through the Grapevine.
- PG&E Distribution Planning has received multiple load requests in this area which include EV charging, distribution center and merchandise center.
- For the Arvin Distribution Planning Area, load is expected to grow from 179 MW in 2023 to over 220 MW in 2035.



Existing Tejon Area System (Base System Configuration)

Projected & Potential Tejon Area Load Growth

- **Projected Local Distribution Load Growth**
  The table below shows expected load at Tejon and San Bernard over the next several years and for the three Assessment study years.

Distribution Bank Name	2023	2024	2025	2028	2035
TEJON BANK 1	18.6	11.9	14.2	15.0	17.5
TEJON BANK 2	20.7	26.3	26.6	26.1	27.9
SAN BERNARD BANK 1	12.8	6.5	6.5	6.0	6.1
SAN BERNARD BANK 2 (FUTURE)	0.0	19.4	19.4	19.4	19.4

- **Freight Infrastructure Planning Potential Load Growth**
  The table below illustrates significant potential load growth for Freight Infrastructure Planning that is *not* captured in the Assessment results.

Point of Interconnection	Voltage (kV)	Bank (MVA)	2030 (MW)	2035 (MW)	2040 (MW)
TEJON BANK 1	70	18	65.6	135.4	187.2
TEJON BANK 2	70	30	83.0	154.5	207.4
WHEELER RIDGE BANK 1	70	30	11.0	16.9	23.2
WHEELER RIDGE BANK 3 (FUTURE)	230	45	43.5	45.0	46.1
LAKEVIEW BANK 1	70	18	16.5	17.8	18.9
LAKEVIEW BANK 2	70	30	21.6	22.3	23.9

Assessment Results

- **Contingency Description:**
  - P1, P2-1, & P3 category events that cause loss of Wheeler Ridge – San Bernard or Wheeler – Tecuya – Tejon 70 kV with Kern Canyon gen for P3.

- **Power Flow Results:**

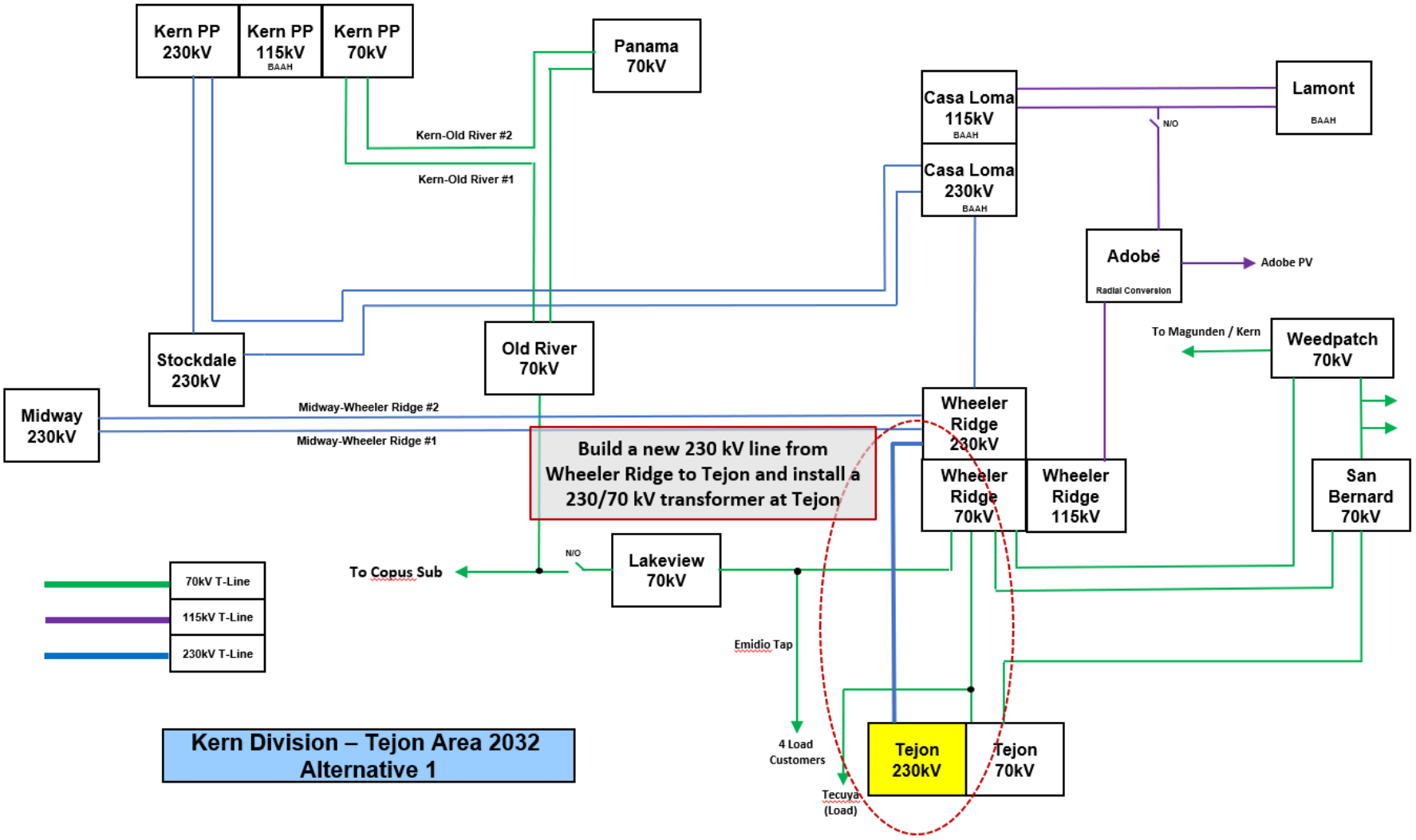
Monitored Facility		Pre-Project		Contingency	
Facility	SE Rating (Amps)	2025 HS (%)	2035 HS (%)	Category	Contingency Name
Wheeler Ridge – San Bernard 70 kV Line	563	**102.9**	**105.9**	P1	P1-2: WHEELER RIDGE-TEJON 70KV
Wheeler Ridge – San Bernard 70 kV Line	563	**104.8**	**108.5**	P2-1	P2-1: WHEELER RIDGE-TEJON 70KV (WHEELER-TECUYA T)*
Wheeler Ridge – San Bernard 70 kV Line	563	**110.4**	**113.6**	P3	P3: KERNCNYN GEN UNIT 1 & WHEELER RIDGE-TEJON 70KV
Wheeler Ridge – Tecuya – Tejon 70 kV Line (Wheeler-Tecuya Tap)*	599	**102.2**	**106.1**	P3	P3: KERNCNYN GEN UNIT 1 & WHEELER RIDGE-SAN BERNARD 70KV

*Only the worst-case line section study result or contingency is shown for tapped lines with multiple sections.

Proposed Alternative 1

- **Alternative 1 :** Build new 230 kV source from Wheeler Ridge to Tejon to meet not only immediate system needs, but to add substantial capacity for expected major future load growth at this location.
- **Description of Alternative 1 Proposed Scope (230 kV)**:
  - Construct a new 5-mile Wheeler Ridge – Tejon 230 kV transmission line
  - Install a new 230/70 kV transformer at Tejon with future provisions for a second 230/70 kV transformer at Tejon
  - Expand Wheeler Ridge 230 kV bus
  - Expand Tejon Substation and construct new 230 kV bus

Alternative 1 Single Line Diagram

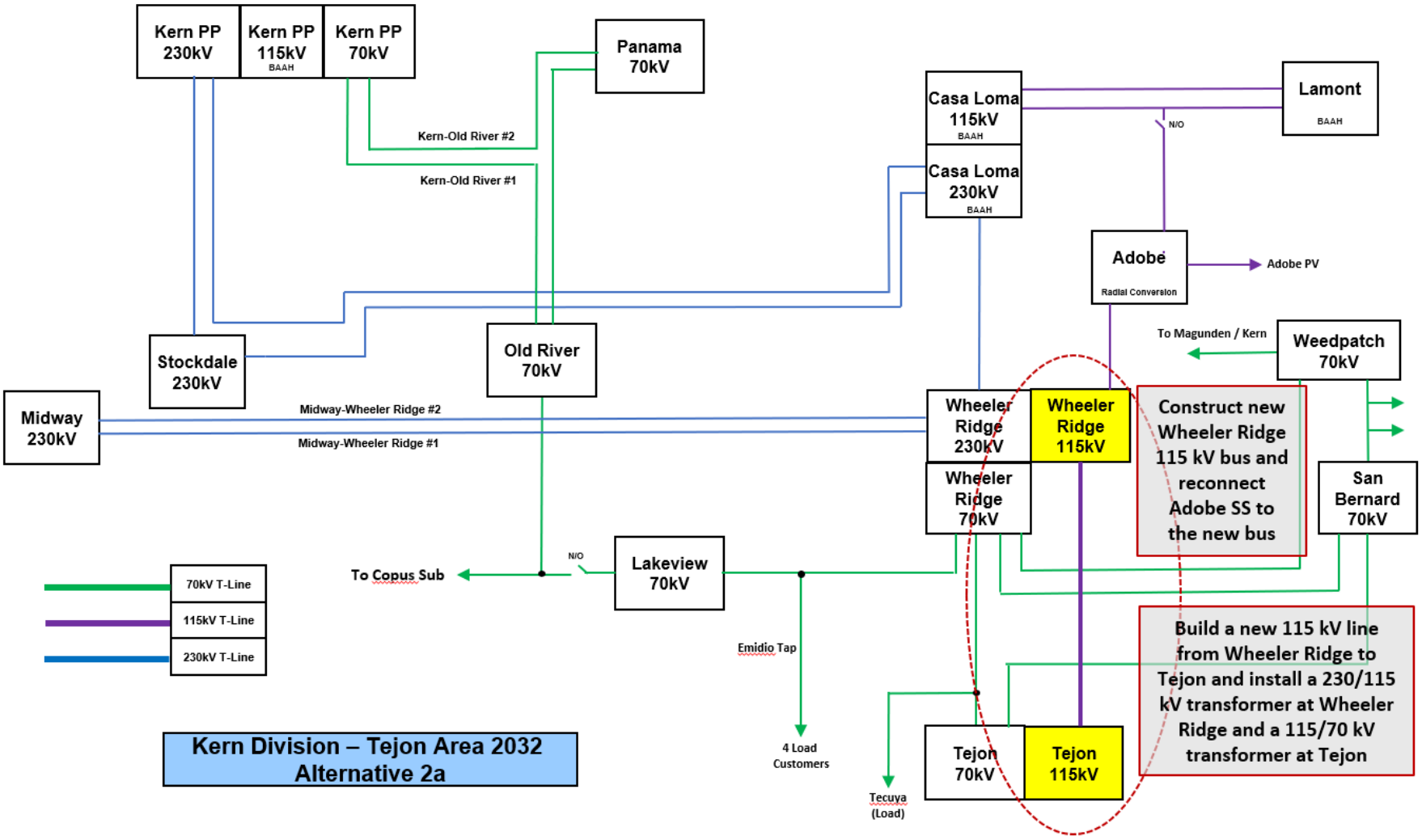


Single Line Diagram for Alternative 1 Scope

Proposed Alternative 2a

- **Alternative 2a :** Build new 115 kV source from Wheeler Ridge to Tejon to meet not only immediate system needs, but to add substantial capacity for expected major future load growth at this location. Potential additional benefits from alignment with reinforcements of nearby areas.
- **Description of Alternative 2a Proposed Scope (115 kV)**:
  - Construct a Wheeler Ridge 115 kV bus and connect existing 115 kV line to Adobe Solar Switching Station to the new 115 kV bus
  - Install a new 230/115 kV transformer at Wheeler Ridge
  - Construct a new 5-mile Wheeler Ridge – Tejon 115 kV transmission line
  - Expand Tejon Substation and construct new Tejon 115 kV bus.
  - Construct a new 115/70 kV transformer at Tejon with future provisions for a second 115 kV circuit between Wheeler Ridge and Tejon and a second 115/70 kV transformer at Tejon

Alternative 2a Single Line Diagram

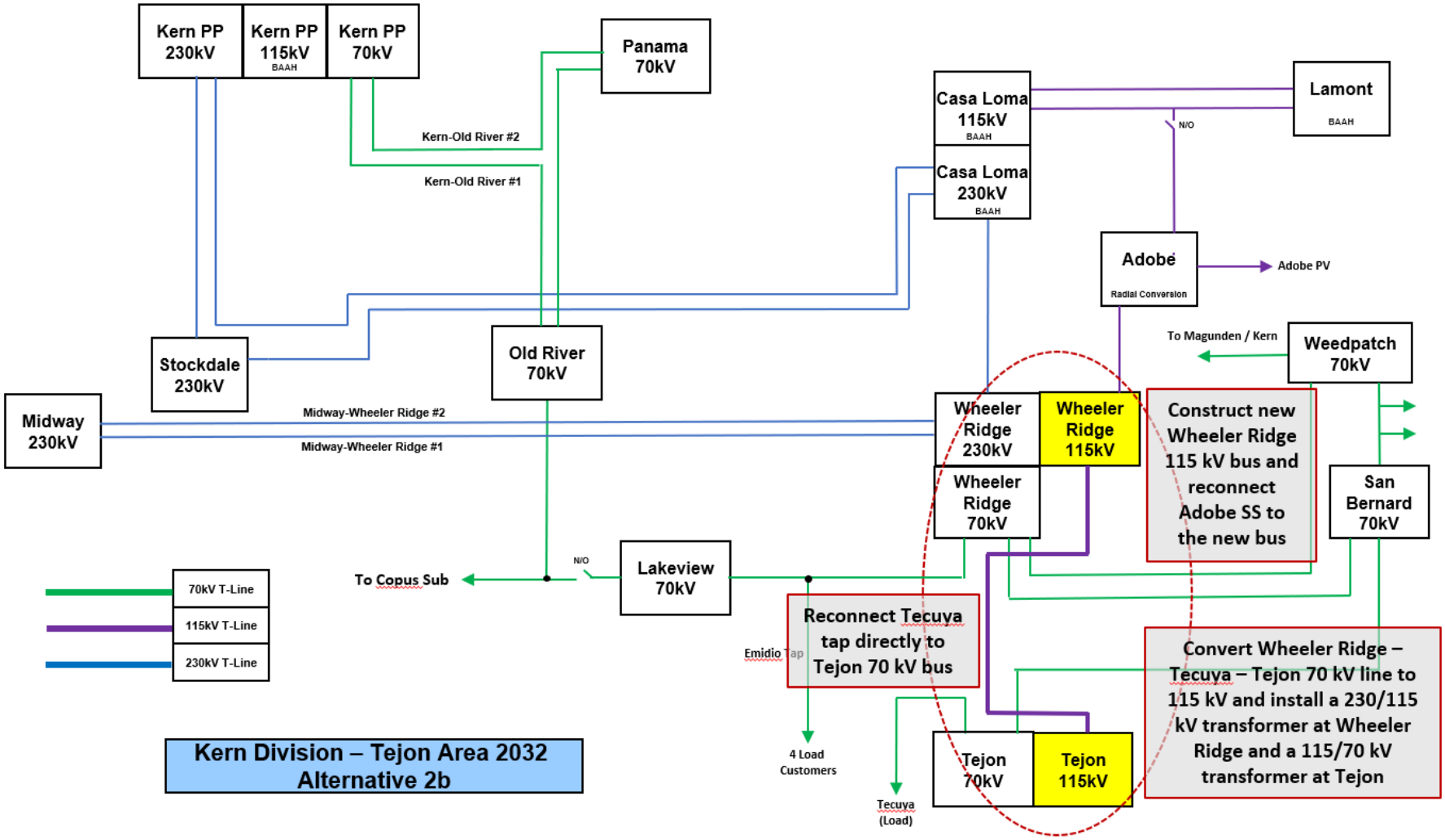


Single Line Diagram for Alternative 2a Scope

Proposed Alternative 2b

- **Alternative 2b :** Same as Alternative 2a, except makes use of existing 70 kV line built for 115 kV rather than adding a greenfield transmission line.
- **Description of Alternative 2b Proposed Scope (115 kV)**:
  - Construct a Wheeler Ridge 115 kV bus and connect existing 115 kV line to Adobe Solar Switching Station to the new 115 kV bus
  - Install a new 230/115 kV transformer at Wheeler Ridge
  - Convert existing Wheeler Ridge – Tecuya – Tejon 70 kV transmission line to 115 kV operation (already constructed for 115 kV); reconnect Tecuya Tap line directly to the Tejon 70 kV bus with a short new transmission line segment
  - Expand Tejon Substation and construct new Tejon 115 kV bus.
  - Construct a new 115/70 kV transformer at Tejon with future provisions for a second 115 kV circuit between Wheeler Ridge and Tejon and a second 115/70 kV transformer at Tejon

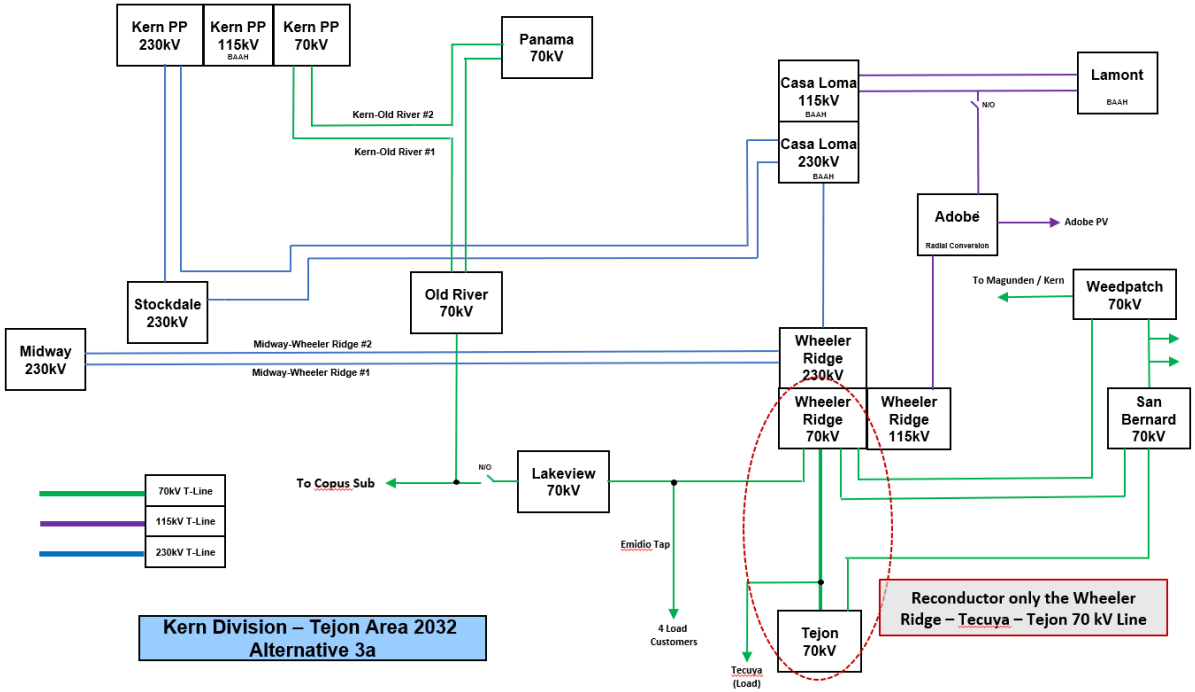
Alternative 2b Single Line Diagram



Single Line Diagram for Alternative 2b Scope

Proposed Project Alternative 3a

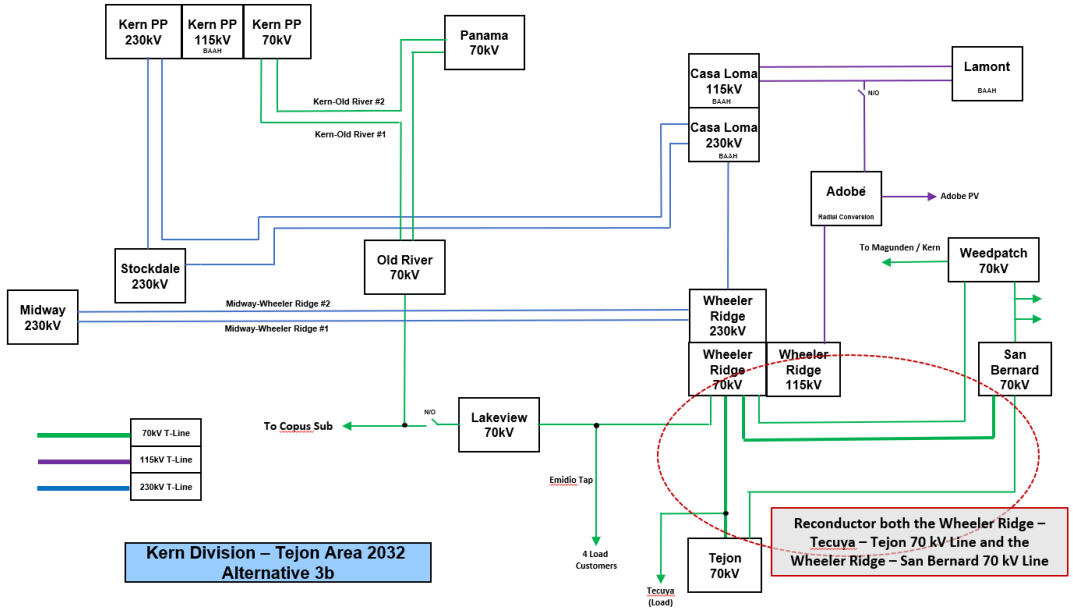
- **Alternative 3a Concept:** Meet immediate system capacity needs by reconductoring an existing 70 kV line with an expectation that the line's upgraded capacity will constitute part of a future incremental capacity increase plan.
- **Description of Alternative 3a Proposed Scope (70 kV)**:
  - Reconductor the Wheeler Ridge – Tejon 70 kV Line, approximately 5 miles, with the maximum size conductor supported by the existing towers



Single Line Diagram for Alternative 3a Scope

Proposed Project Alternative 3b

- **Alternative 3b Concept:** Same as Alternative 3a, except reconductor two 70 kV lines instead of one to provide larger initial incremental capacity increase.
- **Description of Alternative 3b Proposed Scope (70 kV)**:
  - Reconductor the Wheeler Ridge – Tejon 70 kV Line, approximately 5 miles, with the maximum size conductor supported by the existing towers
  - Reconductor the Wheeler Ridge – San Bernard 70 kV Line, approximately 5.9 miles, and rebuild/reinsulate the 70 kV towers for possible future conversion to 115 kV operation



Single Line Diagram for Alternative 3b Scope

Other Options and Ongoing Studies

- **Other Options Considered**
  - ***Option 1: Energy Storage***

    This alternative is not currently feasible because the energy storage charging capability is limited by the existing line capacity and will be further limited by the future load growth at the scale anticipated.

- **Studies of the proposed alternatives are ongoing** to determine the most cost effective, feasible solution to mitigate all the overloads caused by the Tejon area load increases for all contingency categories and reinforce the local grid for long-term load growth.

- One key factor being considered is **how each alternative will scale to address potential major long-term load growth** associated with freight infrastructure upgrades. This includes evaluating how the Tejon area upgrades dovetail with possible upgrades for serving additional freight infrastructure loads at Old River and Lakeview Substations for which a 115 kV alternative is being considered.