



## Agenda

# Draft 2017-2018 Transmission Plan and transmission project approval recommendations

*Kristina Osborne*

*Senior Stakeholder Engagement and Policy Specialist*

*2017-2018 Transmission Planning Process Stakeholder Meeting*

*February 8, 2018*

# 2017-2018 Transmission Planning Process Stakeholder Meeting - Agenda

Topic	Presenter
Introduction	Kristina Osborne
Overview & Key Issues	Neil Millar
Economic Assessment	Yi Zhang, Robert Sparks and Jeff Billinton
Southern California Recommended Reliability Projects	Robert Sparks
Northern California Recommended Reliability Projects	Binaya Shrestha
Wrap-up & Next Steps	Kristina Osborne



## Introduction and Overview Draft 2017-2018 Transmission Plan and transmission project approval recommendations

*Neil Millar  
Executive Director, Infrastructure Development*

*2017-2018 Transmission Planning Process Stakeholder Meeting  
February 8, 2018*

# 2017-2018 Transmission Planning Process

January 2017

April 2017

March 2018

## Phase 1 – Develop detailed study plan

State and federal policy  
CEC - Demand forecasts  
CPUC - Resource forecasts and common assumptions with procurement processes  
Other issues or concerns

## Phase 2 - Sequential technical studies

- Reliability analysis
- Renewable (policy-driven) analysis
- Economic analysis

Publish comprehensive transmission plan with recommended projects

## Phase 3 Procurement

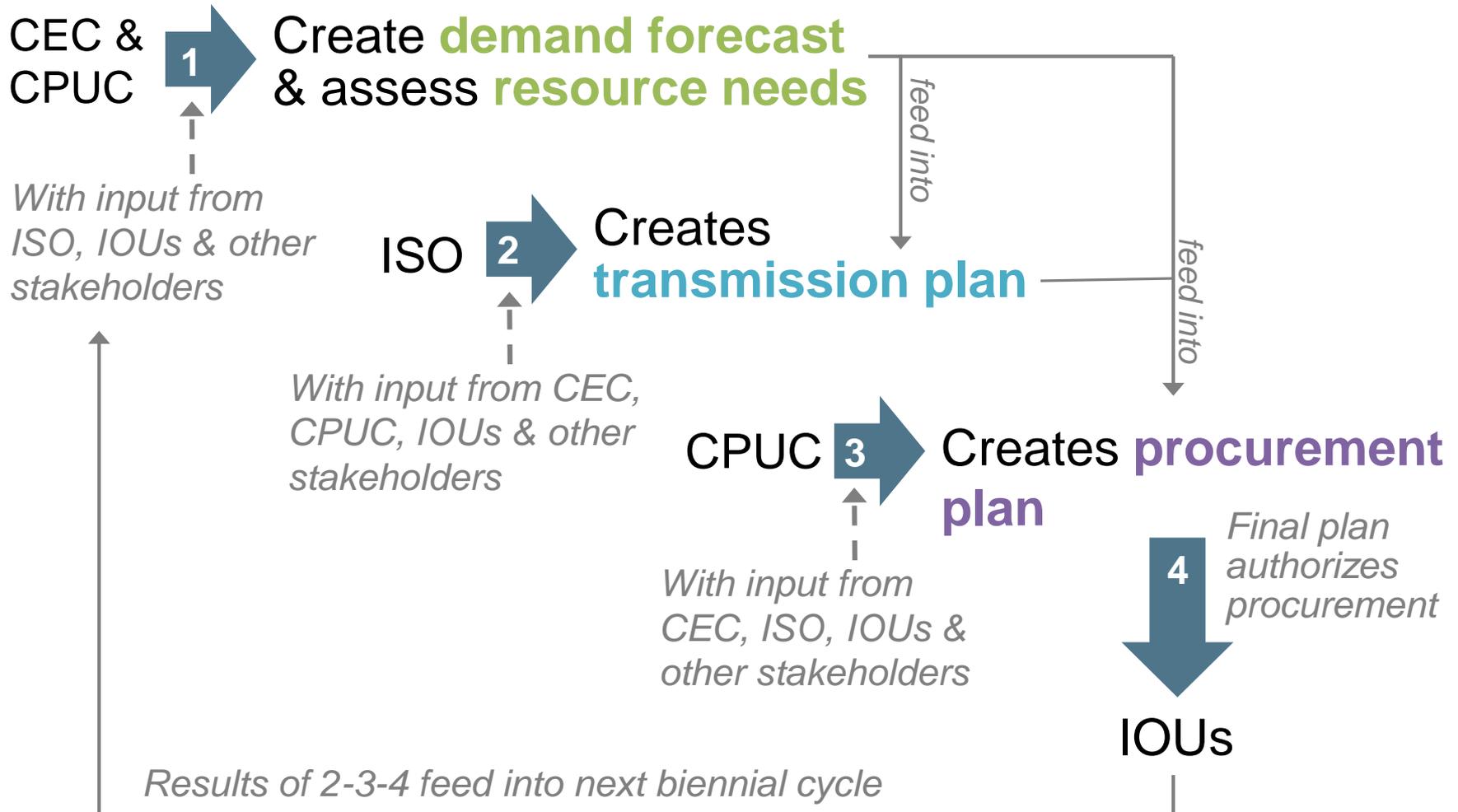
Draft transmission plan presented for stakeholder comment.

ISO Board for approval of transmission plan

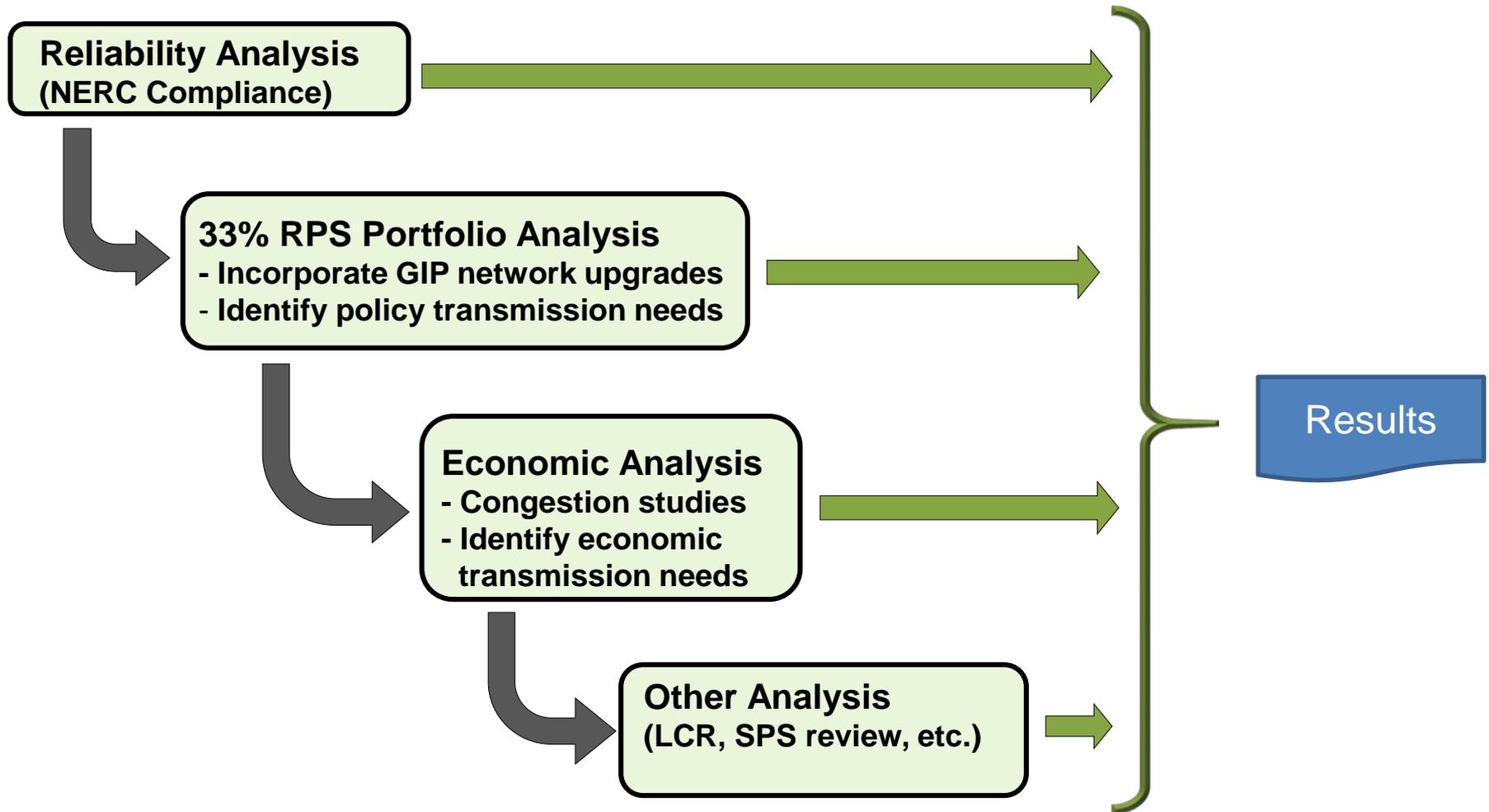
# 2017-2018 Ten Year Plan Milestones

- Preliminary reliability study results were posted on August 15
- Stakeholder session September 21st and 22nd
- Comments received October 6
  - (slow response resource special study extended to October 10)
- Request window closed October 15
- Preliminary policy and economic study results and update on other issues November 16
- Comments received November 30
- Draft plan posted February 1, 2018
- **Today's session to review draft plan**
- Comments due February 22
- Revised draft for approval at March Board of Governor meeting

# Planning and procurement overview



# Development of 2017-2018 Annual Transmission Plan



## Emphasis in the transmission planning cycle:

- A modest capital program, as:
  - Reliability issues are largely in hand, especially with load forecasts declining from previous years and behind the meter generation forecasts increasing from previous projections
  - Policy work was largely informational as we await actionable renewable portfolio policy direction regarding moving beyond 33% (for approvals)
  - Modestly-sized economic-driven projects emerging as evolving industry circumstances create some new opportunities
- A major effort in this third and final year of the programmatic review of previously-approved projects
- Preferred resources and transmission upgrades playing a critical role in the integrated solutions in several areas
- Emerging issues continuing to drive re-thinking on how we study and assess transmission system issues

## Consideration of the impacts of behind the meter photovoltaic generation on load shapes – and shifting the time of load peaks to later in the day – is evolving:

- In CED 2015 (2016-2026 Forecast), the CEC determined peak loads through downward adjustments to the traditional mid-day peak loads and acknowledged the issue of later-day peaks. In the 2016-2017 planning cycle the ISO conducted its own sensitivities.
- In CEDU 2016 (2017-2027), the CEC provided sensitivities of later day peaks. The ISO used those sensitivities in this 2017-2017 planning cycle to review previously-approved projects, but not as the basis for approving new projects.
- Through CED 2017 (2018-2028) the ISO is anticipating hourly load shapes.

## The ISO's reliability analysis led to the following:

- 12 new reliability projects are recommended – firming up the February 1 posted plan
- In the PG&E service territory ,19 previously-approved projects are recommended to be canceled and 21 have been re-scoped, paring over \$2.7 billion from current estimates. 6 have been identified as needing further review
- Two previously-approved projects in the SDG&E service territory are recommended to be canceled

## Policy-driven analysis for approval purposes was not needed - no policy-driven approvals are recommended

- Portfolio direction received from the CPUC and CEC on June 13, 2016:

*“Recommend reusing the “33% 2025 Mid AAEE” RPS trajectory portfolio that was used in the 2015-16 TPP studies, as the base case renewable resource portfolio in the 2016-17 TPP studies”*

*“Given the range of potential implementation paths for a 50 percent RPS, it is undesirable to use a renewable portfolio in the TPP base case that might trigger new transmission investment, until more information is available.”*

- This policy direction remained in place for the 2017-2018 transmission planning cycle.
- Portfolios used in the ISO’s informational 50% RPS special studies and evaluation of interregional projects were provided by CPUC staff.

## The ISO is recommending a number of economic-driven projects:

- One – in the VEA service territory – provides production simulation benefits.
- One – in the Imperial Valley area – provides both local capacity requirement reduction benefits and production simulation benefits
- Two – in the East Bay/Moss Landing Sub-area – focus on reducing local capacity requirements in the area

## Status of proposal to add Phasor Measurement Units (PMUs) to all CAISO Interties:

- In November 2017, the ISO introduced the proposal that PMUs be added to all ISO intertie transmission facilities to other balancing areas
- Phasor measurement units will enhance accuracy of measurements to demonstrate compliance with NERC Reliability Standard BAL-003-1.1
- The ISO must meet frequency response obligation based on net actual interchange measurements
- The ISO is continuing to refine the scope of the effort and will bring forward a recommendation in the future.

## Other considerations:

- No regional (i.e. greater than 200 kV) transmission solutions recommended for approval are eligible for competitive solicitation
- Transmission Access Charge model to be incorporated into final draft transmission plan – model preparation and data collection in progress
- The six special studies conducted in 2017 have been summarized in the 2017-2018 Transmission Plan:
  - These were presented previously and are not being revisited today
  - They will help inform future planning efforts
  - Three were extensions of 2016-2017 studies and are also documented on the 2016-2017 transmission plan website

# Questions?

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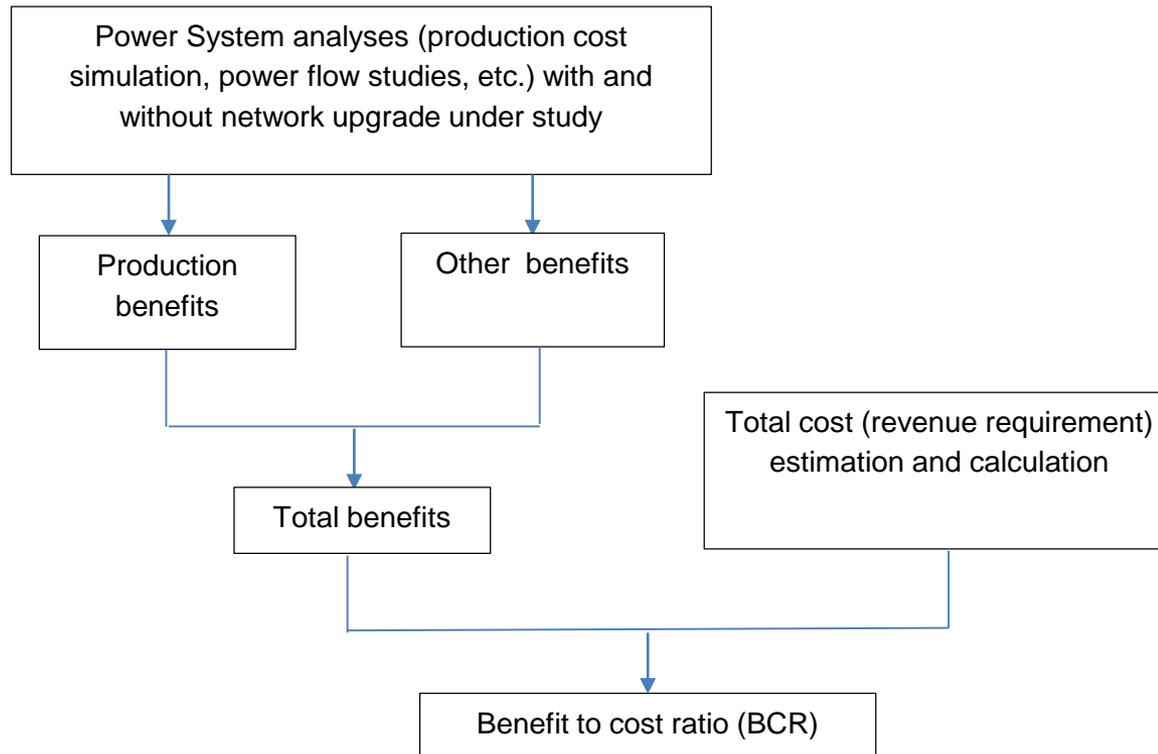
## Economic Assessment Draft 2017-2018 Transmission Plan and transmission project approval recommendations

Yi Zhang  
Regional Transmission Engineer Lead

*2017-2018 Transmission Planning Process Stakeholder Meeting*  
February 08, 2018

# Overview of economic planning methodology

- ISO's economic planning study follows the updated TEAM documentation updated in 2017
- Study approach:

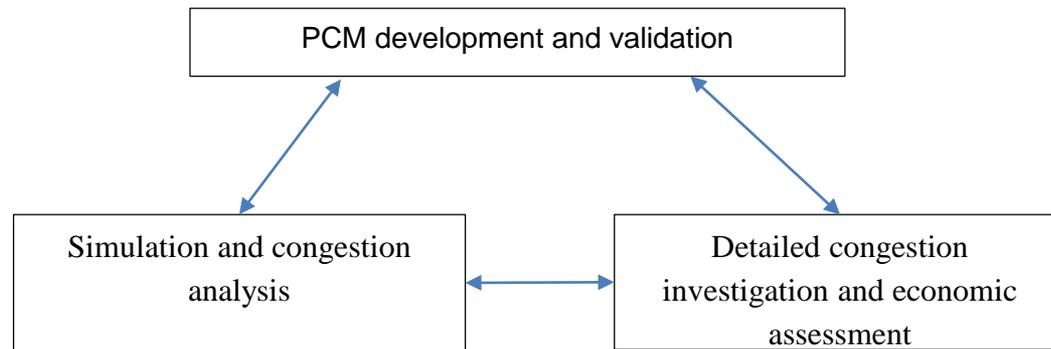


# Financial analysis in economic planning

- Key parameters as identified in TEAM document and used in 2017~2018 planning cycle
- Use 1.45 cost-to-capital ratio for “total cost” estimation
- For present value calculation
  - 7% discount rate (real)
  - 50 years of economic life for new transmission
  - 40 years of economic life for reconductoring

# Production cost simulation in economic planning

- Three steps interacting with each other



- Production cost simulation software in 2017~2018 planning cycle
  - GridView version 9.7.26.20 (compatible with version 10.1.3)
- ISO's planning Production cost model (PCM) was developed from WECC common case, and has been modified and enhanced on both modeling and data

# Overview of ISO's planning PCM development and enhancement

- Continued to enhance the production cost simulation tool in collaboration with the software vendor
  - Effectively reflecting market and grid operation (e.g. A/S, Nomograms, RAS, etc..)
  - Efficient data management for system modeling
- Implemented in this planning cycle
  - Multi-tier renewable curtailment prices following the CPUC's recommendations

Tier	Total curtailment (GWh)	Curtailment price (\$/MWh)
1	<200	-\$15
2	Between 200~12400	-\$25
3	>12400	-\$300

# Overview of ISO's planning PCM development and enhancement (cont.)

- Database development with more accurate representation of network models
  - Identical network models for the ISO system in PCM and in the reliability power flow cases
    - Transmission topology, generator location, load distribution
  - Load modifiers were modeled as generators at the locations as in power flow cases
  - Coordinated with other regions to update their system models
- Most recently updated operational data and models
  - Updated solar profiles (in collaboration with WPR ADS process) with higher granularity based on NREL measurements
  - Updated thermal unit ramp rates based on industry average
  - IV PFC dispatchable

# Summary of the final congestion results

No	Aggregated congestion	2027	
		Costs (M\$)	Duration (hr)
1	BOB SS (VEA) - MEAD S 230 kV line	60.11	654
2	PG&E NCNB	8.24	427
3	PG&E/TID Exchequer	4.74	2,199
4	Path 45	3.00	1,062
5	COI Corridor	2.39	120
6	PG&E POE-RIO OSO	1.37	106
7	Moenkopi-Eldorado 500 kV	1.02	49
8	SDGE IV-SD Import	0.87	172
9	Path 26	0.63	22
10	Path 61/Lugo - Victorville	0.39	50
11	Path 24	0.37	137
12	SCE Inyo Phase Shifter	0.22	2,364
13	Path 52 Silver Peak-Control 55 kV	0.20	2,131
14	SDGE North	0.18	66
15	PG&E/Sierra MARBLE transformer	0.15	129
16	IID-SDGE (S line)	0.14	30
17	Path 15/CC	0.13	8
18	SCE J.HINDS-MIRAGE 230 kV line	0.13	27
19	PG&E Fresno	0.11	13
20	SCE Devers-RedBluff 500 kV line	0.08	2
21	PG&E GBA	0.03	4,999
22	PG&E LCR Sierra Gridley-Live Oak 60 kV	0.00	1

# Economic planning study requests

#	Study request	Major concerns or comments in request
1	Bob SS to Mead S upgrade	Benefit of reducing curtailment, participant benefit
2	COI congestion	COI congestion due to scheduling limit
3	Mira Loma - Red Bluff 500 kV line	Benefit of reducing LA Basin LCR and LA Basin/SD combined LCR
4	Devers - Suncrest 500 kV line	Benefit of reducing LA Basin LCR and LA Basin/SD combined LCR
5	Renewable Energy Express* (AC-DC Conversion of N. Gila-IV-MG)	Benefit of reducing LA Basin LCR and LA Basin/SD combined LCR
6	Round Mtn. - Cottonwood 230 kV lines flow control devices	COI nomogram with the flow control devices
7	SunZia and 1500 MW wind in NM*	Renewable integration
8	LCR benefit evaluation (South Bay-Moss Landing, Vilson, LA Basin, SD/IV)	LCR benefit

\* Inter-regional transmission planning (ITP) projects

# Summary of evaluating economic planning study requests

- Eight study requests have been accepted and evaluated
- Evaluations followed the ISO Tariff Section 24.3.4.1
- Detail evaluation results can be found in the transmission plan report
- Study request for Bob SS to Mead S congestion was further investigated

## Detailed studies were performed for four areas:

- IID S-line (from IID El Centro to SDG&E Imperial Valley)
- Bob SS – Mead S 230 kV line
- San Diego North area
- South Bay/Moss Landing area

## The ISO and IID are pursuing upgrades to IID's existing S-line:

- The S-Line is an 18.1 mile, 230 kV single circuit wood pole construction line from IID's El Centro substation to SDG&E's Imperial Valley substation owned by IID
- The project would consist of the ISO - through a participating transmission owner – funding the upgrade of the existing wood pole line to 230 kV double circuit steel tower construction, and the necessary upgrades to termination equipment, in return for entitlements to the incremental transmission capacity created by the upgrade.
- Cost estimate from IID is \$32 million for the line upgrade; \$50 million evaluated to allow for IV termination upgrades
  - “Total cost is approximately \$72 million using screening 1.45 ratio

# S-line congestion mitigation and production benefit assessment

- A double circuit upgrade was studied with each circuit rated at 786 MVA
  - This project design was provided by IID for use in the ISO's GIP studies in 2014

	Pre S line upgrade (\$M)	Post S line upgrade (\$M)	Savings (\$M)
ISO load payment	7,575.95	7,602.79	
ISO owned generation profits	3,909.36	3,935.32	
ISO owned transmission revenue	178.66	182.37	
ISO Net payment	<b>3,487.92</b>	<b>3,485.10</b>	<b>2.82</b>
WECC Production cost	18,836.17	18,837.07	-0.9

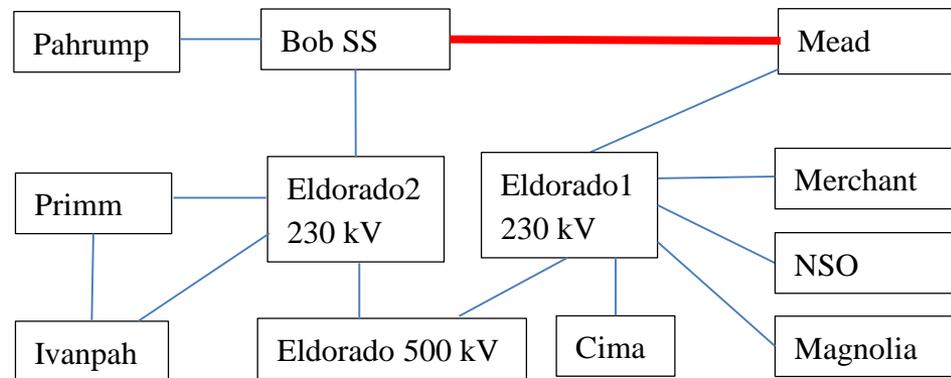
- ISO ratepayer's benefit was \$2.82 million
- Present value is approximately \$40 million
  - Assume 50 year life of the project and 7% discount rate
- Renewable curtailment in production cost simulation reduced by about 50 GWh with S line upgrade in place

## S-line local capacity benefit assessment

- The primary and most immediate benefit to ISO ratepayers is a reduction in local capacity requirement in the San Diego-Imperial Valley area
  - With the S-Line upgrade project in-service the local capacity requirement can be reduced by approximately 213 MW, potentially up to 500 MW in the future
- LCR benefit with a 213 MW reduction is \$111.3 million to \$222.6 million based on the following parameters
  - CPM price of \$6.31/kw-month or \$75,720/MW-year as set out in the ISO tariff
  - Revenue stream over 50 years
- Summing the production benefit and the low end of the capacity benefit yields “total” benefits of \$151.3 million
  - BCR is approximately 2.08

# Bob SS to Mead S 230 kV line congestion mitigation and production benefit assessment

- Congestion was observed from Bob SS to Mead S since the last planning cycle



- A study request from GridLiance, which owns and operates the VEA 230 kV system, proposed to upgrade the congested line with higher rating
  - Capital cost estimate was about \$25M, total revenue requirement was about  $1.45 \times \$25M = \$37M$

## Bob SS to Mead S 230 kV line congestion mitigation and production benefit assessment (cont.)

	Pre Bob SS-Mead S upgrade (\$M)	Post Bob SS-Mead S upgrade (\$M)	Savings (\$M)
ISO load payment	7,602.79	7,576.60	
ISO owned generation profits	3,935.32	3,985.82	
ISO owned transmission revenue	182.37	118.78	
ISO Net payment	<b>3,485.10</b>	<b>3,472.00</b>	<b>13.10</b>
WECC Production cost	<b>18,837.07</b>	<b>18,818.19</b>	<b>18.88</b>

- Renewable curtailment in production cost simulation reduced by about 28 GWh with Bob SS to Mead S line upgrade in place
- ISO ratepayer benefit was \$13.10 million
- Present value of benefit is approximately \$180 million, assuming 40 year life of the project and 7% discount rate
  - Greater than the total cost of \$37 million

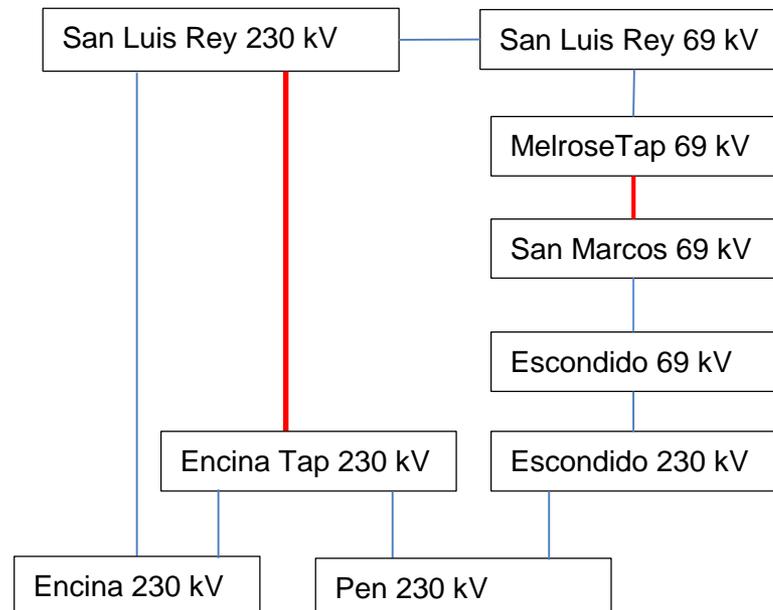
# Bob SS to Mead S 230 kV line congestion mitigation and production benefit assessment (cont.) – Sensitivity without ISO Net Export Limit

	Pre Bob SS-Mead S upgrade (\$M)	Post Bob SS-Mead S upgrade (\$M)	Savings (\$M)
ISO load payment	8,010.32	7,993.65	
ISO owned generation profits	4,202.71	4,320.77	
ISO owned transmission revenue	356.07	229.52	
ISO Net payment	<b>3,451.53</b>	<b>3,443.36</b>	<b>8.17</b>
WECC Production cost	<b>18,691.89</b>	<b>18,659.76</b>	<b>32.13</b>

- ISO ratepayer's benefit was \$8.17 million
- Present value is approximately \$112 million
  - Assume 40 year life of the project and 7% discount rate
- Still greater than the total cost of \$37 million

# San Diego North congestion mitigation and production benefit assessment

- Congestions were observed:
  - From Encina Tap to San Luis Rey 230 kV line under the N-1 of Encina to San Luis Rey
  - From San Marcos to Melrose Tap 69 kV line under the N-2 of Encina and Encina Tap to San Luis Rey



# San Diego North congestion mitigation and production benefit assessment (cont.)

- These congestions were observed in correlation with high flows from south to north on the Encina to San Luis Rey corridor
- Two potential mitigations were studied in this planning cycle:
  - To build the second Encina to San Luis Rey 230 kV line and de-loop the Pen to San Luis Rey 230 kV line from the Encina Tap
    - Capital cost approximately \$70~\$80 million based on per unit cost, total cost is \$101 ~ \$116 million
  - SPS solution that includes tripping generators at Carlsbad, Palomar, and Otay Mesa under N-1 and N-2 contingencies of the 230 kV lines, and open the 69 kV loop at Melrose to San Marcos under the N-2 contingency of the 230 kV lines

# San Diego North congestion mitigation and production benefit assessment (cont.) – New line solution

	Pre Encina-San Luis Rey new line upgrade (\$M)	Post Encina-San Luis Rey new line upgrade (\$M)	Savings (\$M)
ISO load payment	7,602.79	7599.91	
ISO owned generation profits	3,935.32	3936.56	
ISO owned transmission revenue	182.37	180.18	
ISO Net payment	<b>3,485.10</b>	<b>3483.17</b>	<b>1.93</b>
WECC Production cost	<b>18,837.07</b>	<b>18,839.01</b>	<b>-1.94</b>

- ISO ratepayer's benefit was \$1.93 million
- NPV is approximately \$27 million
  - Assume 50 year life of the project and 7% discount rate
- Is less than the total cost of \$101~ \$116 million

# San Diego North congestion mitigation and production benefit assessment (cont.) – SPS solution

	Pre SPS solution (\$M)	Post SPS solution (\$M)	Savings (\$M)
ISO load payment	7,602.79	7,595.01	
ISO owned generation profits	3,935.32	3,927.15	
ISO owned transmission revenue	182.37	180.59	
ISO Net payment	<b>3,485.10</b>	<b>3,487.28</b>	<b>-2.18</b>
WECC Production cost	<b>18,837.07</b>	<b>18,839.01</b>	<b>-1.94</b>

- The SPS solution can completely mitigate the congestions in this area and did not cause any unserved load in simulation
- However, the SPS solution did not provide production benefit to ISO ratepayers
- The SPS solution may be a valid option to consider in future planning cycles if it can eliminate potential reliability violations that may evolve in the future in this local area

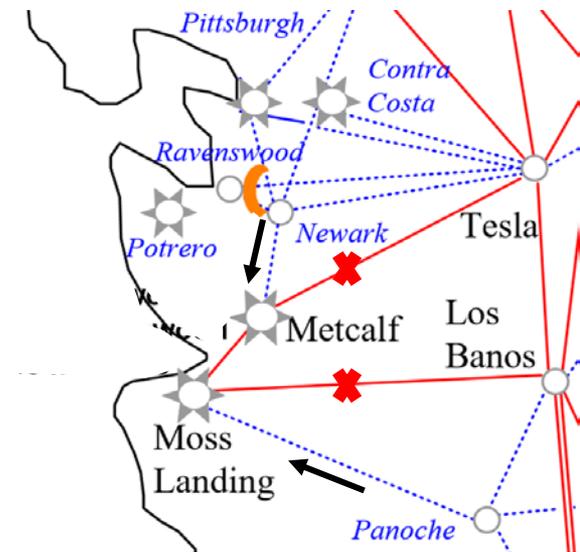
# Mitigation Plan to Reduce the LCR Need in South Bay - Moss Landing Sub-area

# Established Need – Primary Limitation

## 2018 Local Capacity Requirement:

- Outage of the Tesla-Metcalf 500 kV and Moss Landing-Los Banos 500 kV
- Limitation is thermal overloading of the Las Aguilas-Moss Landing 230 kV

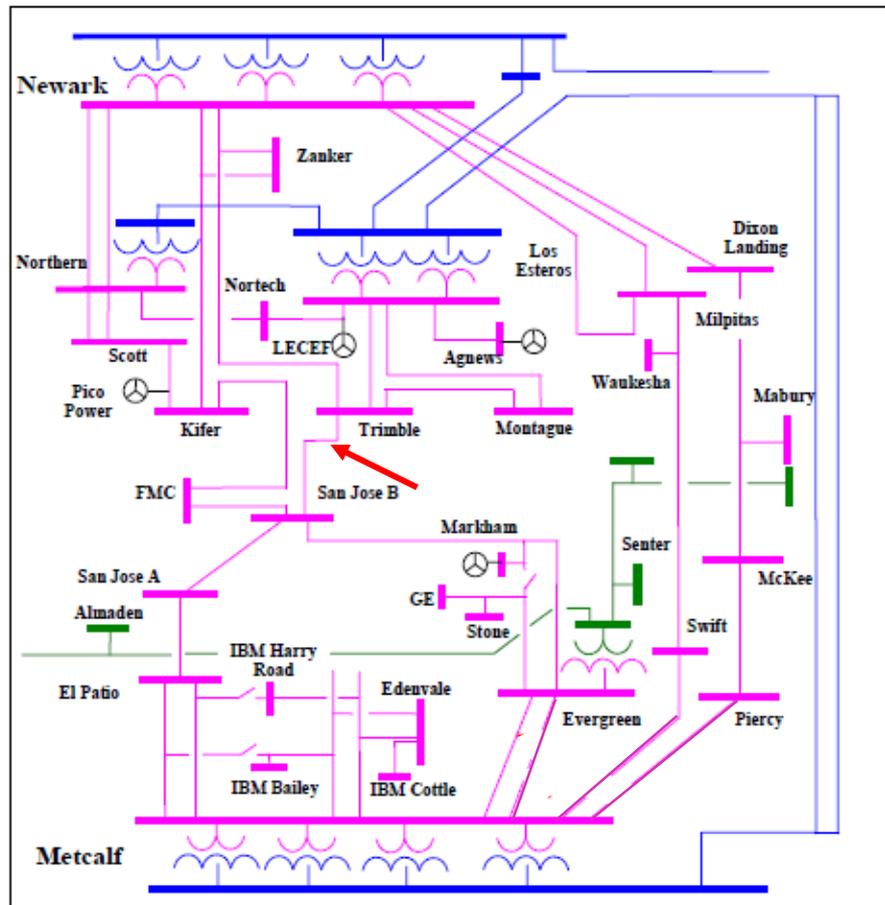
The sub-area local capacity requirement was determined to be 2,221 MW in the 2018 LCR technical study and 2,346 MW in the 2022 LCR technical study. At the time the LCR studies were conducted by the ISO there was 2,408 MW of generation located within the LCR area.



# Established Need – Secondary Limitation

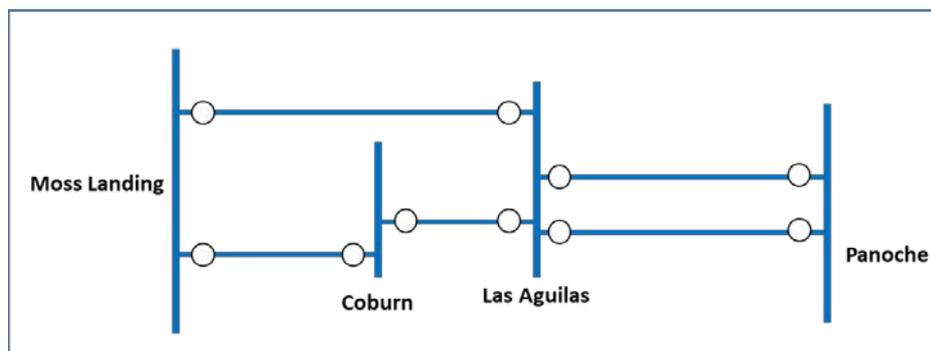
## 2018 Local Capacity Requirement

- Outage of the Tesla-Metcalf 500 kV and Moss Landing-Los Banos 500 kV
- Limitation is thermal overloading of the Trimble-San Jose 'B' 115 kV



## Moss Landing–Panoche 230 kV Path Upgrade

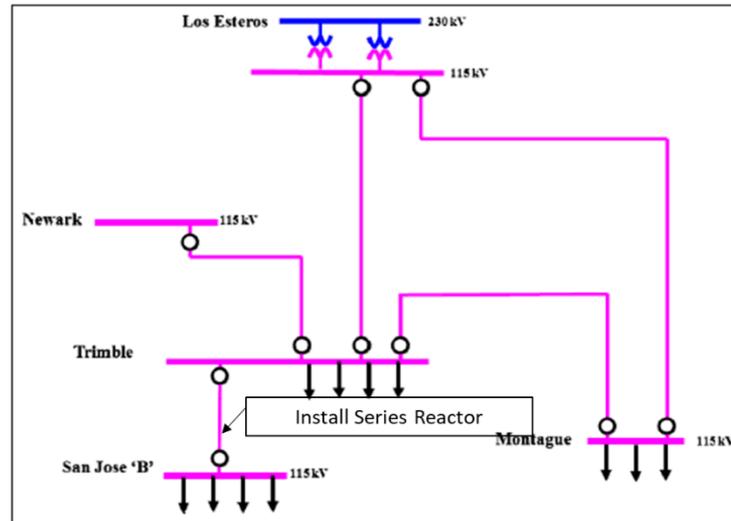
South Bay-Moss Landing sub-area is connected to the Fresno area through a double circuit 230 kV line between the Moss Landing and Panoche substations with interconnections to the Los Aguilas and Coburn substations.



- Existing emergency rating of the Moss Landing-Las Aguilas 230 kV line and the Las Aguilas-Panoche #1 230 kV line is 339 MVA.
- The Moss Landing-Coburn 230 kV line and the Coburn-Las Aguilas 230 kV lines are rated at 318 MVA due to terminal equipment limitations associated with the current transformers (CT) at Coburn substation.
- The Las Aguilas-Panoche #2 230 kV line is rated at 318 MVA due to terminal equipment limitations associated with the wavetraps at Panoche substation.
- To achieve the rerate of the lines to 400 MVA for the Moss Landing-Panoche 230 kV Path, terminal equipment upgrades at Coburn and Panoche are required.
- The cost estimate to rerate the 230 kV lines and upgrade the terminal equipment is \$5 million dollars with an expected in-service date of December 2018.

## San Jose-Trimble 115 kV line limitation and consideration of series reactors

The San Jose-Trimble 115 kV line is also identified as a limiting facility for establishing local capacity requirements for the South Bay-Moss Landing sub-area. The ISO assessed the size of series reactor necessary to alleviate the potential thermal overloading of this circuit, and found that under the most limiting P6 contingency, a 4 ohm series reactor would be sufficient.



- Based on the per unit cost calculated from Request Window submissions for similar projects, the estimated cost for the addition of this series reactor is expected to be between \$6M to \$9M and the expected in-service date is May, 2019.
- In the event that the project is not in-service by the expected in-service date, operational action plans during abnormal operating conditions can be implemented as a temporary mitigation plan to mitigate the overloads in the interim until the series reactor is in-service.

## Summary of results:

The combination of the modeling changes, proposed line re-rating, recommended reliability-driven projects, and the two economic-driven projects collectively reduce the local capacity requirements for the South Bay-Moss Landing sub-area by approximately 400 to 600 MW beginning in 2019:

- Re-rate the Moss Landing-Los Aguilas 230 kV lines to 400 MVA. (PG&E action)
- Re-scoping of the South of San Mateo Capacity Increase (reliability-driven project found to be needed in this 2017-2018 transmission plan)
- San Jose-Trimble 115 kV Line Limiting Facility Upgrade (reliability-driven project found to be needed in this 2017-2018 transmission plan)
- Moss Landing–Panoche 230 kV Path Upgrade (economic-driven project found to be needed in 2017-2018 transmission plan)
- San Jose-Trimble 115 kV Series Reactor (economic-driven project found to be needed in this 2017-2018 transmission plan)
- Interim operating procedures to mitigate delay of San Jose-Trimble 115 kV Series Reactor if delays occur (PG&E action)
- Since several of the identified upgrades will not be in effect until the end of 2018 or early 2019, the identified RMR need for the Metcalf Energy Center in 2018 as well as the need for the CPM designation for Moss Landing 2 remain valid.

# Summary and recommendations

Four upgrades were found to be needed as economic-driven projects in the 2017-2018 planning cycle:

- S-Line Upgrade
- Bob SS to Mead S 230 kV Line Upgrade,
- South Bay-Moss Landing enhancements comprising of the San Jose-Trimble 115 kV series reactor and the Moss Landing–Panoche 230 kV Path Upgrade

Congestion or study area	Production benefit (\$M)	Capacity benefit (\$M)	Estimated total cost (\$M)	Economic justification
S-Line	40	85~110	46~72	Yes
Bob SS-Mead S	180	Not applicable	37	Yes
San Diego North	27	Not applicable	101~116	No
South Bay-Moss Landing area	Not applicable	400-600 MW LCR benefit	\$14	Yes

# Questions?

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# Southern Area - Reliability Assessment Draft 2017-2018 Transmission Plan and the transmission project approval recommendations

*Robert Sparks  
Manager, Regional Transmission - South*

*2017-2018 Transmission Planning Process Stakeholder Meeting  
February 8, 2018*

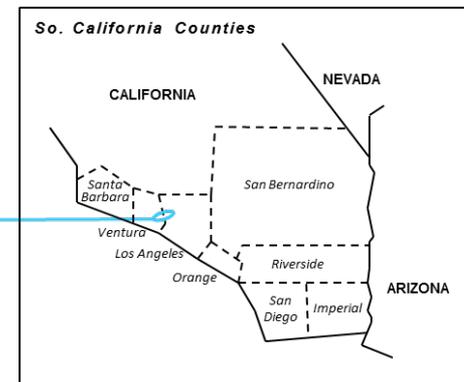
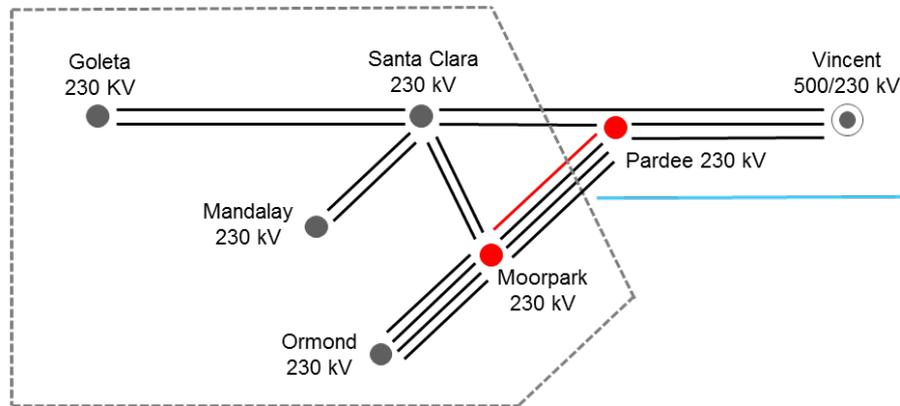
# Overview of Southern Area Project Recommendations

- The Moorpark-Pardee #4 230 kV transmission circuit is recommended to be approved
- Two reliability projects less than \$50 million that were already presented for management approval in November 2017:
  - San Ysidro 69 kV Reconductoring Project
  - Suncrest 500/230 kV Transformers Rating Increase
- Two reliability projects recommended to be canceled:
  - Mission Penasquitos 230 kV line (presented in November 2017)
  - Sycamore-Chicarita Reconductor Project

# Moorpark-Pardee #4 230 kV transmission circuit

- The project is proposed by SCE to address the local capacity deficiency in the Moorpark subarea and involves:
  - stringing a fourth Moorpark-Pardee 230 kV circuit approximately 26 miles on existing structures
  - installing terminal equipment at Moorpark and Pardee Substations and
  - relocating existing circuit terminations in the 230 kV switchrack at Moorpark Substation.

Moorpark Local Capacity Sub-Area



## Project overview – cont'd

- The project has an estimated cost of \$45 million.
- The required in service date is 12/31/2020 to coincide with the retirement of OTC generation in the area
- SCE has requested ISO approval by March 2018 in order to meet the required in service date.

## Alternatives considered

- Alternative 1 – Moorpark-Pardee project to address Moorpark LCR need coupled with 86 MW to 105 MW (NQC) of local capacity located downstream of Goleta to address Santa Clara LCR and SCE's Goleta resiliency objectives
- Alternative 2 – Approximately 318 MW (NQC) of local capacity to address Moorpark LCR need of which 105 MW is located downstream of Goleta to address Santa Clara LCR and SCE's Goleta resiliency objectives
- Alternative 3 – 240 Mvar dynamic reactive power support coupled with 135 MW (NQC) of local capacity to address Moorpark LCR need of which 105 MW is located downstream of Goleta to address Santa Clara LCR and SCE's Goleta resiliency objectives

# Comparison of alternatives

Criteria	Alternative 1 (Tx + 86 MW to 105 MW LC)	Alternative 2 (318 MW LC)	Alternative 3 (240 Mvar + 135 MW LC)
Increase in post contingency voltage stability area load limit	916-928 MW	300 MW	294 MW
Maximum thermal loading under critical contingency	<100%	159% (Pardee-Santa Clara 230 kV)	189% (Pardee-Santa Clara 230 kV)
Grid resiliency	Neutral	Better	Neutral
Operational complexity due to variability, run-time limitation and charging needs of local capacity resources	Lower	Higher	Lower
Capital cost	Lower	Much higher	Higher
Required 12/31/2020 in-service date	Achievable	Most aggressive	More aggressive

# Conclusion

- Alternative 1 was identified as the recommended alternative

# Questions?

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## Northern Area - Reliability Assessment Draft 2017-2018 Transmission Plan and the transmission project approval recommendations

*Binaya Shrestha*

*Regional Transmission - North*

*2017-2018 Transmission Planning Process Stakeholder Meeting  
February 8, 2018*

# Overview

- High level summary of results of previously-approved projects review.
  - Discussion of projects with revised scopes that were not discussed in November stakeholder meeting #3.
- Review of new projects.
- Review of request Window submissions.

## High level summary of results of previously approved projects review.

Description	Number	Current PG&E Project Estimate (\$M)	Revised 2017-2018 Estimate (\$M)	Comment
Projects Modeled in 2017-2018 TPP Base Cases (Based on Phase-1 assessment recommendations)	33	1,137	1,137	Please refer to slide 4 for detailed list of projects
Projects Not Modelled in 2017-2018 TPP Base Cases - Found to be needed with original approved scope based on Phase-2 assessment	16	569	572	Please refer to slide 5 for detailed list of projects
Projects found to be not needed - Recommended to be cancelled	19	1,066	6	Please refer to slide 6 for detailed list of projects
Projects to Put on Hold for One More Year	6	638	548	Please refer to slide 7 for detailed list of projects
Projects Not Modelled in 2017-2018 TPP Base Cases -Found to be needed with revised scope based on Phase-2 assessment	21	2299	705	Please refer to slides 8 for detailed list of projects
	95	5,709	2,968	

## Projects Modeled in 2017-2018 TPP Base Cases

Projects	Planning Area
Maple Creek Reactive Support (Install 10 Mvar SVC at Maple Creek Sub)	Humboldt
Cortina No. 3 60 kV Line Reconductoring Project	Central Valley
Lodi-Eight Mile 230 kV Line	Central Valley
Missouri Flat-Gold Hill 115 kV Line	Central Valley
Rio Oso 230/115 kV Transformer Upgrades	Central Valley
Ripon 115 kV Line	Central Valley
South of Palermo 115 kV Reinforcement Project	Central Valley
Stockton A-Weber 60 kV Line Nos. 1 and 2 Reconnector	Central Valley
West Point-Valley Springs 60 kV Line	Central Valley
Christie 115/60 kV Transformer No. 2	Greater Bay Area
Contra Costa Sub 230 kV Switch Replacement	Greater Bay Area
Cooley Landing 115/60 kV Transformer Capacity Upgrade	Greater Bay Area
East Shore-Oakland J 115 kV Reconductoring Project	Greater Bay Area
Martin 230 kV Bus Extension	Greater Bay Area
Metcalf-Piercy & Swift and Newark-Dixon Landing 115 kV Upgrade	Greater Bay Area
Monta Vista 230 kV Bus Upgrade	Greater Bay Area
North Tower 115 kV Looping Project	Greater Bay Area
NRS-Scott No. 1 115 kV Line Reconnector	Greater Bay Area
Pittsburg 230/115 kV Transformer Capacity Increase	Greater Bay Area
Estrella Substation Project	Central Coast and Los Padres
Gregg-Herndon #2 230 kV Line Circuit Breaker Upgrade	Fresno
Helm-Kerman 70 kV Line Reconnector	Fresno
Lemoore 70 kV Disconnect Switches	Fresno
Los Banos-Livingston Jct-Canal 70 kV Switch Replacement	Fresno
Panoche-Ora Loma 115 kV Line Reconductoring	Fresno
Series Reactor on Warnerville-Wilson 230 kV Line	Fresno
Warnerville-Bellota 230 kV Line Reconductoring	Fresno
Wilson-Le Grand 115 kV Line Reconductoring	Fresno

Projects	Planning Area
Kern PP 230 kV Area Reinforcement	Kern
Midway-Kern PP Nos. 1,3 and 4 230 kV Lines Capacity Increase	Kern
Midway-Kern PP#2 230 kV Line	Kern
San Bernard-Tejon 70 kV Line Reconnector	Kern
Semitropic-Midway 115 kV Line Reconnector	Kern

## Projects Not Modeled in 2017-2018 TPP Base Cases – Found to be needed with original approved scope

Projects	Planning Area	Comment
Delevan 230 kV Substation Shunt Reactor	North Valley	Presented in Nov meeting
Glenn 230/60 kV Transformer No 1 Replacement	North Valley	Presented in Nov meeting
Bellota 230 kV Substation Shunt Reactor	Central Valley	Presented in Nov meeting
Vierra 115 kV Looping Project	Central Valley	Presented in Nov meeting
Ignacio 230 kV Substation Shunt Reactor	North Coast and North Bay	Presented in Nov meeting
Metcalf-Evergreen 115 kV Line Reconductoring	Greater Bay Area	Presented in Nov meeting
Moraga-Castro Valley 230 kV Line Capacity Increase Project	Greater Bay Area	Presented in Nov meeting
Ravenswood – Cooley Landing 115 kV Line Reconductor	Greater Bay Area	Presented in Nov meeting
Los Esteros 230 kV Substation Shunt Reactor	Greater Bay Area	Presented in Nov meeting
Gates No. 2 500/230 kV Transformer	Fresno	
Wilson Voltage Support	Fresno	Presented in Nov meeting
Kearney - Herndon 230 kV Line Reconductor	Fresno	
Wheeler Ridge Junction Substation	Kern	
Midway-Temblor 115 kV Line Reconductor and Voltage Support	Kern	Presented in Nov meeting
Wheeler Ridge-Weedpatch 70 kV Line Reconductor	Kern	
Wheeler Ridge Voltage Support	Kern	Presented in Nov meeting

## Projects found to be not needed - Recommended to be canceled

Projects	Planning Area	Comment
Glenn #1 60 kV Reconductoring	North Valley	Presented in Nov meeting
Table Mountain – Sycamore 115 kV Line	North Valley	Presented in Nov meeting
Rio Oso–Atlantic 230 kV Line Project	Central Valley	Presented in Nov meeting
Stagg – Hammer 60 kV Line	Central Valley	Presented in Nov meeting
Napa – Tulucay No. 1 60 kV Line Upgrades	North Coast and North Bay	Presented in Nov meeting
Fulton 230/115 kV Transformer	North Coast and North Bay	
Evergreen-Mabury Conversion to 115 kV	Greater Bay Area	Presented in Nov meeting
Los Esteros-Montague 115 kV Substation Equipment Upgrade	Greater Bay Area	Presented in Nov meeting
San Mateo – Bair 60 kV Line Reconductor	Greater Bay Area	
Cayucos 70 kV Shunt Capacitor	Central Coast and Los Padres	
Watsonville Voltage Conversion Project	Central Coast and Los Padres	
Ashlan - Gregg and Ashlan - Herndon 230 kV Line Reconductor	Fresno	Presented in Nov meeting
Caruthers - Kingsburg 70 kV Line Reconductor	Fresno	Presented in Nov meeting
Kearney - Caruthers 70 kV Line Reconductor	Fresno	Presented in Nov meeting
Reedley-Dinuba 70 kV Line Reconductor	Fresno	
Reedley-Orosi 70 kV Line Reconductor	Fresno	
McCall - Reedley #2 115 kV Line	Fresno	
Oro Loma-Mendota 115 kV Conversion Project	Fresno	
North East Kern Voltage Conversion Project	Kern	

## Projects to Put on Hold for One More Year

Projects	Planning Area
Atlantic-Placer 115 kV Line	Central Valley
Jefferson - Stanford #2 60 kV Line	Greater Bay Area
Midway-Andrew Project	Central Coast and Los Padres
Morrow Bay 230/115 kV Transformer Project	Central Coast and Los Padres
Diablo Canyon Voltage Support Project	Central Coast and Los Padres
Gates-Gregg 230 kV Line	Fresno

## Projects Not Modeled in 2017-2018 TPP Base Cases – Found to be needed with revised scope

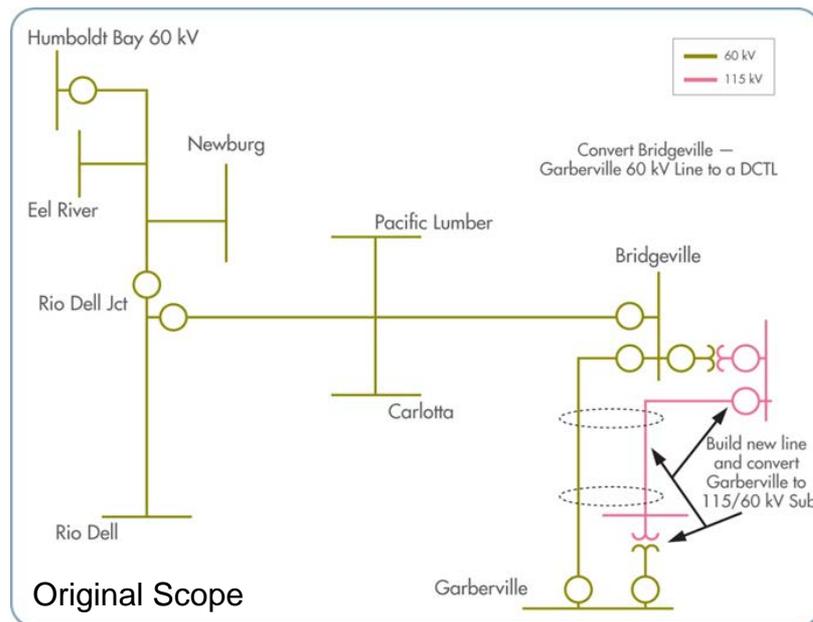
Projects	Planning Area	Comment
New Bridgeville – Garberville No. 2 115 kV Line	Humboldt	
Cottonwood 115 kV Substation Shunt Reactor	North Valley	Presented in Nov meeting
Cascade 115/60 kV No2 Transformer Project and Cascade – Benton 60 kV Line Project	North Valley	Presented in Nov meeting
Cottonwood-Red Bluff No2 60 kV Line Project and Red Bluff Area 230/60 kV Substation Project	North Valley	
Pease 115/60 kV Transformer Addition and Bus Upgrade	Central Valley	Presented in Nov meeting
Rio Oso Area 230 kV Voltage Support	Central Valley	Presented in Nov meeting
Lockeford-Lodi Area 230 kV Development	Central Valley	
Vaca – Davis Voltage Conversion Project	Central Valley	
Mosher Transmission Project	Central Valley	Presented in Nov meeting
Fulton-Fitch Mountain 60 kV Line Reconductor (Fulton-Hopland 60 kV Line)	North Coast and North Bay	Presented in Nov meeting
Clear Lake 60 kV System Reinforcement	North Coast and North Bay	Presented in Nov meeting
Ignacio–Alto 60 kV Line Voltage Conversion	North Coast and North Bay	Presented in Nov meeting
South of San Mateo Capacity Increase	Greater Bay Area	
Spring 230/115 kV substation near Morgan Hill (Morgan Hill Area Reinforcement)	Greater Bay Area	
Northern Fresno 115 kV Area Reinforcement	Fresno	
Borden 230 kV Voltage Support	Fresno	
Wilson 115 kV Area Reinforcement	Fresno	
Oro Loma 70 kV Area Reinforcement	Fresno	
Reedley 115/70 kV Transformer No. 2 Replacement Project	Fresno	
Reedley 70 kV Reinforcement	Fresno	
Kern PP 115 kV Area Reinforcement	Kern	

# Previously-Approved Projects with Revised Scope Not Presented in November Meeting

# Bridgeville-Garberville 60 kV #2 Line

## Original Project Scope:

- Build a new 36 mile Bridgeville – Garberville No.2 115 kV line as a DCTL (built to 115 kV specs) with the existing Bridgeville – Garberville No.1 60 kV Line.
- Build new 115 kV bus and install a 115/60 kV transformer at Garberville substation
- 2011-2012 TPP estimated cost: \$55-65 million
- Current estimated cost: \$80-90 million
- Current In-Service Date: Jan-2024



## Revised Project Scope:

- Generation dispatch at Humboldt Bay Power Plant to address P-1 contingencies
- Reconductor the Humboldt – Rio Dell Jct line from tower 1/2 to tower 3/7, tower 3/12 to tower 6/1, tower 6/6 to 11/4, tower 15/4 to 19/6 (i.e. the 336.4-19 AAC and 4/0-7 AAC sections), which is approximately 13 miles with a WE rating of at least 600 amps.
- Reconductor the Humboldt – Rio Dell Jct Line from Tower 11/4 to 15/5 with a WE rating of at least 600 amps (same conductor as the second item of this project scope).
- Rerate sections of the Rio dell – Bridgeville line to 4 feet per second from Rio Dell Junction (tower 19/6) to Carlotta Substation and Swains Flat substation to Bridgeville Substation.
- Rerate the Bridgeville – Garberville 60 kV Line to 4 feet per second.
- 2017-2018 TPP estimated cost: \$60 million
- In-service date: 2023

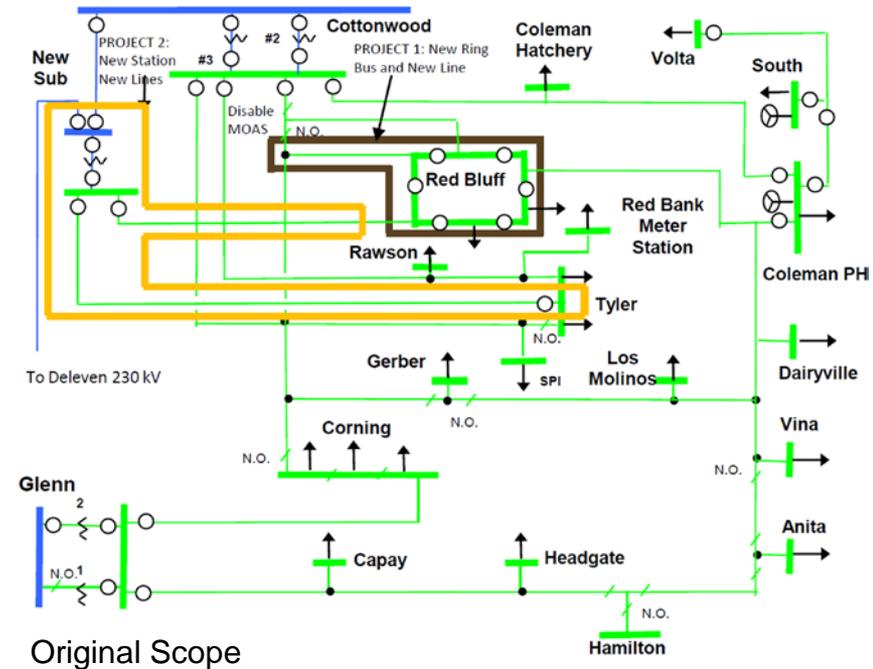
# Cottonwood-Red Bluff No. 2 60 kV Line and Red Bluff 230/60 kV Substation Project

## Original scope:

- Cottonwood-Red Bluff No2 60 kV Line and Red Bluff Area 230/60 kV Substation
- Original estimated cost: \$43-57 million
- Current estimated cost: \$200-300 million

## Revised scope:

- Current need: P1, P2 and P6
- Reconductor Coleman to Red Bluff 60 kV line. PG&E is reconductoring Cottonwood – Red Bluff line as part of their maintenance due to asset condition.
- Install sectionalizing breaker at Cottonwood 60 kV substation
- 2017-2018 TPP estimated cost: \$40 million
- In-service Date: 2021

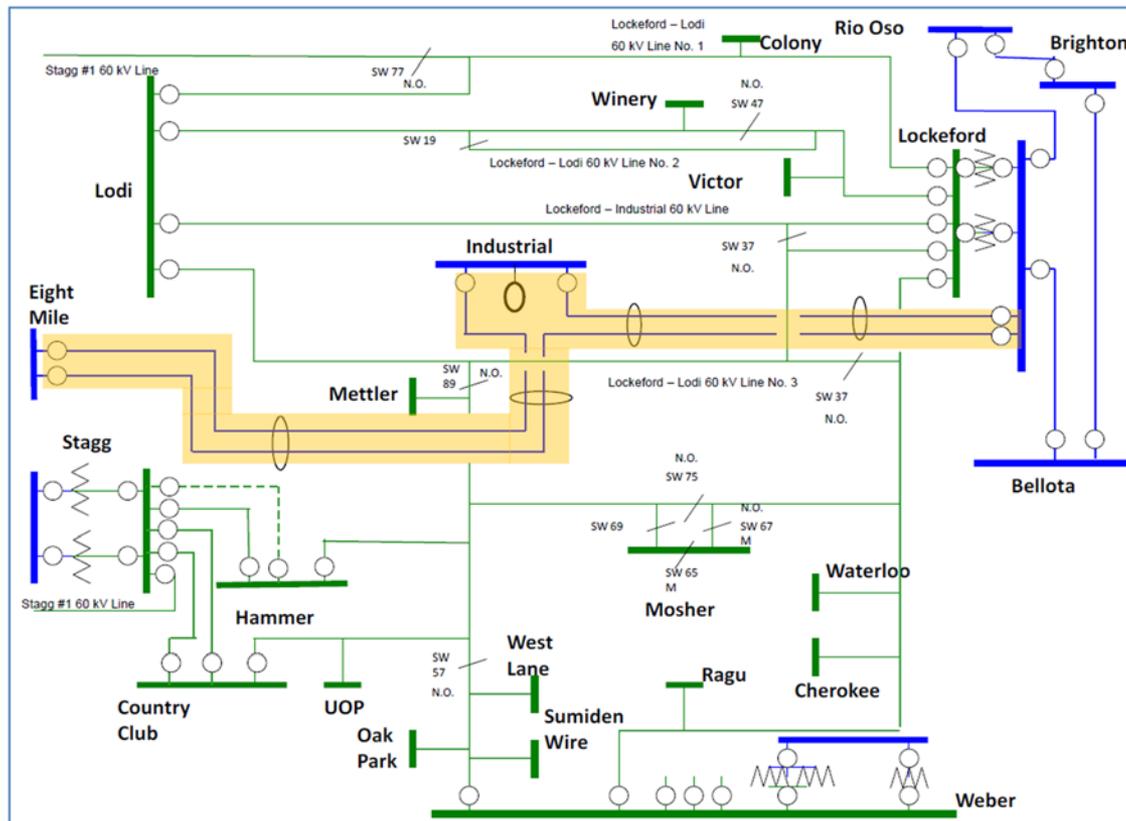


Original Scope

# Lockeford-Lodi Area 230 kV Development Project (1/2)

## Original Scope:

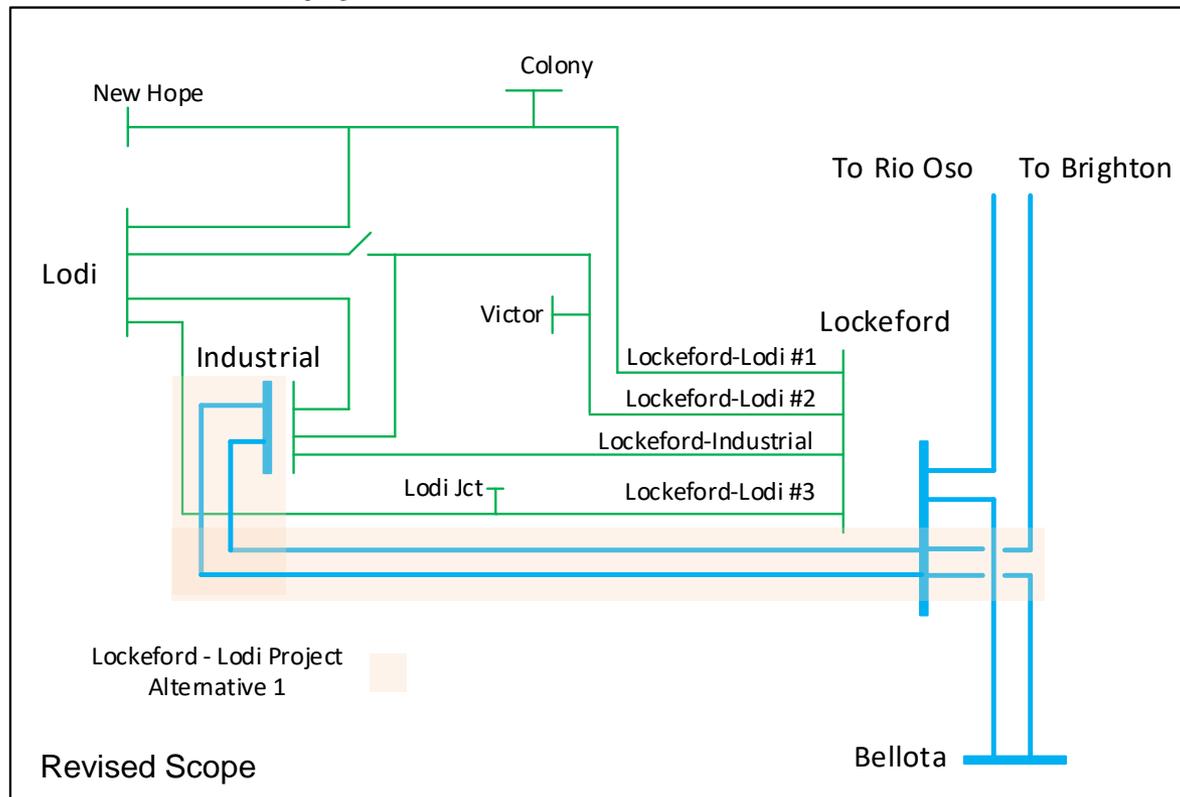
- A double circuit 230 kV line from Lockeford to Eight Mile
- Loop in one of the lines at a new Lodi 230 kV substation.
- 2012-2013 TPP estimated cost: \$80 to 105 million
- Current estimated cost: \$166 million



# Lockeford-Lodi Area 230 kV Development Project (2/2)

## Revised Scope:

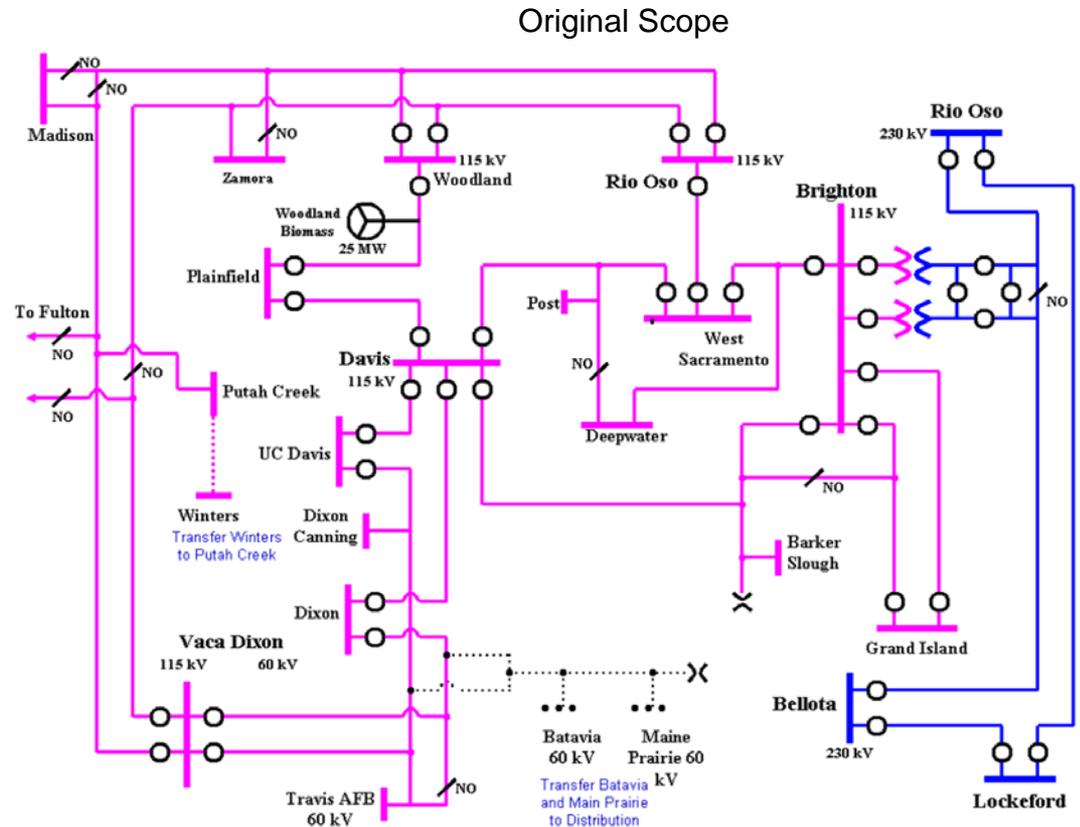
- Current need: P1 voltage and P6 thermal
- Loop-in the Brighton – Bellota 230 kV line into Lockeford substation.
- Approximately 6 miles of double-circuit 230 kV line from Lockeford to a new Industrial 230 kV substation.
- 2017-2018 TPP estimated cost: \$95 million
- In-service Date: 2023



# Vaca-Davis Voltage Conversion Project (1/2)

## Original Scope:

- Convert the 60 kV network between Vaca Dixon to Davis to 115 kV.
- Reconductor and convert the two 60 kV lines to 115 kV operation.
- Reconductor/re-rate four other 115 kV.
- Construct/convert four 115 kV switching station.
- Replace Vaca Dixon 230/115 kV transformer
- 2010-2011 TPP estimated cost: \$70 to \$107 million
- Current estimated cost: \$192 million

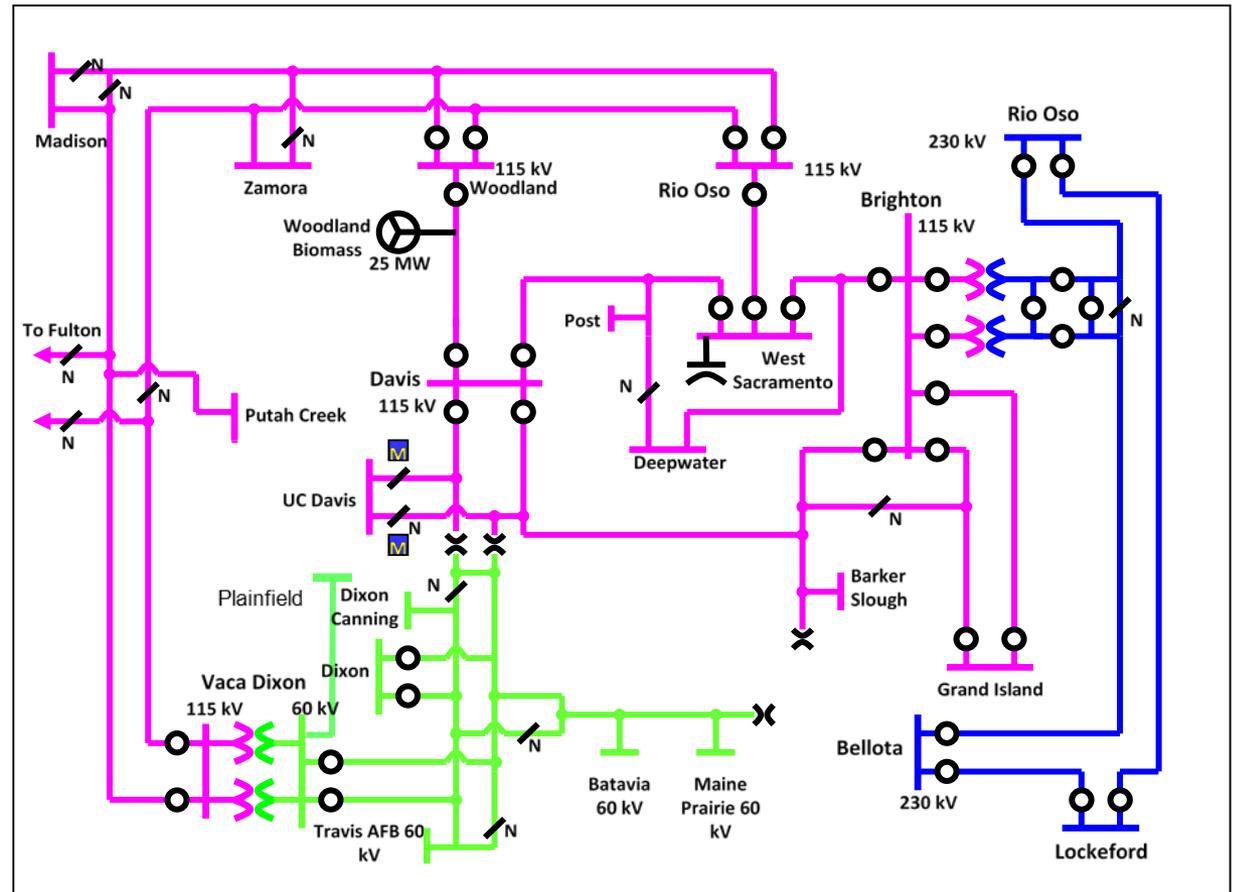


# Vaca-Davis Voltage Conversion Project (2/2)

## Revised Scope:

- Current need: P0 voltage, P1, P2, P6 & P7 thermal
- Add 10 Mvar capacitor at Plainfield 60 kV substation
- Upgrade Vaca Dixon 115/60 kV Transformer bank #5
- Address terminal equipment at Dixon 60 kV substation
- Recommend PG&E to re-rate the 115 kV lines in Davis and West Sacramento areas and address remaining issues by modifying existing SPS or add new SPS.
- 2017-2018 TPP estimated cost: \$15 million
- In-service Date: 2021

Existing System



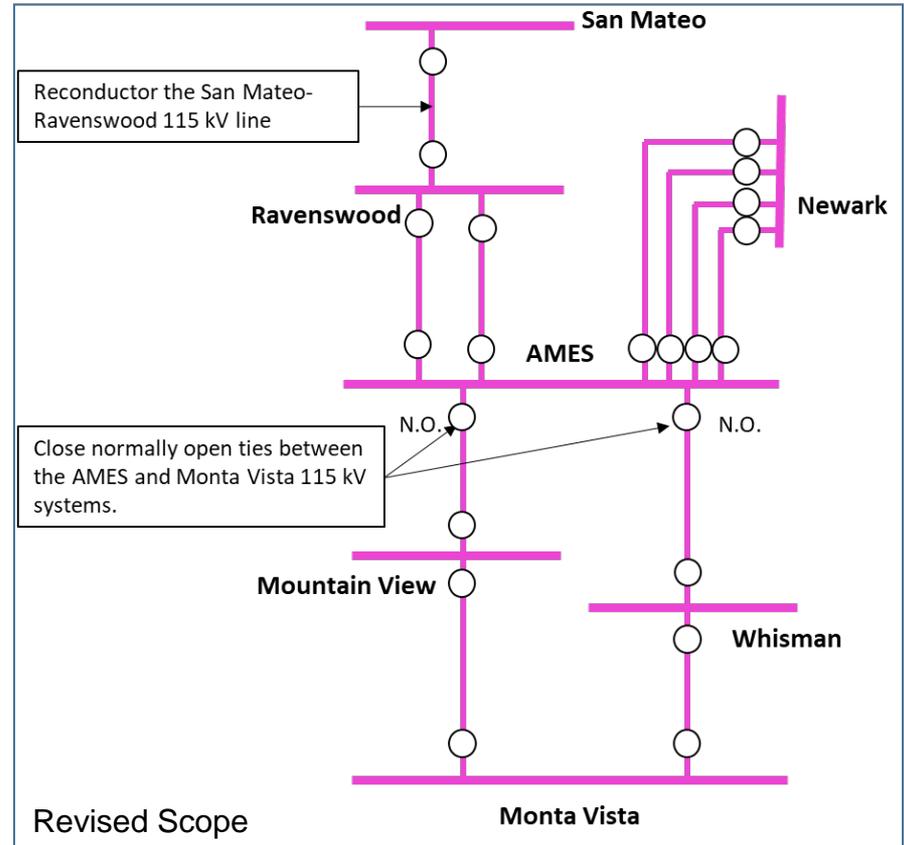
# South of San Mateo Capacity Increase Project

## Original Scope:

- Reconductor the Newark-Ames and San Mateo-Ravenswood 115 kV Lines with higher capacity conductors and substation equipment, as needed.
- 2007 TPP estimated cost: \$10 to 20 million
- Current estimated cost: \$80 to 200 million

## Revised Scope:

- Current need: P6 thermal
- Normally close Monta Vista-AMES 115 kV Path.
- Reconductor San Mateo-Ravenswood 115 kV line
- 2017-2018 TPP estimated cost: \$15 million
- In-service Date:
  - Monta Vista-AMES 115 kV path closing – January 2019
  - San Mateo-Ravenswood Reconductoring – Mar 2026



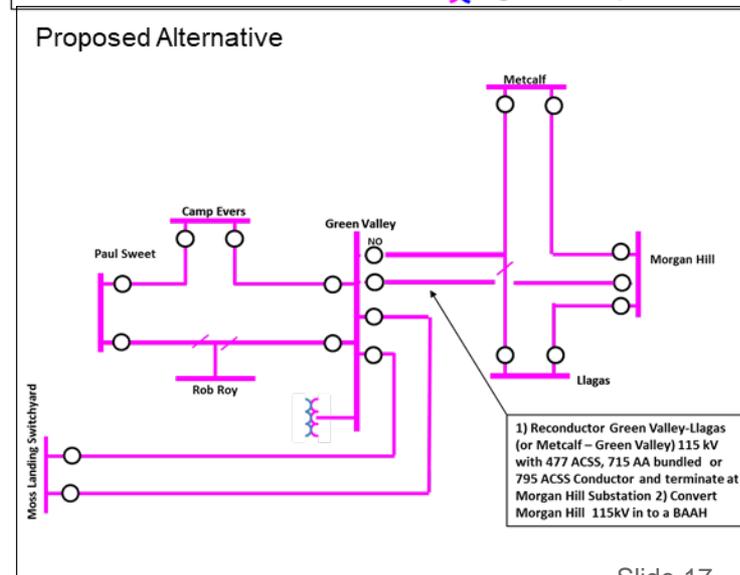
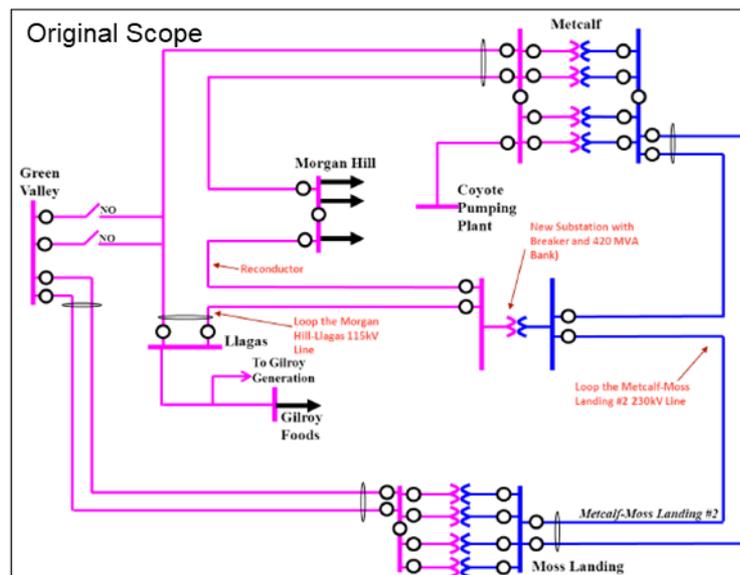
# Morgan Hill Area Reinforcement (Spring) Project

## Original scope:

- Construct new 230/115 kV Spring Substation in Morgan Hill, with connections into the Metcalf-Moss Landing No. 2 230 kV Line and the Morgan Hill-Llagas 115 kV Line.
- Original cost: \$35M-\$45M
- Current estimated cost: \$250M-\$350M
- Current estimated cost of Watsonville project: \$40M-\$70M

## Revised scope:

- Current need: P6 thermal
- Rebuild Metcalf - Green Valley 115kV into the Green Valley - Morgan Hill 115kV (all new structures; 15 miles) and rebuild Morgan Hill 115kV into a BAAH
- Current estimated cost: \$72-104 million
- In-service Date: May 2021



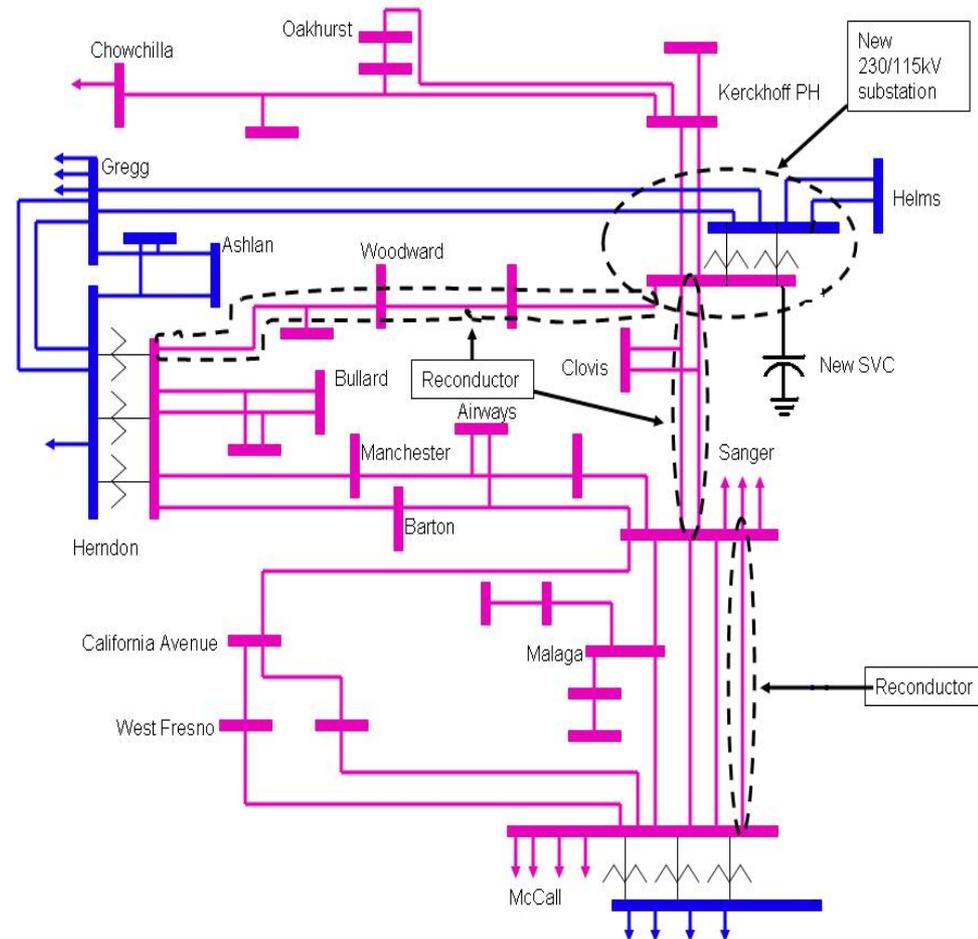
# Northern Fresno 115 kV Area Reinforcement

## Original scope:

- Build new 230/115kV substation northeast of Fresno.
- Reconductor multiple 115kV facilities using existing right of ways ( ROWs). Sectionalize Herndon 230 kV and McCall 230 kV buses.
- 2012-2013 TPP estimated cost: \$110 to 190 Million
- Install one +/- 200 MVAR SVC at the new substation
- Current estimated cost: \$300 to 381 million

## Revised scope:

- Sectionalize Herndon 230 kV and McCall 230 kV buses and develop an operating solution for any incremental P6 overloads.
- 2017-2018 TPP estimated cost: \$26 million
- In-service Date: March 2020



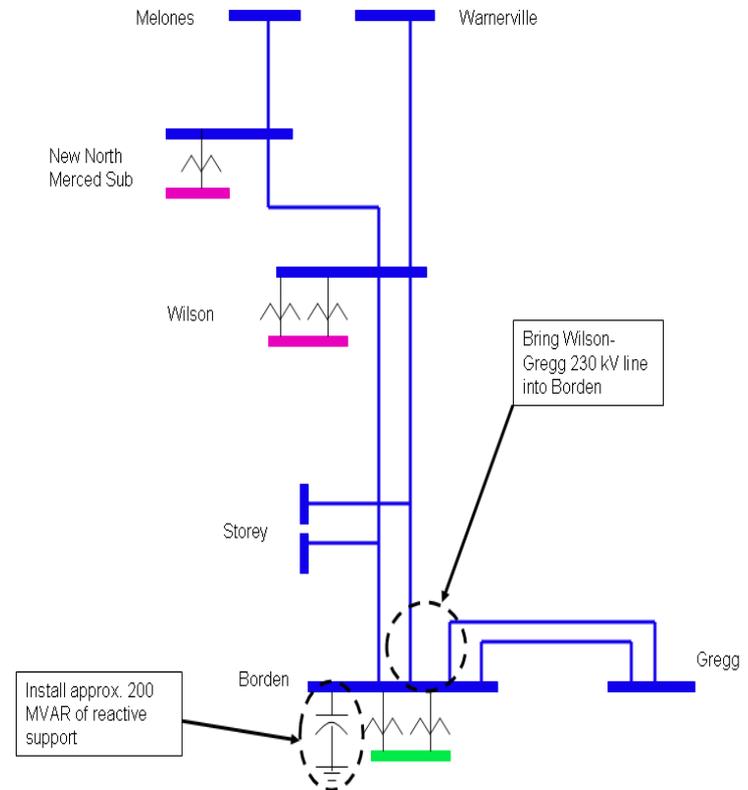
# Borden 230 kV Voltage Support

## Original scope:

- Loop the Wilson-Gregg 230 kV line into Borden substation.
- Install approximately 200 MVAR of reactive support on the 230 kV bus at Borden substation.
- 2011-2012 TPP estimated cost: \$15 to 20 million
- Current estimated cost: \$40 million

## Revised scope:

- Loop the Wilson-Gregg 230 kV line into Borden substation.
- 2017-2018 TPP estimated cost: \$23 million
- In-service Date: February 2019



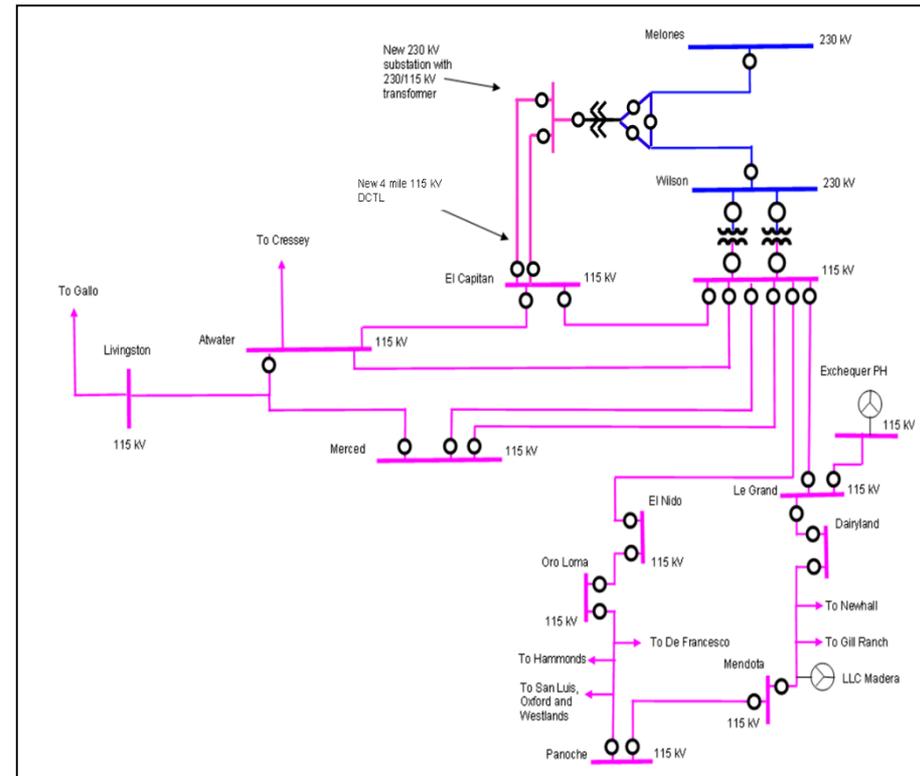
# Wilson 115 kV Area Reinforcement

## Original scope:

- Build a new 230 /115 kV substation.
- Build a 4 mile 115 kV line to El Capitan.
- Reconfigure El Capitan Substation.
- 2010-2011 TPP estimated cost:\$35 to 45 million
- Current estimated cost: \$91 million
- Current In-service date: 2026

## Revised scope:

- Line relocation by 2020 to make room for approved Wilson 115 kV SVC project
- Convert existing Wilson 115 kV bus to breaker and a half configuration.
- Replace limiting equipment on Wilson 230/115 kV Bank #1 to obtain full bank capacity (269 MVA SN, 322.9 MVA SE)
- Install third 230 /115 kV transformer at Wilson
- Replace limiting components and rerate the Atwater-Atwater Junction 115 kV Line section
- 2017-2018 TPP estimated cost: \$71 million
- In-service Date: 2023



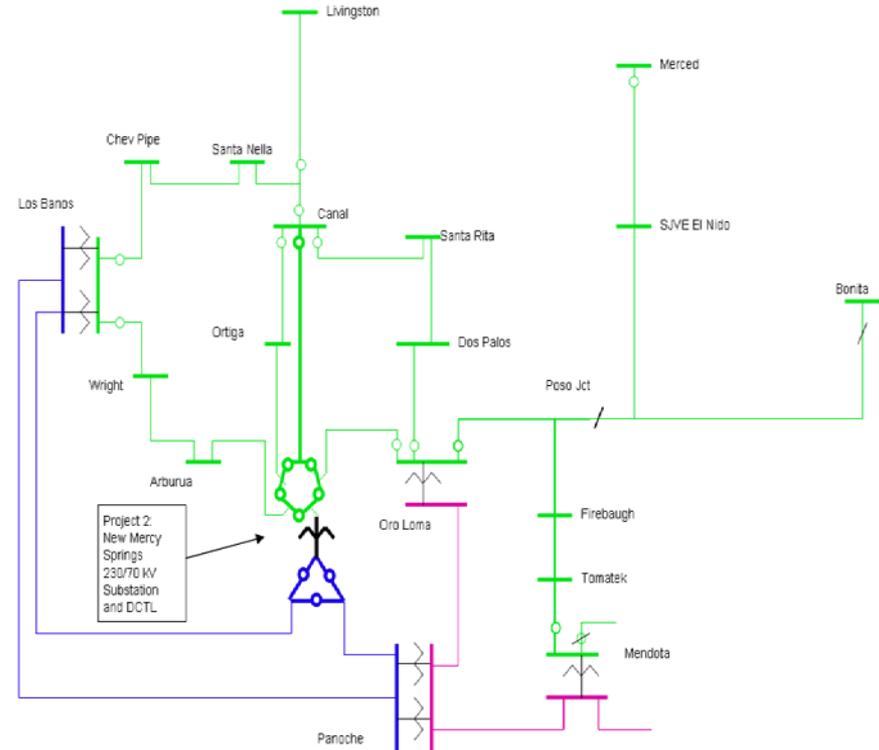
# Oro Loma 70 kV Area Reinforcement

## Original scope:

- Build a new 230/70 kV Mercy Springs Substation looped into the Los Banos – Panoche #2 230 kV Line.
- Install one 200 MVA 230/70 kV transformer
- Install a 70 kV ring bus sectionalizing the Los Banos-Canal-Oro Loma 70 kV Line.
- Rebuild the line from Mercy Springs Junction to Canal as a double circuit tower line.
- 2012-2013 TPP estimated cost: \$110 to 190 million
- Current estimated cost: \$300 to 381 million

## Revised scope:

- Cancel the Oroloma-Mendota 115 kV conversion project
- Maintain seasonal setup on Oro Loma CB 32, and Canal CB 32
- Re-conductor 2.4 miles of the Los Banos-Livingston Jct-Canal 70 kV Line, from Los Banos to Santa Nella
- Re-conductor 10.8 miles of the Mercy Springs SW STA-Canal-Oro Loma 70 kV Line, from Mercy Springs SW STA to Canal
- 2017-2018 TPP estimated cost: \$31 million
- In-service Date: May 2020



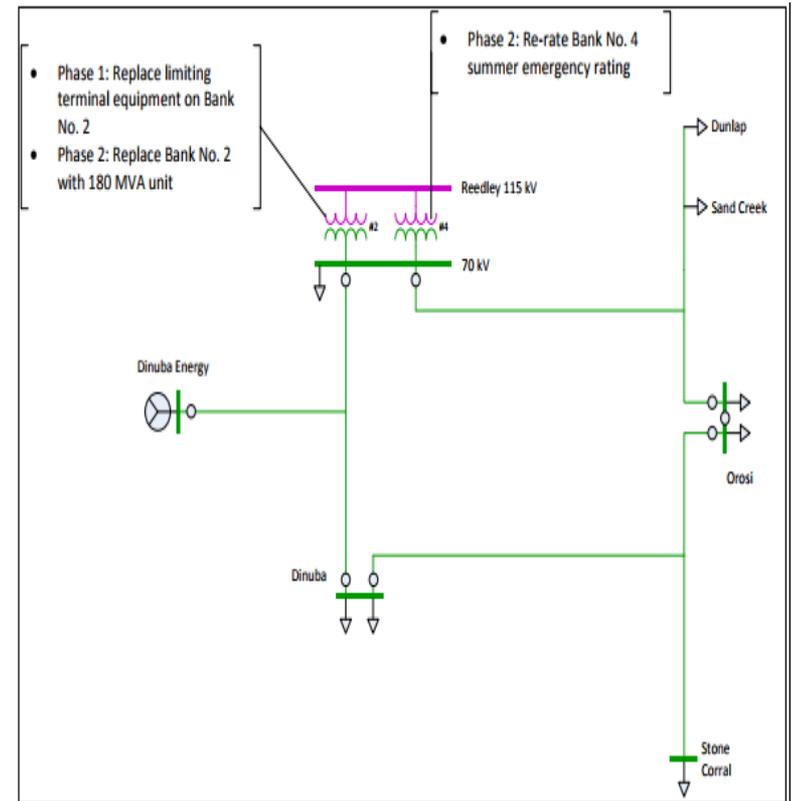
# Reedley 115/70 kV Transformer No. 2 Replacement Project

## Original scope:

- Phase 1: Replace the limiting substation equipment to obtain the full bank rating of existing bank (90 MVA summer normal, and 108 MVA summer emergency).
- Phase 2: Replace the four single-phase transformers comprising the Reedley 115/70 kV Transformer No. 2 with four single phase 60 MVA transformers to obtain a 180 MVA summer normal and 198 MVA summer emergency capacity.
- 2012-2013 TPP estimated cost: \$12 to \$18 million
- Current estimated cost: \$10 to \$15 million

## Revised scope:

- Cancel the replacement of Bank # 2
- Other terminal equipment work to utilize the full rating of the transformer is already completed.
- Project already completed based on the revised scope of work



# Reedley 70 kV Reinforcement

## Original scope:

### Reedley 70 kV Reinforcement

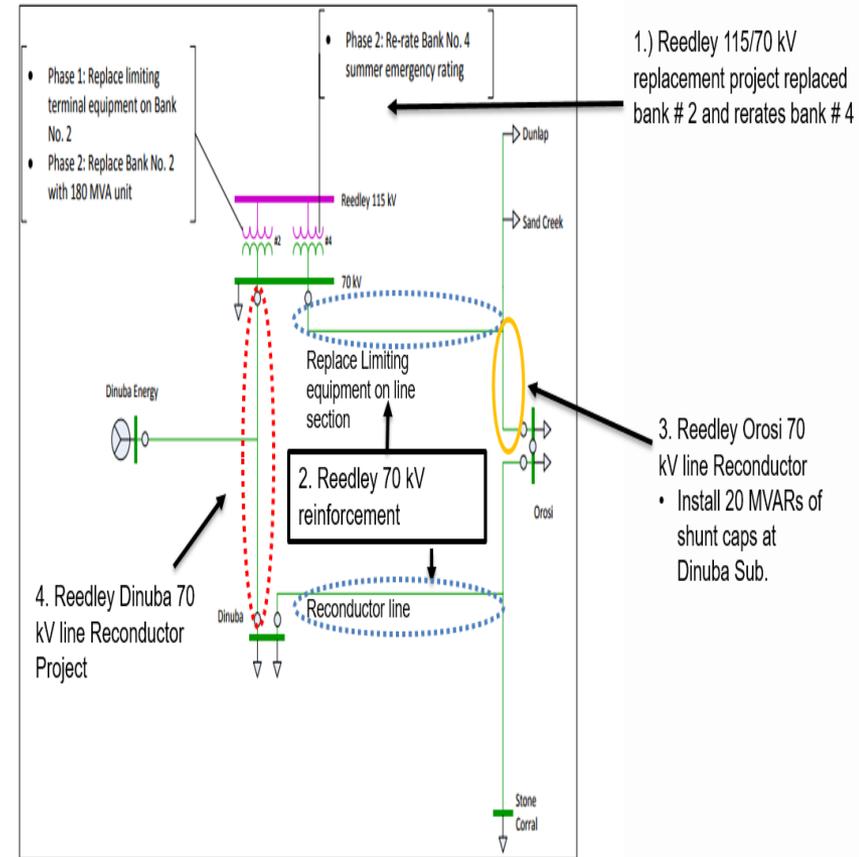
- Replace limiting equipment on the Reedley-Orosi 70 kV Line # 1
- Reconductor 9 miles of the Dinuba-Orosi 70 kV Line #1 from Dinuba to Stone Corral Junction.
- 2010 TPP estimated cost: \$7-10 million
- Current estimated cost: \$5 - 15 million
- Current In-service date: February 2020

### Reedley-Orosi 70 kV Line Reconductor

- Reconductor 2 miles of the Reedley-Orosi 70 kV line from Orosi Jct to Orosi Substation.
  - In addition, 20 MVARs of shunt capacitors will be installed at Dinuba Substation.
- 2010 TPP estimated cost: \$4 million
- Current estimated cost: \$6 million
- Current In-service date: December 2018

### Reedley-Dinuba 70 kV Line Reconductor

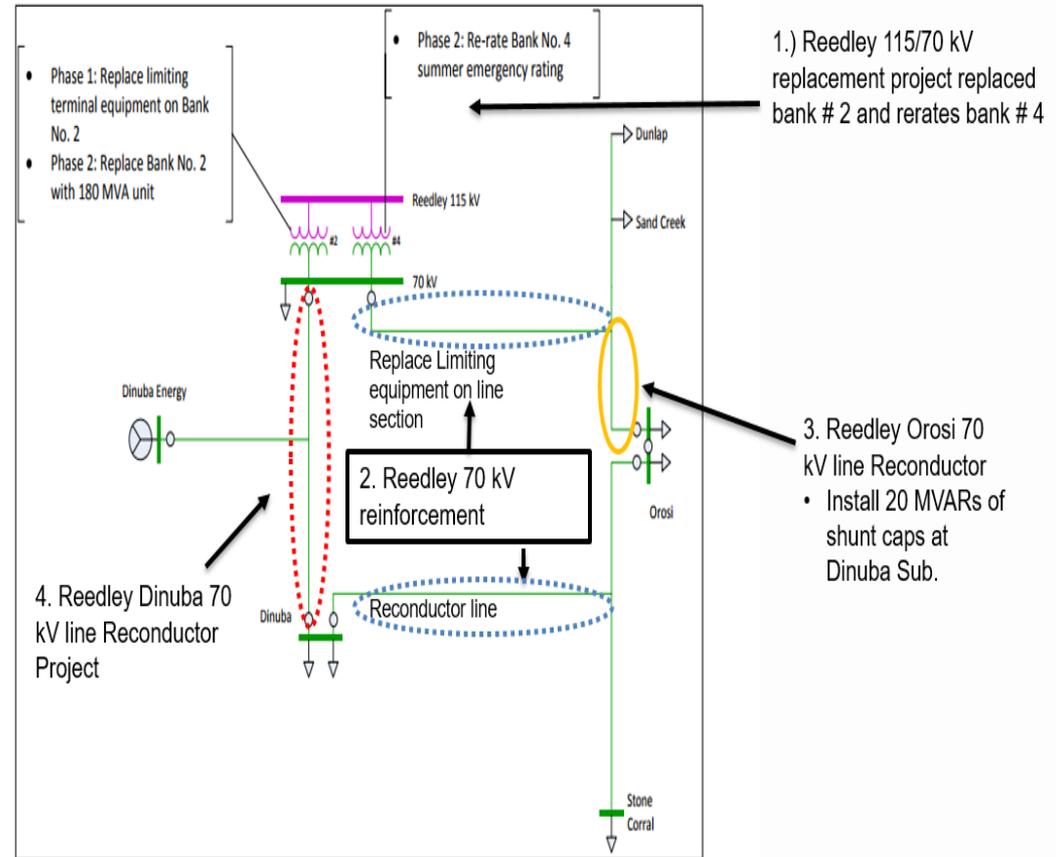
- Reconductor approximately 8 miles of the Reedley Dinuba 70 kV Line
- 2010 TPP estimated cost: \$8 million
- Current estimated cost: \$10 million
- Current In-service date: March 2019



# Reedley 70 kV Reinforcement-Continued

## Revised scope:

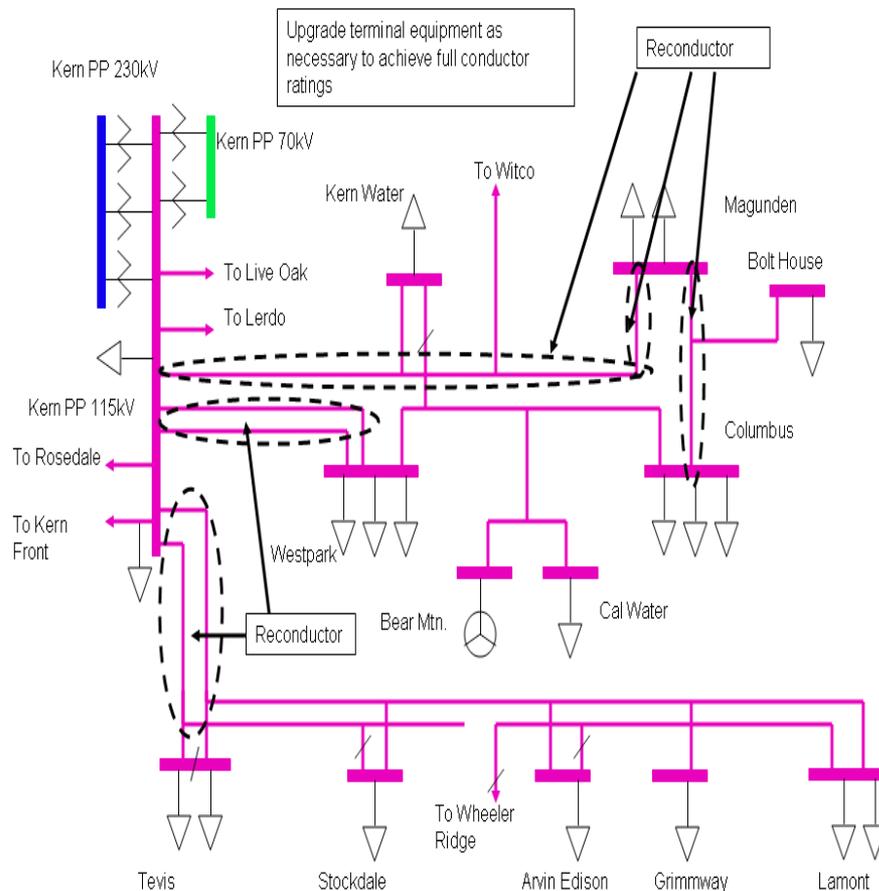
- Install 10 MW 51 MWh Energy Storage device at Dinuba 70 kV substation
  - Energy storage to be a transmission asset.
- Upgrade Dinuba 70 kV substation to accommodate new Energy Storage
- 2017-2018 TPP estimated cost: \$14 million
- In-service Date: 2021



# Kern PP 115 kV Area Reinforcement

## Original Scope

- Reconductor 3.8 miles of the Kern PP-West park #1 115 kV line with 795 ACSS.
- Reconductor 3.8 miles of the Kern PP-Westpark #2 115 kV line with 795 ACSS.
- Reconductor 16.5 miles of the Kern-Magunden-Witco 115 kV line with 795 ACSS.
- Reconductor 3.5 miles of the Westpark-Magunden 115 kV line from Columbus to Magunden with 795 ACSS.
- Reconductor 5.0 miles of the Kern-Lamont 115 kV line from Kern PP to Tevis Jct. with 795 ACSS.
- Reconductor 5.0 miles of the Kern-Stockdale 115 kV line from Kern PP to Tevis Jct. with 795 ACSS.
- 2011-2012 TPP estimated cost: \$40 to 65 million
- Current estimated cost: \$50 to 64 million

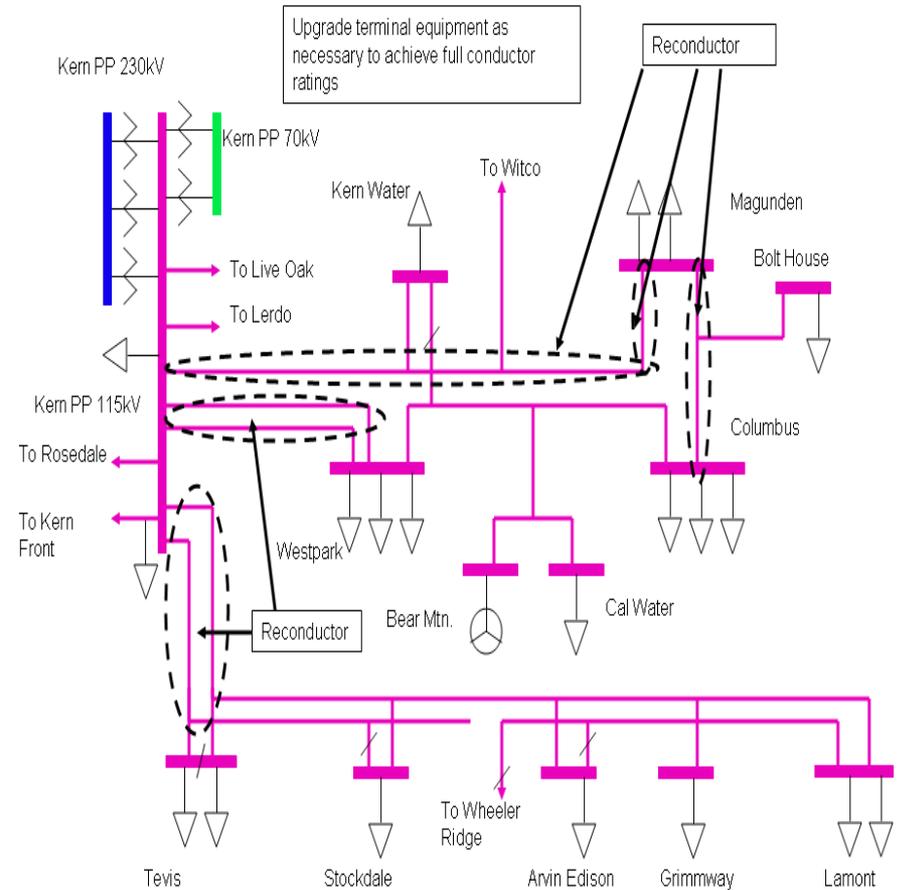


# Kern PP 115 kV Area Reinforcement-Continued

## Revised scope:

- Rerate 9 miles of the Kern-Magunden-Witco 115 kV line (Kern Oil Junction to Magunden) with at least 805 Amp & upgrade Magunden CB122.
- Rerate Kern-Magunden-Witco 115 kV line (Kern Oil Junction to Kern Water & Kern Power to Kern Water) with at least 780 Amp.
- Reconductor 3.5 miles of the West park-Magunden 115 kV line from Columbus to Magunden with 560 Amp.
- Reconductor 6.63 miles of the Kern – Live Oak 115 kV Line with a conductor capable of at least 595 amps during summer emergency conditions. This was originally part of *North East conversion project*.
- Reconductor 4.6 miles of the Live Oak – Kern Oil 115 kV Line with a conductor capable of at least 822 amps during summer emergency conditions. This was originally part of *North East conversion project*.
- 2017-2018 TPP estimated cost: \$24 million
- In-service Date: December 2023

*Note: Revised scope has been updated from the 2017-2018 Draft Transmission Plan*



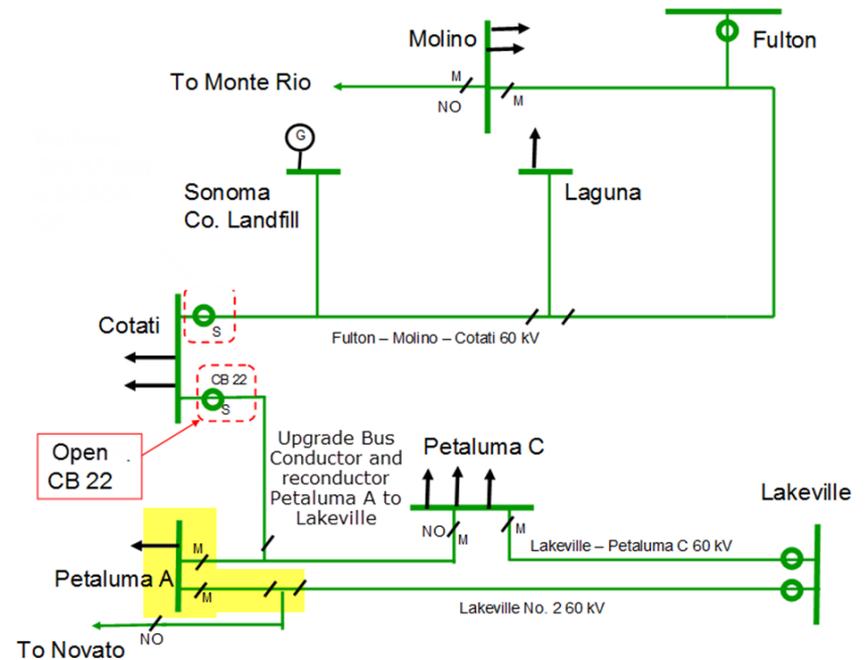
# New Projects Recommended for Approval in 2017-2018 TPP

## New Projects Recommended for Approval in 2017-2018 TPP

Projects	Planning Area	Comment
Shingle Springs Reconfiguration	Central Valley	Presented in Nov meeting
Lakeville 60 kV Area Reinforcement	North Coast and North Bay	
Vaca Dixon-Lakeville 230 kV Corridor Series Compensation	North Coast and North Bay	
Newark-Lawrence 115 kV Line Upgrade	Bay Area	Presented in Nov meeting
Newark-Milipitas #1 115 kV Line Upgrade	Bay Area	Presented in Nov meeting
Trimble-San Jose B 115 kV Line Upgrade	Bay Area	Presented in Nov meeting
Cooley Landing-Palo Alto and Ravenswood-Cooley Landing 115 kV Rerate	Bay Area	
Oakland Clean Energy Initiative Project	Bay Area	
Oil Fields 60 kV Capacitor Bank	Central Coast and Los Padres	Presented in Nov meeting
Herndon-Bullard 115 kV Reconductoring Project	Fresno	

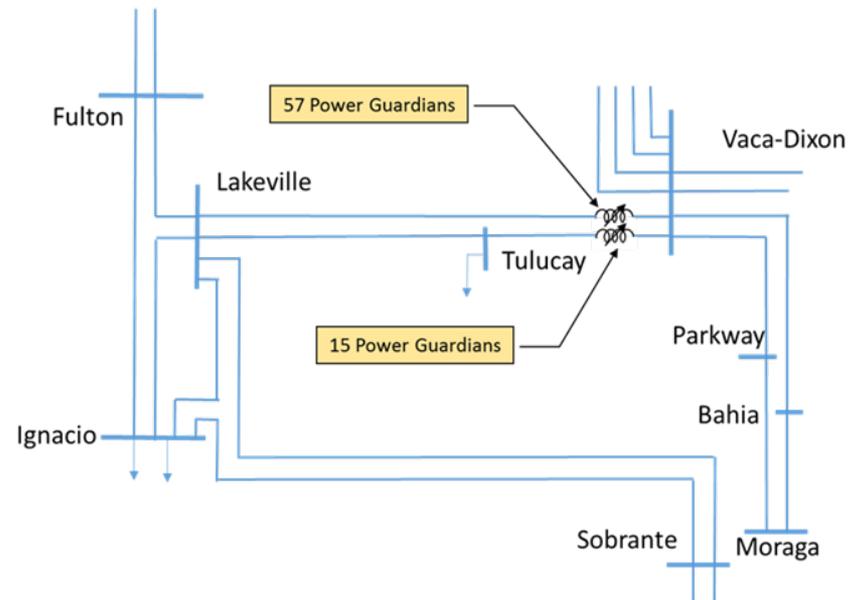
# Lakeville 60 kV Area Reinforcement

- Reliability Assessment Need
  - NERC Category P6 thermal overloads in 2019, 2022 and 2027 summer peak and winter peak scenarios without local generation
- Project Submitter
  - CAISO
- Project Scope
  - Reconductor the line sections on the Lakeville #2 60 kV Line between Petaluma A to Lakeville Junction (tower 4/100) and Cotati to tower 11/236 (approx. 3.39 miles) with 397.5 AAC
  - Upgrade the capacity of the Petaluma A bus conductor with at least a summer emergency (SE) rating of 490 amps (currently, the bus consists of 250 Cu)
  - Upgrade limiting equipment, including terminal equipment and disconnect switches, on the line and buses so that the full capacity of the line can be used.
  - Open 60kV line between Cotati and Petaluma
- Project Cost
  - Current estimated cost: \$7 million
- In-service Date
  - 2021
- Alternatives Considered
  - SPS to drop load
- Recommendation
  - Approval



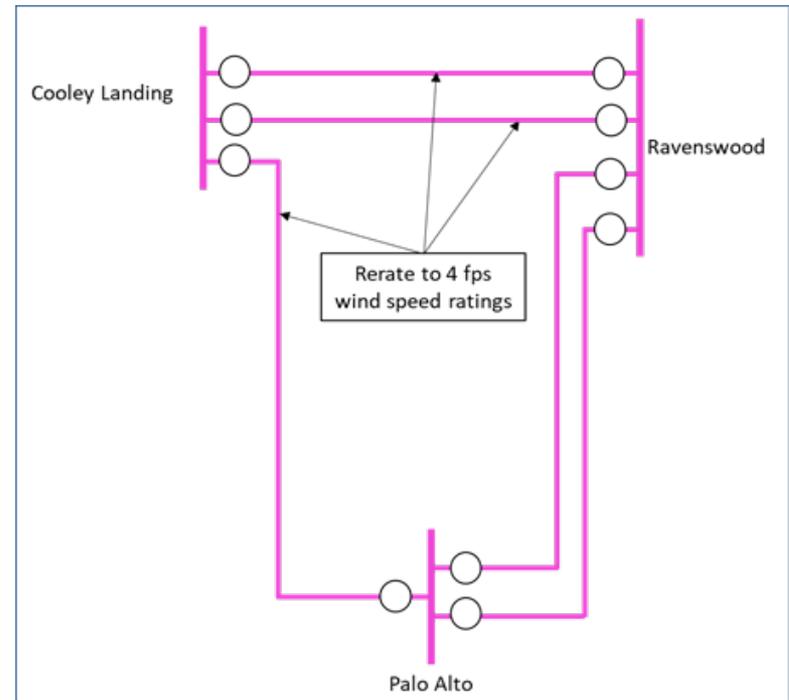
# Vaca Dixon-Lakeville 230 kV Corridor Series Compensation project

- Reliability Assessment Need
  - NERC Category P2 and P6 thermal overloads in 2019, 2022 and 2027 winter peak and Peak Shift study scenarios without local generation
- Project Submitter
  - CAISO
- Project Scope
  - Install series compensation device on these 230 kV lines.
- Project Cost
  - Current estimated cost: \$11 million
- In-service Date
  - October 2019
- Alternatives Considered
  - Smart Wires in 2017 Request Window
  - SPS to drop load
- Recommendation
  - Approval



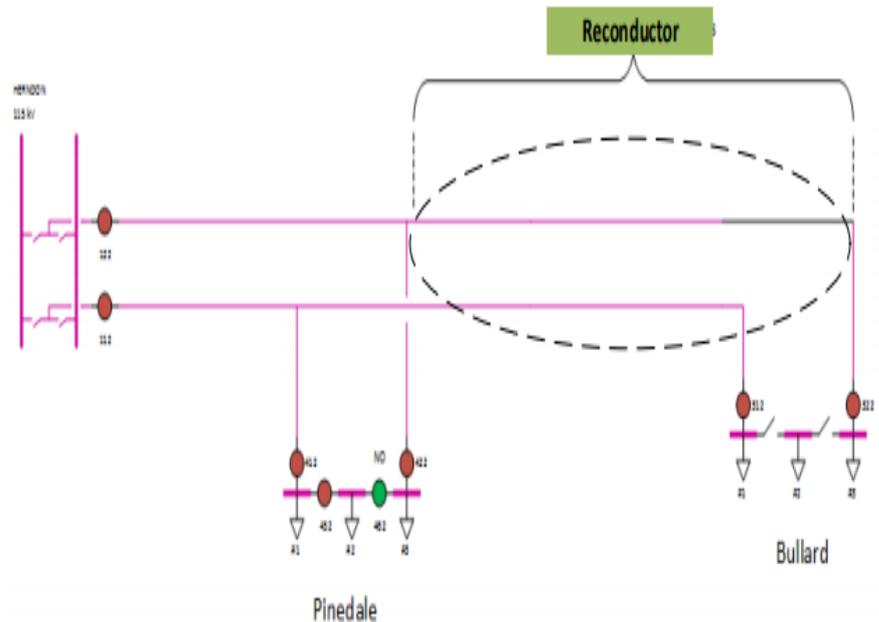
# Cooley Landing-Palo Alto and Ravenswood-Cooley Landing 115 kV Rerate

- Reliability Assessment Need
  - NERC Category P2, P6 and P7 thermal overloads
- Project Submitter
  - CAISO
- Project Scope
  - Rerate Cooley Landing-Palo Alto and Ravenswood-Cooley Landing 115 kV lines to 4 fps wind speed ratings.
- Project Cost
  - Current estimated cost: \$1 million
- In-service Date
  - February 2019
- Alternatives Considered
  - None
- Recommendation
  - Approval



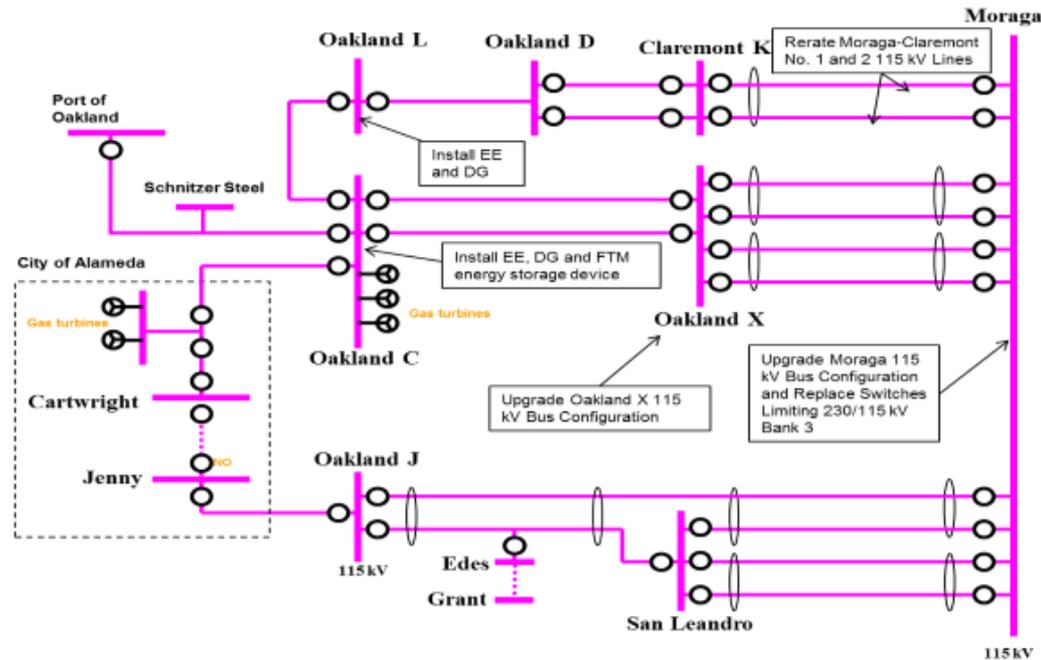
# Herndon-Bullard 115 kV Reconductoring Project

- Reliability Assessment Need
  - NERC Categories P2 & 2-1 thermal overload in baseline and sensitivity scenarios.
  - Overloads worsen in 2027 peak-shift and high CEC forecast sensitivities.
- Project Submitter
  - PG&E
- Project Scope
  - Reconductor ~6 circuit miles (3 miles of double circuit transmission lines) between Pinedale Junction and Bullard Substation on the Herndon-Bullard #1 and #2 115kV Lines.
- Project Cost
  - Current estimated cost: \$6 - \$8 million
- Alternatives Considered
  - Energy Storage was not considered due to expected high costs as compared to reconductoring
- Recommendation
  - Approval



# Oakland Clean Energy Initiative

- Reliability Assessment Need
  - NERC Category P2 and P6 thermal overloads in baseline and sensitivity scenarios without local generation
- Project Submitter
  - PG&E
- Project Scope
  - Rerate
  - Substation upgrade
  - Front-of-the-meter energy storage
  - Preferred resources
- Project Cost
  - Estimated Capital Cost: \$56-73<sup>1</sup> (2022 \$M)
  - Expected PVRR: \$102<sup>2</sup> (2022 \$M)
- Alternatives Considered
  - Generation: \$232 (2022 \$M)
  - New 115 kV Transmission: \$193-217 (2022 \$M)
  - New 230 kV Transmission: \$280-300 (2017 \$M)
  - 40MW BESS: \$60 (2022 \$M)
- Recommendation
  - Approval
  - Requires ISO Board approval (>\$50M)



## Notes:

- 1 Proportion of capital to contract spend will be determined by the most cost effective portfolio determined through the RFO
- 2 Calculated using unit costs of the expected portfolio, including land and O&M as appropriate

# Alternative Comparison

Projects Comparison				
Submitter	Scope	In-Service Date	Mitigates Reliability Concerns?	Comment
PG&E	Rerate	Aug-22	Yes	Mitigates all reliability issues identified. Continued reliance on existing load switching capabilities following the first N-1 contingency for N-1-1 contingency condition.
	Substation upgrades			
	10MW / 4 hour Energy Storage			
	Portfolio of DERs (DG, EE, DR)			
NEER	40MW / 4 hour Battery Energy Storage	Dec-22	No	Doesn't mitigate all reliability issues identified. Submitted as part of a wider solution to all the reliability issues identified in the Oakland area.
NEET	230 kV overhead line from Moraga close to Claremont (~4 miles)	Dec-23	No	C-X 2 and D-L overloads unresolved.
	230 kV underground line from close to Claremont to new Oakland C 230 kV substation (~5.4 miles)			
	Oakland C 230/115 kV autotransformer connecting to the existing PG&E's Oakland C 115 kV substation			
	230 kV overhead line from Sobrante close to Claremont (~5 miles)	Dec-23	No	C-X 2 and D-L overloads unresolved.
	230 kV underground line from close to Claremont to new Oakland C 230 kV substation (~5.4 miles)			
	Oakland C 230/115 kV autotransformer connecting to the existing PG&E's Oakland C 115 kV substation			

# Alternative Cost Comparison

	Estimated Cost (2022 \$M)	Expected PVRR (2022 \$M)
OCEI	\$56-\$73 <sup>1</sup>	\$102 <sup>2</sup>
115 kV	\$193-\$217	\$367 <sup>3</sup>
230 kV	\$316	\$574 <sup>4</sup>
Generation	\$232	\$368 <sup>5</sup>

Notes:

- 1 Proportion of capital to contract spend will be determined by the most cost effective portfolio determined through the RFO
- 2 Calculated using unit costs of the expected portfolio, including land and O&M as appropriate
- 3 Based on the \$193 capital estimate assuming 2022 installation date
- 4 Based on the capital estimate assuming 2022 installation date
- 5 Based on the capital estimate assuming 2022 installation date

# 2017 Request Window Submissions

Ref. #	Project Name	Submitted by	In-Service Date	Cost (\$M)	ISO Recommendation
1	California High-Speed Rail Project Load Interconnection	PG&E	2020	737	Concur (Load interconnection)
2	Oakland Clean Energy Initiative	PG&E	2022	56	Approve
3	Oil Fields 60 kV Voltage Support	PG&E	2022	7	Approve
4	Herndon-Bullard 1 and 2 115 kV Reconductoring	PG&E	2021	6-8	Approve
5	Wellhead Merchant Transmission Line	WellHead	2018	NA	No reliability concerns identified with this merchant transmission facility.
6	Alto 45 MW & Las Gallinas 22 MW Battery Energy Storage Systems (BESS)	NEER	2022	100	Lower cost alternative of transmission upgrade recommended.
7	Oakland 40 MW Battery Energy Storage System (BESS)	NEER	2022	60	Doesn't address all reliability issues identified. Project that mitigates all reliability issues recommended.
8	Lodi 40MW Battery Energy Storage System (BESS)	NEER	2022	60	Doesn't address all reliability issues identified. Project that mitigates all reliability issues recommended.
9	Lockeford - Industrial Transmission Reliability Project	NEET West	2022	30	Doesn't address all reliability issues identified. Project that mitigates all reliability issues recommended.
10	Lopez to Divide 500/230 kV Transmission System	NEET West	2023	100	Doesn't address all reliability issues identified. Project that mitigates all reliability issues is currently on hold.
11	Oakland 230 kV Transmission System (Moraga-Oakland C)	NEET West	2023	280	Doesn't address all reliability issues identified and also higher cost. Project that mitigates all reliability issues and is lower cost is recommended..
12	Oakland 230 kV Transmission System (Sobrante-Oakland C)	NEET West	2023	300	Doesn't address all reliability issues identified and also higher cost. Project that mitigates all reliability issues and is lower cost is recommended..
13	Round Mountain Dynamic Reactive 500 kV Transmission System	NEET West	2023	80	Continuing to assess the bulk system reactive needs after the retirement of the Diablo generation in the 2018-2019 transmission planning process.
14	Vaca Dixon – Lakeville Corridor Smart Wires Project	Smart Wires	2018-2027	8.5 - 11	Feasible alternative for the Vaca-Lakeville 230 kV Corridor Series Compensation project.
15	Metcalfe - Evergreen No. 1 115 kV Smart Wires Project	Smart Wires	2021	1.0 – 1.5	Doesn't address all reliability issues identified. Project that mitigates all reliability issues recommended.
16	Feather River Energy Center Clutch	Calpine	2019	6-7	Need addressed by other previously approved project. This project does not eliminate the need or reduce the scope of the previously approved project.
17	TBC Bi-Directional flow control Upgrade	TBC	2020	15	Need addressed by other previously approved project.
18	NRS-Scott No. 2 115 kV Line Reconductor	SVP	2018	2-4	Previously approved project rescope to include reconductoring of the NRS-Scott #2 line.

# Questions?

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## Next Steps

Draft 2017-2018 Transmission Plan and  
transmission project approval recommendations

*Kristina Osborne*

*Senior Stakeholder Engagement and Policy Specialist*

*2017-2018 Transmission Planning Process Stakeholder Meeting  
February 8, 2018*

# 2017-2018 Transmission Planning Process

## Next Steps

- Comments due February 22, 2018
  - [regionaltransmission@caiso.com](mailto:regionaltransmission@caiso.com)
- ISO Board Meeting on March 21-22, 2018

# THANK YOU

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