Agenda
Reliability Assessment and Study Updates

Jody Cross

Stakeholder Engagement and Policy Specialist

2018-2019 Transmission Planning Process Stakeholder Meeting

September 20-21, 2018

2018-2019 Transmission Planning Process Stakeholder Meeting – Day 1 (September 20) Agenda

Topic	Presenter
Introduction	Jody Cross
Overview	Jeff Billinton
Key Issues	Neil Millar
Reliability Assessment - North	Regional Transmission Engineers - North
Reliability Assessment - South	Regional Transmission Engineers - South
Consideration of Storage as a Transmission Asset	Neil Millar
Next Steps	Jody Cross

2018-2019 Transmission Planning Process Stakeholder Meeting – Day 2 (September 21) Agenda

Topic	Presenter
GridLiance Proposed Reliability Solutions	GridLiance
SDG&E Proposed Reliability Solutions	SDG&E
PG&E Proposed Reliability Solutions	PG&E
Policy Assessment Update	Sushant Barave
Inter-regional Process Update	Gary DeShazo
Economic Study Assumptions and PCM Development	Yi Zhang
LCR 10-Year Assessments	Regional Transmission Engineers
Economic Valuing of Local Capacity Requirements	Jeff Billinton
Special Study – PNW Study Update	Ebrahim Rahimi
Wrap-up and Next Steps	Jody Cross

Introduction and Overview
Preliminary Reliability Assessment Results

Jeff Billinton
Manager, Regional Transmission - North

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

2018-2019 Transmission Planning Process

January 2018 | April 2018 | March 2019

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

ISO Board for approval of transmission plan

California ISO

The reliability assessment is a key component of the overall 2018-2019 Transmission Plan Study Plan

- Reliability Assessment to identify reliability-driven needs
  - CPUC IRP default portfolio used for reliability assessment
  - Load forecast based on California Energy Demand Revised Forecast 2018-2030 adopted by California Energy Commission (CEC) on February 21, 2018
- This is foundational to other aspects of the plan, which continues to evolve in each cycle:
  - Policy Assessment
  - Economic Planning Study to identify economically-driven elements
  - Interregional Transmission Planning Process (new section)
  - Other Studies
    - Local Capacity Requirements (near term, mid term, long term)
    - Long-term Congestion Revenue Rights
    - Frequency Response
  - Special Studies

2018-2019 Ten Year Reliability Assessment To Date

- Preliminary study results were posted on August 15
  - Based on assumptions identified in 2018-2019 Study Plan
  - Satisfy requirements of:
    - NERC Reliability Standards
    - WECC Regional Criteria
    - ISO Planning Standards
- Transmission request window (reliability driven projects) opened on August 15
  - PTO proposed mitigations submitted to ISO by September 15

2018-2019 Ten Year Reliability Assessment going forward

- Comments on Stakeholder Meeting due October 5
- Request Window closes October 15
  - Request Window is for alternatives to reliability assessment
- ISO recommended projects:
  - For management approval of reliability projects less than $50 million will be presented at November stakeholder session
  - For Board of Governor approval of reliability projects over $50 will be included in draft plan to be issued for stakeholder comments by January 31, 2019
- Purpose of today's stakeholder meeting
  - Review the results of the reliability analysis
  - Set stage for stakeholder feedback on potential mitigations

Critical Energy Infrastructure Information

- The ISO is constantly re-evaluating its CEII practices to ensure they remain sufficient going forward.
- Continuing with steps established in previous years:
  - Continuing to not post extreme event contingency discussions in general - only shared on an exception basis where mitigations are being considered:
    - Details on secure web site
    - Summaries on public site
  - Continuing to migrate previous planning cycles material to the secure website.
- One “bulk system” presentation has also been posted on the secure site.

2018-2019 Transmission Plan Milestones

- Draft Study Plan posted on February 22
- Stakeholder meeting on Draft Study Plan on February 28
- Comments to be submitted by March 14
- Final Study Plan to be posted on March 31
- Preliminary reliability study results to be posted on August 15
- Stakeholder meeting on September 20 and 21
- Comments to be submitted by October 5
- Request window closes October 15
- Preliminary policy and economic study results on November 16
- Comments to be submitted by November 30
- Draft transmission plan to be posted on January 31, 2019
- Stakeholder meeting in February
- Comments to be submitted within two weeks after stakeholder meeting
- Revised draft for approval at March Board of Governor meeting

Study Information

- Stakeholder comments to be submitted by October 5
  - Stakeholder comments are to include potential alternatives for economic LCR assessment
  - Stakeholders requested to submit comments to: regionaltransmission@caiso.com
  - Stakeholder comments are to be submitted within two weeks after stakeholder meetings
  - ISO will post comments and responses on website

Key Issues for the 2018-2019 Transmission Plan
Transmission Planning Process

Neil Millar

Executive Director, Infrastructure Development

2018-2019 Transmission Planning Process Stakeholder Meeting

September 20-21, 2018

Key Issues (continued)

- Forecast coordination is continuing with CPUC and CEC, with focus on renewable integration issues – both in-front-of and behind-the-meter resources
  - Stakeholder concerns expressed re retirement assumptions for generators “falling off” contracts in reliability studies
  - Consideration of storage in this cycle needs to consider status of stakeholder effort re storage providing both regulated transmission service and also market services (SATA) – see later presentation
- Policy Assessment
  - RPS portfolio direction for 2018-2019 transmission planning process was received from the CPUC/CEC
  - No base portfolio was transmitted for the policy-driven assessment
  - The IRP 42 MMT Scenario portfolio will be studied as a sensitivity in the 2018-2019 TPP policy-driven assessment to identify Category 2 transmission based on the CPUC IRP Reference System Plan

Key Issues in 2018-2019 Transmission Plan Cycle

- Preparation for economic study results are underway
  - Re major economic study being focused on local capacity areas – needs are being discussed today, not potential mitigations
  - Economic study modeling parameters are being discussed today
    - A key topic for stakeholder feedback is how to value reducing the local capacity requirements in an area?
- Interregional transmission planning process being documented in a separate chapter in this cycle and going forward.
  - Interregional projects will be addressed as per tariff-defined processes
  - The ISO is not planning additional “special study” efforts at this time focusing on out-of-state renewables

Special study Issues in 2018-2019 Transmission Plan Cycle

- Special studies targeting:
  - ISO support for CPUC proceeding re Aliso Canyon
  - Potential for increasing opportunities for transfers of low carbon electricity with the PAC Northwest, and for PAC Northwest Hydro to play role in reducing dependence on resources impacted by Aliso Canyon
- In addition to previously identified special studies,
  - Updating the assessment of the ***system*** risks to reliability of economically driven early retirement of gas fired generation – using the 42 MMT Scenario portfolio from the CPUC IRP Reference System Plan
  - <u>May</u> also revisit production cost modeling benefits of large storage as a simple sensitivity

Humboldt
Preliminary Reliability Assessment Results

Emily Hughes
Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Humboldt Area

- 3000 sq. mile area located NW corner of PG&E service area
- Cities include
  - Eureka
  - Arcata
  - Garberville
- Transmission facilities: 115 kV from Cottonwood and 60 kV – from Mendocino

Load and Load Modifier Assumptions - HUMB Area

Study Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
					Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
HMB-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	116	2	19	1	112	4	3
HMB-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	122	5	32	0	117	4	3
HMB-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	130	9	48	0	121	4	3
HMB-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – weekend morning.	76	2	19	15	59	4	3
HMB-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – weekend morning.	77	3	32	26	47	4	3
HMB-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	145	2	19	0	143	4	3
HMB-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	139	4	32	0	134	4	3
HMB-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	163	9	48	0	155	4	3
HMB-2023HS-SP-P7	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	121	0	32	0	120	4	3
HMB-2020-HR-P7	Sensitivity	2020 summer peak load conditions with hi renewable dispatch sensitivity	81	2	19	19	59	4	3
HMB-2023-HR-P7	Sensitivity	2023 summer peak load conditions with hi renewable dispatch sensitivity	77	3	32	31	42	4	3

Note: Includes PG&E load only. DR and storage are modeled offline in starting base cases.

Generation Assumptions - HUMB Area

Study Case	Scenario Type	Description	Solar		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
HMB-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	5	0	259	176
HMB-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	5	0	259	174
HMB-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	5	0	259	175
HMB-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – weekend morning.	0	0	0	0	5	0	259	65
HMB-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – weekend morning.	0	0	0	0	5	0	259	25
HMB-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	5	0	259	172
HMB-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	5	0	259	173
HMB-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	5	0	259	172
HMB-2023HS-SP-P7	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	0	0	0	0	5	0	259	90
HMB-2020-HR-P7	Sensitivity	2020 summer peak load conditions with hi renewable dispatch sensitivity	0	0	0	0	5	0	259	164
HMB-2023-HR-P7	Sensitivity	2023 summer peak load conditions with hi renewable dispatch sensitivity	0	0	0	0	5	0	259	29

Note: Includes PG&E load only. DR and storage are modeled offline in starting base cases.

Previously approved transmission projects modelled in base cases

Project Name	First Year Modeled
Maple Creek Reactive Support (Install 10 Mvar SVC at Maple Creek Sub)	2022

Previously approved transmission projects not modelled in base cases (on-hold)

Project Name	First Year Modeled
New Bridgeville – Garberville No. 2 115 kV Line	NA

Reliability assessment preliminary results summary

HUMB – Results Summary

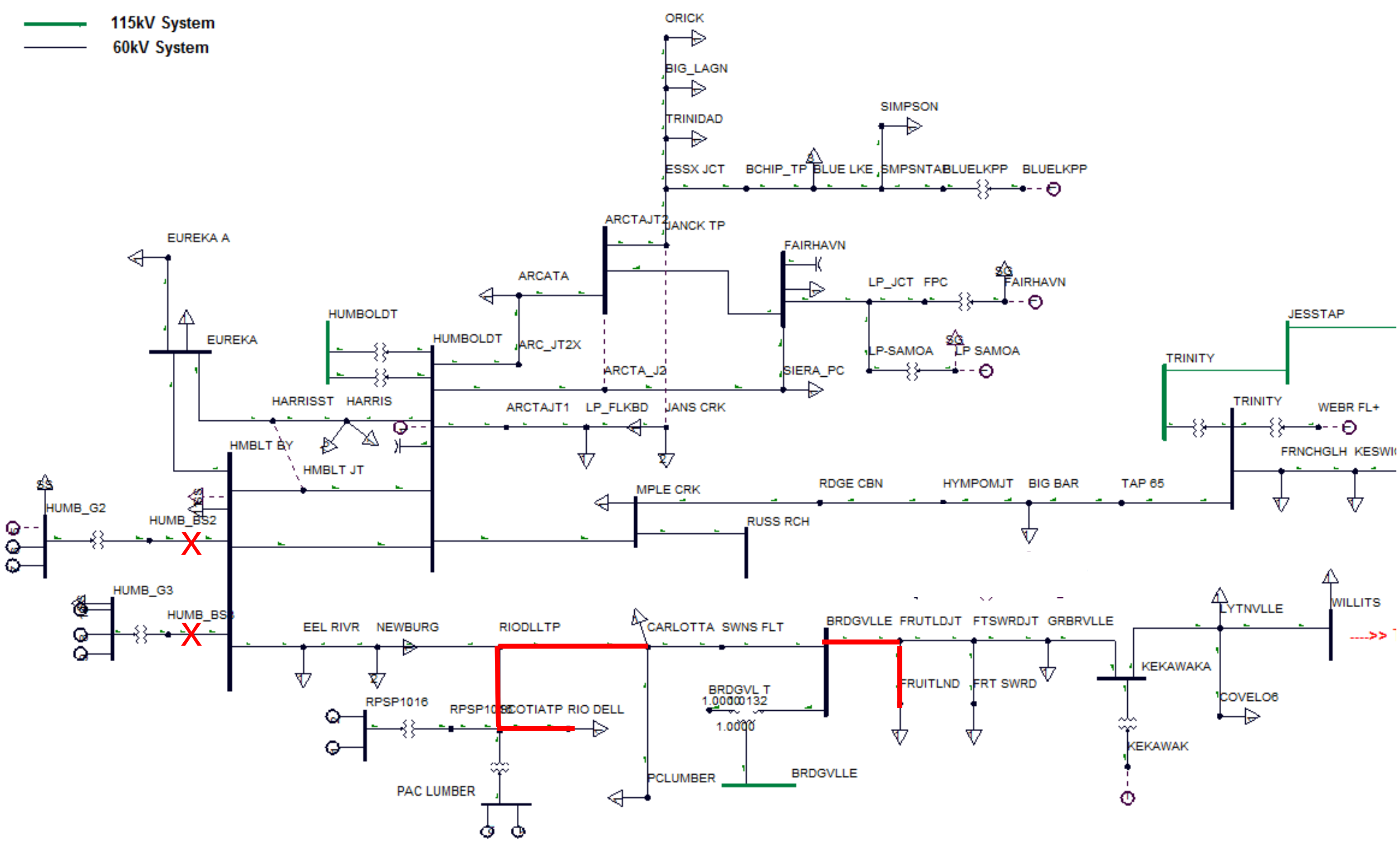
Observations

- P6 BES contingency resulting in overload on the Carlotta – Rio Dell 60 kV line
- P6 BES contingency resulting in overload on the Bridgeville – Fruitland JT 60 kV line
- P2, P6, P7 overloads at the following Non-BES Facilities:
  - Humboldt – Humboldt JT 60 kV
  - Eureka – Humboldt Bay 60 kV
  - Carlotta – Rio Dell 60 kV
  - Carlotta – Swains Flat 60 kV
  - Swains Flat – Bridgeville 60 kV
- High voltages observed in 115 kV system at Humboldt, Humboldt Bay, Bridgeville, and low voltages observed in 60 kV system

Potential Mitigations

- Carlotta – Rio Dell 60kV overload due to loss of both Humboldt 115kV lines. System upgrade or preferred resource needed.
- Bridgeville – Fruitland JT 60kV overload due to loss of Bridgeville/Cottonwood 115kV line, and Humboldt 115kV line. System upgrade or preferred resource needed.
- Voltage issues can be addressed with reactive support

HUMB – Results Summary



Sensitivity Study Assessment

- Below is the list of facility overloads identified in sensitivity scenario(s) only.

Overloaded Facility	Category	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen
HUMBOLDT - BRDGVLLE 115kV Line	P6	√		√
HUMBOLDT - TRINITY 115kV Line	P6			√
HUMBOLDT - HMBLT JT 60.0kV Line	P1, P2, P6	√		√
EUREKA - HMBLT BY 60.0kV Line	P1, P2	√		√
CARLOTTA - RIODLLTP 60.0kV Line	P1, P2, P6	√		√
CARLOTTA - SWNS FLT 60.0kV Line	P1, P2	√		√
SWNS FLT - BRDGVLLE 60.0kV Line	P1, P2	√		√
BRDGVLLE - FRUTLDJT 60.0kV Line	P0, P1, P2, P7	√		
FRUTLDJT - FTSWRDJT 60.0kV Line	P1, P2	√		
FTSWRDJT - GRBRVLLE 60.0kV Line	P0, P1, P2	√		

Assessment of on-hold projects

New Bridgeville – Garberville No.2 115kV Line

Approved cycle:

- 2011-2012 TPP

Original scope:

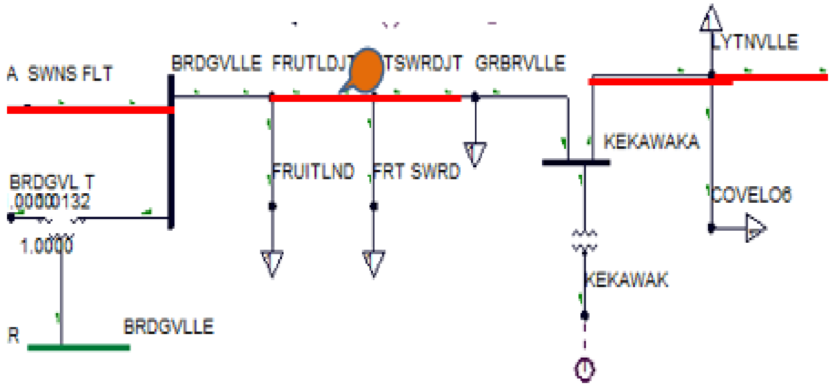
- Install new 36 mile long 115kV line between Bridgeville and Garberville substations as a double circuit tower with existing 60kV line.
- Will also require construction of new 115kV bus at Garberville substation and 115/60kV transformer.
- Reliability need, P1 and P2 thermal overloads

Project cost:

- Original cost: $55 - $65 million

Current In-service Date:

- January 2024



Conclusion and Preliminary Recommendation

Conclusion

- No reliability issues identified in current assessment.

Preliminary Recommendation

- Cancel current scope of project.
- Possible new project including reactive solutions.

Next Step

- Work with PG&E on feasibility and cost for proposed new projects.

North Coast & North Bay Area
Preliminary Reliability Assessment Results

Bryan Fong
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

North Coast and North Bay Areas

- 10,000 sq. mile area located north of the Bay Area and south of Humboldt
- Counties include:
  - Sonoma, Mendocino, Lake, Marin and part of Napa and Sonoma counties – 10,000 sq. miles
- Cities include:
  - Laytonville, Petaluma, San Rafael, Novato, Benicia, Vallejo
- Transmission facilities: 60kV, 115kV and 230 kV

Load and Load Modifier Assumptions - NCNB Area

Study Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
					Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
NCNB-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	1,571	23	388	56	1,492	16	10
NCNB-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	1,621	46	552	6	1,569	16	10
NCNB-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	1,695	88	811	0	1,607	16	10
NCNB-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – weekend morning.	734	17	388	306	411	16	10
NCNB-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – weekend morning.	751	34	552	464	253	16	10
NCNB-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	1,600	22	388	0	1,578	16	10
NCNB-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	1,182	23	388	0	1,159	16	10
NCNB-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	1,731	86	811	0	1,645	16	10
NCNB-2023HS-SP	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	1,621	0	552	6	1,615	16	10
NCNB-2020-HR	Sensitivity	2020 summer peak load conditions with hi renewable dispatch sensitivity	1,182	23	388	384	775	16	10
NCNB-2023-HR	Sensitivity	2023 summer peak load conditions with hi renewable dispatch sensitivity	751	34	552	547	170	16	10
NCNB-2028-QF	Sensitivity	2027 summer peak load conditions with QF retirement sensitivity	1,695	88	0	0	1,607	16	10

Note: Includes PG&E load only. DR and storage are modeled offline in starting base cases.

Generation Assumptions - NCNB Area

Study Case	Scenario Type	Description	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
				Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
NCNB-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	0	25	12	1,534	709
NCNB-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	0	25	12	1,534	709
NCNB-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	0	25	12	1,534	705
NCNB-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – weekend morning.	0	0	0	0	0	25	3	1,534	704
NCNB-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – weekend morning.	0	0	0	0	0	25	2	1,534	702
NCNB-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	0	25	12	1,534	707
NCNB-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	0	25	3	1,534	709
NCNB-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours between 16:00 and 18:00.	0	0	0	0	0	25	12	1,534	707
NCNB-2023HS-SP	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	0	0	0	0	0	25	12	1,534	709
NCNB-2020-HR	Sensitivity	2020 summer peak load conditions with hi renewable dispatch sensitivity	0	0	0	0	0	25	3	1,534	709
NCNB-2023-HR	Sensitivity	2023 summer peak load conditions with hi renewable dispatch sensitivity	0	0	0	0	0	25	2	1,534	707
NCNB-2028-QF	Sensitivity	2027 summer peak load conditions with QF retirement sensitivity	0	0	0	0	0	25	12	1,534	701

Note: Includes PG&E load only. DR and storage are modeled offline in starting base cases.

Previously approved transmission projects modelled in base cases

Project Name	First Year Modeled
Fulton-Fitch Mountain 60kV Line Reconductor (Fulton-Hopland 60kv Line) Project – Revised Scope	2019
Clear Lake 60kV System Reinforcement - Revised Scope	2023
Ignacio-Alto 60kV Line Conversion - Revised Scope	2023
Lakeville 60kV Area Reinforcement	2021
Vaca-Lakeville 230kV Corridor Series Compensation	2020

Previously approved transmission projects not modelled in base cases (on-hold)

Project Name	First Year Modeled
Fulton 115/60 kV Transformer	N/A
Napa – Tulucay #1 60kV Line Upgrade – Canceled	N/A

Reliability assessment preliminary results summary

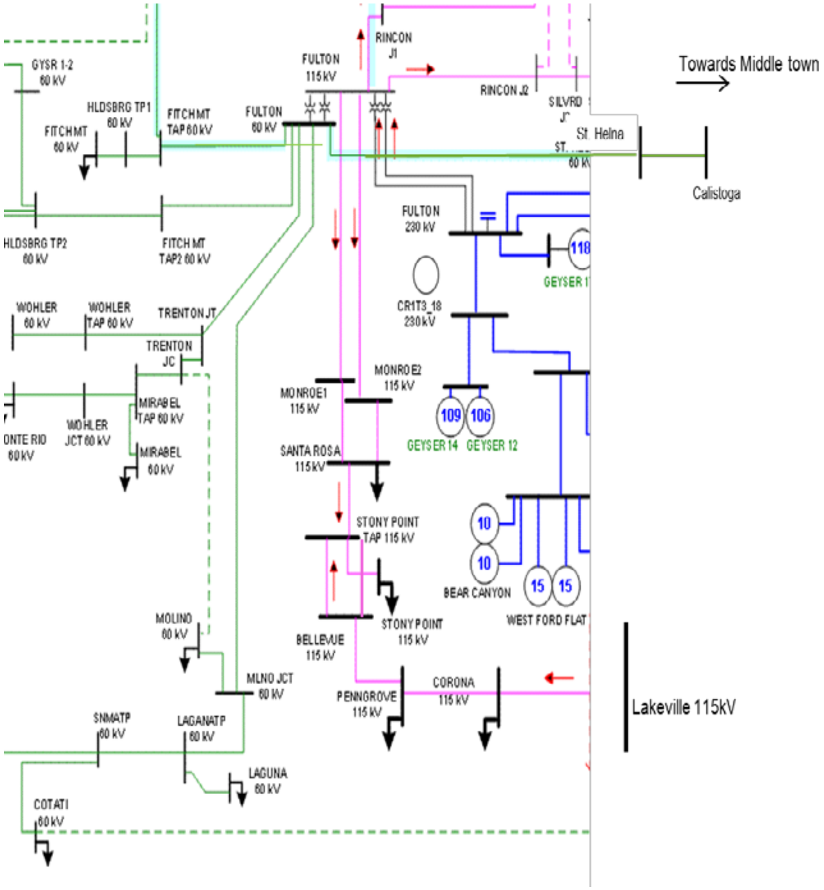
NCNB – Results Summary

Observations

- P1, P2 overload in the Clear Lake area
- P1, P2, P3, P6 & P7 Overloads in the Lakeville and Ignacio areas
- P2, P5, P6 & P7 Overloads in the Fulton and Hopland areas

Potential Mitigations

- P1, P2 overload in the Clear Lake area disappear after 2023 due to Clear Lake - Hopland is reconductored by 2022 (per Clear Lake Revised Scope)
- P1, P2, P3, P6 & P7 Overloads in the Lakeville and Ignacio areas disappear after 2023 due to Ignacio Area Reinforcement
- P2, P5, P6 & P7 Overloads in the Fulton and Hopland areas disappear after 2023 due to open line between Cotati and Petaluma setup per Lakeville 60kV Area Reinforcement
- Potential Bus Upgrade - Lakeville 230KV - Section 2E & 2D & Lakeville 115KV - Section 1D & 2D



NCNB – Results Summary

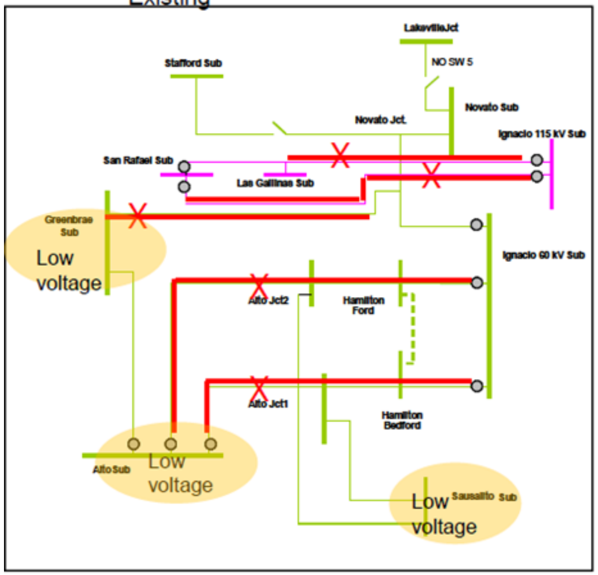
Observations

- P1, P2, P3, P6 & P7 Overloads in the Napa/ Tulucay areas
- P1, P2 & P3 Overloads in the Upper Lake areas
- P1, P2, P3 & P6 Overloads of Ignacio – San Rafael 115kV Line

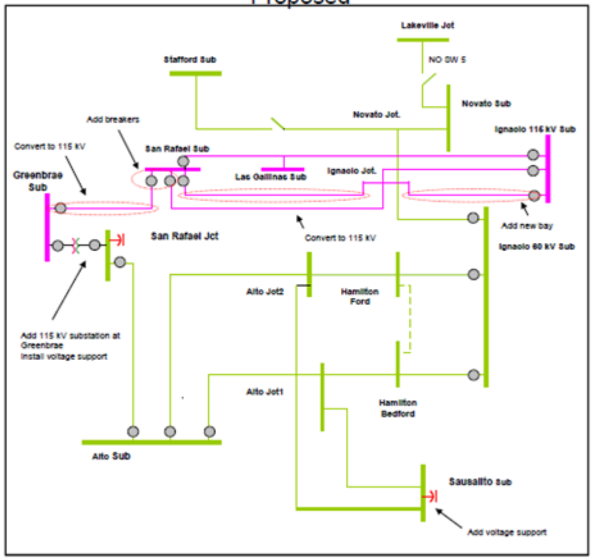
Potential Mitigations

- P1, P2, P3 & P6 Overloads of Ignacio – San Rafael 115kV Line disappear after 2023 due to Ignacio Area Reinforcement (Ignacio-Alto 60kV Line Conversion - Revised Scope).
- Operation Procedure or SPS
- Non-BES Information only - No mitigation Required
- The load forecast within NCNB area increased, continue to monitor overloads in later years.

Existing



Proposed



Sensitivity Study Assessment

- Below is the list of facility overloads identified in sensitivity scenario(s) only.

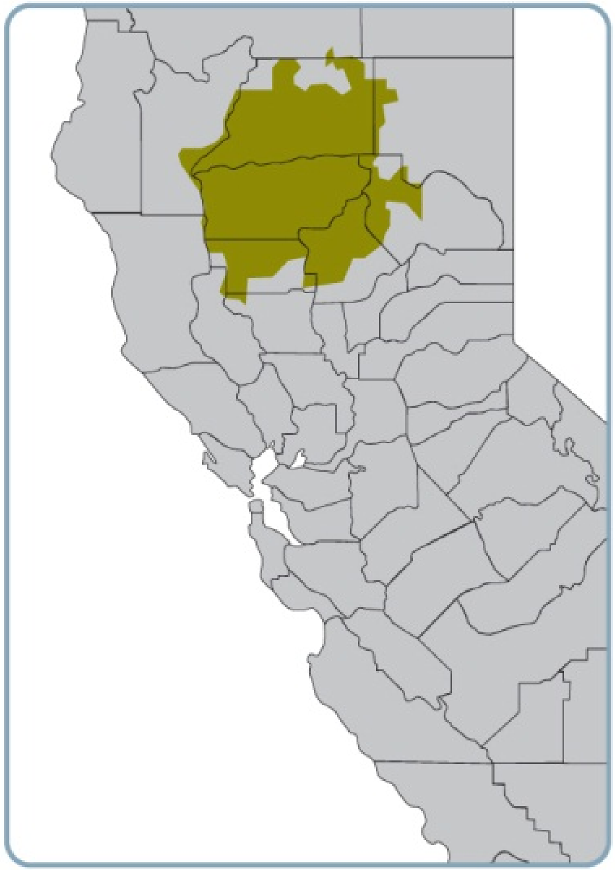
Overloaded Facility	Category	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	2028 Retirement of QF Generations
Cache J2-Redbud J2 115 kV Line	P6	√			
Indian Valley-Lucern J1 115kV Line	P6	√			

North Valley Area
Preliminary Reliability Assessment

Ebrahim Rahimi
Lead Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

North Valley Area



- North Valley Area located in the NE corner of PG&E system
- Major cities: Chico, Redding, Red Bluff, Paradise
- Comprised of 60, 115 & 230 & 500 kV transmission facilities.
- Supply sources include Table Mountain, Cottonwood, and Palermo

Load and Load Modifier Assumptions – North Valley Area

Study Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
					Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
NVLY-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 18:00.	970	15	254	48	907	36	28
NVLY-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 18:00.	1,012	29	353	51	932	37	28
NVLY-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 18:00.	1,012	29	353	51	932	37	28
NVLY-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – hours ending 12:00.	319	11	254	201	108	36	28
NVLY-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – hours ending 13:00.	320	21	353	297	2	37	28
NVLY-2023-SP-HiCEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	1,012	0	353	51	961	37	28
NVLY-2023-SOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	320	21	353	350	51	37	28
NVLY-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	941	15	254	252	675	36	28
NVLY-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	1,012	29	353	51	932	37	28

Note: DR and storage are modeled offline in sarting base cases.

Generation Assumptions – North Valley Area

Study Case	Scenario Type	Description	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
				Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
NVLY-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 18:00.	0	0	0	103	39	1,774	1,472	1,064	821
NVLY-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 18:00.	0	0	0	103	69	1,774	1,470	1,064	821
NVLY-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 18:00.	0	0	0	103	69	1,774	1,450	1,064	785
NVLY-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – hours ending 12:00.	0	0	0	103	7	1,774	778	1,064	250
NVLY-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – hours ending 13:00.	0	0	0	103	0	1,774	486	1,064	748
NVLY-2023-SP-HiCEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	0	0	0	103	93	1,774	1,451	1,064	815
NVLY-2023-SOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	0	0	0	103	0	1,774	423	1,064	886
NVLY-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	0	0	0	103	69	1,774	1,472	1,064	351
NVLY-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	0	0	0	103	0	1,774	1,339	1,064	651

Note: DR and storage are modeled offline in sarting base cases.

Previously approved transmission projects modelled in base cases

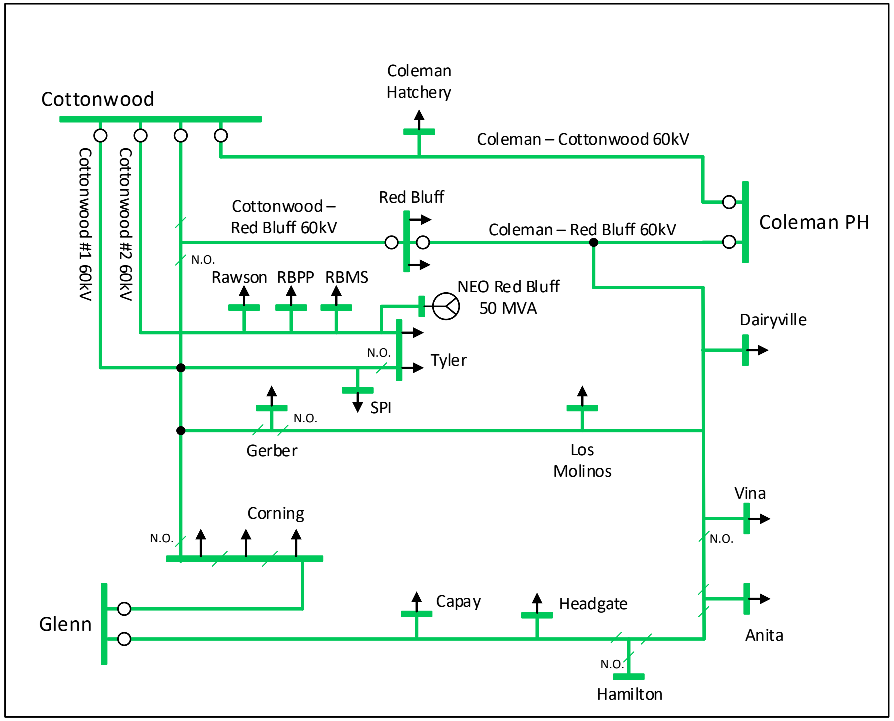
Project Name	First Year Modeled
Glen 230/60 kV Transformer No. 1 Replacement	2020
Cascade 115/60 kV No. 2 Transformer Project	2020
Delevan 230 kV Substation Shunt Reactor	2020
Cottonwood-Red Bluff 60 kV Line Upgrade (PG&E MWC61)	2023
Cottonwood 230/115 kV Transformer replacement	2023
Red Bluff-Coleman 60 kV Line Upgrade	2023

Reliability assessment preliminary results summary

North Valley Area – Results Summary

Observations

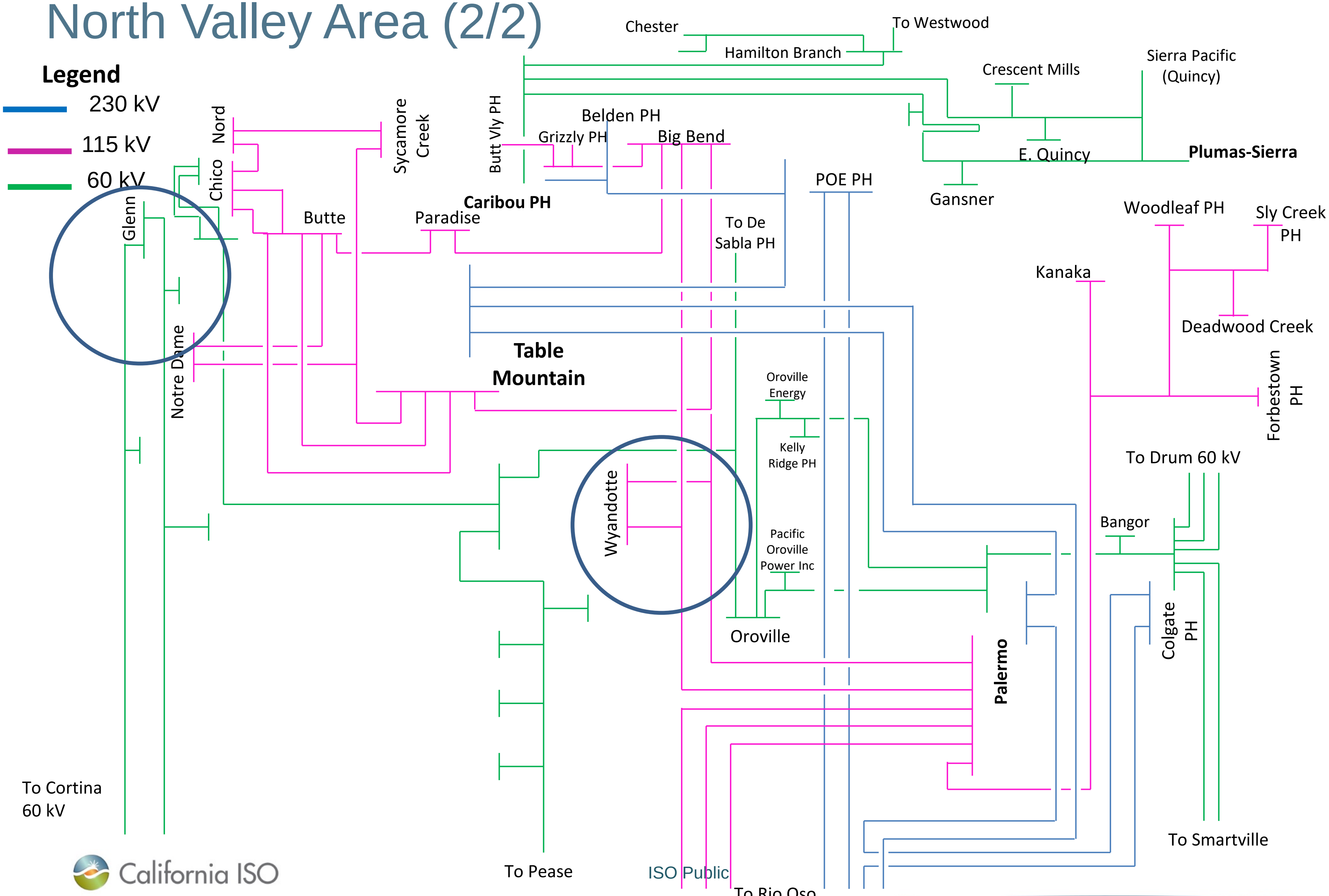
- Red Bluff – Coleman 60 kV Reinforcement and Cottonwood – Red Bluff Reconductoring projects address number of near term issues in the area
- There are voltage range and deviation issues at Tyler/Rawson area following P1 contingency in near-term.
- There are overloads in the long term under different contingencies:
  - Cottonwood #1 and #2 60 kV line for P1
  - Glen #1, #3, and #4 60 kV line for P0
  - Wyandotte 115 kV sub jumber for P0
  - Volta – South 60 kV line for P1
  - Cottonwood 230/115 kV Tx for P6
- P2-4 at Cottonwood 230 kV or 115 kV causes criteria violation.



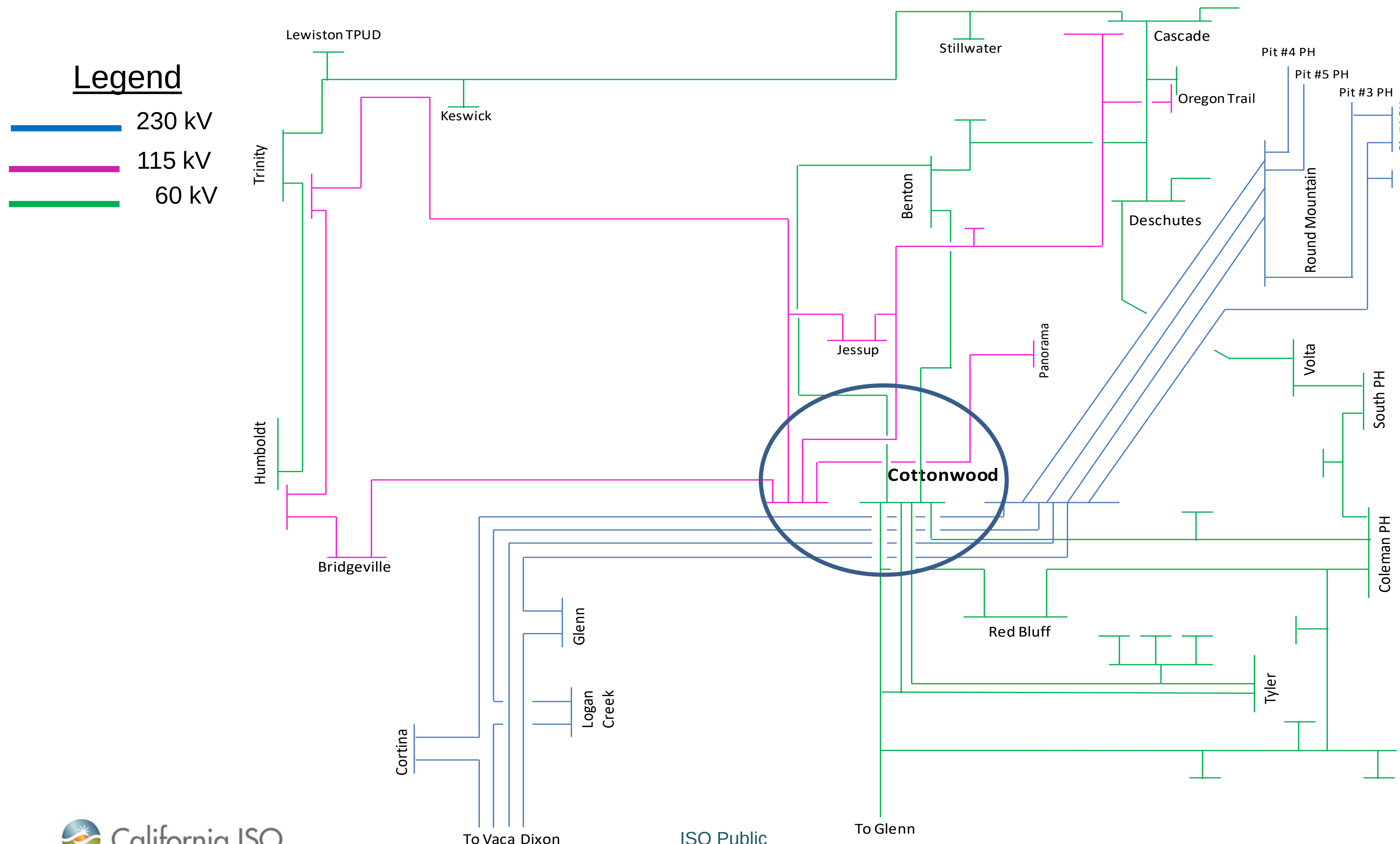
Potential Mitigations

- Add 20 Mvar capacitor banks at Tyler/Rawson to address voltage issues
- Review and if required update Caribou SPS
- The load forecast has increased for later years. The ISO will continue to monitor overloads.
- Substation upgrade or SPS to address P2-4 issue at Cottonwood substation.

North Valley Area (2/2)



North Valley Area (2/2)



Sensitivity Study Assessment

- Below is the list of facility overloads identified in sensitivity scenario(s) only.

Overloaded Facility	Category	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	2028 Retirement of QF Generations
Table Mountain – Palermo 230 kV Line	P6	√			
Cottonwood – Benton 60 kV Line	P2		√	√	
Benton – Deschutes 60 kV Line	P3		√		

Summary of Potential New Upgrades

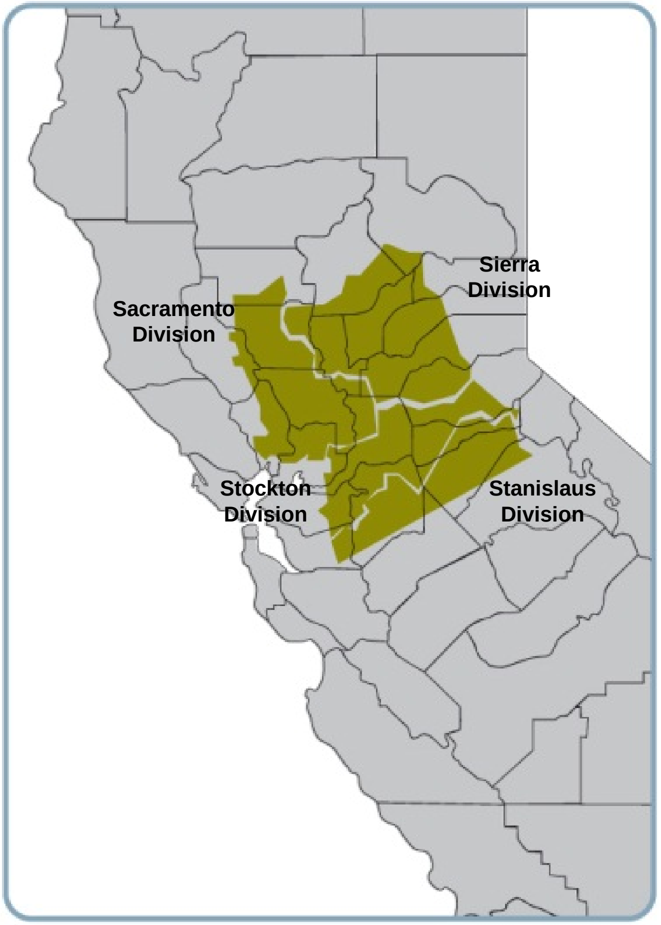
- Install 20 Mvar capacitor bank at Tyler/Rawson 60 kV area to address voltage issues
- Potential mitigation for the P2-4 (internal bus-tie breaker faults) issue at Cottonwood 230 kV and 115 kV buses is substation upgrade or an SPS.
- Continue to monitor the minor overloads identified only in the long term

Central Valley Area
Preliminary Reliability Assessment

Ebrahim Rahimi
Lead Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Central Valley Area



- The Central Valley Area covers the central part of the Sacramento Valley.
- The area is divided into four divisions:
  - Sacramento
  - Sierra
  - Stockton
  - Stanislaus
- Comprised of 60, 115 & 230 & 500 kV transmission facilities.
- Supply sources include Vaca Dixon, Rio Oso, Gold Hill, Atlantic, Brighton, Lockeford, Bellota

Load and Load Modifier Assumptions – Central Valley Area

S. No.	Base Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
						Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
1	CVLY-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 19:00.	4,067	71	1,037	0	3,996	102	59
2	CVLY-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 19:00.	4,251	141	1,354	0	4,110	103	59
3	CVLY-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 19:00.	4,519	268	1,741	0	4,251	104	59
4	CVLY-2020-SpOP	Baseline	2020 spring off-peak load conditions. Off-peak load time - hours ending 12:00.	1,460	52	1,037	820	588	102	59
5	CVLY-2023-SpOP	Baseline	2023 spring off-peak load conditions. Off-peak load time - hours ending 13:00.	1,460	105	1,354	1137	218	103	59
6	CVLY-2023-SP-Hi-CEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	4,251	0	1,354	0	4,251	103	59
7	CVLY-2023-SpOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	1,460	105	1,354	1340	15	103	59
8	CVLY-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	3,876	71	1,037	1027	2,778	102	59
9	CVLY-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	4,519	268	1,741	0	4,251	104	59

Note:
Includes PG&E load only.
DR and storage are modeled offline in starting base cases.

Generation Assumptions – Central Valley Area

S. No.	Base Case	Scenario Type	Description	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
					Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
1	CVLY-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 19:00.	0	841	0	0	0	0	0	3,939	1,221
2	CVLY-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 19:00.	0	841	0	0	0	0	0	3,939	1,221
3	CVLY-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 19:00.	0	841	0	0	0	0	0	3,939	1,252
4	CVLY-2020-SpOP	Baseline	2020 spring off-peak load conditions. Off-peak load time - hours ending 12:00.	0	841	832	0	0	0	0	3,939	1,177
5	CVLY-2023-SpOP	Baseline	2023 spring off-peak load conditions. Off-peak load time - hours ending 13:00.	0	841	742	0	0	0	0	3,939	130
6	CVLY-2023-SP-Hi-CEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	0	841	0	0	0	0	0	3,939	1,252
7	CVLY-2023-SpOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	0	841	800	0	0	0	0	3,939	145
8	CVLY-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	0	841	832	0	0	0	0	3,939	653
9	CVLY-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	0	841	0	0	0	0	0	3,939	1,252

Note:
Includes PG&E load only.
DR and storage are modeled offline in starting base cases.

Previously approved transmission projects modelled in base cases

Project Name	First Year Modeled
Lodi-Eight Mile 230 kV Line	2020
Ripon 115 kV Line	2020
Bellota 230 kV Substation Shunt Reactor	2020
Stockton A-Weber 60 kV Line Nos. 1 and 2 Reconductor	2020
West Point-Valley Springs 60 kV Line Reinforcement	2020
Mosher Transmission Project	2020
Pease 115/60 kV Transformer Addition	2020
South of Palermo 115 kV Reinforcement Project	2023
Vaca-Davis Area Reinforcement	2023
Rio Oso 230/115 kV Transformer Upgrades	2023
Rio Oso Area 230 kV Voltage Support	2023
Vierra 115 kV Looping Project	2023
Lockeford-Lodi Area 230 kV Development	2028

Previously approved transmission projects not modelled in base cases (on-hold)

Project Name	Division	First Year Modeled
Atlantic – Placer 115 kV Line Project	Sierra	N/A

Reliability assessment preliminary results summary

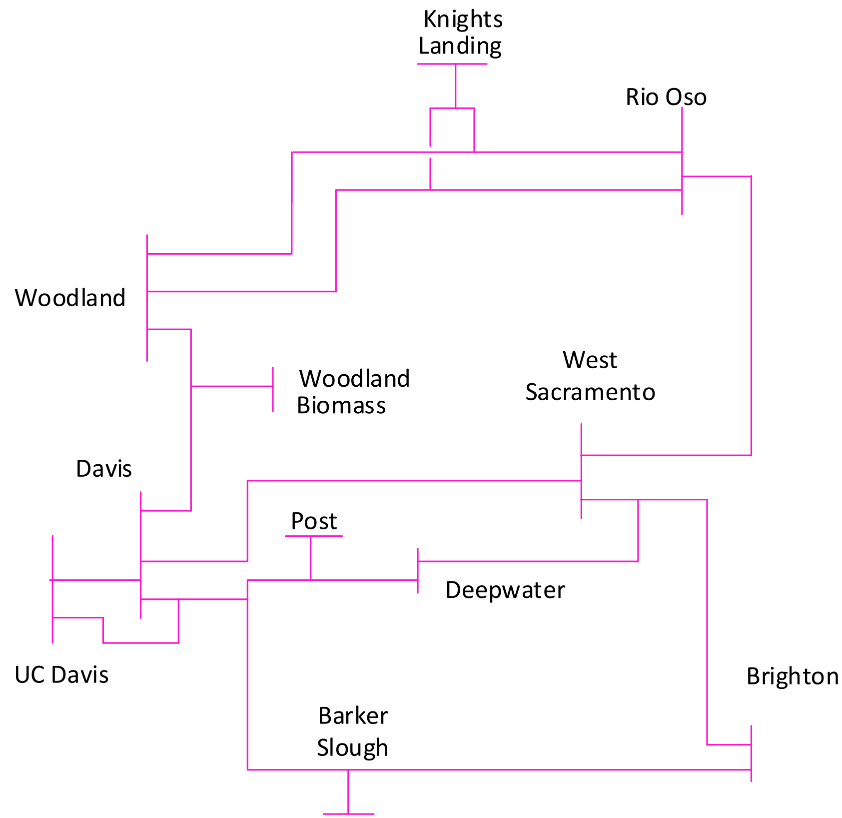
Sacramento Division – Results Summary

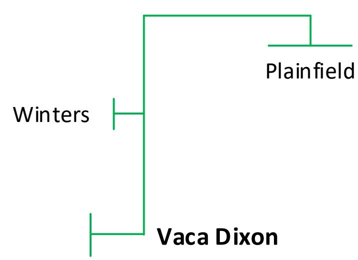
<u>Observations</u>

- There are issues in 2020 that are addressed by Vaca Dixon Area Reinforcement project.
- Two existing SPSes in the area are needed to address P6 (N-1-1) overloads
- P2-4 contingency of Rio Oso 115KV - Section 1D & 2D causes overload
- P0 overload observed on Vaca Dixon to Plainfield 60 kV radial line, in 5-10 years due to load forecast increase.

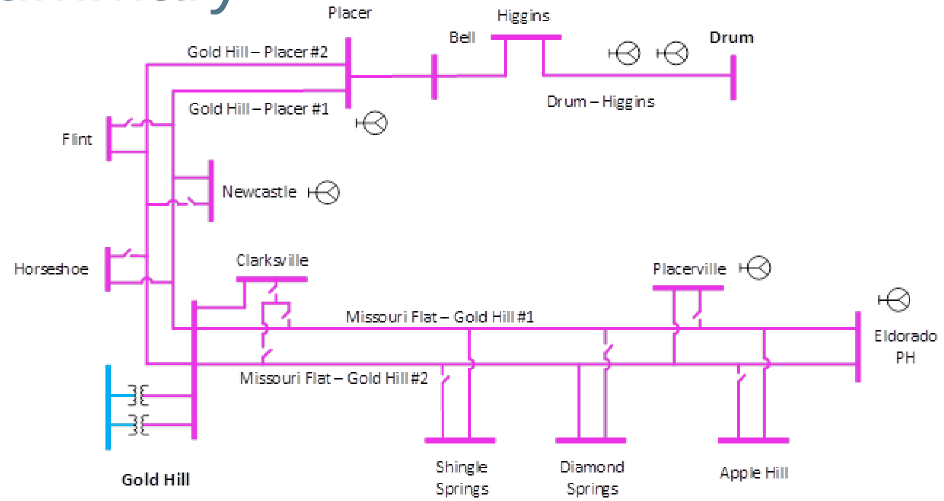
<u>Potential Mitigation</u>

- Continue to monitor long term overload on Vaca Dixon 230/115 kV Transformers
- Load forecast has increased at Plainfield, continue to monitor
- Substation upgarde or SPS to address P2-4 issue at Rio Oso





Sierra Division – Results Summary

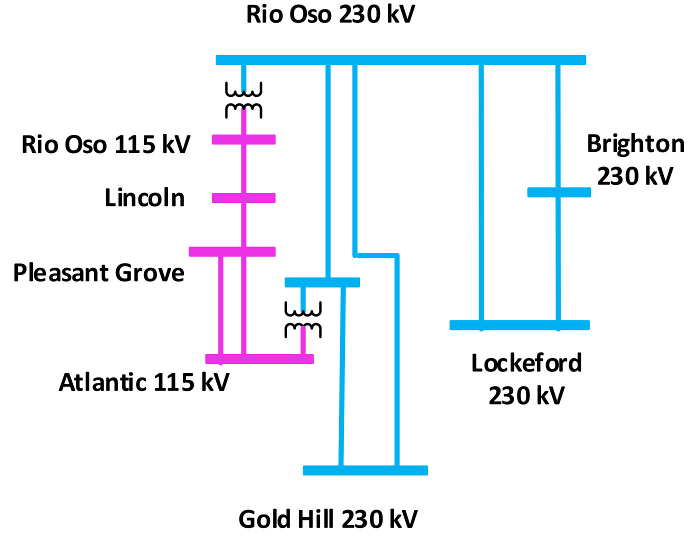


Observations

- Outage of both Gold Hill 230/115 kV transformers under P6 or P2-4 cause voltage collapse.
- Rio Oso – Lincoln 115 kV line overloads for DCTL of Rio Oso – Atlantic and Gold Hill 230 kV lines in the long term

Potential Mitigation

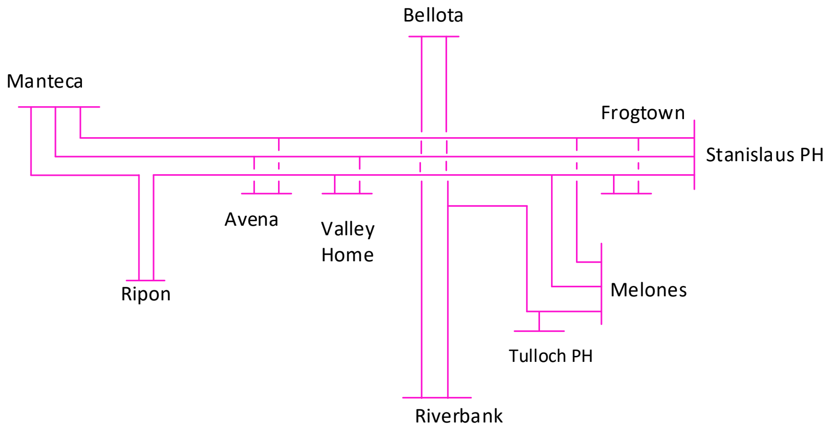
- SPS to address P7 overload on Rio Oso - Lincoln 115 kV line
- Substation upgrade or SPS to address P2-4 issue at Gold Hill 230 kV substation



Stockton/Stanislaus Division – Results Summary

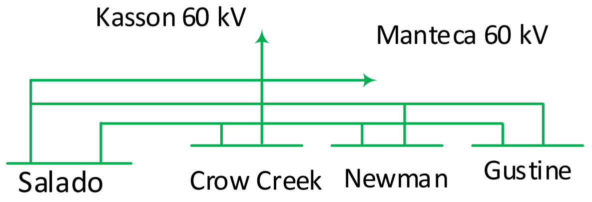
Observations

- Minor overloads under P1 contingency in the long term or under sensitivity on Stanislaus-Melones-Riverbank 115 kV Line.
- Salado – Crow Creek SW STA 60 kV line overloads for P1 contingency due to automatic scheme to pick up load following contingency.
- P2-4 at Bellota 230 kV and Tesla 115 kV buses will cause criteria violations and potential voltage collapse.

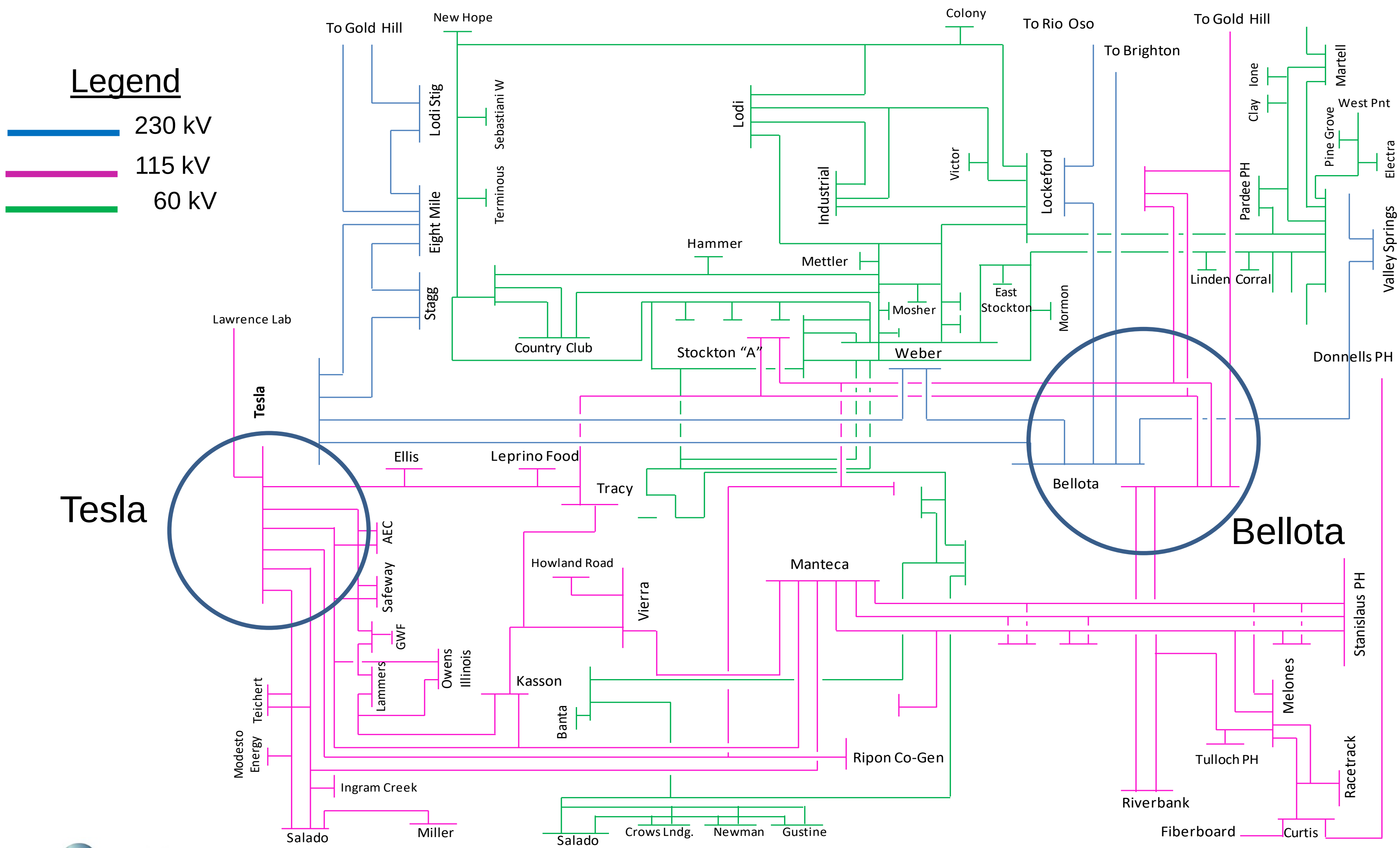


Potential Mitigations

- Overload on 60 kV could be addressed by disabling automatic load pick up
- Continue to monitor P1 overloads on Stanislaus-Melones-Riverbank 115 kV Line in the long term.
- Substation upgrade or SPS to address P2-4 issue at Bellota 230 kV and Tesla 115 kV substations



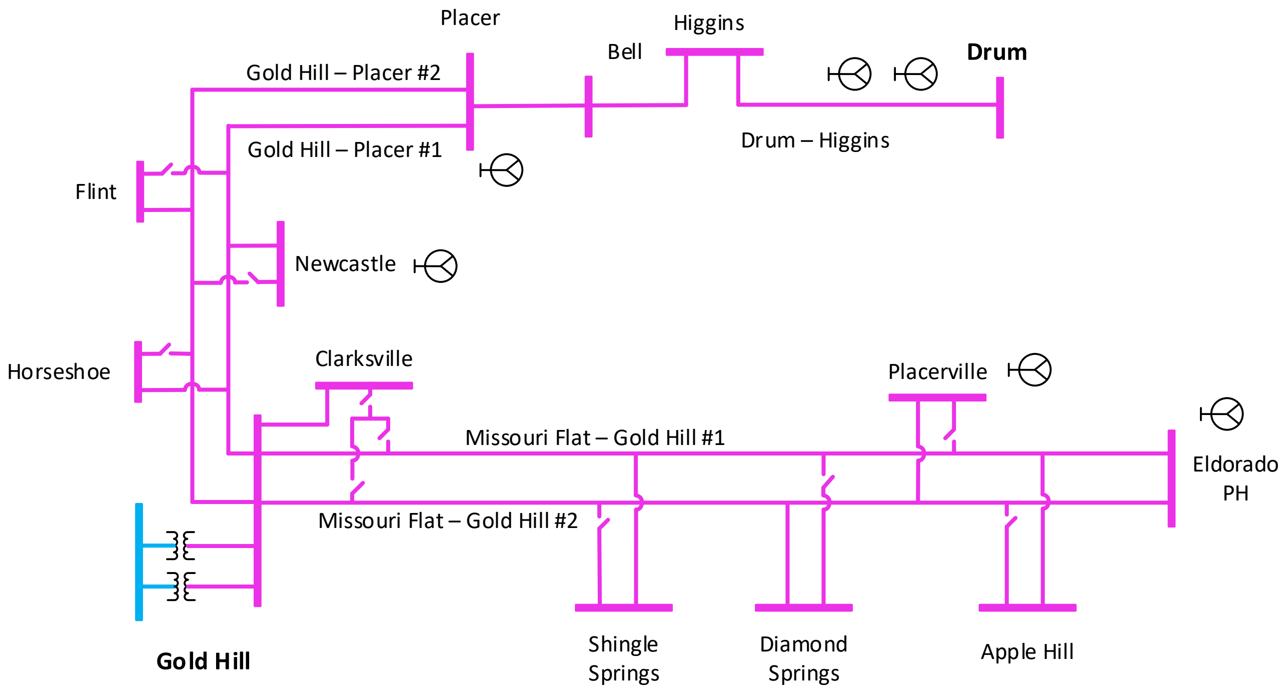
Stockton/Stanislaus Area



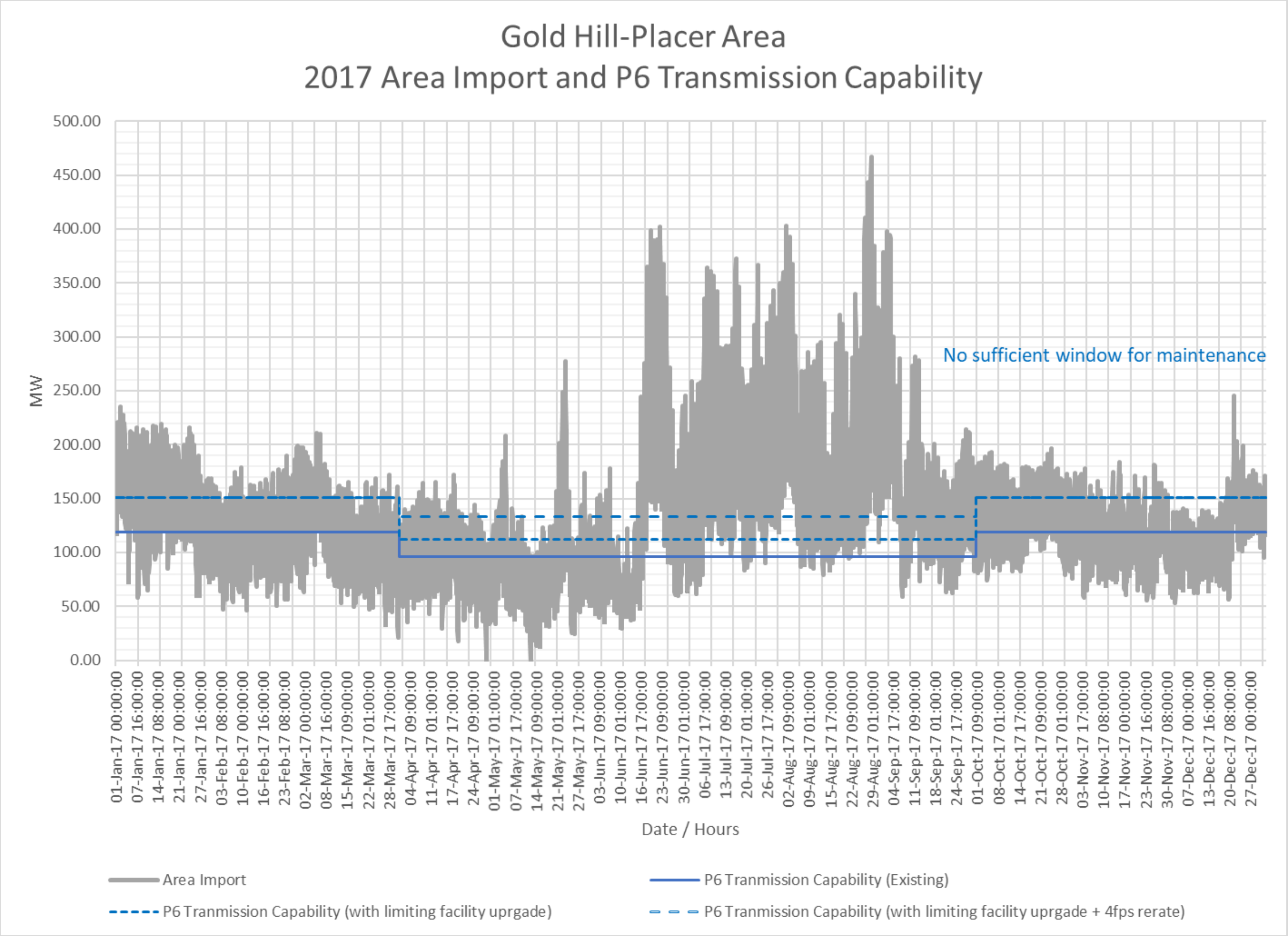
Assessment of on-hold projects

Atlantic-Placer 115 kV Line Project

- 2012-2013 TPP studies identified NERC P0, P1, P2, P6, P7 overload and P1 voltage deviation, P6, P7 low voltage (voltage collapse). This project was approved to address the issues.
- 2018-2019 Assessment: No P0, P1, or P7 issues. Availability of maintenance window for Gold Hill Transformers was reviewed



Gold Hill 230/115 kV Transformers Maintenance



Conclusion and Preliminary Recommendation

<u>Conclusion</u>

- No P0 and P1 driven reliability issues identified in current assessment due to decrease in load forecast.
- No maintenance windows available for Gold Hill 230/115 kV transformers (considering historical output of the local hydro generations)

<u>Potential mitigations</u>

- Re-scope approved Atlantic-Placer 115 kV line project to following:
  - Upgrade Drum-Higgins 115 kV line and SPS to drop load for Gold Hill T-1-1 under peak load. Gold Hill 115 kV bus upgrade.
  - Third 230/115 kV transformer at Gold Hill.
  - Explore the possibility of connecting to SMUD 230 kV network in the area.

<u>Next Step</u>

- Work with PG&E on feasibility and cost for proposed revised scope.

Sensitivity Study Assessment

- Below is the list of facility overloads identified in sensitivity scenario(s) only.

Overloaded Facility	Category	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	2028 Retirement of QF Generations
RIO OSO - Woodland 115 kV Lines #1 and #2	P6				√
CURTISS - SPISONORAJCT 115 kV Line	P6				√
Gold Hill - Lake 230 kV Line	P7			√	
West Sacramento - Davis 115 kV Line	P7				√
Brighton - Davis 115 kV Line	P7				√
Drum - Higgins 115 kV Line	P7	√			
Drum - Rio Oso 115 kV Line	P1			√	
Bellota - Rancho Seco 230 kV Lines #1 and #2	P1			√	
Rancho Seco - Camanche 230 kV Line	P1			√	
Tesla - LLNL 115 kV Line	P2-4		√	√	

Summary of Potential New Upgrades

- The overload on the radial Vaca Dixon – Plainfield 60 kV line to be mitigated if the load forecast is confirmed

- Potential mitigation for the P2-4 (internal bus-tie breaker faults) issue at Bellota, Tesla, Gold Hill, and Rio Oso 230 kV substations is substation upgrade or SPS.

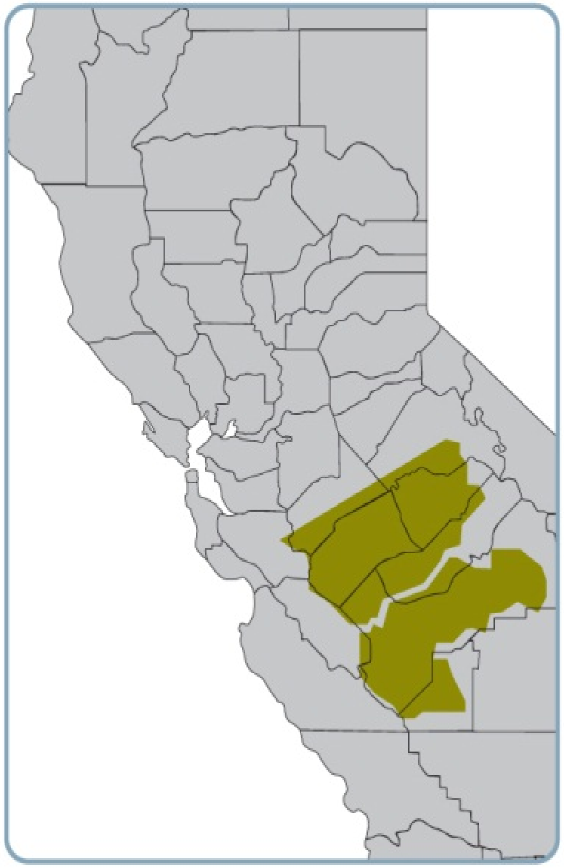
- Continue to monitor the minor overloads identified only in the long term

Greater Fresno Area
Preliminary Reliability Assessment

Vera Hart
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Greater Fresno Area



- Service areas cover Fresno, Kings, Tulare and Madera counties.
- Supply Source: Gates, Los Banos and Wilson
- Comprised of 70,115, 230 & 500 kV transmission facilities.

Load and Load Modifier Assumptions - Greater Fresno Area

S. No.	Base Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
						Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
1	GFA-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 18:00.	3,248	62	920	0	3,186	59	29
2	GFA-2020-SpOP	Baseline	2020 spring off-peak load conditions. Off-peak load time - hours ending 12:00.	1,035	45	920	727	263	59	29
3	GFA-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	3,212	62	920	911	2,239	59	29
4	GFA-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 18:00.	3,430	123	1,165	0	3,307	60	29
5	GFA-2023-SpOP	Baseline	2023 spring off-peak load conditions. Off-peak load time - hours ending 13:00.	1,051	91	1,165	978	(18)	60	29
6	GFA-2023-SP-Hi-CEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	3,430	0	1,165	0	3,430	60	29
7	GFA-2023-SpOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	1,051	91	1,165	1153	(193)	60	29
8	GFA-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 18:00.	3,676	233	1,568	0	3,443	60	29
9	GFA-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	3,676	233	1,568	0	3,443	60	29

Generation Assumptions - Greater Fresno Area

S. No.	Base Case	Scenario Type	Description	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
					Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
1	GFA-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 18:00.	156	2402	0	13	5	1892	1766	1,453	1,185
2	GFA-2020-SpOP	Baseline	2020 spring off-peak load conditions. Off-peak load time - hours ending 12:00.	156	2402	2238	13	1	1892	-560	1,453	453
3	GFA-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	156	2402	2378	13	9	1892	1775	1,453	609
4	GFA-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 18:00.	156	2402	0	13	9	1892	1744	1,453	1,199
5	GFA-2023-SpOP	Baseline	2023 spring off-peak load conditions. Off-peak load time - hours ending 13:00.	156	2402	1987	13	0	1892	-561	1,453	226
6	GFA-2023-SP-Hi-CEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	156	2402	0	13	5	1892	1685	1,453	1,232
7	GFA-2023-SpOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	156	2402	2045	13	9	1892	-550	1,453	717
8	GFA-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 18:00.	156	2402	0	13	9	1892	1799	1,453	1,227
9	GFA-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	156	2402	0	13	0	1892	1799	1,453	1,239

Previously approved transmission projects modelled in base cases

Project Name	Expected ISD
Borden 230 kV Voltage Support	19-Feb
Gregg-Herndon #2 230 kV Line Circuit Breaker Upgrade	18-May
Helm-Kerman 70 kV Line Reconductor	18-Mar
Lemoore 70 kV Disconnect Switches Replacement	18-Jun
Los Banos-Livingston Jct-Canal 70 kV Switch Replacement	18-Jun
Oro Loma 70 kV Area Reinforcement	20-May
Reedley 70 kV Reinforcement (Renamed to Reedley 70 kV Area Reinforcement Projects Include Battery at Dinuba)	21-Dec
Reedley 115/70 kV Transformer Capacity Increase	Completed
Wilson 115 kV Area Reinforcement	23-Dec
Wilson-Le Grand 115 kV line reconductoring	20-Dec
Panoche – Oro Loma 115 kV Line Reconductoring	20-Dec
Wilson 115 kV SVC	19-Dec
Gates #12 500/230 kV Transformer Addition	19-Dec
Kearney - Hearndon 230 kV Line Reconductoring	19-May
Northern Fresno 115 kV Area Reinforcement	20-Mar
Bellota-Warnerville 230kV line Reconductoring	23-Dec
Herndon-Bullard 230kV Reconductoring Project	21-Jan

Previously approved transmission projects not modelled in base cases (on-hold)

Project Name	First Year Modeled
Gates-Gregg 230kV Line	N/A

Reliability assessment preliminary results summary

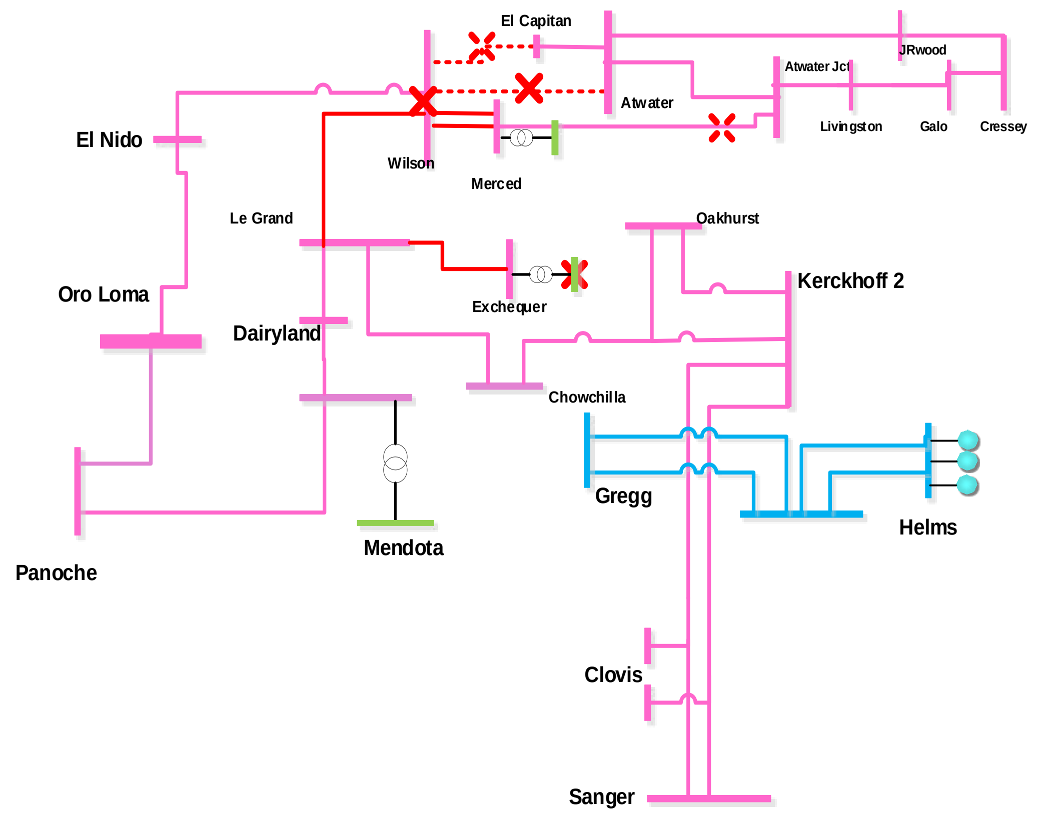
Wilson 115kV Area– Results Summary

Observations

1. P6 & P7 Overloads observed in the Wilson 115kV Area for all years
2. P2 Bus contingencies on the Wilson 115kV bus causing low voltage in the area and overloads on the 115kV nearby lines in first year
3. P6 Overloads on Exchequer Le-Grand 115kV line in 2020 & 2028
4. P0 High Voltage observed in 2020 Spring Off-Peak case in the area
5. P5 (non-Redundant Relay protection) on the Gregg 230kV BAAH causing overloads in this area
6. P6 overload on Wilson-Le Grand 115kV line in 2020 Off-peak

Potential Mitigations

1. Expand Atwater SPS
   - For the loss of Wilson-El Capitan and Wilson-Atwater 115kV DCTL Lines and Wilson-Merced 115kV lines overload SPS will drop El Capitan 115kV Station.
     - Expand to drop EL Capitan for loss of El Capitan Wilson and Atwater-Livingston-Merced 115kV line and Wilson-Atwater 115kV line with Atwater-Livingston-Merced 115kV line P6 contingencies
     - Short term rating option under review
   - Switching post first contingency
2. Mitigated by the Wilson 115kV Reinforcement project
3. Generation redispatch
4. Wilson Voltage Support 100MVAR SVC mitigates future years.
5. Protection upgrade
6. Wilson-Le Grand 115kV Reconductoring Project mitigates future years



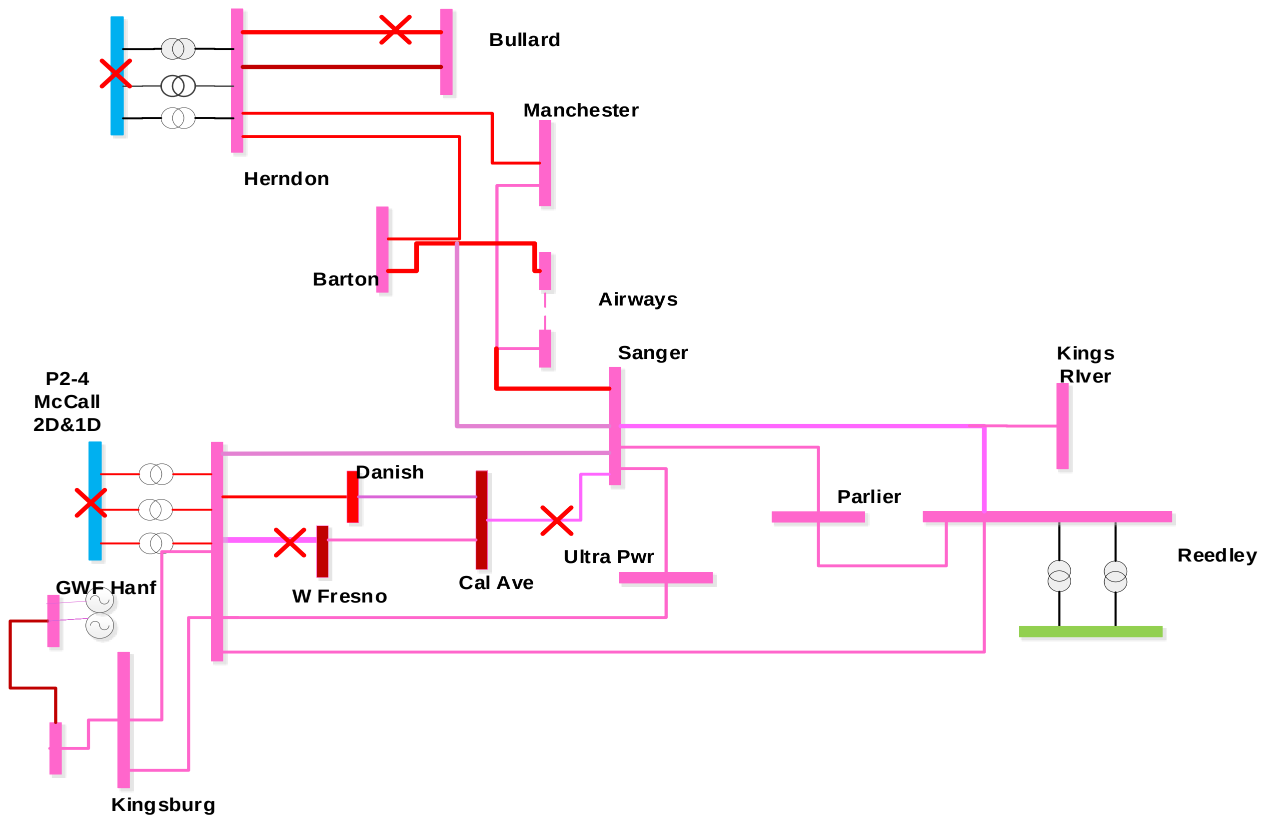
Fresno Area – Results- Herndon-McCall Area

Observations

1. P2 Overloads observed on the Herndon-Barton115kV line in the Spring cases
2. P2 Bus contingencies on the McCall 115kV bus causing low voltage in the area and overloads on the McCall115kV TB's in 2023 & 2028
3. P6 Overloads in 2028 on McCall-Danish 115kV section for loss of McCall-West Fresno and Sanger to CalAve 115kV. Low voltage in the area
4. P2-1 overloads on the Herndon-Bullard 115kV line in 2020
5. P5 (non-Redundant Relay protection) on the McCall 230kV BAAH causing overloads in this area
6. P2 Herndon Bus section contingency overloading in 2020

Potential Mitigations

1. Redispatch generation.
2. Short term rating and Generation redispatch;
3. Monitor future forecast.
4. Herndon-Bullard Reconductoring Project mitigates future years.
5. Protection upgrade.
6. Northern Fresno sectionalizing breaker at Herndon 230kV mitigates future years.



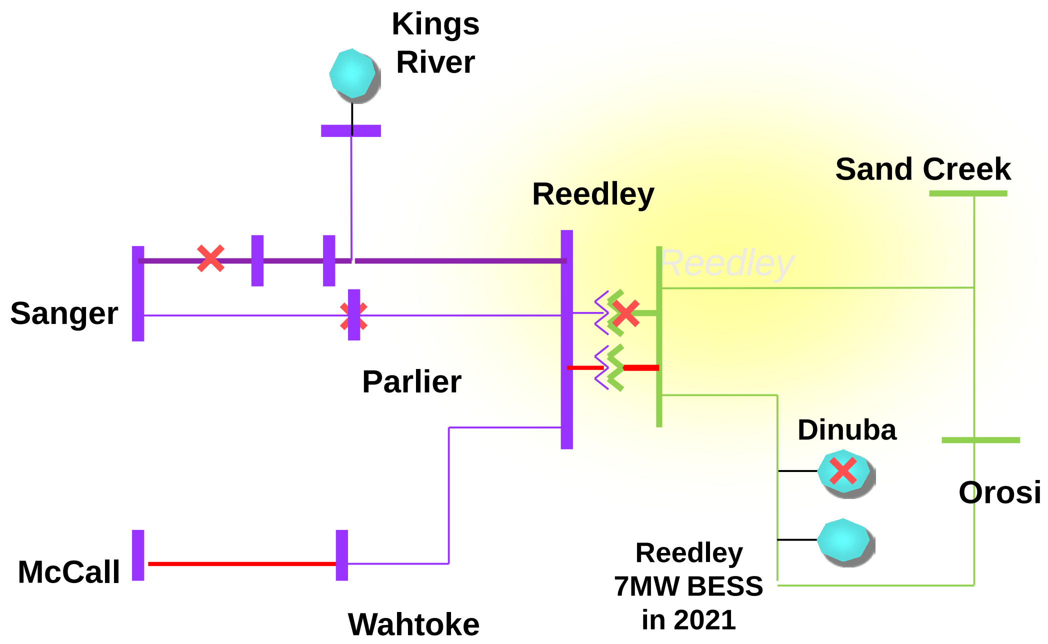
Fresno Area – Results-Reedley Area

Observations

1. Multiple P1, P2, P3, P6 overloads
2. Low voltage at Dinuba observed

Potential Mitigations

1. Dinuba BESS project mitigates



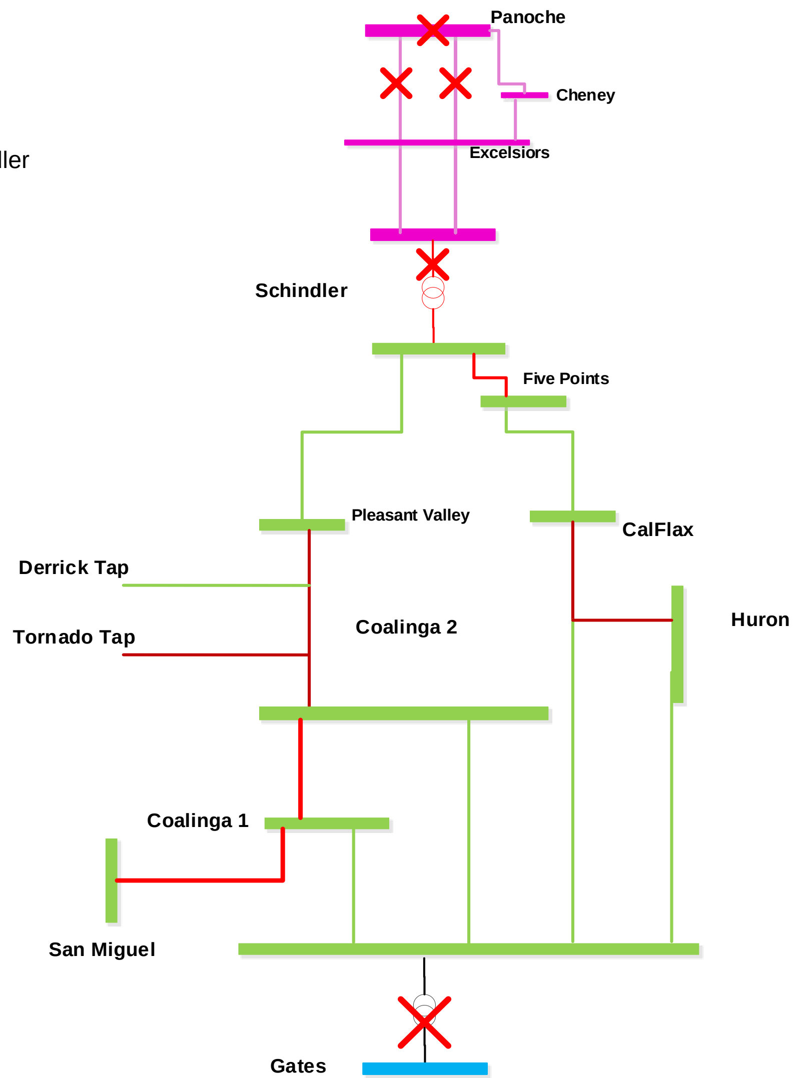
Fresno Area –Coalinga 70kV Results

Observations

1. P2, P6, P7 Contingencies causing overloads on Gates 230/70kV TB, Schindler 115/70kV TB and 70kV lines in the area in all years.
2. Low voltages in the Coalinga area for P6

Potential Mitigations

1. Generation re-dispatch.



Sensitivity Study Assessment

- 2023 Spring Off-Peak High Renewable and low gas generation Sensitivity Case had the most identified overloads
- Followed by 2020 Heavy renewable and low gas generation Sensitivity Case with the second most overloads.
  - Mitigation for both cases is Generation re-dispatch

Summary of Potential New Upgrades

Area	Expected Upgrade
Wilson 115kV	Atwater SPS expansion

Assessment of on-hold project Gates-Gregg 230kV Line

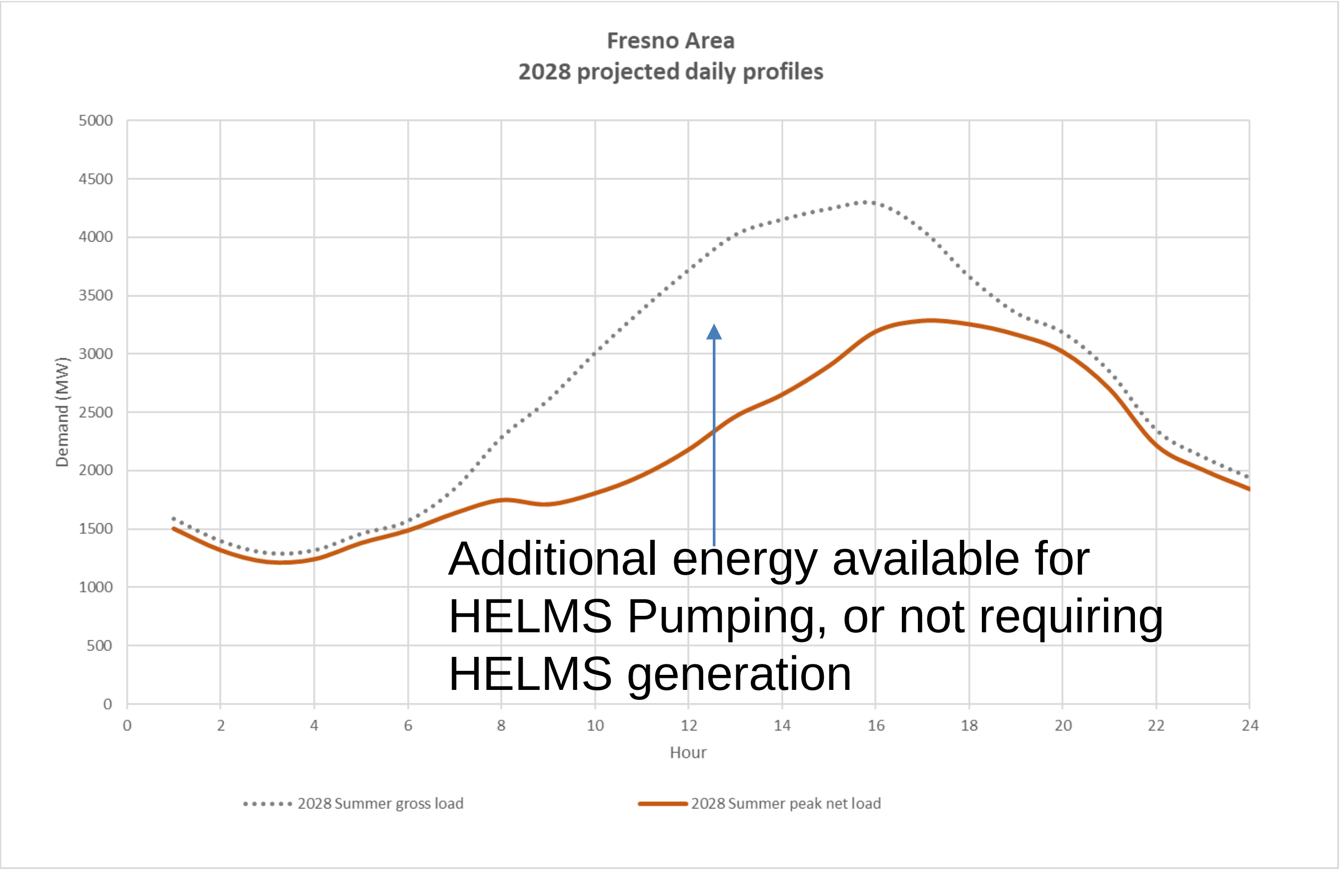
2012-2013 Transmission Plan
Central California Study

- The following was approved in the ISO 2012-2013 Transmission Plan to address the:
  - reliability needs of the Central California/Fresno area;
  - the pumping requirements of HELMs for area reliability; and
  - provide flexibility for the HELMs Pump Storage facility to provide ancillary services and renewable integration requirements.

Project	Estimated In-Service Date	Estimated Cost
Series Reactor on Warnerville-Wilson 230 kV Line	In Service	In Service
Gates #12 500/230 kV Transformer Addition	Dec-2019	$90-100 million
Kearney - Hearndon 230 kV Line Reconductoring	May-2019	$10-15 million
Gates-Gregg 230 kV Line	On Hold	$200-250 million

Impact of increased behind the meter solar generation:

- The impact is to create additional pumping opportunities, or reduce the local need for energy to be generated by HELMS

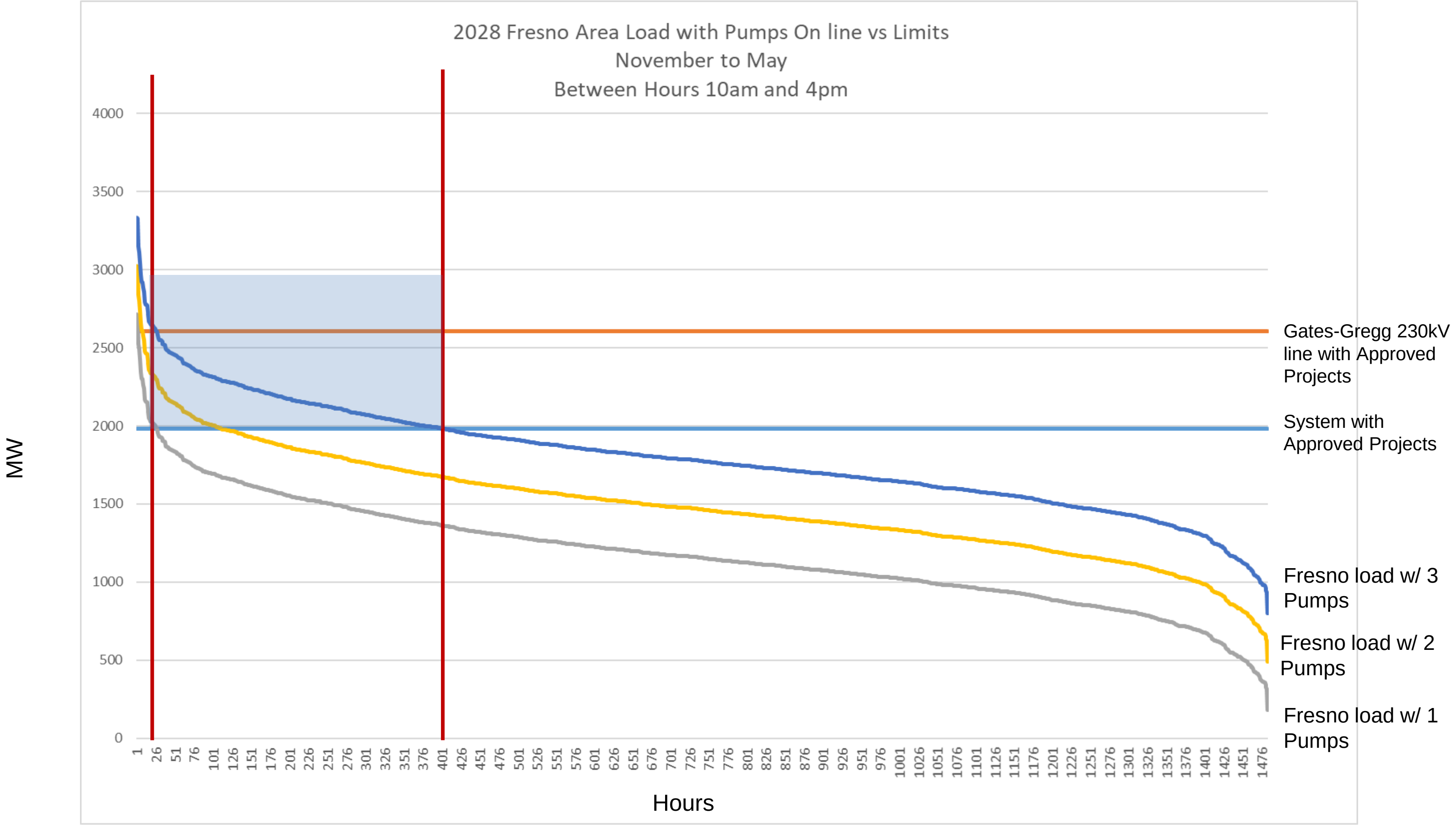


Transmission System Capability Assessment

- System Approved Projects 1980 MW
  - Warnerville-Wilson 230 kV series reactor
  - Gates Gregg 500/230 kV transformer addition
  - Kearney-Herndon 230 kV line reconductor
- With Gates-Gregg 230kV Line 2605 MW
  - 3 projects plus
  - Gates-Gregg 230 kV line

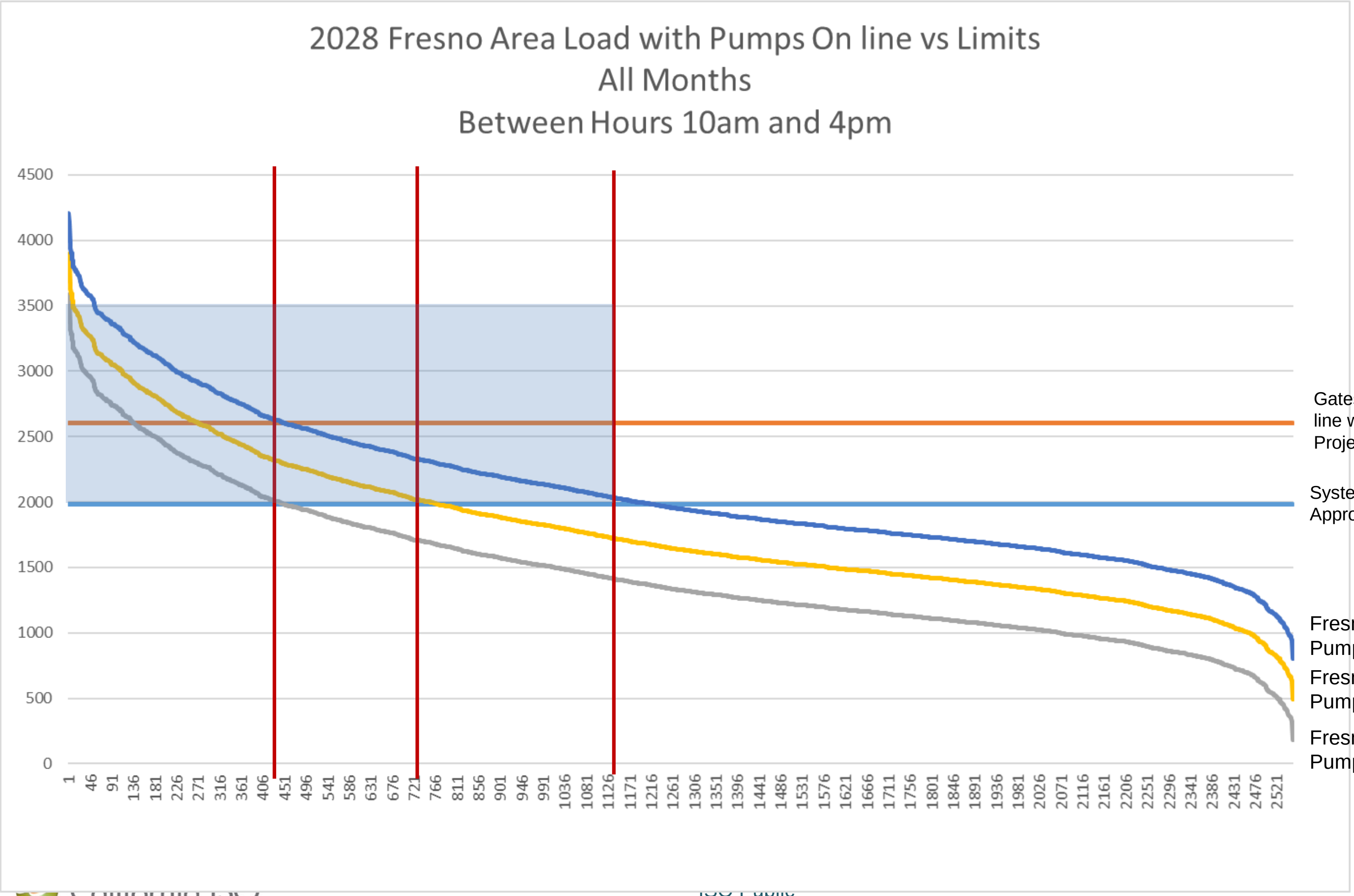
2028 Area Loads with Pumps versus Capability

(Non Summer Months – when oversupply conditions are expected)



2028 Area Loads with Pumps versus Capability

Bookend Assessment – assuming oversupply appears all year



Assessment Conclusion

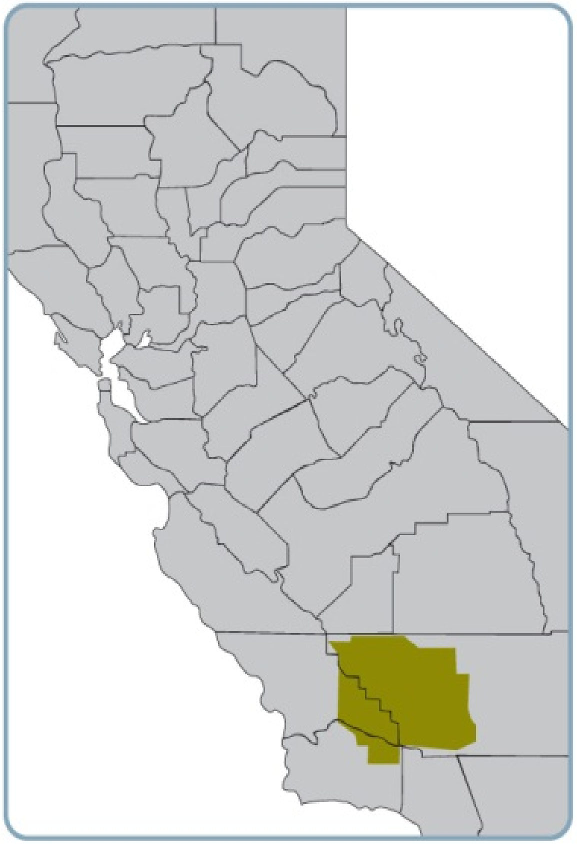
- No reliability need was identified
- Transient Stability was performed and no significant benefit was found with the addition of the Gates-Gregg 230kV line
- Value of Pumping to be further assessed for November stakeholder meeting

Kern Area
Preliminary Reliability Assessment Results

Abhishek Singh
Regional Transmission Engineer Lead

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Kern Area



- Located south of the Yosemite-Fresno area and includes southern portion of the PG&E San Joaquin Division
- Major stations include Midway and Kern Power Plant
- Transmission system includes 60, 115 and 230 kV facilities.

Load and Load Modifier Assumptions - Kern Area

S. No.	Study Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
						Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
1	KERN-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 19:00.	1,935	34	431	0	1,901	76	57
2	KERN-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 19:00.	2,039	67	512	0	1,973	77	57
3	KERN-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 19:00.	2,183	127	587	0	2,056	77	57
4	KERN-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – hours ending 12:00.	857	24	431	340	492	76	57
5	KERN-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – hours ending 13:00.	866	50	512	430	386	77	57
6	KERN-2023-SP-HiCEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	2,039	0	512	0	2,039	77	57
7	KERN-2023-SOP-HiRene	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	866	50	512	507	309	77	57
8	KERN-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	1,935	34	431	426	1,475	76	57
9	KERN-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	2,183	127	587	0	2,056	77	57
	Note:									
	DR and storage are modeled offline in sarting base cases.									

Generation Assumptions - Kern Area

S. No.	Study Case	Scenario Type	Description	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
					Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
1	KERN-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 19:00.	2	673	0	0	0	29	7	3,288	1,899
2	KERN-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 19:00.	0	673	0	0	0	29	6	3,288	1,905
3	KERN-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 19:00.	0	673	0	0	0	29	6	3,288	1,906
4	KERN-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – hours ending 12:00.	2	673	532	0	0	29	14	3,288	529
5	KERN-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – hours ending 13:00.	0	673	407	0	0	29	9	3,288	567
6	KERN-2023-SP-HiCEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	0	673	0	0	0	29	13	3,288	2,126
7	KERN-2023-SOP-HiRene	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	0	673	421	0	0	29	21	3,288	717
8	KERN-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	2	673	628	0	0	29	9	3,288	567
9	KERN-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	0	673	0	0	0	29	6	3,288	1,906
	Note:											
	DR and storage are modeled offline in sarting base cases.											

Previously approved transmission projects modelled in base cases

Project Name	First Year Modeled
Wheeler Ridge-Weed patch 70 kV Line Reconductor	2020
Kern PP 115 kV Area Reinforcement	2028
Wheeler Ridge Junction Substation	2028
Midway-Temblor 115 kV Line Reconductor and Voltage	2023
Wheeler Ridge Voltage Support	2023
Midway-Kern PP 230 kV Line Nos. 1, 3 and 4 Capacity Increase Project	2023

Reliability assessment preliminary results summary

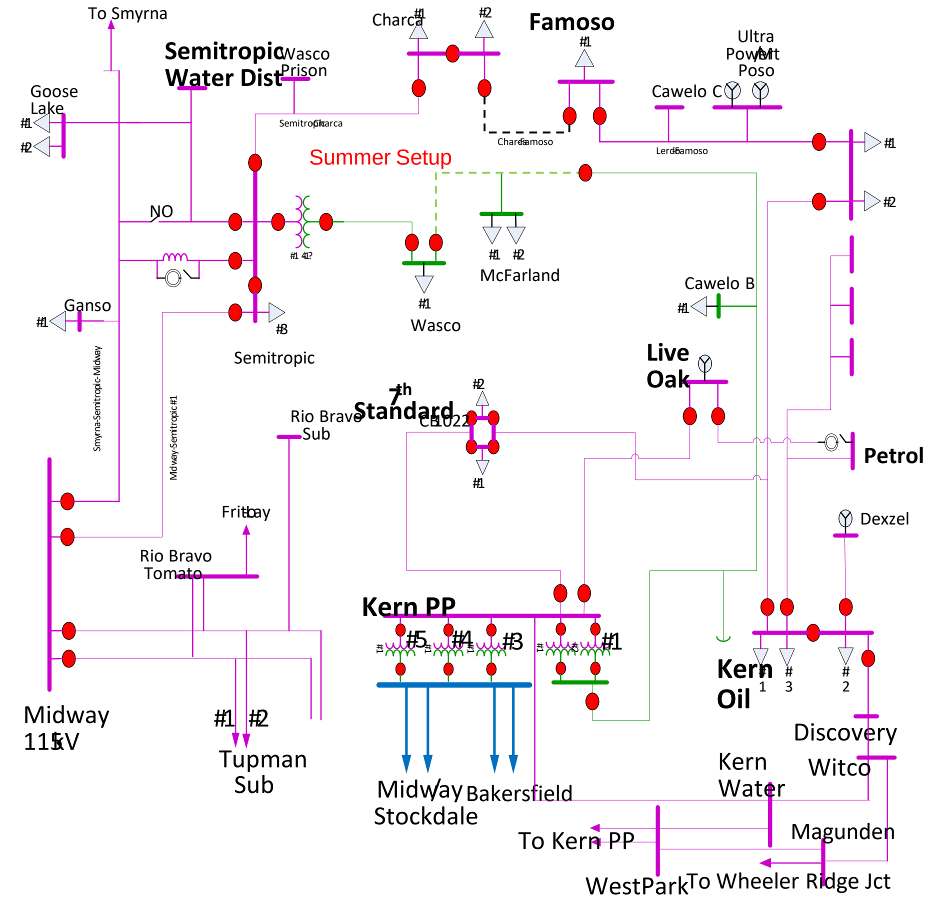
Summer Setup related Kern Area Issues

<u>Observations</u>

- Multiple 70 kV overloads (P1/P2/P3 and P6) between
  Semitropic and Kern PP 70 kV substations
- Multiple 70 kV Voltage Issues (P1/P2/P3 and P6)
  between Semitropic and Kern PP 70 kV
  substations
- Multiple 115 kV Thermal/Voltage issues(P1/P2/P3
  and P6) observed in Semitropic 115 kV area

<u>Potential Mitigations</u>

- Continue with Summer Setup



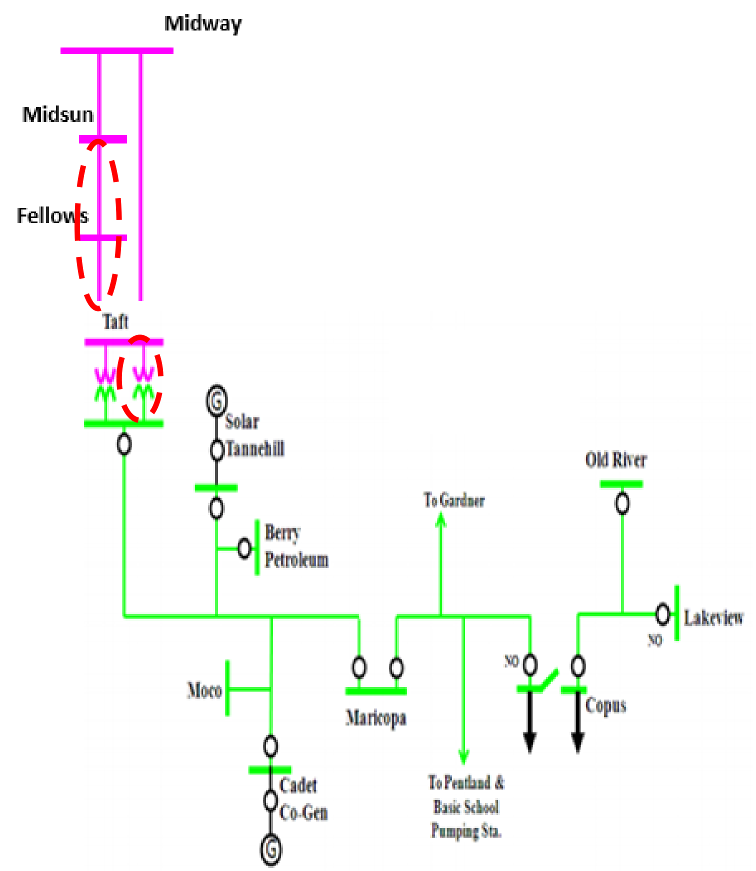
Kern– Results Summary New 115 kV Issue

Observations

- P3 Overload observed On Taft 115/70 kV T/F bank # 2 (Starting in 2019 and subsequently goes down)
  - 2028 Area load (68 MW) is lower than the 2019 and 2023 area load.
- P1/P2 contingencies resulting in loss of one of Midway-Taft lines results in overload on the other line for off-peak and sensitivities.

Potential Mitigations

- Monitor the Bank overload due to the long term load decline trend.
- Rely on operating solutions including redispatch /Preferred Resource/upgrade for the 115 kV overloads



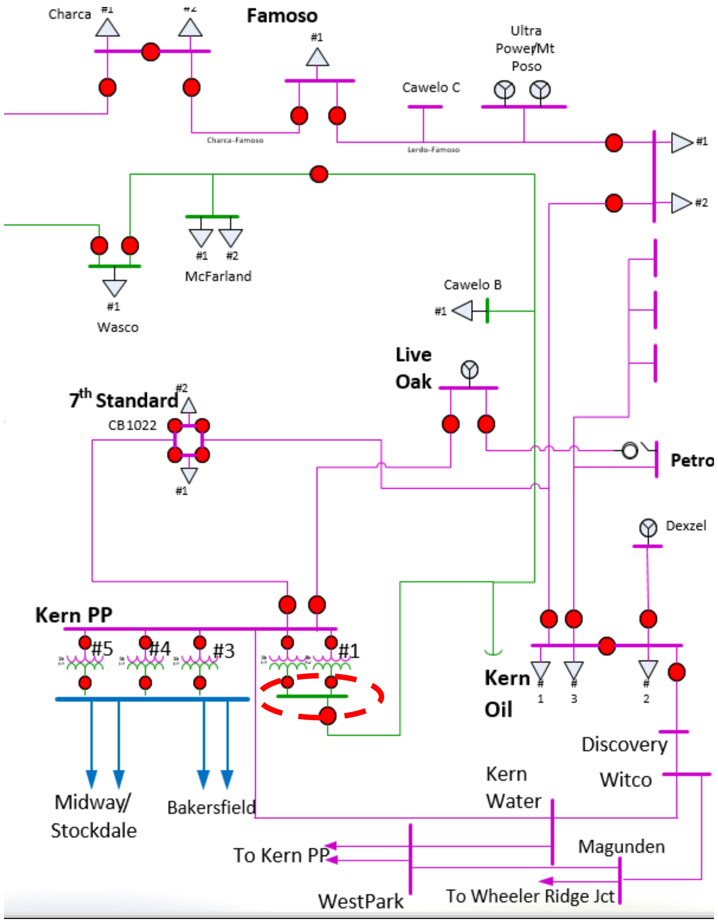
Kern– Results Summary New 70 kV Issue

<u>Observations</u>

- P2/P6 Overload observed on the kern PP 70 kV bus tie in the summer peak and sensitivity cases
- This limiting element also shows up in the long term LCR study for the area.

<u>Potential Mitigation</u>

Replace the limiting element.



Sensitivity Study Assessment

- Below is the list of facility overloads identified in sensitivity scenario(s) only.

Overloaded Facility	Category	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	2028 Retirement of QF Generations
ARCO-CARNERAS - FROM ARCO TO 3/4	P0/P1		√		
KERN-LIVE OAK - FROM KERN PP TO LIVE OAK SUB	P6		√		
FELLOWS-SANTAFE Sub	P3		√	√	

Greater Bay Area
Preliminary Reliability Assessment Results

Binaya Shrestha
Regional Transmission Engineer Lead

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Greater Bay Area

- Service areas cover Alameda, Contra Costa, Santa Clara, San Mateo and San Francisco counties.
- Supply sources: Vaca Dixon, Tesla and Metcalf
- Comprised of 60, 115 & 230 & 500 kV transmission facilities.
- For ease of conducting the performance evaluation, the Greater Bay Area is divided into Seven sub-areas:
  - San Francisco
  - San Jose
  - Peninsula
  - Mission
  - East Bay
  - Diablo
  - De Anza

Load and Load Modifier Assumptions - Greater Bay Area

Base Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
					Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
GBA-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 18:00.	8,741	127	1,323	192	8,422	183	95
GBA-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours ending 19:00.	7,901	122	1,323	0	7,779	183	95
GBA-2020-SpOP	Baseline	2020 spring off-peak load conditions. Off-peak load time - hours ending 12:00.	5,072	92	1,323	1045	3,935	183	95
GBA-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	7,320	127	1,323	1310	5,883	183	95
GBA-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 18:00.	9,121	253	1,900	275	8,593	184	95
GBA-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours ending 18:00.	8,192	199	1,900	19	7,974	184	95
GBA-2023-SpOP	Baseline	2023 spring off-peak load conditions. Off-peak load time - hours ending 13:00.	5,109	187	1,900	1596	3,326	184	95
GBA-2023-SP-Hi-CEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	9,121	0	1,900	275	8,846	184	95
GBA-2023-SpOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	5,109	187	1,900	1881	3,041	184	95
GBA-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 18:00.	9,514	480	2,795	281	8,753	184	95
GBA-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours ending 19:00.	8,618	473	2,795	0	8,145	184	95
GBA-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	9,514	480	2,795	281	8,753	184	95

Note: Includes PG&E load only. DR and storage are modeled offline in starting base cases.

Generation Assumptions - Greater Bay Area

Base Case	Scenario Type	Description	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
				Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
GBA-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 18:00.	5	21	4	263	97	0	0	7,848	5,118
GBA-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours ending 19:00.	5	21	0	263	11	0	0	7,848	3,174
GBA-2020-SpOP	Baseline	2020 spring off-peak load conditions. Off-peak load time - hours ending 12:00.	5	21	21	263	13	0	0	7,848	1,684
GBA-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	5	21	21	263	176	0	0	7,848	1,896
GBA-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 18:00.	5	21	3	263	136	0	0	7,848	4,742
GBA-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours ending 18:00.	5	21	0	263	8	0	0	7,848	4,226
GBA-2023-SpOP	Baseline	2023 spring off-peak load conditions. Off-peak load time - hours ending 13:00.	5	21	20	263	5	0	0	7,848	527
GBA-2023-SP-Hi-CEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	5	21	3	263	122	0	0	7,848	5,477
GBA-2023-SpOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	5	21	21	263	140	0	0	7,848	281
GBA-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 18:00.	5	21	2	263	55	0	0	7,848	4,091
GBA-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours ending 19:00.	5	21	0	263	28	0	0	7,848	3,269
GBA-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	5	21	2	263	55	0	0	7,848	4,142

Note: Includes PG&E load only. DR and storage are modeled offline in starting base cases.

Previously approved transmission projects modelled in base cases

Project Name	Division	First Year Modeled
Christie 115/60 kV Transformer No. 2	East Bay	2020
East Shore-Oakland J 115 kV Reconductoring Project	East Bay	2023
North Tower 115 kV Looping Project	East Bay	2023
Oakland Clean Energy Initiative Project	East Bay	2023
Contra Costa Sub 230 kV Switch Replacement	Diablo	2020
Pittsburg 230/115 kV Transformer Capacity Increase	Diablo	2023
Martin 230 kV Bus Extension	San Francisco	2023
South of San Mateo Capacity Increase (revised scope)	Peninsula	2020 2028
Cooley Landing 115/60 kV Transformer Capacity Upgrade	Peninsula	2020
Ravenswood – Cooley Landing 115 kV Line Reconductor	Peninsula	2020
Cooley Landing-Palo Alto and Ravenswood-Cooley Landing 115 kV Rerate	Peninsula	2020
Moraga-Castro Valley 230 kV Line Capacity Increase Project	Mission	2023
Monta Vista 230 kV Bus Upgrade	De Anza	2020
Newark-Lawrence 115 kV Line Upgrade	De Anza	2020
NRS-Scott No. 1 & 2 115 kV Lines Reconductor	San Jose	2020
Metcalf-Evergreen 115 kV Line Reconductoring	San Jose	2020
Los Esteros 230 kV Substation Shunt Reactor	San Jose	2020
Newark-Milipitas #1 115 kV Line Upgrade	San Jose	2020
Trimble-San Jose B 115 kV Line Upgrade	San Jose	2020
San Jose-Trimble 115 kV Series Reactor	San Jose	2020
Morgan Hill Area Reinforcement (revised scope)	San Jose	2023
Metcalf-Piercy & Swift and Newark-Dixon Landing 115 kV Upgrade	San Jose	2023

Previously approved transmission projects not modelled in base cases (on-hold)

Project Name	Division	First Year Modeled
Jefferson - Stanford #2 60 kV Line	Peninsula	N/A

Reliability assessment preliminary results summary

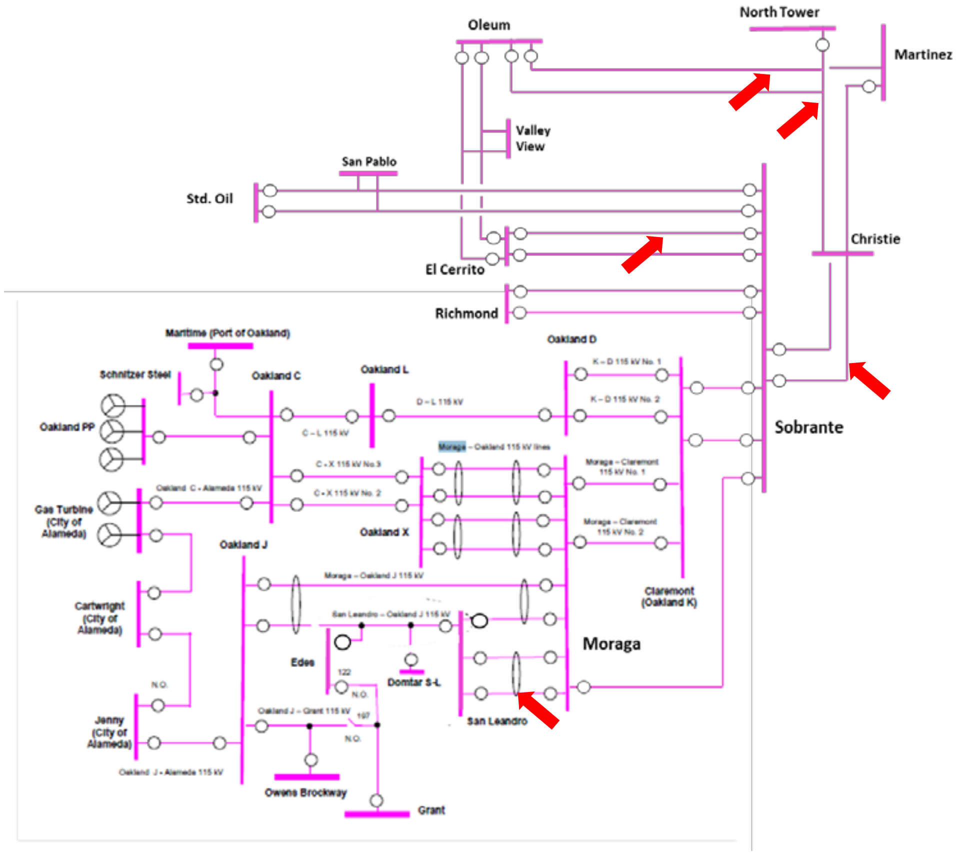
East Bay Division – Results Summary

<u>Observations</u>

- No issues identified in Northern Oakland area due to modeling of OCEI project.
- P2, P3 & P6 Overloads observed in Southern Oakland even with East Shore-Oakland J 115 kV reconductoring project (New).
  - Due to load increase from last year and also higher than recorded 3-year average.
- P2 & P6 overloads in Oleum/Martinez 115 kV system.
- High voltages observed mainly in 115 kV system in 2023 off-peak high renewable sensitivity case.

<u>Potential Mitigations</u>

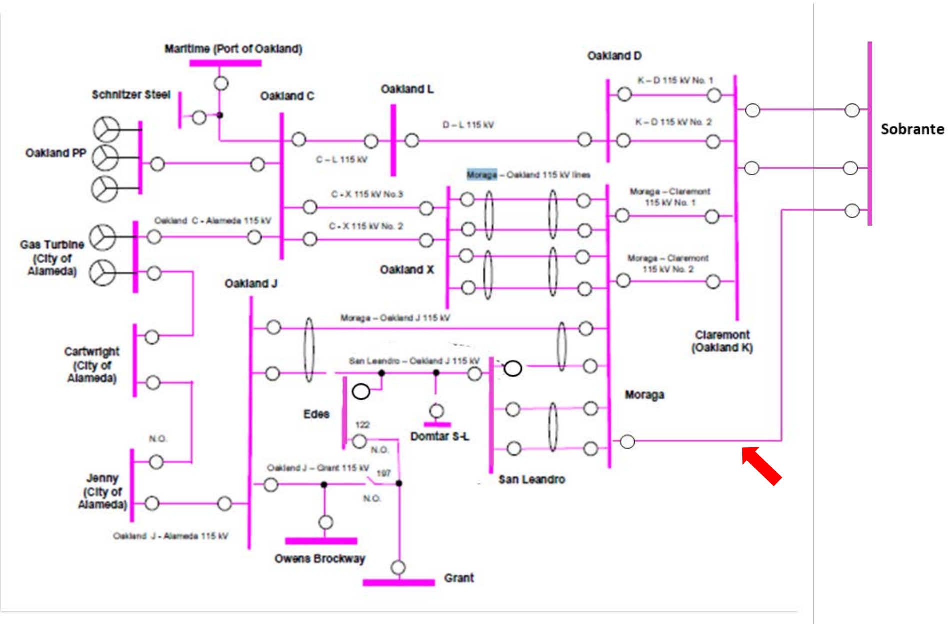
- The overall East Bay area load appears higher than historical recorded. Continue to monitor loads at stations served by the overloaded lines.
- New project in Oleum/Martinez 115 kV system expected.



Diablo Division – Results Summary

<u>Observations</u>

- P2 overloads observed on the Sobrante-Moraga 115kV line.
  - The Sobrante-Moraga 115kV line serves loads in East Bay area. The overall East Bay area load looks higher than historical recorded.
  - P3 overload observed on Pittsburg 230/115 kV bank #13.
- High voltages observed mainly in 115 kV system in 2023 peak and off-peak cases. High voltage observed in some 230 kV buses as well in 2023 off-peak high renewable sensitivity case.



<u>Potential Mitigations</u>

- Moraga and Sobrante 230 kV bus upgrade or line rerate.
- Pittsburg 230/115 kV Transformer Capacity Increase

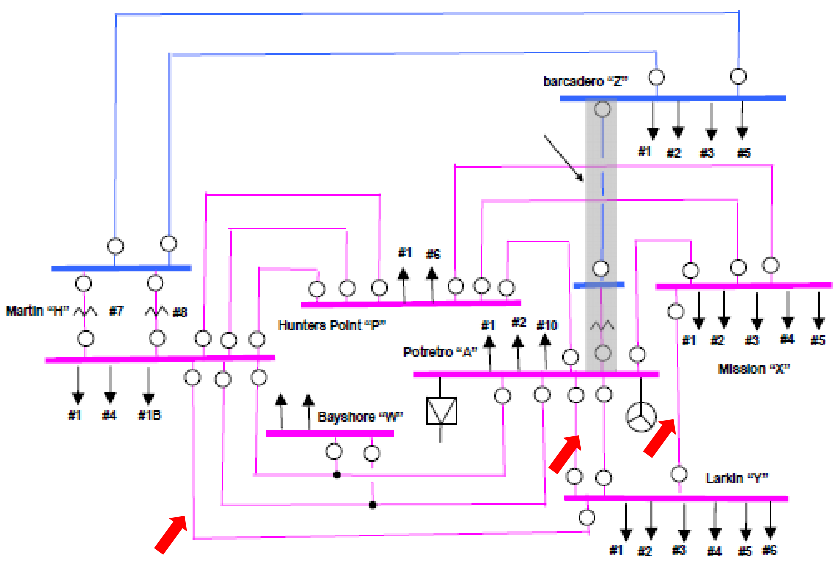
San Francisco Division – Results Summary

Observations

- P6 overloads identified on 115 kV cables.
- High voltages observed at Martin in most of the cases. High voltage observed in some other 115 kV buses as well in 2023 off-peak high renewable sensitivity case.

Potential Mitigations

- Mitigated by Larkin bus upgrade (maintenance project) and TBC runback scheme modification.
- Verify tap settings at Martin.



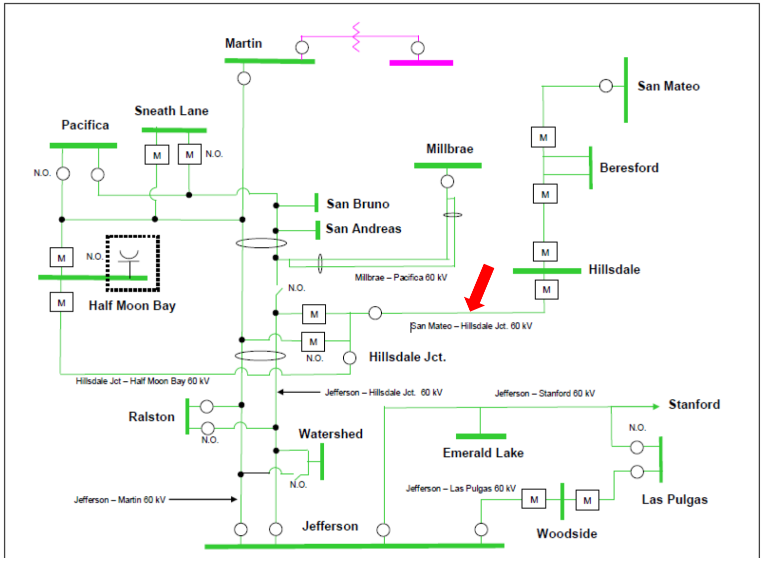
Peninsula Division – Results Summary

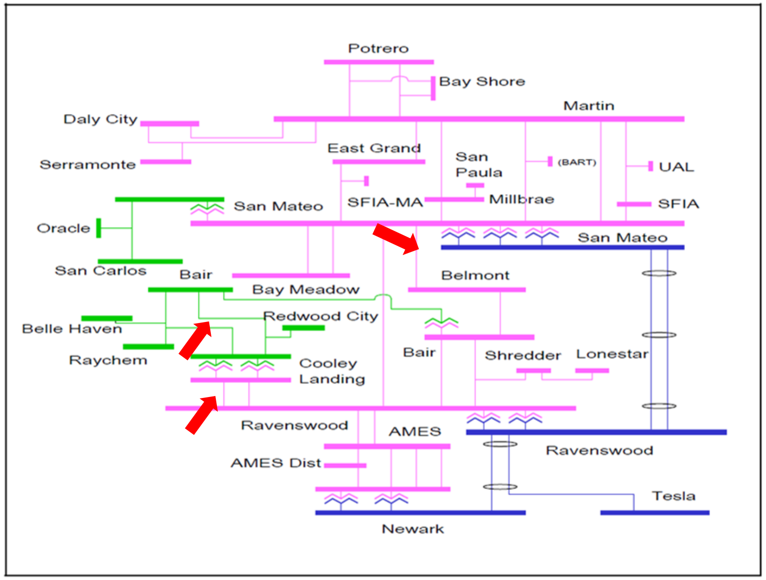
<u>Observations</u>

- P2 & P6 overloads identified on Peninsula 60 kV lines.
  - Due to interim setup for Jefferson-Stanford #2 60 kV line project
  - Mostly non-BES facilities
- P2, P3 & P6 overloads on Ravenswood 230/115kV Transformer #1 (New)
  - Due to higher load and South of San Mateo revised scope
- P2 overloads on Ravenswood-Cooley Landing #1 115kV Line
- P2 & P6 overloads on San Mateo-Belmont 115kV Line
- High voltages observed mainly in 60 kV system in 2023 off-peak. Low voltages also observed in 60 kV system for loss of 230 kV source at Jefferson.

<u>Potential Mitigations</u>

- Upgrade limiting equipment on the Ravenswood 230/115 kV Transformer #1.
- Ravenswood - Cooley Landing 115 kV Line Reconductor mitigates most of the overloads
- Continue to monitor load in Peninsula division.





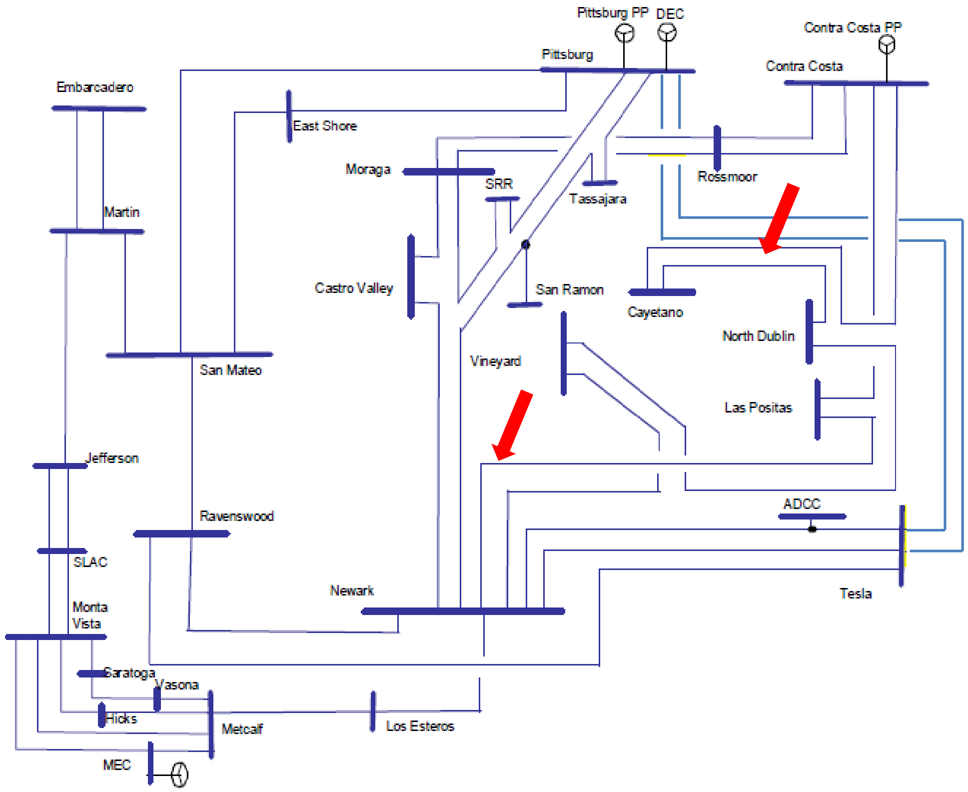
Mission Division – Results Summary

Observations

- P1, P2 & P6 overloads starting 2023 on 230 kV lines between Contra Costa and Newark (New).
  - Due to significant load increase from last year.
- High voltages observed mainly in sub-transmission (115 & 60 kV) system in 2020 and 2023 off-peak cases.

Potential Mitigations

- The overall Mission division load appears higher than historical recorded. Continue to monitor load in Mission division.



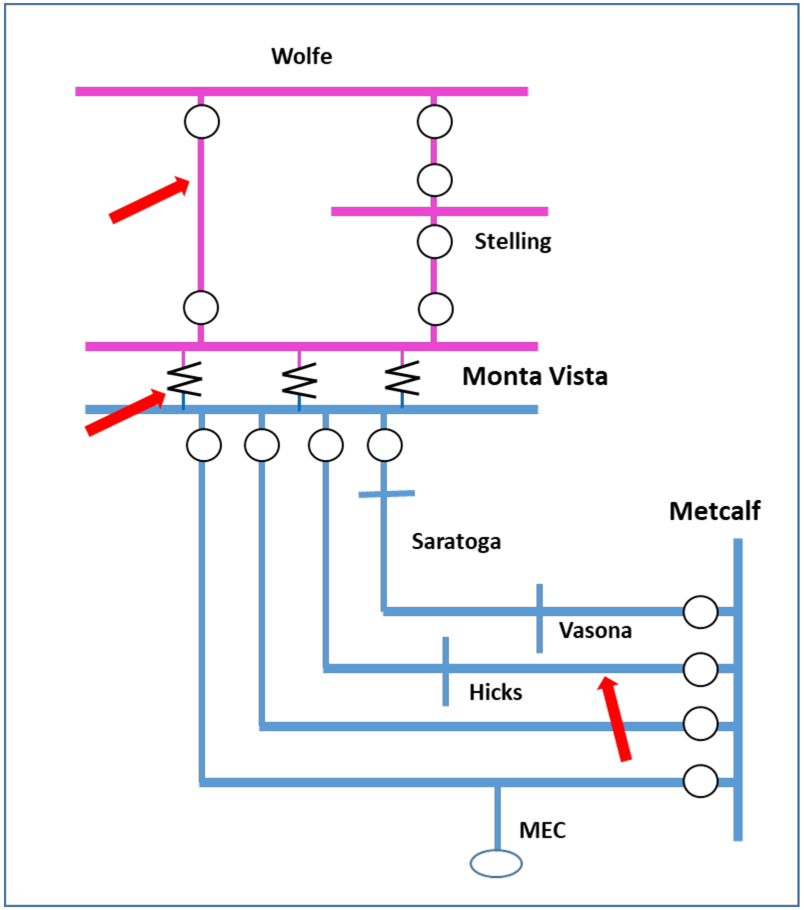
De Anza Division – Results Summary

Observations

- P1 overload starting 2023 on Monta Vista-Wolfe 115 kV Line (New).
  - Due to significant load increase from last year and also higher than recorded 3-year average.
- P2 overloads on Monta Vista 230/115 kV banks 2 & 3
- P2 overload on Monta Vista-Hicks 230 kV line (2028 only)
- High voltages observed mainly in sub-transmission (115 & 60 kV) system in 2020 off-peak case.

Potential Mitigations

- Continue to monitor loads at Wolfe and Stelling in future cycle.
- Monta Vista 230 kV Bus Upgrade.
- No new upgrades expected this year.



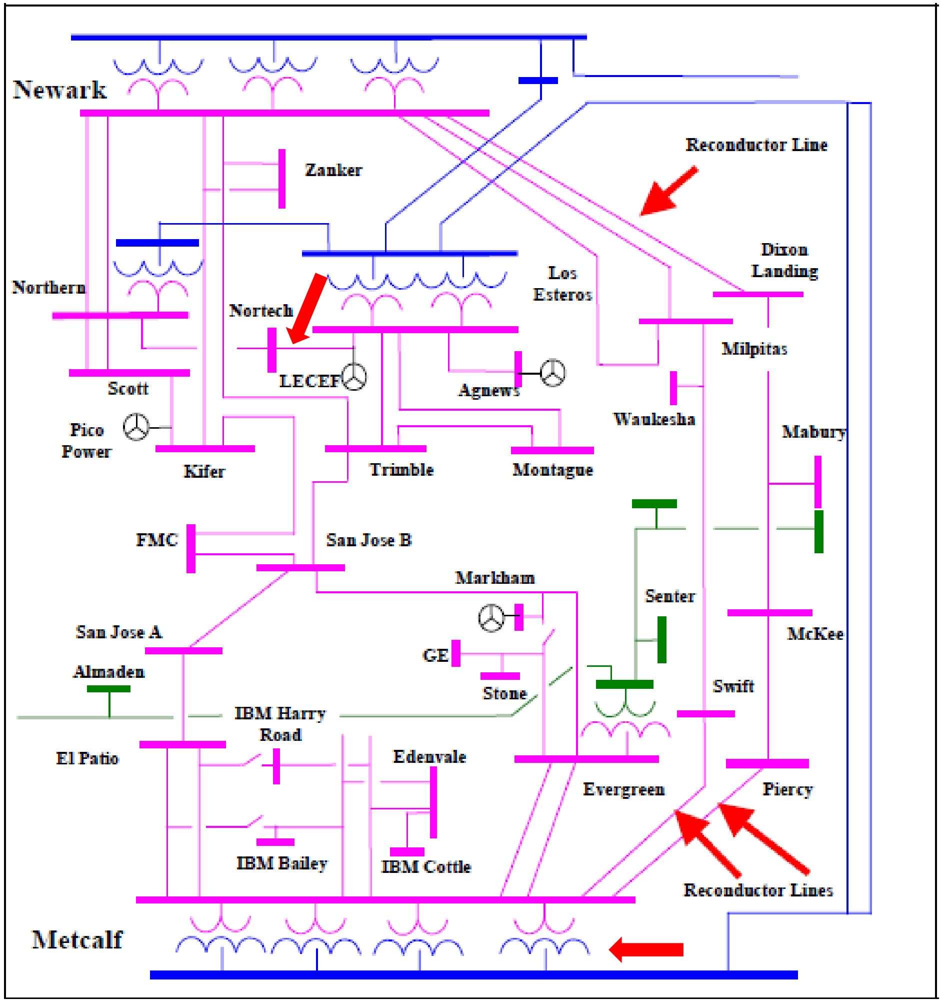
San Jose Division – Results Summary

Observations

- P1 & P2 overloads on Newark-Dixon Landing and Piercy-Metcalf 115kV lines.
- P1 overload starting 2028 on Los Esteros-Nortech and NRS-Scott 115 kV Lines (New). P2, P3 & P6 overloads on other 115 kV lines in the area, some starting 2023 (New).
  - Due to high load in the area
- P2 overloads on Metcalf 230/115 kV transformers starting 2020.
- High voltages observed mainly in sub-transmission (115 & 60 kV) system in 2020 and 2023 off-peak cases. Low voltage also observed in 60 kV system for Metcalf 115 kV and breaker outage.

Potential Mitigations

- Metcalf - Piercy & Swift and Newark - Dixon Landing 115 kV Upgrade.
- Continue to monitor loads in the area in future cycle.
- Bus upgrade or preferred resource mitigation for Metcalf banks overloads.



Assessment of on-hold projects

Jefferson-Stanford #2 60 kV Line

Approved cycle:
- 2010-2011 TPP

Original scope:
- Build a new Jefferson- Stanford #2 60 kV line

Project cost:
- Original cost: $25M-$35M
- Current estimated cost: $30M-$40M

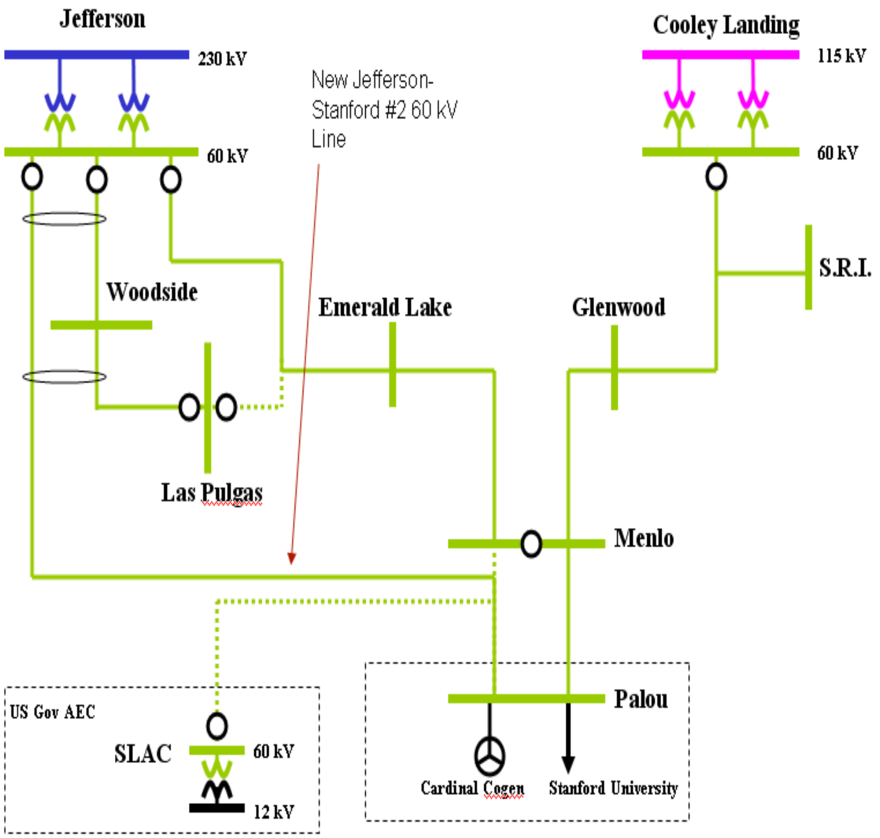
Current In-service Date:
- On hold

Reliability Assessment Need:
- NERC Category P6 and P7 BES contingencies resulting in overloads on Peninsula 60 kV system.

Mitigation still required {or not}:
- Mitigation required for reliability

Review of current project to meet need:
- Current needs are driven by interim system reconfiguration.
- Project scope does mitigate original need.

Next Step:
- Work with Stanford for status of project to connect to alternate source.
- If the project is moving forward, the Jefferson-Stanford #2 60 kV line project could be canceled and continue to monitor P6 & P7 driven issues.
- Work towards developing potential mitigations which could include Peninsula 60 kV system redialization and/or SPS.



Sensitivity Study Assessment

- Below is the list of facility overloads identified in sensitivity scenario(s) only.

Overloaded Facility	Category	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	2028 Retirement of QF Generations
Los Esteros-Montague 115 kV Line	P6	√			
San Mateo-Belmont 115kV Line	P7	√			

Summary of Potential New Upgrades

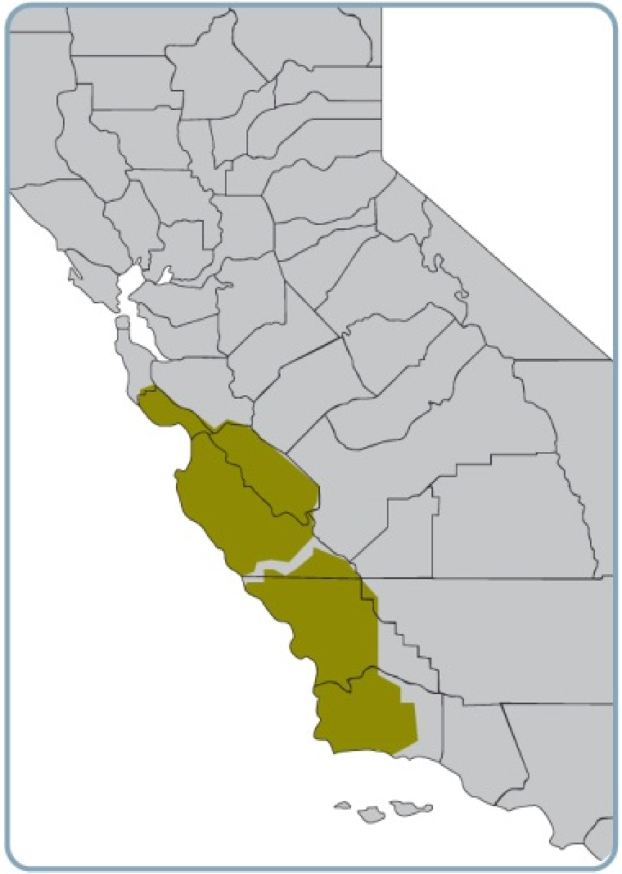
Division	Expected Upgrade
East Bay	New project in Oleum/Martinez 115 kV system
Diablo	Sobrante 230 kV bus upgrade or Sobrate-Moraga 115 kV line rerate
San Francisco	None
Penninsula	Upgrade limiting equipment on the Ravenswood 230/115 kV Transformer #1
Mission	None
De Anza	None
San Jose	Bus upgrade or preferred resource mitigation for Metcalf banks overloads
Voltage Mitigation	None

Central Coast Los Padres
Preliminary Reliability Assessment Results

Lindsey Thomas
Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Central Coast / Los Padres Area



- Central Coast is located south of the Greater Bay Area, it extends along the central coast from Santa Cruz to King City
- Major substations in Central Coast: Moss Landing, Green Valley, Paul Sweet, Salinas, Watsonville, Monterey, Soledad and Hollister
- Central Coast supply sources: Moss Landing, Panoche, King City and Monta Vista
- Central Coast transmission system includes 60, 115, 230 and 500 kV facilities

- Los Padres is located south of the Central Coast Division
- Major substations in Los Padres : Paso Robles, Atascadero, Morro Bay, San Luis Obispo, Mesa, Divide, Santa Maria and Sisquoc
- Key supply sources in Los Padres include Gates, Midway and Morro Bay
- Diablo Canyon nuclear power plant (2400 MW) is located in Los Padres but does not serve the area
- Los Padres transmission system includes 70, 115, 230 and 500 kV facilities

Study Scenarios - Load

S. No.	Study Case	Scenario Type	Description	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response	
						Installed (MW)	Output (MW)		Total (MW)	D2 (MW)
1	CCLP-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 20:00.	1,253	23	324	0	1,231	29	16
2	CCLP-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 20:00.	1,298	46	403	0	1,252	29	16
3	CCLP-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 20:00.	1,356	86	487	0	1,270	29	16
4	CCLP-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – hours ending 12:00.	655	17	324	256	382	29	16
5	CCLP-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – hours ending 13:00.	653	34	403	339	281	29	16
6	CCLP-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours ending 19:00.	1,188	22	324	0	1,166	29	16
7	CCLP-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours ending 18:00.	1,225	25	403	4	1,197	29	16
8	CCLP-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours ending 19:00.	1,292	85	487	0	1,207	29	16
9	CCLP-2023-SP-HiCEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	1,298	0	403	0	1,298	29	16
10	CCLP-2023-SOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	653	34	403	399	220	29	16
11	CCLP-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	1,105	23	324	321	761	29	16
12	CCLP-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	1,226	86	487	0	1,134	29	16

Study Scenarios - Generation

S. No.	Study Case	Scenario Type	Description	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
					Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
1	CCLP-2020-SP	Baseline	2020 summer peak load conditions. Peak load time - hours ending 20:00.	0	841	0	0	0	0	0	3,939	1,237
2	CCLP-2023-SP	Baseline	2023 summer peak load conditions. Peak load time - hours ending 20:00.	0	841	0	0	0	0	0	3,773	1,221
3	CCLP-2028-SP	Baseline	2028 summer peak load conditions. Peak load time - hours ending 20:00.	0	816	0	0	0	0	0	3,773	1,252
4	CCLP-2020-SOP	Baseline	2020 spring off-peak load conditions. Off-peak load time – hours ending 12:00.	0	841	832	0	0	0	0	3,939	1,177
5	CCLP-2023-SOP	Baseline	2023 spring off-peak load conditions. Off-peak load time – hours ending 13:00.	0	841	742	0	0	0	0	3,773	130
6	CCLP-2020-WP	Baseline	2020 winter peak load conditions. Peak load time - hours ending 19:00.	0	841	0	0	0	0	0	3,939	1,228
7	CCLP-2023-WP	Baseline	2023 winter peak load conditions. Peak load time - hours ending 18:00.	0	841	0	0	0	0	0	3,939	1,176
8	CCLP-2028-WP	Baseline	2028 winter peak load conditions. Peak load time - hours ending 19:00.	0	816	0	0	0	0	0	3,773	1,252
9	CCLP-2023-SP-HiCEC	Sensitivity	2023 summer peak load conditions with hi-CEC load forecast sensitivity	0	841	0	0	0	0	0	3,773	1,252
10	CCLP-2023-SOP-HiRenew	Sensitivity	2023 spring off-peak load conditions with hi renewable dispatch sensitivity	0	841	800	0	0	0	0	3,773	145
11	CCLP-2020-SP-HiRenew	Sensitivity	2020 summer peak load conditions with hi-renewable dispatch sensitivity	0	841	832	0	0	0	0	3,939	653
12	CCLP-2028-SP-QF	Sensitivity	2028 summer peak load conditions with QF retirement sensitivity	0	816	0	0	0	0	0	3,773	1,122

Previously approved transmission projects modelled in base cases

Project Name	Division	First Year Modeled
Coburn – Oil fields 60kv System	Central Coast	2022
Morgan Hill Scope Revision	Central Coast	2021
Estrella Substation Project	Los Padres	2019

Previously approved transmission projects not modelled in base cases (on-hold)

Project Name	Division	First Year Modeled
Midway – Andrew 230kv	Los Padres	N/A
Morrow Bay 230/115 kV Transformer Project	Los Padres	N/A
Diablo Canyon Voltage Support Project	Los Padres	N/A

Reliability assessment preliminary results summary

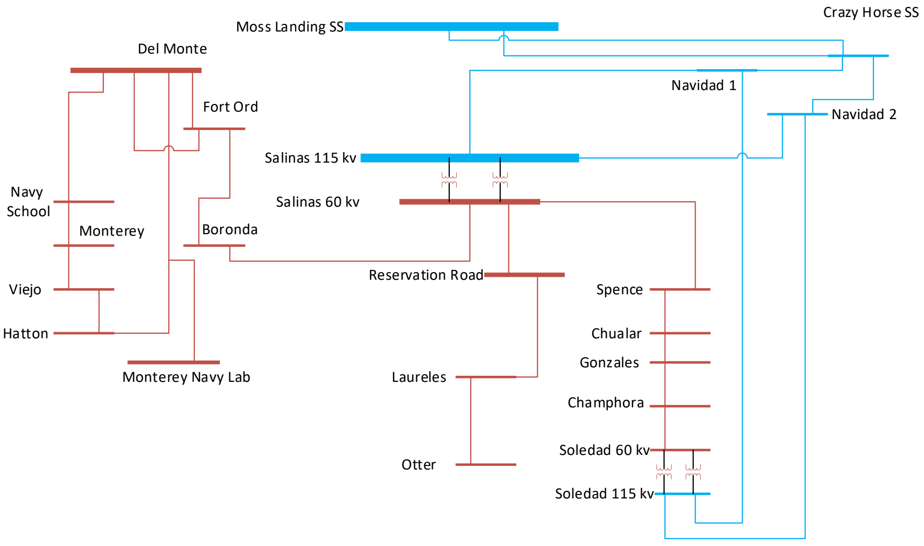
Central Coast Division – Results Summary

<u>Observations</u>

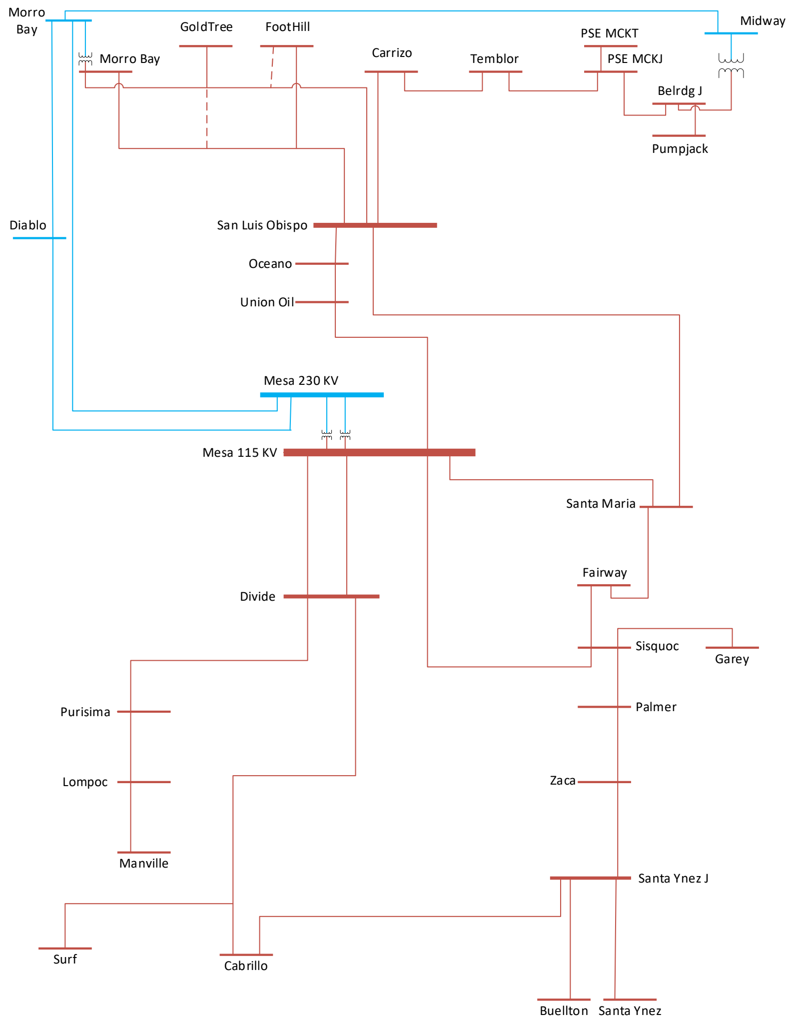
- Loss of Salinas 115/60kv banks 2 and 3 cause overloads and voltage collapse in the area.
- Moss landing-green valley #1 and #2 lines cause 2020 overloads.

<u>Potential Mitigations</u>

- Modify the existing UVLS and/or update the operating solution for this contingency.
- Once Morgan Hill goes into service overloads are mitigated.



Los Padres Division – Results Summary



Observations

- Overloads at Morro Bay, Mesa, and Diablo
- P6 Overloads and voltage in Paso Robles area

Potential Mitigations

- Midway – Andrew project
- Modify the existing Paso Robles area UVLS for load growth in area.

Assessment of on-hold projects

Midway – Andrew

Approved cycle:

- 2012-2013 TPP

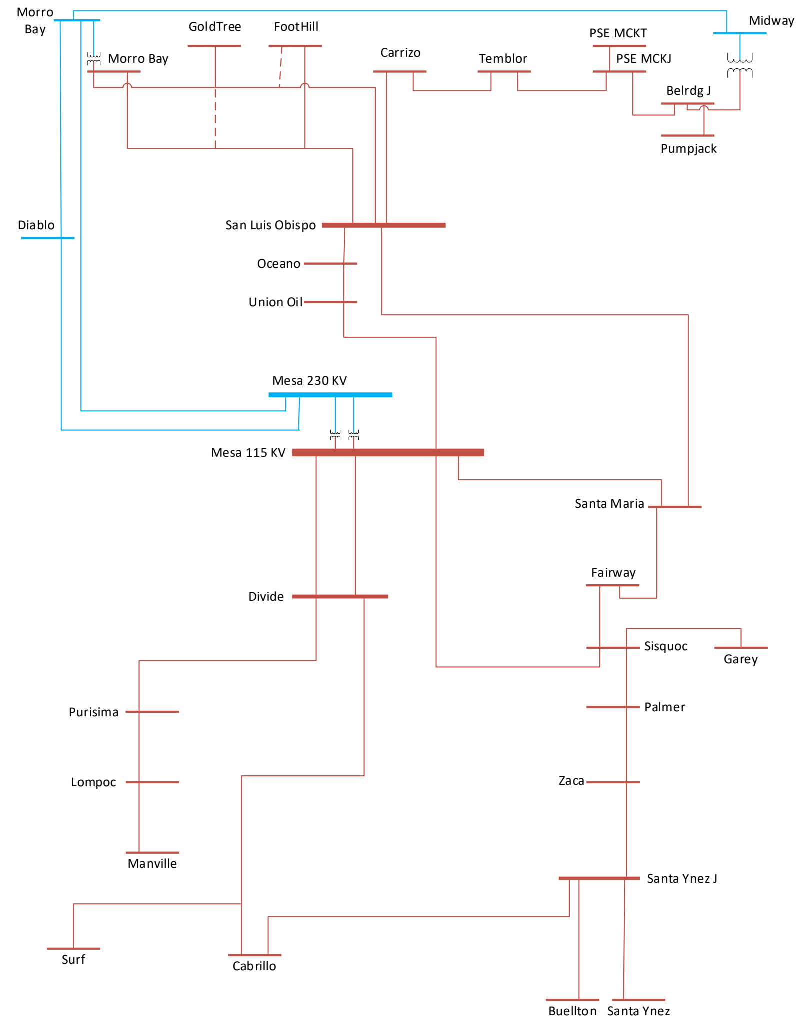
Original scope:

- Build new 230/115 kV Andrew substation

- Upgrade existing Midway-Santa Maria 115 kV line to 230 kV and build new Andrew-Divide 115 kV line.

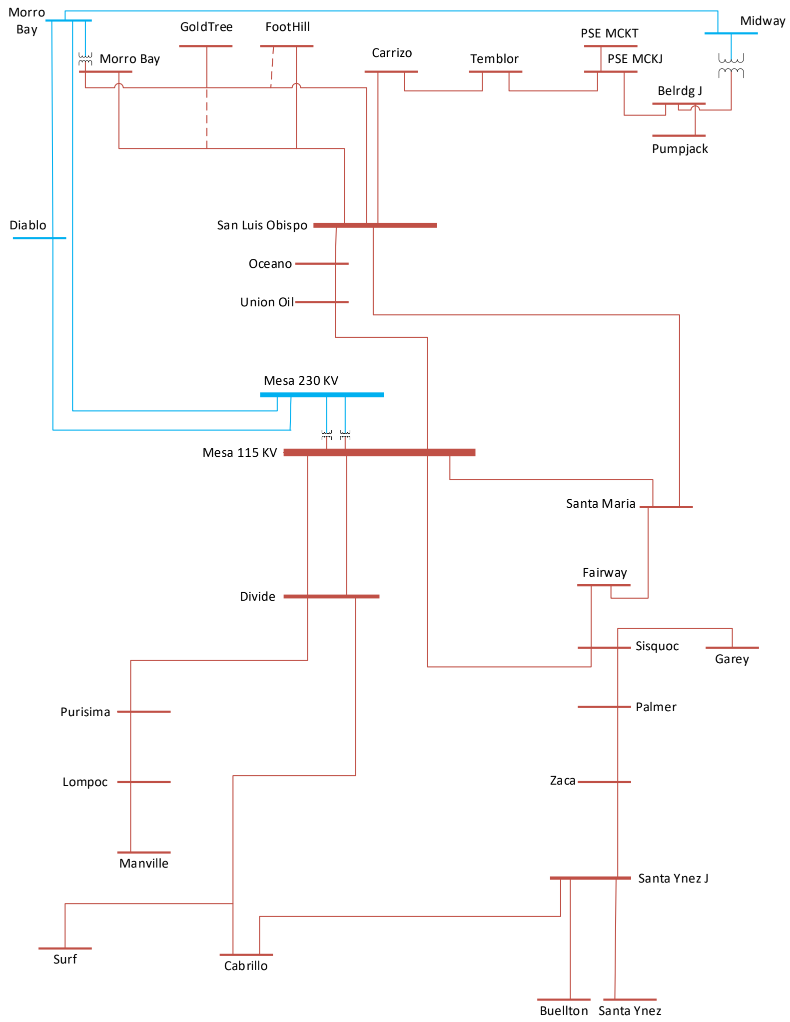
Project cost:

- Original cost: $120 to $150 million
- Current estimated cost: $215 million
- **Current In-service Date:**
- June 2025

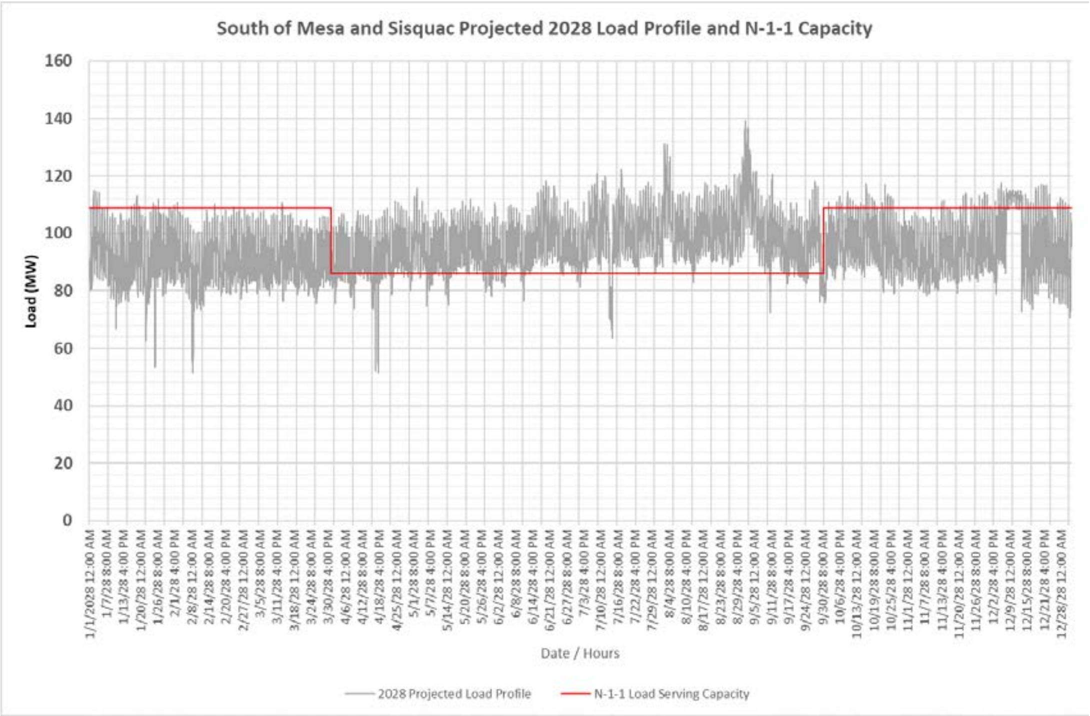


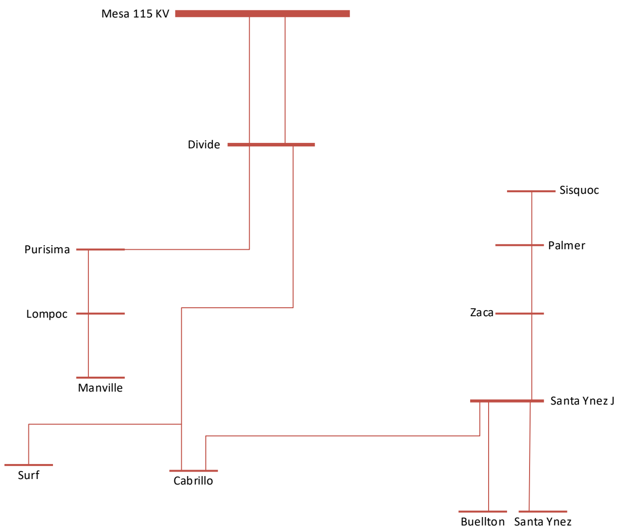
Midway – Andrew

- In this year's analysis, no P0, P1, or P3 overload were identified in this area.
- The following P6 contingencies cause criteria violation:
  - Mesa – Morro Bay and Mesa – Diablo 230 kV lines
  - Mesa-Divide #1 and #2 115 kV line
  - Mesa 230/115 kV transformer #1 and #2
- Maintenance outage review



Maintenance Outage of Mesa – Divide 115 kV Lines

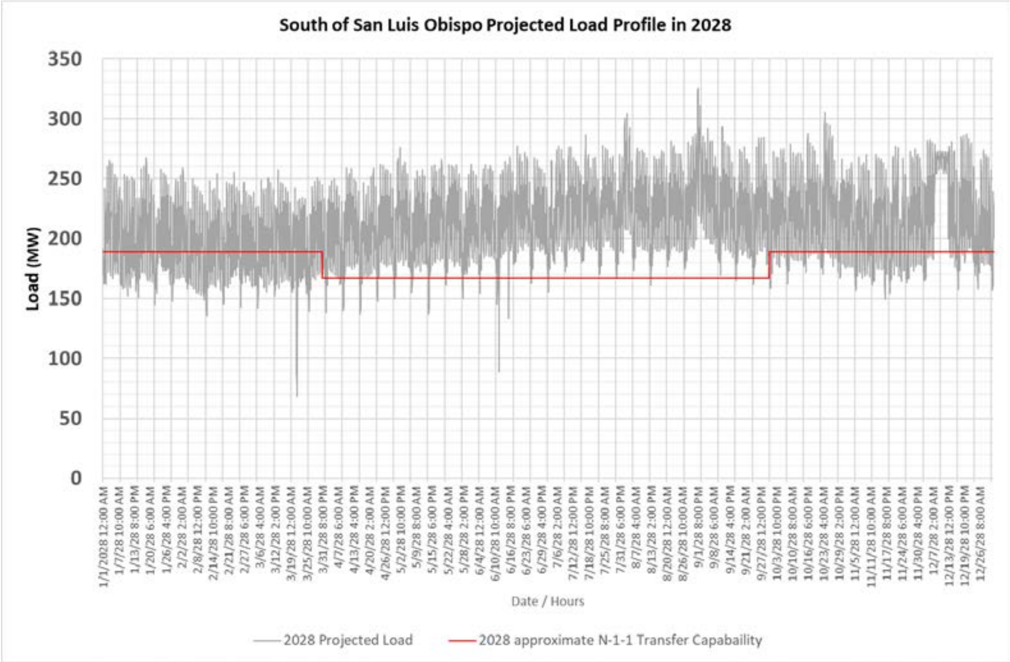


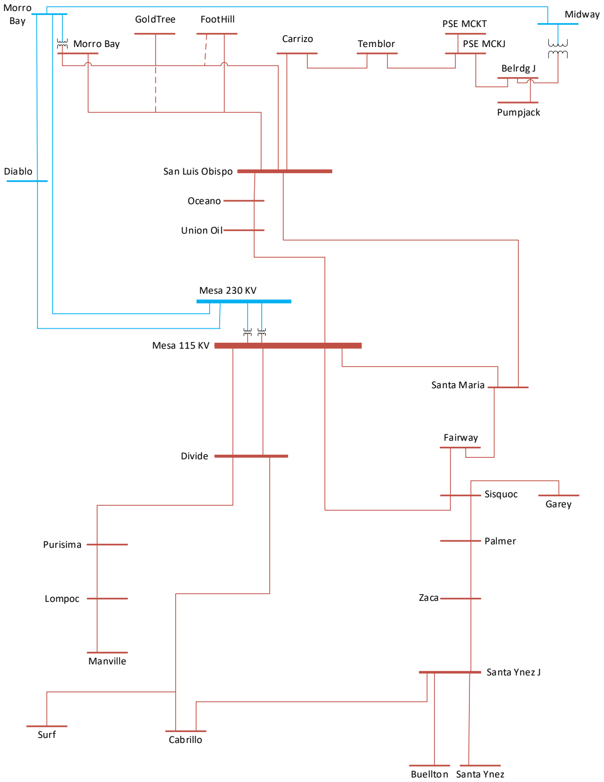


Potential Mitigations

- Alternative 1: Increase the Winter emergency rating of Sisquoc - Santa Ynez 115 kV line to 120 MVA, install 20 Mvar capacitor bank at Cabrillo, and install SPS to shed load if P6 occurs under peak load
- Alternative 2: Increase the Summer emergency rating of Sisquoc - Santa Ynez 115 kV line to around 160 MVA and install SVC at Cabrillo
- Alternative 3: Build a new greenfield 115 kV line from Divide to Mesa or other substations.

Maintenance Outage of Mesa 230 kV Lines or Transformers





Potential Mitigations

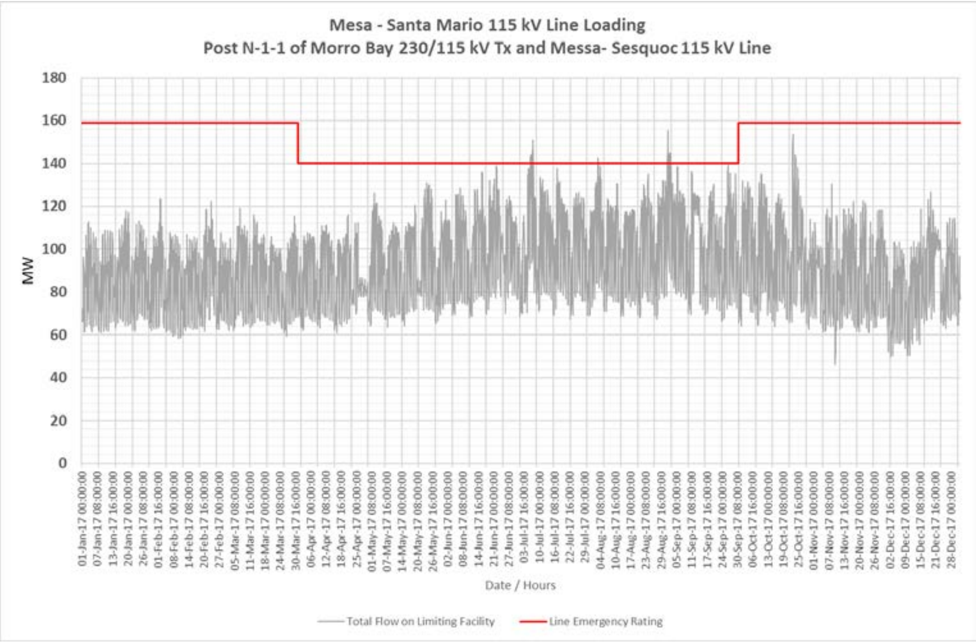
- Alternative 1: Increase the Winter emergency rating of San Luis Obispo (SLO) – Santa Maria 115 kV line to 170 MVA, increase the Winter emergency rating of SLO – Mesa 115 kV line to 130 MVA, and install 50 Mvar capacitor bank at Mesa or SLO, and install SPS to shed load if P6 occurs under peak load

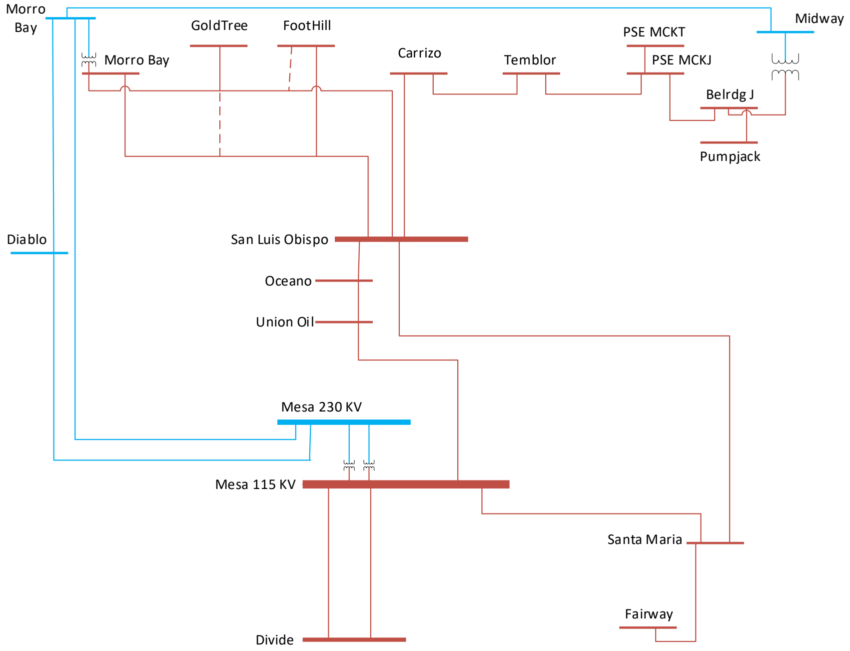
- Alternative 2: Build Andrew 230/115 kV substation, energize Diablo – Midway 500 kV line at 230 kV and connect to Andrew substation, and loop-in the SLO – Santa Maria 115 kV line to Andrew and Mesa substations.

Morro Bay 230/115 kV Transformer Project

- In this year's analysis, no P0, P1, or P3 overload were identified following the Morro Bay 230/115 kV Tx outage.
- Maintenance outage review based on historical data indicated that reasonable opportunity is available to take transformer out for maintenance. Therefore this project could be canceled.

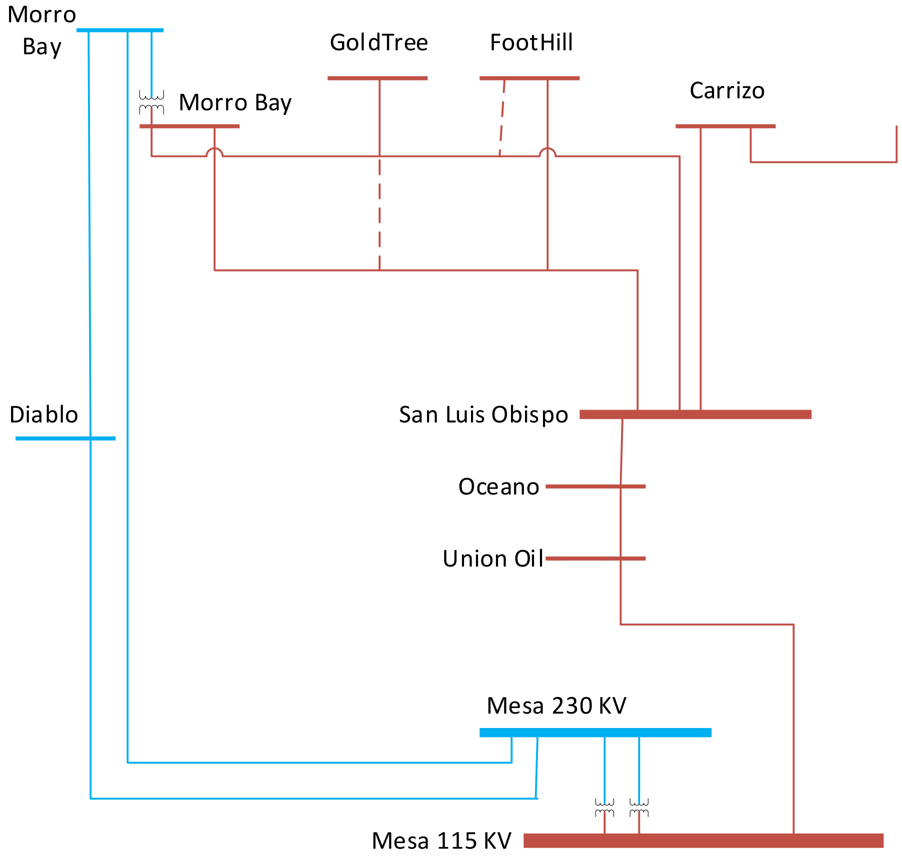
2017 Historical Flows





Diablo Canyon Voltage Support Project

- This project will be evaluated as part of the review of voltage support required for system and nuclear power intertie requirements



PG&E Bulk System
Preliminary Reliability Assessment Results

Irina Green
Senior Advisor, Regional Transmission North

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Presentation Posted on Market Participant Portal

SCE Metro Area
Preliminary Reliability Assessment Results

Nebiyu Yimer
Regional Transmission Engineer Lead

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

SCE Metro Area

- Includes Los Angeles, Orange, Ventura and Santa Barbara counties
- Comprised of 500 kV and 230 kV transmission facilities
- 1-in-10 summer peak net load of 18,192 MW in 2028
- Forecast load includes the impact of 4,229 MW of BTM PV and 1,473 MW of AAEE
- Generation capacity will decrease by 3800 MW from 9,600 MW by 2021.

SCE Metro Area Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	Summer peak load time (9/3 HE 16 PST)
B2	2023 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B3	2028 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B4	2020 Spring Light Load	Spring minimum net load time (4/9 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

No	Case	Change From Base Assumption
S1	2023 Summer Peak	High CEC forecasted load
S2	2023 Spring Off-Peak	Heavy renewable output and minimum gas generation commitment
S3	2020 Summer Peak	Heavy renewable output and minimum gas generation commitment

Demand Side Assumptions

Scenario No.	Base Case	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response (installed)	
				Installed (MW)	Output (MW)		Fast (MW)	Slow (MW)
B1	2020 Summer Peak	19,887	317	2,000	940	18,630	287	384
B2	2023 Summer Peak	19,938	707	2,738	1,314	17,917	287	384
B3	2028 Summer Peak	21,695	1,473	4,229	2,030	18,192	287	384
B4	2020 Spring Light Load	7,392	105	1,882	1,412	5,875	287	384
B5	2023 Spring Off-Peak	13,396	488	2,883	0	12,908	287	384
S1	2020 SP High CEC Load	21,189	879	2,738	1,314	18,996	287	384
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen.	14,710	488	1,883	1,314	12,908	287	384
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	19,887	317	2,000	940	18,630	287	384
Note:	*DR and storage are modeled offline in starting base cases.*							

Supply Side Assumptions

No.	Base Case	Battery Storage (Installed)	Solar (Grid		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
B1	2020 Summer Peak	70	12	6	0	0	10	0	9,030	4,543
B2	2023 Summer Peak	385	12	6	0	0	10	0	6,189	4,653
B3	2028 Summer Peak	409	12	5	0	0	10	0	6,189	4,388
B4	2020 Spring Light Load	70	12	11	0	0	10	0	9,030	35
B5	2023 Spring Off-Peak	385	12	0	0	0	10	0	6,189	3,285
S1	2023 SP High CEC Load	385	12	6	0	0	10	0	6,189	4,853
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen.	385	12	11	0	0	10	0	6,189	1,888
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	70	12	11	0	0	10	0	9,030	4,504

Note: DR and storage are modeled offline in starting base cases.

Previously approved transmission projects modelled in base cases

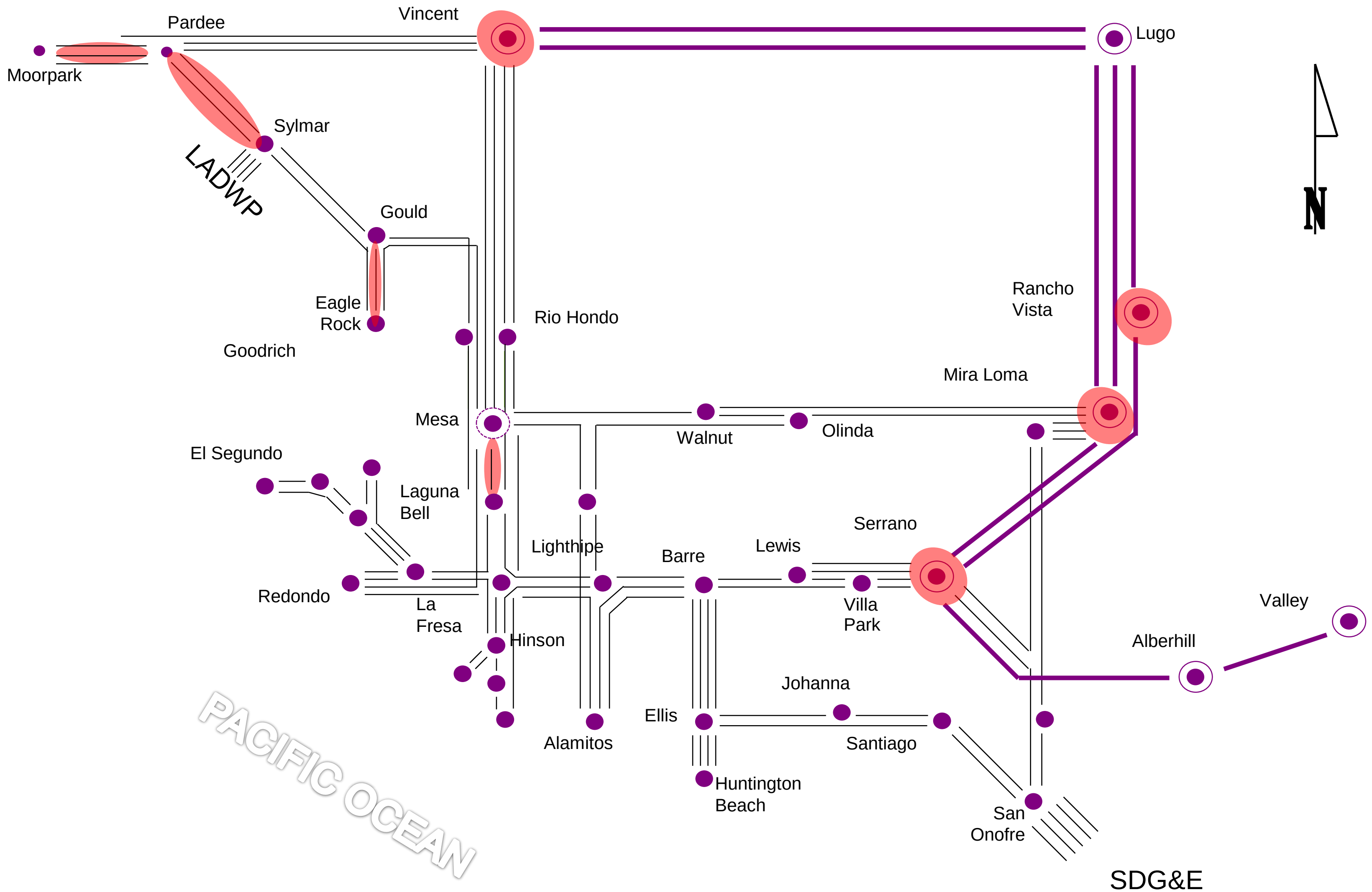
Project Name	ISD	First Year Modeled
Mesa 500 kV Substation	Mar. 2022	2023
Laguna Bell Corridor Upgrade	Mar. 2022	2023
Moorpark–Pardee No. 4 230 kV Circuit	Dec. 2020	2023
Wilderness 230/66 kV substation	July. 2023	2023
Alberhill 500 kV Substation	Jun. 2021	2023

Reliability assessment preliminary results summary

Thermal loading Results

Overloaded Facility	Worst Contingencies	Category	Loading (%)			Potential Mitigation Solutions
			B1 2020 Summer Peak	B2 2023 Summer Peak	B3 2028 Summer Peak	
Pardee - Sylmar 230 kV	Other Pardee - Sylmar 230 kV & Victorville - Lugo 500 kV	P6	**116**	<100	<100	OP 7680
Eagle Rock - Gould 230 kV	Gould - Sylmar 230 kV & Victorville - Lugo 500 kV	P6	**114**	<100	<100	Re-dispatch resources
Mesa - Laguna Bell 230 kV #1	Mesa - Lighthipe & Mesa–Redondo /Mesa - Laguna Bell #2 230 kV lines	P6/P7	<100	**106**	**103**	Re-dispatch resources, monitor economic impact
Pardee – Moorpark 230 kV #2 or #3	Pardee – Moorpark #1 and Pardee – Moorpark #3 or #2 230 kV lines	P6	**102**	<100	<100	Re-dispatch resources; Pardee-Moorpark # 4 Project
Serrano 500/230 kV Transformer	Two Serrano 500/230 kV Transformers	P6	**123**	**109**	**100**	OP 7590
Vincent 500/230 kV Transformer #2 or #3	Vincent – Mira Loma or PDCI Monopole & Vincent 500/230 kV Transformer #3 or #2	P6	**103**	<100	<100	OP 7550 and OP 6410
Mira Loma 500/230 kV Transformer #4	Lugo - Rancho Vista & Mira Loma - Serrano 500 kV lines	P6	**125**	<100	<100	OP 7580
Mira Loma 500/230 kV Transformer #1 or #2	Mira Loma - Serrano 500 kV & Mira Loma 500/230 kV Tr. #2 or #1	P6	**113**	<100	<100	

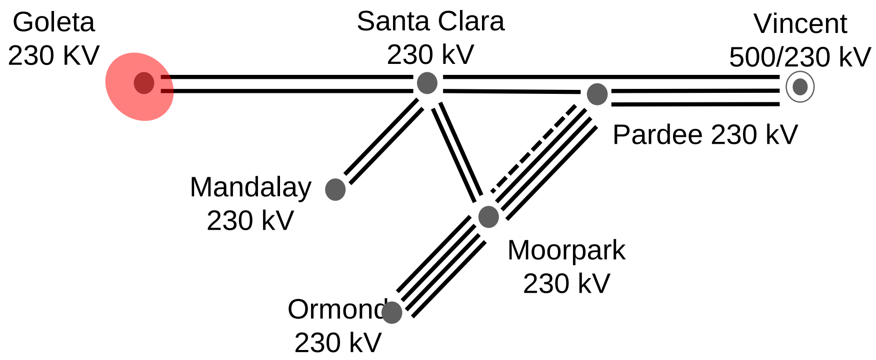
Thermal loading Results – Cont'd



Slide 9

Low/High Voltage Results

Substation	Worst Contingencies	Category	Voltage (P.U.) 2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2023 SP High CEC Load Sensitivity	Potential Mitigation Solutions
Goleta	All elements in service	P0	>0.95	**0.93**	**0.94**	**0.91**	Ellwood RMR (Pre-2021), LCR RFO resources (Post-2020) & potentially reactive power device at Goleta;
	Santa Clara–Goleta #1 or #2 230 kV	P1	**0.89**	**0.84**	**0.84**	**0.8**	
	Santa Clara 230 kV Shunt Capacitor	P1	>0.9	>0.9	>0.9	**0.89**	
	Ellwood & Santa Clara–Goleta #1 or #2 230 kV (assuming Ellwood is not retired until 2021)	P3	**0.89**	N/A	N/A	N/A	
	Santa Clara–Goleta #1 or #2 230 kV & Santa Clara 230 kV Shunt Capacitor	P6	**0.86**	**0.8**	**0.8**	**0.77**	



Sensitivity Assessment

- Below is the list of facility overloads identified in sensitivity scenarios only.

Overloaded Facility	Category	2023 SP High CEC Load	2023 SOP Heavy Ren. Output & Min Gas Gen. Commitment	2020 SP Heavy Ren. Output & Min Gas Gen. Commitment
Rancho Vista 500/230 kV Transformers	P6			√

Summary of Potential New Upgrades

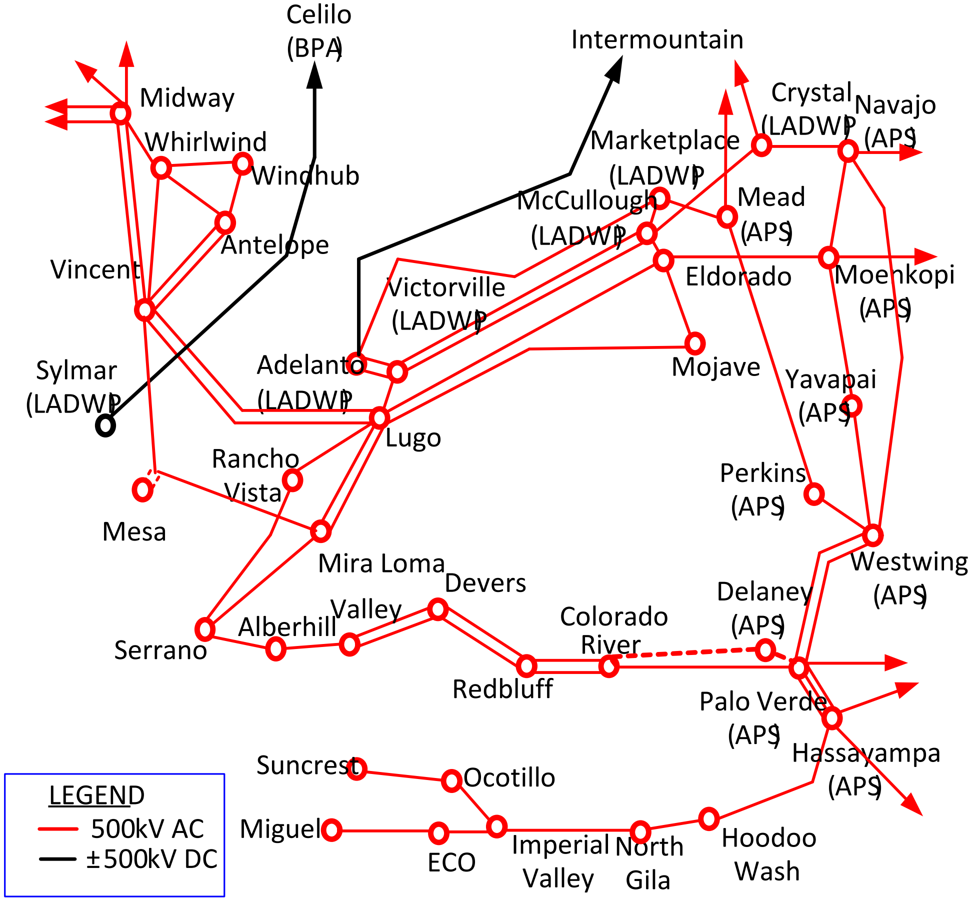
Concern	Potential Upgrade
Low voltage	Ellwood RMR, RFO Resources & potentially reactive power device at Goleta

SCE Bulk System
Preliminary Reliability Assessment Results

Mudita Suri
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

SCE Bulk System



- SCE 500 kV system including interconnections with neighboring systems
- 1-in-5 summer peak net load of 22,722 MW in 2028
- Forecast 5,296 MW of BTM PV and 2,462 MW of AAEE by 2028
- 39,256 MW of existing generation

SCE Bulk Area Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	1-in 5 summer peak load - hours between 16:00 and 18:00
B2	2023 Summer Peak	
B3	2028 Summer Peak	
B4	2020 Spring Light Load	Spring minimum net load time (4/9 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

No	Case	Change From Base Assumption
S1	2023 Summer Peak	High CEC forecasted load
S2	2023 Spring Off-Peak	Heavy renewable output and minimum gas generation commitment
S3	2020 Summer Peak	Heavy renewable output and minimum gas generation commitment

SCE Bulk Demand Side Assumptions

S. No.	Base Case	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response (installed)	
				Installed (MW)	Output (MW)		Fast (MW)	Slow (MW)
B1	2020 Summer Peak	26112.4	511.0	2400.0	1561.3	24040.1	435.5	502.2
B2	2023 Summer Peak	27364.7	1183.5	3195.0	2247.8	23933.4	435.5	502.2
B3	2028 Summer Peak	28444.5	2462.4	5296.0	3259.7	22722.5	435.5	502.2
B4	2020 Spring Light Load	13088.3	511.0	2400.0	2491.5	10085.9	435.5	502.2
B5	2023 Spring Off-Peak	16982.3	1183.5	3195.0	0.0	15798.8	435.5	502.2
S1	2023 SP High CEC Load	29171.2	1183.5	3195.0	2247.8	25739.9	435.5	502.2
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen.	21477.9	1183.5	3195.0	2247.8	15798.8	435.5	502.2
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	26112.4	511.0	2400.0	1561.3	24040.1	435.5	502.2

Note:

DR and storage are modeled offline in starting base cases.

SCE Bulk Supply Side Assumptions

S. No.	Base Case	Battery Storage (MW) installed	Solar		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
B1	2020 Summer Peak	70.9	6899.2	3587.8	4204.0	1515.0	1215.5	414.2	19659.5	7370.0
B2	2023 Summer Peak	120.9	6899.7	3656.9	4223.0	886.8	1215.5	784.0	13336.1	8208.9
B3	2028 Summer Peak	144.9	9686.5	5134.2	4371.6	918.0	1256.5	364.0	13942.2	6907.8
B4	2020 Spring Light Load	70.9	6899.3	6372.7	4087.9	0.0	1215.5	144.0	19644.5	390.0
B5	2023 Spring Off-Peak	120.9	6899.7	0.0	4103.0	2827.9	1215.5	219.0	13336.1	10565.2
S1	2023 SP High CEC Load	120.9	6899.7	3656.9	4103.0	861.6	1215.5	784.0	13336.1	9004.2
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen.	120.9	6899.7	6771.7	4103.0	2827.9	1215.5	12.0	13336.1	8111.2
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	70.9	6899.2	6810.6	4084.0	2736.2	1215.5	414.2	19659.5	5380.6

Note:

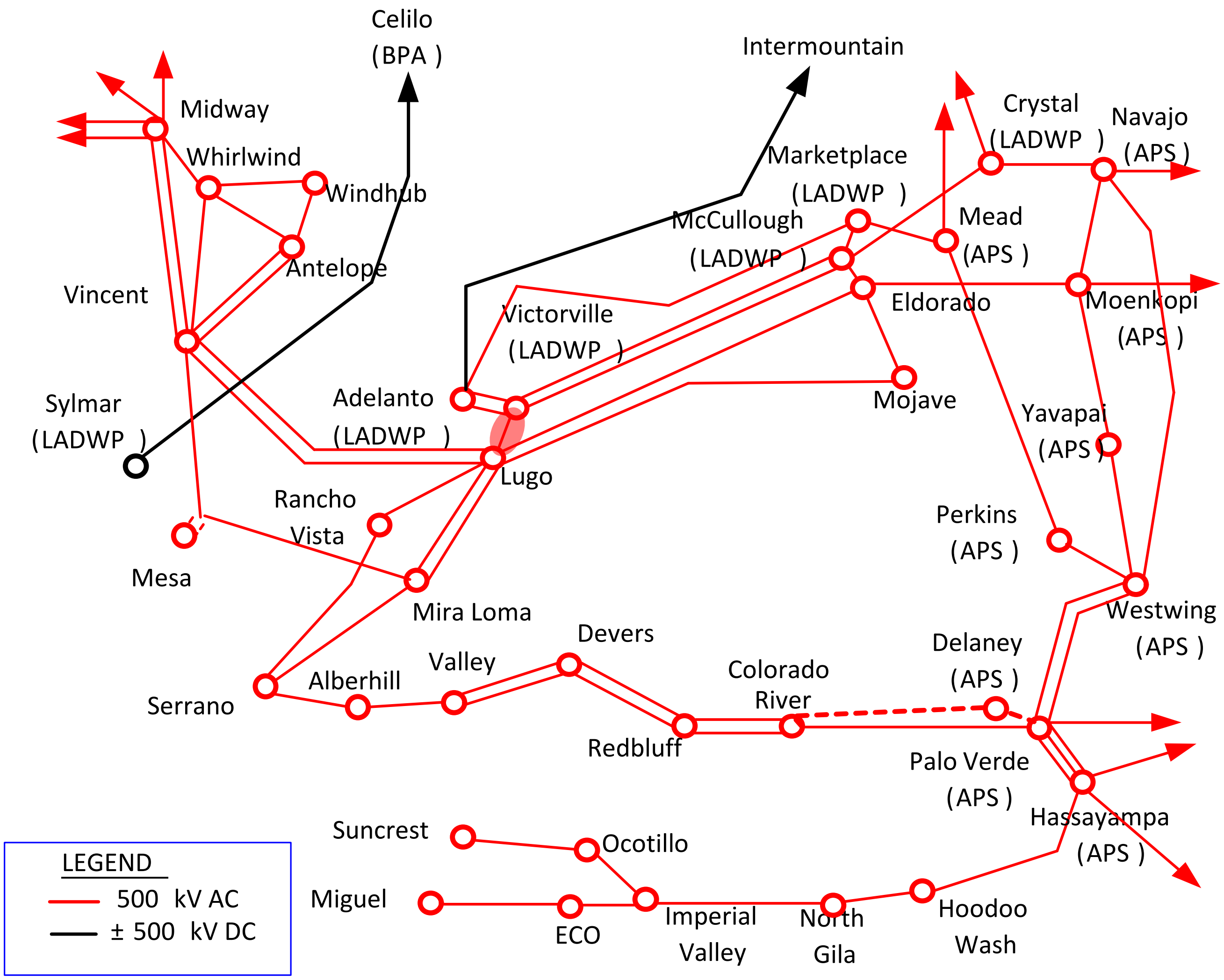
DR and storage are modeled offline in starting base cases.

Reliability assessment preliminary results summary

SCE Bulk Assessment Summary

Overloaded Facility	Worst Contingencies	Category	Category Description	Loading (%)		Potential Mitigation Solutions
				B1 - 2020 Summer Peak	S3- 2020 Summer Peak	
Lugo–Victorville 500 kV line	Delany - Colorado River 500kV 1 and Paloverde - Colorado River 500kV 1	P6	N-1-1	**113.9%**	**117.8%**	Project: Lugo-Victorville line upgrade. ISD: 06/2021 Short term: System re-dispatch
	Devers - Redbluff 500kV 1 and 2	P7	N-2	**115%**	**119.9%**	
	Colorado River - Redbluff 500kV 1 and 2	P7	N-2	**110.4%**	**111.2%**	

SCE Bulk Thermal Overloads



Tehachapi and Big Creek Corridor Preliminary Reliability Assessment Results

Mudita Suri
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Tehachapi and Big Creek Corridor Area

- Comprises of 66kV, 230 kV, and 500kV transmission facilities.
- Over 6,500 MW of existing generation.
- Existing pumping load of 720 MW.
- Existing Hydro installed capacity of 1100 MW

Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	Summer peak load time (9/3 HE 16 PST)
B2	2023 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B3	2028 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B4	2020 Spring Light Load	Spring minimum net load time (4/9 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

No	Case	Change From Base Assumption
S1	2023 Summer Peak	High CEC forecasted load
S2	2023 Spring Off-Peak	Heavy renewable output and minimum gas generation commitment
S3	2020 Summer Peak	Heavy renewable output and minimum gas generation commitment

Demand Side Assumptions

S. No.	Base Case	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response (Installed)	
				Installed (MW)	Output (MW)		Fast (MW)	Slow (MW)
B1	2020 Summer Peak	2474.4	47.3	527.0	168.0	2259.1	77.7	48.2
B2	2023 Summer Peak	2607.6	109.2	527.0	241.9	2256.5	77.7	48.2
B3	2028 Summer Peak	2781.5	229.5	841.0	357.9	2194.2	77.7	48.2
B4	2020 Spring Light Load	1243.1	47.3	527.0	268.1	927.8	77.7	48.2
B5	2023 Spring Off-Peak	1465.8	109.2	527.0	0.0	1356.6	77.7	48.2
S1	2023 SP High CEC Load	2740.4	109.2	527.0	241.9	2389.3	77.7	48.2
S2	2023 SOP Heavy RenewableOutput & Min. Gas Gen.	1707.7	109.2	527.0	241.9	1356.6	77.7	48.2
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	2474.4	47.3	527.0	168.0	2259.1	77.7	48.2

Note:

DR and storage are modeled offline in starting base cases.

Hydro Assumption

- Summer Peak Base Cases:

  Worst hydro generation periods (during peak load hours) were analyzed from 2015 summer to evaluate lowest generation amounts (330MW)

- Light Load and Off Peak Cases:

  High Hydro

Supply Side Assumptions

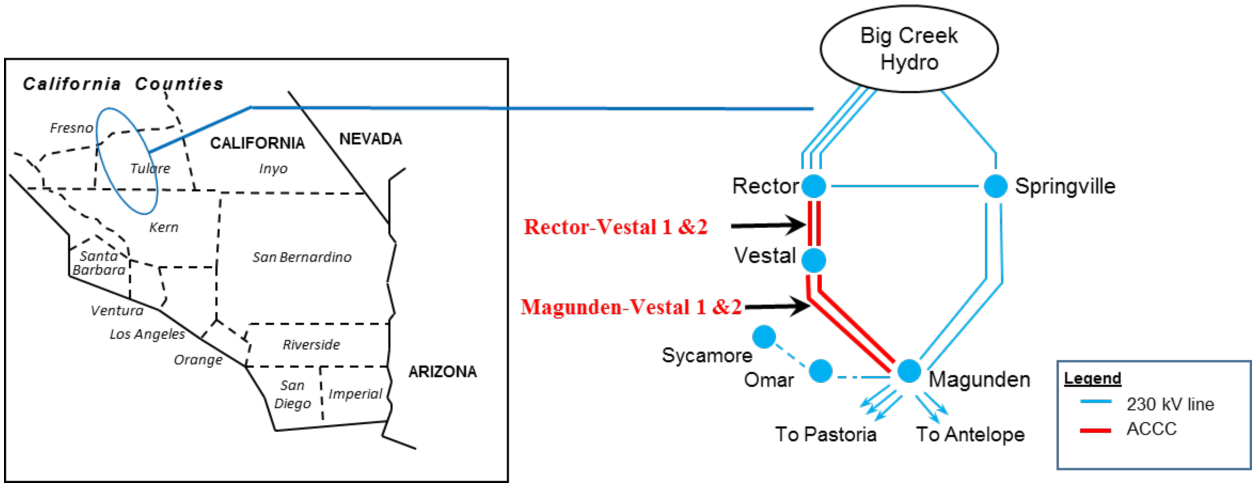
S. No.	Base Case	Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
B1	2020 Summer Peak	0.0	3065.1	1593.9	3490.7	1256.8	1092.7	339.2	1836.6	1132.2
B2	2023 Summer Peak	0.0	3065.6	1625.5	3493.7	733.7	1092.7	331.0	1836.6	1129.9
B3	2028 Summer Peak	0.0	4878.6	2586.6	3642.3	764.9	1092.7	332.0	1836.6	629.7
B4	2020 Spring Light Load	0.0	3065.2	2698.9	3490.7	0.0	1092.7	1002.0	1836.6	0.0
B5	2023 Spring Off-Peak	0.0	3065.6	0.0	3493.7	2407.7	1092.7	939.0	1836.6	749.2
S1	2023 SP High CEC Load	0.0	3065.6	1625.5	3493.7	733.7	1092.7	889.0	1836.6	1374.9
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen.	0.0	3065.6	3026.6	3493.7	2407.7	1092.7	586.0	1836.6	184.2
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	0.0	3065.1	3035.0	3490.7	2338.8	1092.7	519.2	1836.6	763.8

Note:

DR and storage are modeled offline in starting base cases.

Recently approved transmission

- **Project Name**: Big Creek Corridor Rating Increase
- **Project type**: Reliability
- **Expected In-Service**: 06/01/2019
- **Project Scope**: Upgrade four transmission structures and terminal equipment at Magunden and Vestal Substations and achieve a 4-hr emergency rating of 1520 Amps (currently 936 Amps) on the four 230 kV transmission lines.

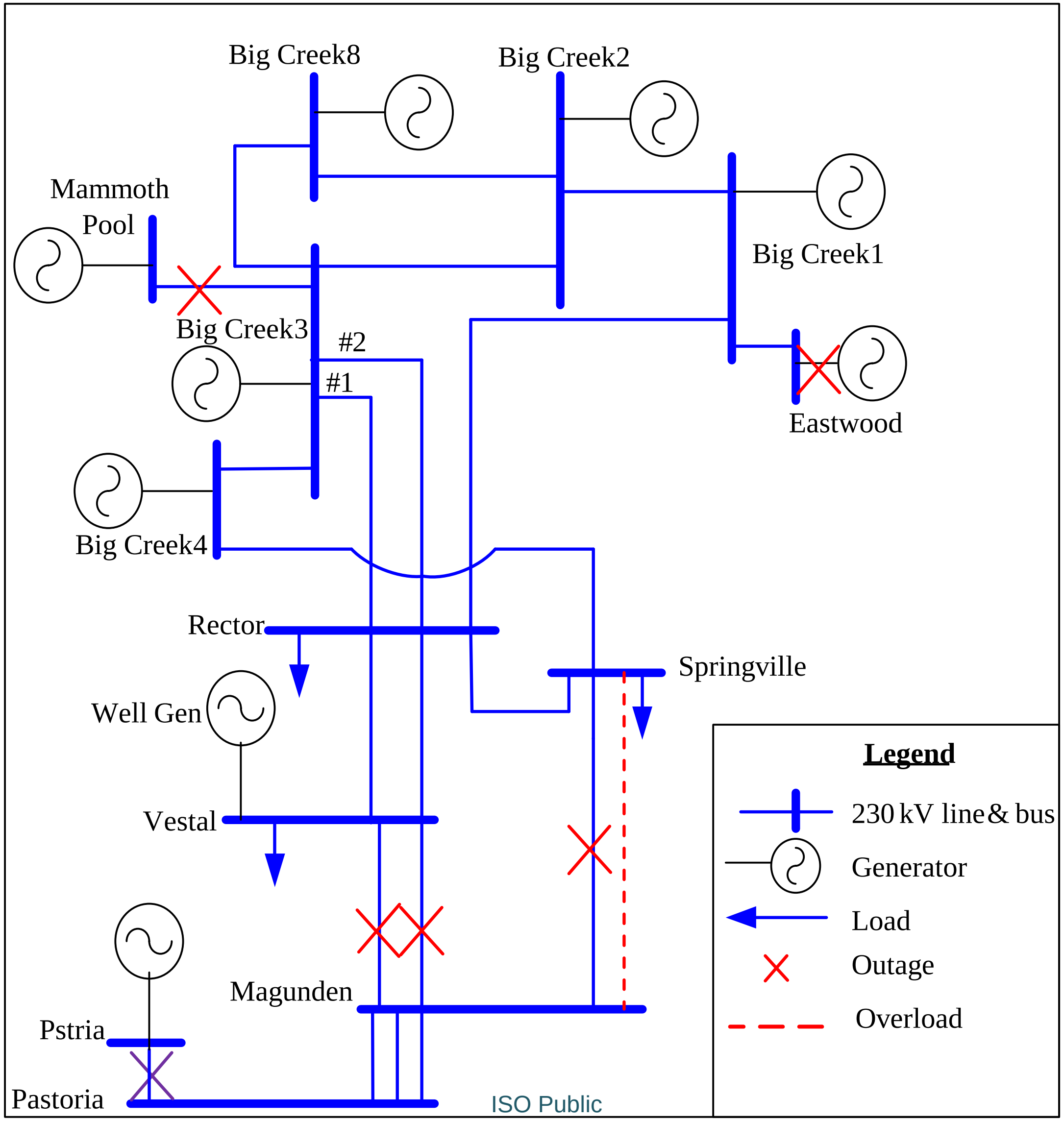


Reliability assessment preliminary results summary

Thermal loading Results

Overloaded Facility	Worst Contingencies	Category	Loading (%)			Potential Mitigation Solutions
			B1 2020 Summer Peak	B2 2023 Summer Peak	B3 2028 Summer Peak	
MAGUNDEN-SPRINGVL 230 kV 1 or 2	MAGUNDEN-VESTAL 230kV 1 and 2 (with RAS)	P7	<100	<100	<100	Big Creek RAS & system adjustment
MAGUNDEN-SPRINGVL 230 kV 2	RECTOR-VESTAL 230 kV 1 and 2 (with RAS)	P7	<100	<100	<100	
	MAGUNDEN-SPRINGVL 230 kV 1 and MAGUNDEN-VESTAL 230kV 1(or)2 (with RAS)	P6	<100	<100	<100	
	MAGUNDEN-SPRINGVL 230 kV 1 and RECTOR-VESTAL 230 kV 1(or)2 (with RAS)	P6	<100	<100	100	
MAGUNDEN-VESTAL 230kV 1 or 2	MAGUNDEN-SPRINGVL 230 kV 1(or) 2 and MAGUNDEN-VESTAL 230kV 1(or)2 (with RAS)	P6	<100	<100	<100	
SPRINGVL-RECTOR 230 kV 1	MAGUNDEN-VESTAL 230kV 1 and 2 (with RAS)	P6	<100	<100	<100	

Thermal loading Results



Low/High Voltage Results

Substation	Worst Contingencies	Category	Voltage (P.U.)								Potential Mitigation Solutions
			2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renew & Min Gas Gen	
BAILEY 230kV	PARDEE-BAILEY 230kV and BAILEY-PASTORIA 230kV	P6	0.88	0.88	0.86	0.85	0.847	0.87	0.846	0.88	Operating Procedure 46

Stability Results

Contingency	Category	2020 Summer Peak	2028 Summer Peak	2023 Spring Off-Peak	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	Potential Mitigation Solutions
Big Creek 1-Big Creek 2 230 kV line	P5	Stable	Stable	local area instability	Stable	Stable	Project: Protection project In-Service Date: 12/31/2019 Short term: system re-dispatch
Big Creek 3 (Bus) NRBD	P5	Stable	Stable	local area instability	Stable	Stable	Redundant bus differential being considered
Mangunden NRBD	P5	local area instability	local area instability	local area instability	local area instability	local area instability	
Pastoria NRBD	P5	Stable	Stable	local area instability	local area instability	Stable	

Summary of Potential New Upgrades

Need	Potential Upgrade
Big Creek Rating increase project	Big Creek RAS review

SCE North of Lugo Area
Preliminary Reliability Assessment Results

Meng Zhang
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

SCE North of Lugo (NOL) Area

- Comprised of 55, 115 and 230 kV transmission facilities
- Total installed generation capacity in the area is over 2300 MW.
- Summer peak net loads of 805, 807 and 787 MW in 2020, 2023 and 2028 respectively. These include AAEE and BTM-PV as forecasted by CEC.
- The loads are mainly served from Control, Kramer and Victor substations. The area can be divided into following subareas:
  - North of Control
  - Kramer/North of Kramer/Cool Water
  - Victor

SCE NOL Area Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	Summer peak load time (9/3 HE 16 PST)
B2	2023 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B3	2028 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B4	2020 Spring Light Load	Spring minimum net load time (4/9 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

No	Case	Change From Base Assumption
S1	2023 Summer Peak	High CEC forecasted load
S2	2023 Spring Off-Peak	Heavy renewable output and minimum gas generation commitment
S3	2020 Summer Peak	Heavy renewable output and minimum gas generation commitment

Demand Side Assumptions

Scenario No.	Case	Gross Load (MW)	AAEE (MW)	BTM-PV MW)		Net Load (MW)	Demand Response (MW)	
				Installed	Output		Fast	Slow
B1	2020 Summer Peak	1078	17	543	255	805	35	59
B2	2023 Summer Peak	1194	38	727	349	807	35	59
B3	2028 Summer Peak	1350	80	1006	483	787	35	59
B4	2020 Spring Light Load	684	10.95	543	407	266	35	59
B5	2023 Spring Off-peak	576	18.42	727	0	557	35	59
S1	2023 SP High CEC Load	1259	38	727	349	872	35	59
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen	576	18.42	727	0	557	35	59
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	1078	17	543	255	805	35	59

Supply Side Assumptions

Scenario No.	Case	Installed Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
B1	2020 Summer Peak	0	898	467	0	0	74	57	1381	1138
B2	2023 Summer Peak	0	898	476	0	0	74	0	1381	1232
B3	2028 Summer Peak	0	1876	994	0	0	74	52	1381	1173
B4	2020 Spring Light Load	0	898	870	0	0	74	0	1381	512
B5	2023 Spring Off-peak	0	898	0	0	0	74	53	1381	986
S1	2023 SP High CEC Load	0	898	476	0	0	74	0	1381	1235
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen	0	898	882	0	0	74	53	1381	951
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	0	898	886	0	0	74	57	1381	226

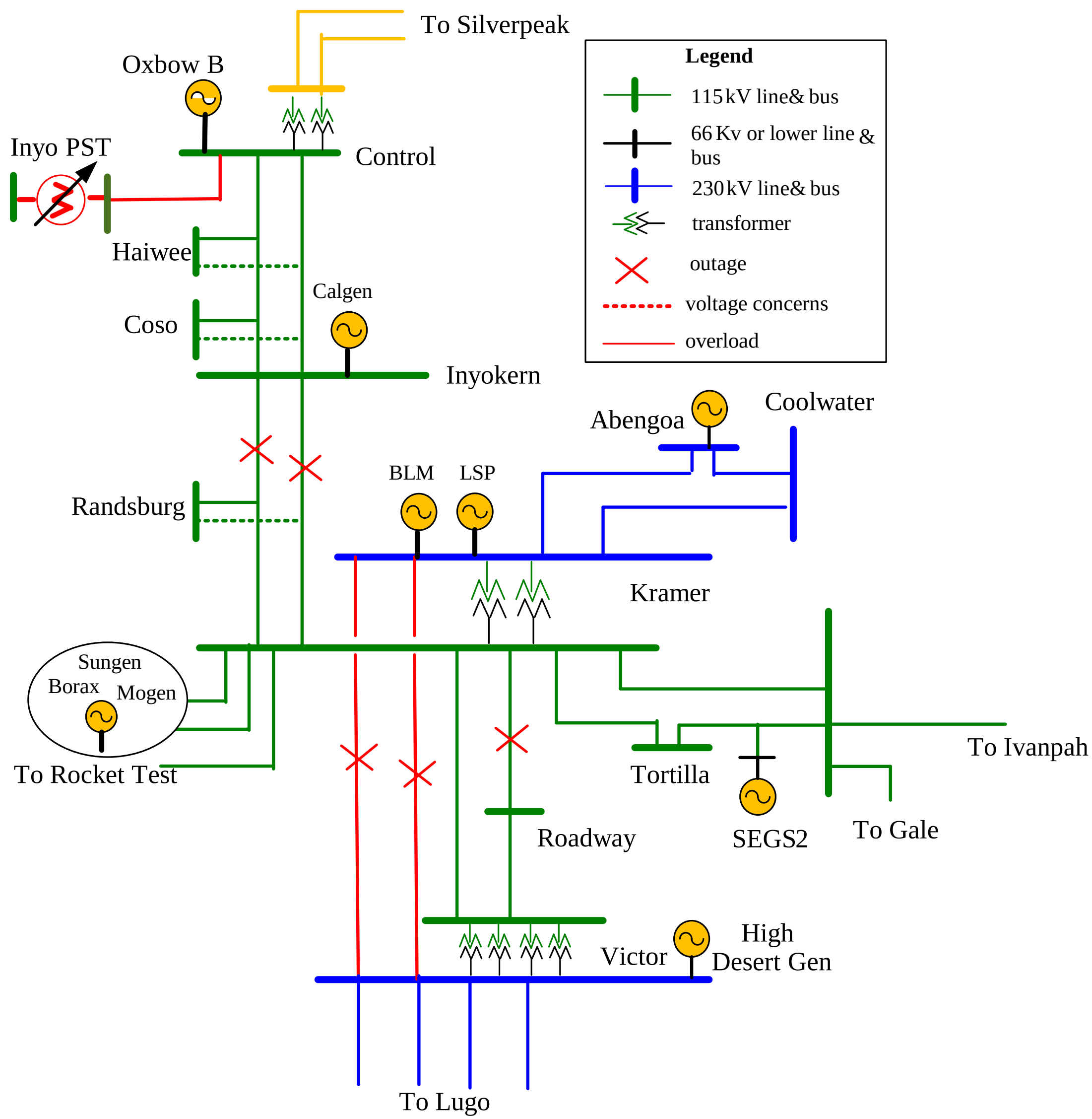
Previously Approved Transmission Projects

No.	Transmission Projects	First Year Modeled	Description
1	Victor Loop-in Project	2020	Loop-in the existing Kramer-Lugo Nos.1&2 230kV lines into Victor Substation
2	Kramer Reactor Project	2020	Install two 34 MVAR reactors to the 12kV tertiary winding of the existing 230/115kV Nos.1&2 transformers and one 45 MVAR shunt reactor at the Kramer 230kV bus

Reliability Assessment Preliminary Results Summary

Thermal Loading Results

Overloaded Facility	Worst Contingency	Category	Loading % (Baseline Scenarios)				Loading % (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
			2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
Kramer-Victor No.1 230kV line	Roadway-Kramer 115kV & Kramer-Victor No.2 230kV lines	P6	<100	111	104	<100	<100	105	<100	Congestion management
Kramer-Victor No.2 230kV line	Roadway-Kramer 115kV & Kramer-Victor No.1 230kV lines	P6	<100	111	104	<100	<100	105	<100	Congestion management
Control-Inyo 115kV line	Inyokern-Kramer & Kramer-Inyokern-Randsburg 115kV lines	P6	<100	144	185	117	<100	147	<100	Operating Procedure 7690
Inyo 115kV PST	Inyokern-Kramer & Kramer-Inyokern-Randsburg 115kV lines	P6	<100	177	217	154	<100	186	<100	Operating Procedure 7690
Case Divergence	Kramer-Coolwater & Kramer-Tortilla 115kV lines	P6	Nconv	<100	<100	Nconv	Nconv	<100	<100	Operating Procedure 127
Case Divergency	Control 115/55kV Nos. 1&2 transformers	P6	Nconv	<100	<100	<100	<100	<100	<100	SOB-4



To Silverpeak
Oxbow B
Inyo PST
Control
Haiwee
Calgen
Coso
Inyokern
Randsburg
BLM
LSP
Abengoa
Coolwater
Kramer
Sungen
Borax
Mogen
To Rocket Test
Tortilla
To Ivanpah
Roadway
SEGS2
To Gale
Victor
High
Desert Gen
To Lugo
Legend
115kV line& bus
66 Kv or lower line & bus
230kV line& bus
transformer
outage
voltage concerns
overload

Low/High Voltage Results

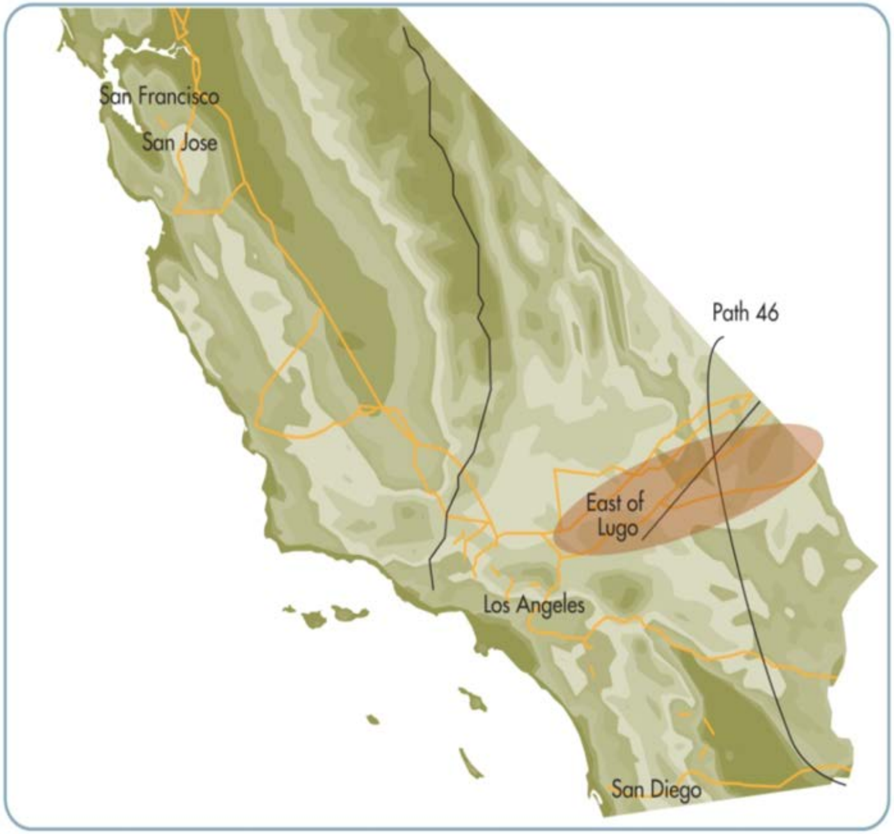
Substation	Worst Contingency	Category	Voltage p.u. (baseline scenarios)					Voltage p.u. (sensitivity scenarios)			Project & Potential Mitigation Solutions
			2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
Baker 115kV	Kramer-Coolwater & Kramer-Tortilla 115kV lines	P6	0.86	0.86	>0.9	>0.9	0.82	0.85	>0.9	>0.9	Operating Procedure 127
Coolwater 115kV	Kramer-Coolwater & Kramer-Tortilla 115kV lines	P6	0.71	0.76	>0.9	>0.9	0.62	0.75	>0.9	>0.9	Operating Procedure 127
Control 115kV	Inyokern-Kramer & Kramer-Inyokern-Randsburg 115kV lines	P6	>0.9	>0.9	0.88	0.84	>0.9	>0.9	>0.9	>0.9	Operating Procedure 7690

SCE East of Lugo Area
Preliminary Reliability Assessment Results

Meng Zhang
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

SCE East of Lugo (EOL) Area



- Comprised of 115, 230 & 500 kV transmission facilities.
- Includes Eldorado, Mohave, Merchant, Ivanpah, CIMA, Pisgah Mountain Pass, Dunn Siding and Baker substations
- Total installed generation capacity is about 1800 MW. And over 70% of the total capacity is solar generation.
- The load is mostly served from CIMA 66kV substation. 2028 load forecast is about 4.1 MW.

SCE EOL Area Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	Summer peak load time (9/3 HE 16 PST)
B2	2023 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B3	2028 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B4	2020 Spring Light Load	Spring minimum net load time (4/9 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

No	Case	Change From Base Assumption
S1	2023 Summer Peak	High CEC forecasted load
S2	2023 Spring Off-Peak	Heavy renewable output and minimum gas generation commitment
S3	2020 Summer Peak	Heavy renewable output and minimum gas generation commitment

Supply Side Assumptions

Scenario No.	Case	Installed Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
B1	2020 Summer Peak	0	1254	652	0	0	0	0	525	330
B2	2023 Summer Peak	0	1254	665	0	0	0	0	525	330
B3	2028 Summer Peak	0	1889	1001	0	0	0	0	525	0
B4	2020 Spring Light Load	0	1254	1196	0	0	0	0	525	0
B5	2023 Spring Off-peak	0	1254	0	0	0	0	0	525	525
S1	2023 SP High CEC Load	0	1254	665	0	0	0	0	525	525
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen	0	1254	1234	0	0	0	0	525	520
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	0	1254	1241	0	0	0	0	525	0

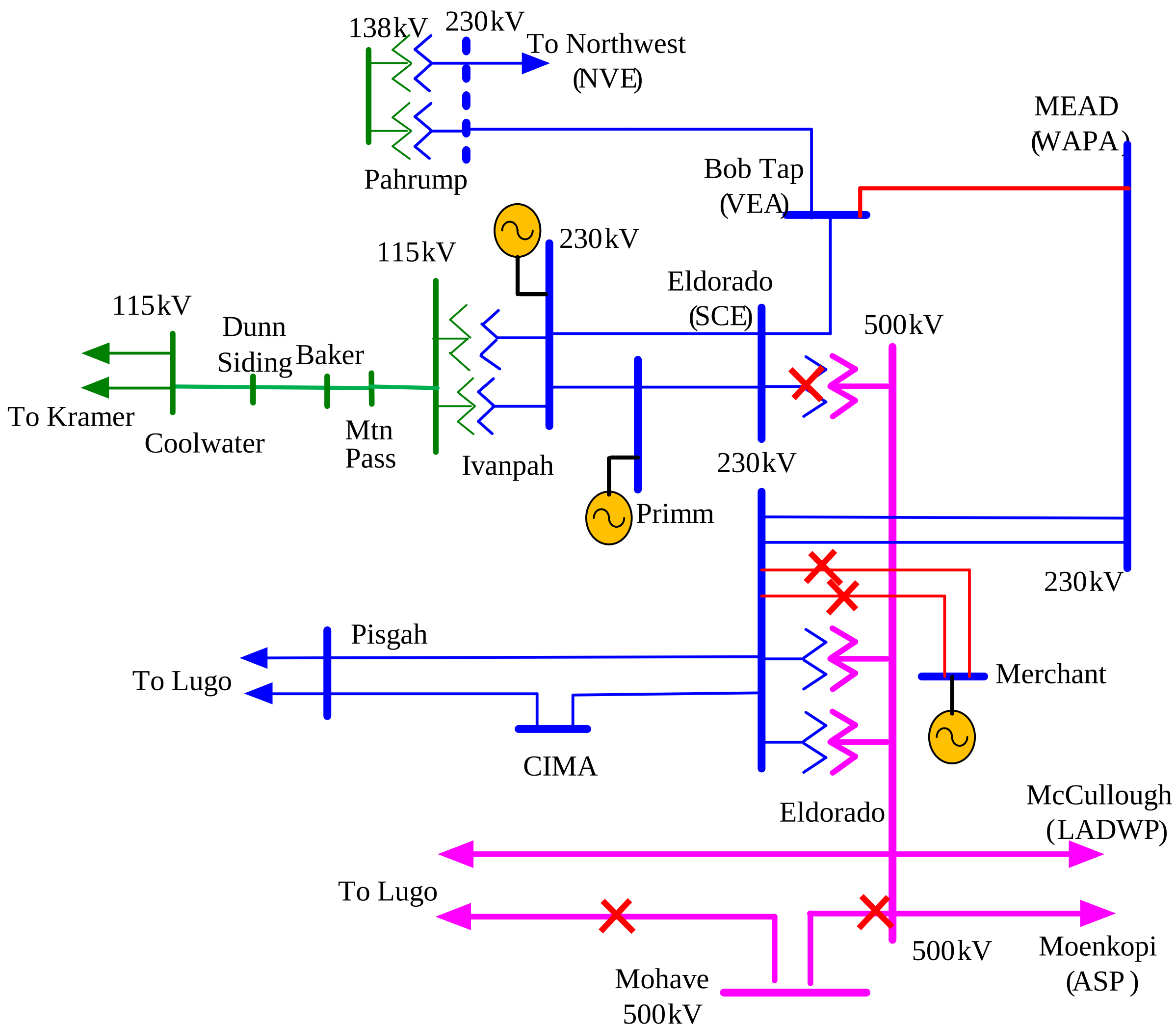
Previously Approved Transmission Projects

No.	Transmission Projects	First Year Modeled	Description
1	Eldorado-Lugo Series Capacitor Upgrade	2023	Upgrade the existing 500KV line series capacitors at Eldorado and Lugo on the Eldorado-Lugo 500KV line
2	Lugo-Mohave Series Capacitor Upgrade	2023	Upgrade the existing 500kV lines series capacitors at Mohave on the Lugo-Mohave 500kV line
3	Calcite 230kV Substation	2023	Construct new Calcite 230kV substation and loop into Lugo-Pisgah #1 230kV line
4	Lugo-Victorville 500kV Line Upgrade	2023	Upgrade terminal equipment and remove ground clearance limitations to achieve higher ratings.

Reliability Assessment Preliminary Results Summary

Thermal Loading Results

Overloaded Facility	Worst Contingency	Category	Loading % (Baseline Scenarios)					Project & Potential Mitigation Solutions
			2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	
Bob SS-Mead 230kV Line	Eldorado 500/230kV Transformer No.5	P1	<100	<100	<100	184.9	<100	Bob-Mead upgrade. Interium solution utilizes Ivanpah RAS
System Diverge	Eldorado-Mohave & Lugo-Mohave 500kV	P6	Nconv	Nconv	Nconv	Nconv	Nconv	NVEnergy protection scheme to radialize Laughlin 69kV system



138kV
230kV
To Northwest
(NVE)
MEAD
(WAPA)
Pahrump
Bob Tap
(VEA)
230kV
115kV
Eldorado
(SCE)
500kV
115kV
Dunn
Siding
Baker
To Kramer
Coolwater
Mtn
Pass
Ivanpah
230kV
Primm
230kV
Pisgah
To Lugo
Merchant
CIMA
Eldorado
McCullough
(LADWP)
To Lugo
500kV
Moenkopi
(ASP)
Mohave
500kV

Sensitivity Assessment Results

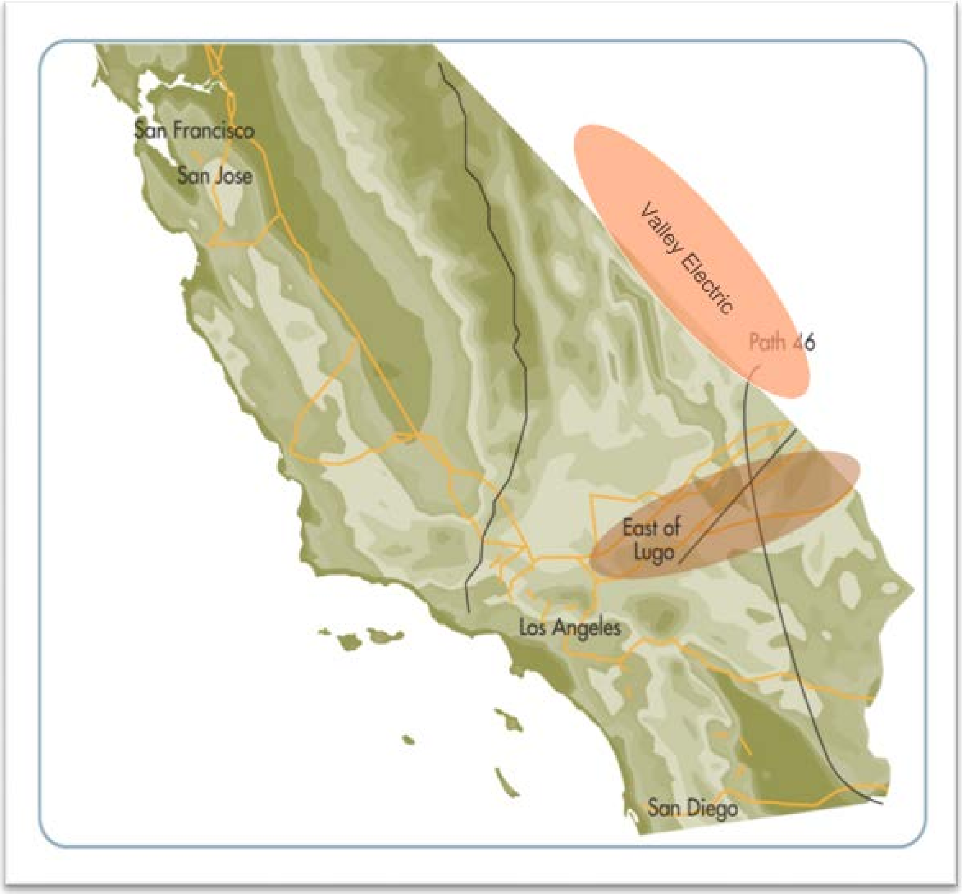
Overloaded Facility	Worst Contingency	Category	Loading % (Sensitivity Scenarios)			Project & Potential Mitigation Solutions
			2023 SP High CEC Forecast	2023 SpOP Hi Renew & Min Gas Gen	2020 SP Heavy Renewable & Min Gas Gen	
Bob SS-Mead 230kV Line	Eldorado 500/230kV Transformer No.5	P1	<100	<100	182.87	Bob-Mead upgrade. Interium solution utilizes Ivanpah RAS
Eldorado-Merchant 230kV No.2 Line	Eldorado-Merchant 230kV No.1 Line	P1	<100	102.46	<100	Reduce generation output at Merchant
System Diverge	Eldorado-Mohave & Lugo-Mohave 500kV	P6	Nconv	Nconv	Nconv	NVEnergy protection scheme to radialize Laughlin 69kV system

Valley Electric Association
Preliminary Reliability Assessment Results

Meng Zhang
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Valley Electric Association (VEA) Area



- VEA system is comprised of 138 and 230 KV transmission facilities under ISO control
- Gridliance West Transco is now the Transmission Owner for the 230 kV facilities in the VEA area
- Connect to WAPA's Mead 230kV substation, WAPA's Amargosa 138kV substation, NV Energy's Northwest 230kV substation and share buses at Jackass 138kV and Mercury 138kV stations
- Approximately 102 MW of renewable generation is modeled in 2023.
- Forecasted 1-in-10 summer peak loads for 2020, 2023 and 2028 are 152, 153 and 164 MW respectively.

VEA Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	Summer peak load time (9/3 HE 16 PST)
B2	2023 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B3	2028 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B4	2020 Spring Light Load	Spring minimum net load time (4/9 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

No	Case	Change From Base Assumption
S1	2020SP Load Addition & NNSS Reconfiguration	New load service application and the NNSS radial line arrangement
S2	2023SP Load Addition & NNSS Reconfiguration	New load service application and the NNSS radial line arrangement
S3	2023OP High Renewable	Active GIDAP projects up to QC9

Demand Side Assumptions

Scenario No.	Case	Gross Load (MW)	AAEE (MW)	BTM-PV MW)		Net Load (MW)	Demand Response (MW)	
				Installed	Output		Fast	Slow
B1	2020 Summer Peak	152	0	0	0	152	0	0
B2	2023 Summer Peak	153	0	0	0	153	0	0
B3	2028 Summer Peak	164	0	0	0	164	0	0
B4	2020 Spring Light Load	124	0	0	0	124	0	0
B5	2023 Spring Off-peak	108	0	0	0	108	0	0
S1	2020SP Load Addition & NNSS Reconfiguration	163	0	0	0	163	0	0
S2	2023SP Load Addition & NNSS Reconfiguration	181	0	0	0	181	0	0
S3	2023OP High Renewable	108	0	0	0	108	0	0

Supply Side Assumptions

Scenario No.	Case	Installed Battery Storage (MW)	Solar		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
B1	2020 Summer Peak	0	15	7	0	0	0	0	0	0
B2	2023 Summer Peak	0	102	54	0	0	0	0	0	0
B3	2028 Summer Peak	0	1113	589	0	0	0	0	0	0
B4	2020 Spring Light Load	0	15	11	0	0	0	0	0	0
B5	2023 Spring Off-peak	0	102	0	0	0	0	0	0	0
S1	2020SP Load Addition & NNSS Reconfiguration	0	15	7	0	0	0	0	0	0
S2	2023SP Load Addition & NNSS Reconfiguration	0	102	54	0	0	0	0	0	0
S3	2023OP High Renewable	0	728	594	0	0	0	0	0	0

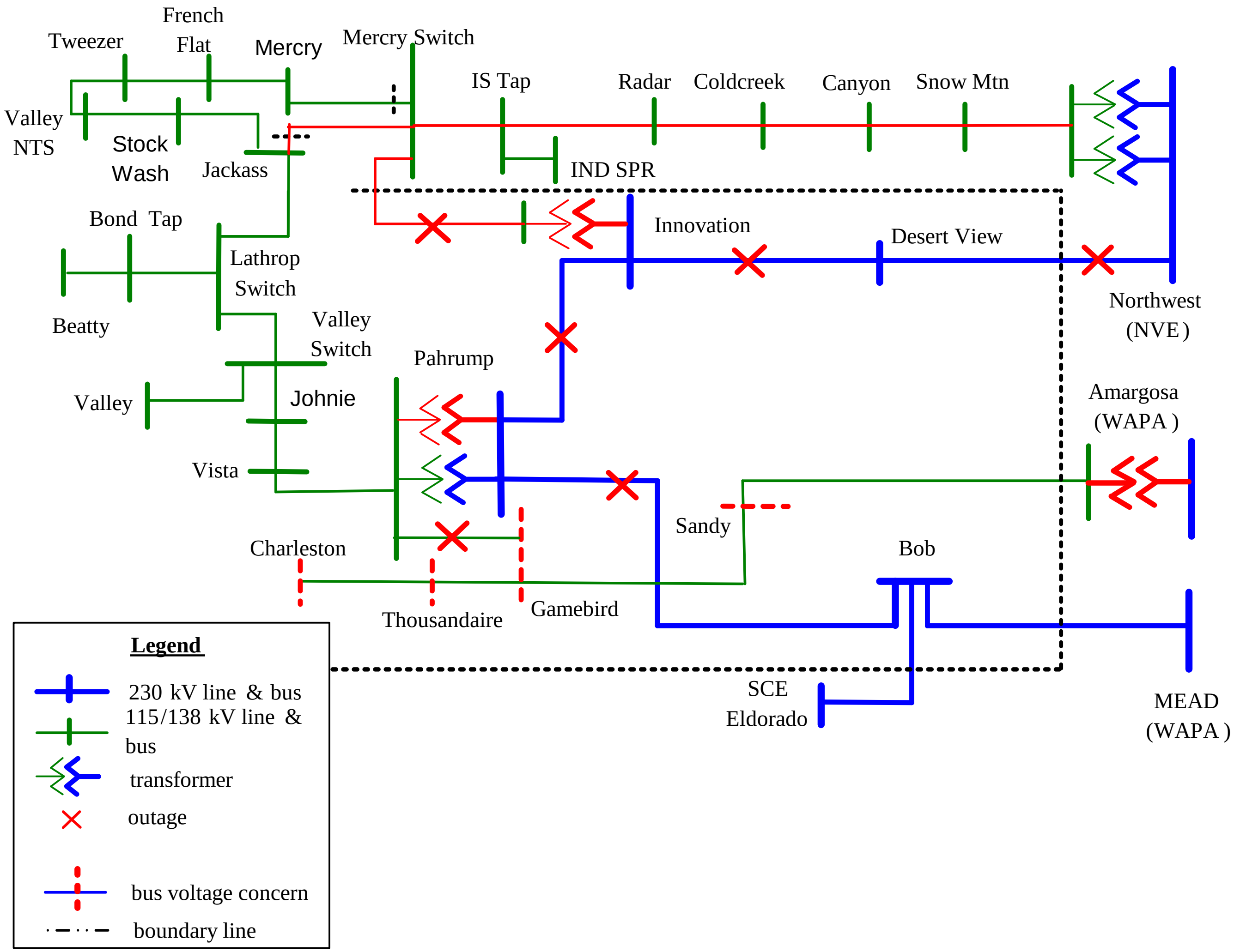
Previously Approved Transmission Projects

No.	Transmission Projects	First Year Modeled	Description
1	Bob 230kV Switching Station	2020	Build a new Bob 230kV Switching Station and loop into existing Pahrump-Mead 230kV Line
2	Eldorado-Bob 230kV Line	2020	New 230kV line between SCE's Eldorado 220kV substation and VEA's 230kV Bob switching station
3	Bob-Mead 230kV Line Reconductoring	2023	Reconductor Bob-Mead 230kV line for a higher rating.

Reliability Assessment Preliminary Results Summary

Thermal Loading Results

Overloaded Facility	Worst Contingency	Category	Loading % (Baseline Scenarios) 2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	Project & Potential Mitigation Solutions
Pahrump 230/138kV Transformer No.3	Desert View-Northwest 230kV & Innovation-Mercury SW 138kV lines	P6	<100	<100	100.95	<100	<100	Congestion management
Innovation 230/138kV Transformer	Innovation-Desert View 230kV & Pahrump-Innovation 230kV lines	P6	<100	<100	197.88	<100	<100	Congestion management
Northwest-Mercury SW 138kV loop	Innovation-Desert View 230kV Line	P1	<100	<100	134.49	<100	<100	New RAS proposed in GIDAP process
	Innovation-Desert View 230kV & Pahrump-Innovation 230kV lines	P6	<100	<100	201.74	<100	<100	Congestion management
Amargosa 230/138kV Transformer	Gamebird-Pahrump 138kV Line	P1	<100	102.59	113.57	<100	<100	New Charleston-Vista line; 230kV source from the new Gamebird 230kV switching station; potential DG/battery in the local pocket
	Pahrump-Bob SS 230kV & Pahrump-Gamebird 138kV lines	P7	<100	102.71	113.57	<100	<100	New Charleston-Vista line; 230kV source from the new Gamebird 230kV switching station; potential DG/battery in the local pocket
	PAHRUMP-VISTA 138 & PAHRUMP-GAMEBIRD 138; BKR PA222	P4-2	<100	102.6	113.57	<100	<100	New Charleston-Vista line; 230kV source from the new Gamebird 230kV switching station; potential DG/battery in the local pocket
	PAHRUMP 138/230kV Tran Bnk. 3 & PAHRUMP-GAMEBIRD 138; BKR PA232	P4-3	<100	102.59	113.57	<100	<100	New Charleston-Vista line; 230kV source from the new Gamebird 230kV switching station; potential DG/battery in the local pocket
Innovation-Mercury SW 138kV Line	Desert View-Northwest 230kV & Pahrump-Innovation 230kV lines	P6	<100	<100	111.34	<100	<100	Congestion management
Jackass Flat-Mercury SW 138kV Line	Desert View-Northwest 230kV & Pahrump-Innovation 230kV lines	P6	<100	<100	119.67	<100	<100	Congestion management
System diverge	Innovation-Desert View 230kV & Pahrump-Bob SS 230kV lines	P6	Nconv	<100	<100	<100	<100	Existing UVLS or operational action plan



Tweezer
French Flat
Mercry
Mercry Switch
Valley NTS
Stock Wash
Jackass
IS Tap
Radar
Coldcreek
Canyon
Snow Mtn
IND SPR
Bond Tap
Beatty
Lathrop Switch
Innovation
Desert View
Northwest (NVE)
Valley Switch
Pahrump
Valley
Johnie
Vista
Amargosa (WAPA)
Sandy
Charleston
Bob
Thousandaire
Gamebird
SCE Eldorado
MEAD (WAPA)
Legend
230 kV line & bus
115/138 kV line & bus
transformer
outage
bus voltage concern
boundary line

Low/High Voltage Results

Substation	Worst Contingency	Category	2020 Summer Peak	2023 Summer Peak	2028 Summer Peak	2020 Spring Off-Peak	2023 Spring Off-Peak	Project & Potential Mitigation Solutions
Sandy-Gamebird-Thousandir-Vista 138kV buses	Gamebird-Pahrump 138V line	P1	0.81	0.80	0.77	>0.9	0.89	New Charleston-Vista line; 230kV source from the new Gamebird 230kV switching station; potentail DG/battery in the local pocket

Sensitivity Assessment Results

- Below is the list of facility overloads identified in sensitivity scenarios only.

Overloaded Facility	Worst Contingency	Category	2020SP Load Addition & NNSS Reconfiguration	2023SP Load Addition & NNSS Reconfiguration	2023OP High Renewable	Project & Potential Mitigation Solutions
Pahrump 230/138kV Transformer No.3	Pahrump 230/138kV Transformer No.4	P1	106.2	<100	<100	Operation procedure to switch in Mercury SW-Jackass-Lanthrop line for emergency
Pahrump 230/138kV Transformer No.4	Pahrump 230/138kV Transformer No.3	P1	105.3	<100	<100	Operation procedure to switch in Mercury SW-Jackass-Lanthrop line for emergency
Jackass - Mercury SW 138kV Line	Vista-Johnnie-ValleyTP 138kV Line	P1	<100	<100	130	New RAS proposed in GIDAP process
Jackass - Mercury SW 138kV Line	Vista-Pahrump 138kV Line	P1	<100	<100	134	New RAS proposed in GIDAP process
System diverge	Pahrump-Bob SS & Pahrump-Innovation 230kV lines	P6	Nconv	Nconv	<100	Existing UVLS or operational action plan

Summary of Potential New Upgrades

Concern	Potential Upgrade
Amargosa 230/138kV transformer thermal overloading	Charleston-Vista 138kV line; new 230kV connection from the new Gamebird 230kV switching station

SCE Eastern Area
Preliminary Reliability Assessment Results

Charles Cheung
Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

SCE Eastern Area

- Includes the SCE owned transmission system in the Riverside County around and west of the Devers Substation
- Comprised of 500, 230 and 161 kV transmission facilities.
- Summer Peak net load of 4,628 MW in 2020

SCE Eastern Area Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	Summer peak load time (9/3 HE 16 PST)
B2	2023 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B3	2028 Summer Peak	Summer peak load time (8/31 HE 16 PST)
B4	2020 Spring Light Load	Spring minimum net load time (4/9 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

No	Case	Change From Base Assumption
S1	2023 Summer Peak	High CEC forecasted load
S2	2023 Spring Off-Peak	Heavy renewable output and minimum gas generation commitment
S3	2020 Summer Peak	Heavy renewable output and minimum gas generation commitment

Demand Side Assumptions

Scenario No.	Base Case	Gross Load (MW)	AAEE (MW)	BTM-PV		Net Load (MW)	Demand Response (installed)	
				Installed (MW)	Output (MW)		Fast (MW)	Slow (MW)
B1	2020 Summer Peak	5074	109	716	336	4628	70	19
B2	2023 Summer Peak	5423	240	1001	481	4702	70	19
B3	2028 Summer Peak	5770	484	1474	707	4579	70	19
B4	2020 Spring Light Load	2097	109	716	537	1451	70	19
B5	2023 Spring Off-Peak	3483	240	1001	0	3244	70	19
S1	2020 SP High CEC Load	5714	240	1001	481	4993	70	19
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen.	3964	240	1001	481	3244	70	19
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	5074	109	716	336	4628	70	19
Note:	*DR and storage are modeled offline in starting base cases.*							

Supply Side Assumptions

No.	Base Case	Battery Storage (Installed)	Solar (Grid		Wind		Hydro		Thermal	
			Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)	Installed (MW)	Dispatch (MW)
B1	2020 Summer Peak	0	1409	733	586	212	0	0	4,350	2,233
B2	2023 Summer Peak	0	1659	879	602	126	0	0	4,350	2,661
B3	2028 Summer Peak	0	1657	878	602	126	0	0	4,350	2,612
B4	2020 Spring Light Load	0	1409	1367	589	0	0	0	4,350	11
B5	2023 Spring Off-Peak	0	1659	0	602	415	0	0	4,350	3,222
S1	2023 SP High CEC Load	0	1659	879	602	126	0	0	4,350	2,968
S2	2023 SOP Heavy Renewable Output & Min. Gas Gen.	0	1659	1606	602	415	0	0	4,350	2,098
S3	2020 SP Heavy Renewable Output & Min. Gas Gen.	0	1409	1378	586	392	0	0	4,350	425

Note: DR and storage are modeled offline in starting base cases.

Previously approved transmission projects modelled in base cases

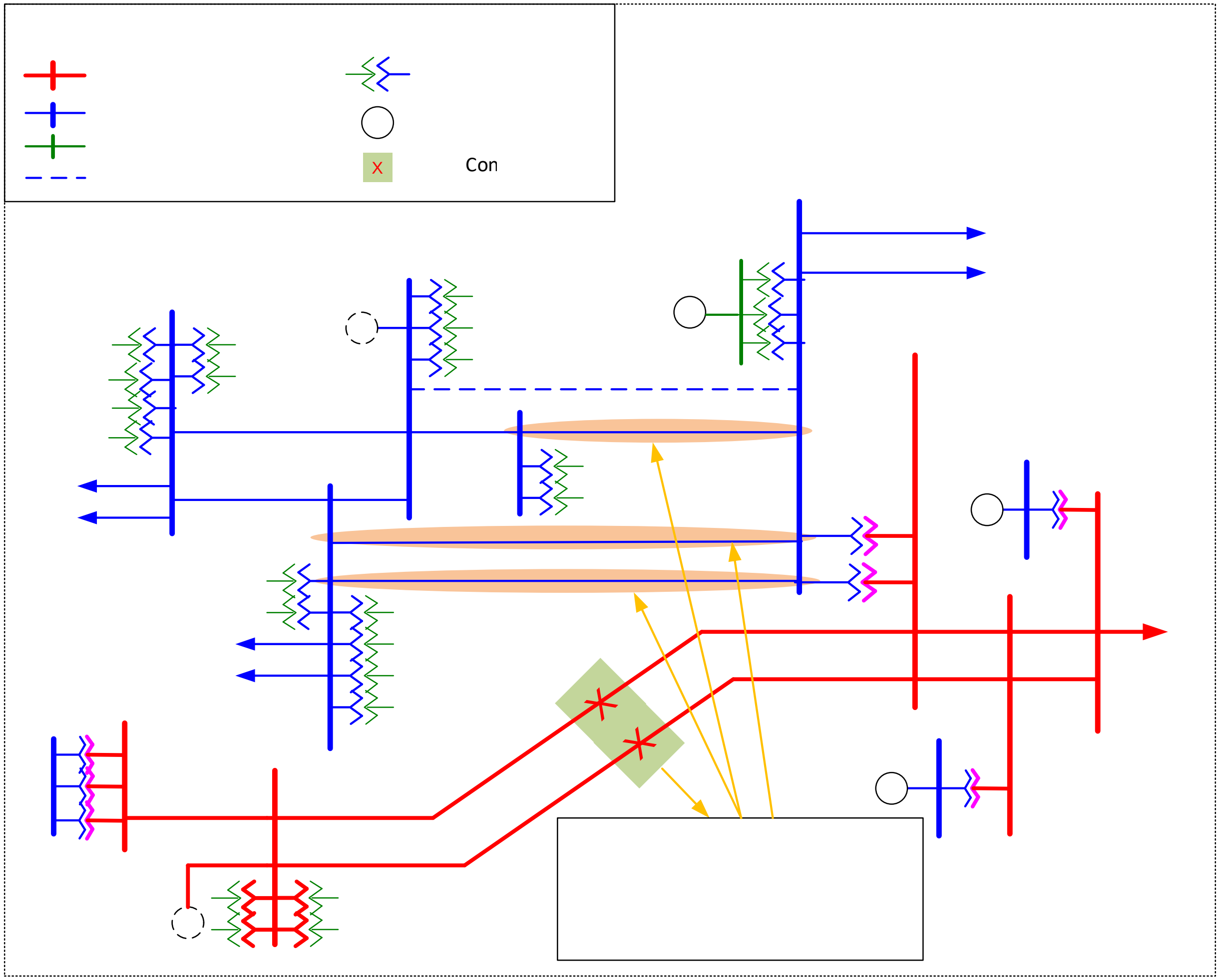
Project Name	ISD	First Year Modeled
Mesa 500 kV Substation	Mar. 2022	2023
Alberhill 500 kV Substation	Jun. 2021	2023
West of Devers Upgrade	Sep. 2021	2023

Reliability assessment preliminary results summary

Thermal loading Results

Overloaded Facility	Contingencies	Category	Loading (%)			Potential Mitigation Solutions
			B1 2020 Summer Peak	B2 2023 Summer Peak	B3 2028 Summer Peak	
Devers – Vista2LR 230 kV	Devers – Valley 500 kV No. 1 & 2	P7	**144.2**	<100	<100	Existing West of Devers SPS, Congestion Management and Curtailment
Vista – Vista2LR 230 kV	Devers – Valley 500 kV No. 1 & 2	P7	**144.2**	<100	<100	
Devers – El CascoLR 230 kV	Devers – Valley 500 kV No. 1 & 2	P7	**131.2**	<100	<100	
El CascoLR – El CascoLR 230 kV	Devers – Valley 500 kV No. 1 & 2	P7	**131.2**	<100	<100	
Devers – Vista1LR 230 kV	Devers – Valley 500 kV No. 1 & 2	P7	**123.1**	<100	<100	
Vista – Vista1LR 230 kV	Devers – Valley 500 kV No. 1 & 2	P7	**123.1**	<100	<100	

Desert Area P7 Contingency Thermal Overload



Thermal Overload:

- In the B1 2020 Peak case, N-2 thermal overload on West of Devers 230 kV lines after losing Devers-Valley 500 kV lines

Mitigation:

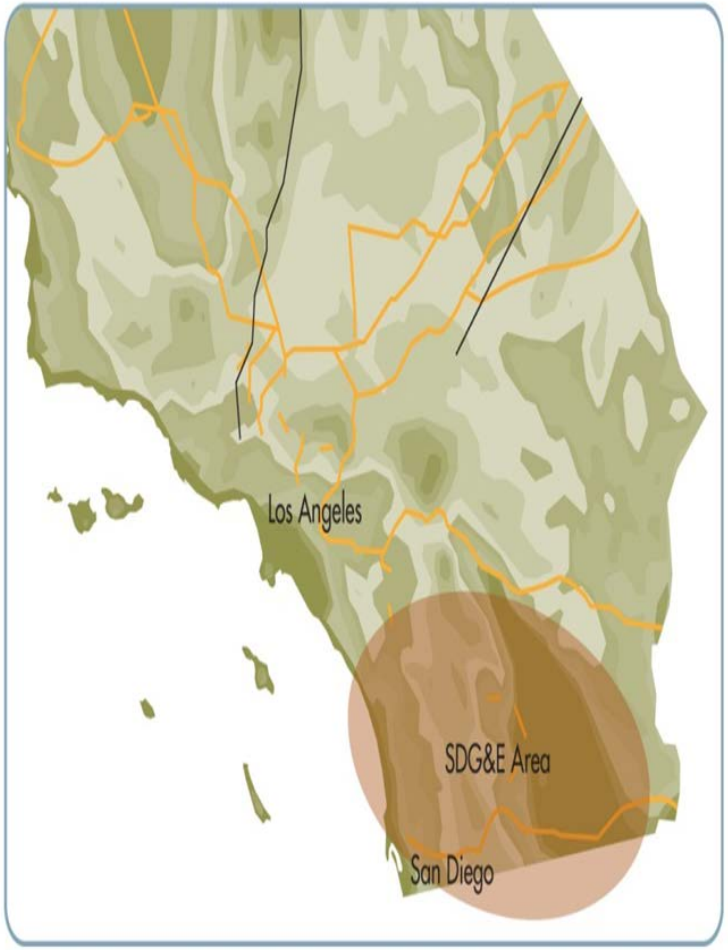
- WOD SPS, Congestion Management, Curtailment

SDG&E Main System
Preliminary Reliability Assessment Results

Frank Chen
Regional Transmission Engineer Lead

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

SDG&E Main Transmission System



- Covers San Diego, Imperial, and Southern Orange counties
- Comprised of 500 kV and 230 kV transmission facilities, along with its sub-transmission system 138/69 kV
- Net peak load of 4,453 MW with AAEE load reduction by 2020
- Generation of 5890 MW installed capacity by 2020, of which 2070 MW of renewable resources and 161 MW of battery storage are operational
- BTM-PV of 1,778 MW installed capacity, 332 MW of AAEE, and 40 MW of Demand Response, by 2028

Baseline Study Scenarios

ID	Case	Description
B1-20SP	2020 Summer Peak	Summer peak load at HE19 PST, 9/3
B2-23SP	2023 Summer Peak	Summer peak load at HE19 PST, 8/31
B3-28SP	2028 Summer Peak	Summer peak load at HE19, 8/31
B4-20LL	2020 Spring Light Load	Spring min. net load at HE13 PST, 4/12 (33% of the peak)
B5-23OP	2023 Spring Off-Peak	Spring shoulder load at HE20, 4/17 (87% of the peak)

Sensitivity Study Scenarios

ID	Case	Change From Base Assumption
S1-23SP HLOAD	2023 SP High CEC Load	High CEC forecasted load
S2-23OP HRPS	2023 OP Heavy Renewable Output	Heavy renewable output and min. gas generation commitment
S3-20SP HRPS	2020 SP Heavy Renewable Output	Heavy renewable output and min. gas generation commitment

Load and Load Reduction Assumptions

Study Case	Gross Load	AAEE	BTM-PV		Net Load	Demand Response	
			Installed Capacity	Output		Fast	Slow
	MW	MW	MW	MW	MW	MW	MW
B1-20SP	4524	71	1119	0	4453	16	24
B2-23SP	4713	159	1395	0	4554	16	24
B3-28SP	5013	332	1778	0	4681	16	24
B4-20LL	2341	23	1119	862	1456	16	24
B5-23OP	3959	134	1395	0	3825	16	24
S1-23SP HLOAD	5005	159	1395	0	4846	16	24
S2-23OP HRPS	5033	133	1395	1074	3825	16	24
S3-20SP HRPS	4524	71	1119	0	4453	16	24

Generation Resources with 50% RPS

Study Case	Solar		Wind		Energy-Storage		Thermal	
	Installed Capacity	Output	Installed Capacity	Output	Installed Capacity	Output	Installed Capacity	Output
	MW	MW	MW	MW	MW	MW	MW	MW
B1-20SP	1399	0	670	208	201	40	3619	3600
B2-23SP	1399	0	670	7	201	40	3619	3616
B3-28SP	1399	0	670	7	201	40	3619	3611
B4-20LL	1399	1357	670	7	201	-161	3619	1805
B5-23OP	1399	0	670	34	201	-161	3619	2084
S1-23SP HLOAD	1399	0	670	208	201	40	3619	3215
S2-23OP HRPS	1399	1343	670	342	201	-161	3619	1918
S3-20SP HRPS	1399	1343	670	342	201	0	3619	2580

Previously Approved Projects Modelled

Project Name	ISD	First Year Modeled
Sycamore - Penasquitos 230 kV Line	Aug-18	2020
Mission-Penasquitos 230 kV Circuit	Canceled	NA
2nd Miguel - Bay Boulevard 230 kV Circuit	Jun-19	2020
Southern Orange County Reliability Upgrade	Dec-21	2023
Miguel 500 kV Voltage Support	Completed	2020
Suncrest 500/230 kV Bank Rating Increase	Completed	2020
San Luis Rey Synchronous Condensers	Completed	2020
San Onofre Synchronous Condenser	Completed	2020
Suncrest 300 Mvar SVC	May-17*	2020
Imperial Valley BK80 Replacement	Jun-19	2020
IID S-Line Upgrade	Dec-21	2023

Note: * In service date to be revisited by project sponsor

Reliability Assessment Results Summary

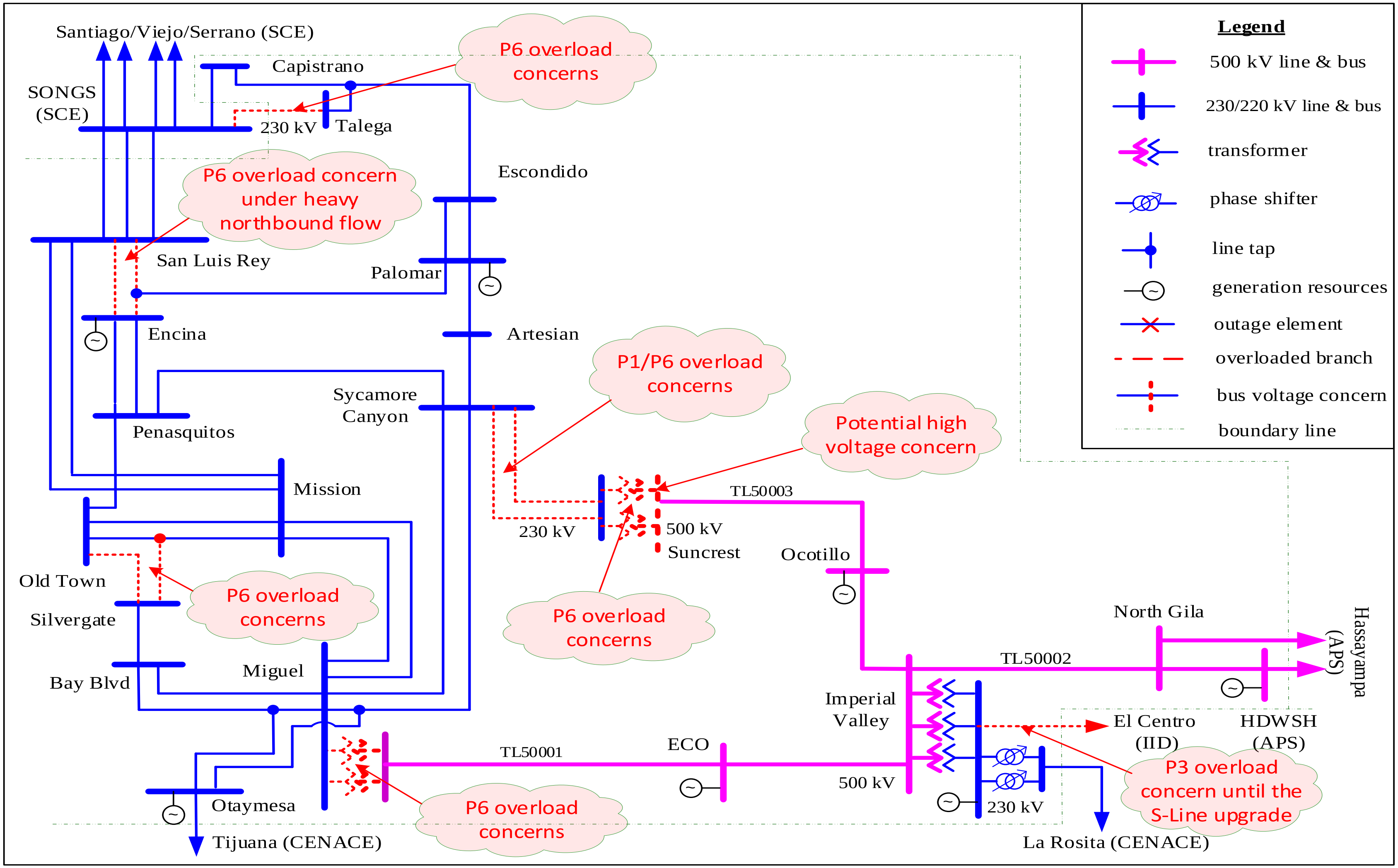
The assessment identified:

- 4 branches 500/230 kV overloaded for P6 outages
- 7 branches 230 kV overloaded for P1/P2/P3/P4/P6 outages
- 1 tie 230 kV overloaded for P3 outages, and
- 1 potential high voltage at 500 kV substation for P2/P4

Reliability Assessment Results Summary

Reliability Concern		Type of Concern	Baseline Scenario					Sensitivity Scenario		
ID	Element		B1-20SP	B2-23SP	B3-28SP	B4-20LL	B5-23OP	S1-23SP HLOAD	S2-23OP HRPS	S3-20SP HRPS
No.1	Talega-San Onofre 230 kV Line	Thermal		P6	P6			P6		
No.2	Encina-San Luis Rey 230 kV path	Thermal				P6				
No.3	Silvergate-OldTown 230 kV path	Thermal		P6	P6			P6	P2/P4/P6	P6
No.4	Miguel BK80 and BK81	Thermal			P6		P6	P6	P6	P6
No.5	Suncrest BK80 and BK81	Thermal		P6	P6		P6	P6	P6	P6
No.6	Suncrest-Sycamore 230 kV path	Thermal	P6	P6	P6		P6	P6	P1/P6	P1/P6
No.7	Suncrest 500 kV bus	Voltage	P2/P4	P2/P4	P2/P4	P2/P4	P2/P4	P2/P4	P2/P4	P2/P4
No.8	IID S-Line 230 kV tie	Thermal	P3							

Reliability Assessment Results Summary



Potential Mitigation Solutions Summary

- Rely on applicable short-term emergency rating that allow operational action after 2nd contingency to mitigate thermal overload concerns on:
  - No.1 Talega-San Onofre 230 kV Line
  - No.3 Silvergate-OldTown 230 kV path
  - No.4 Miguel BK80 and BK81
  - No.5 Suncrest BK80 and BK81
  - No.6 Suncrest-Sycamore 230 kV path
- Reduce northbound flow via the SONGS switchyard to eliminate the overloads on Encina-San Luis Rey 230 kV path (No.2) after the 1st outage;
- Develop a coordinated control scheme for reactive support facilities to prevent the high voltage concern at Suncrest 500 kV substation (No.8)
- Interim OP on the S-Line overload (No.7) until the S-Line upgrade

Compared to last year results

- Variation in load forecast due to peak shift impact (BTM-PV unavailable at HE19:00 PST)

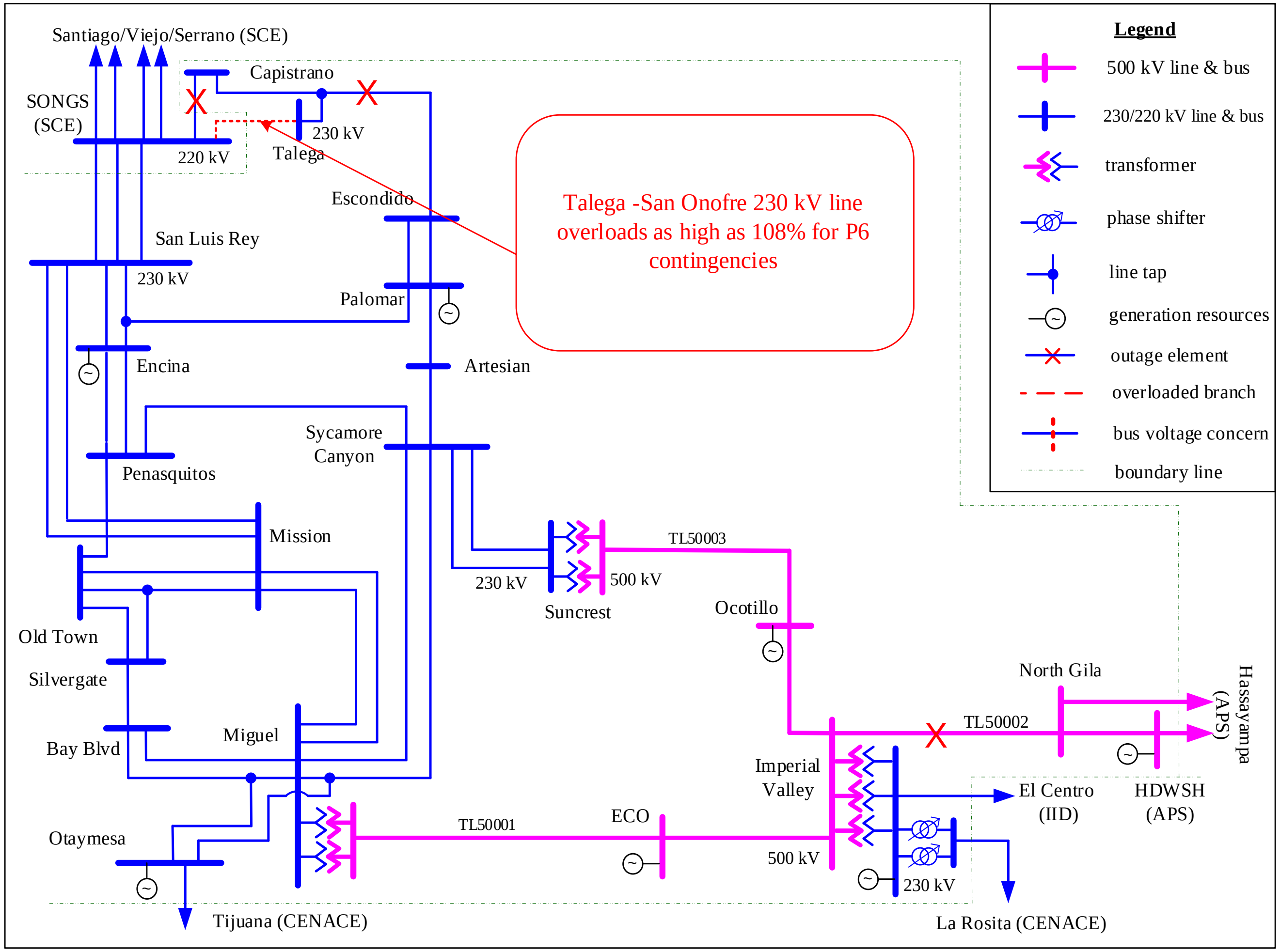
Study Year	TPP 2017~2018			TPP 2018~2019		
	2019	2022	2027	2020	2023	2028
Peak Load Demand (MW)	4753	4704	4555	4453	4554	4681
Peak load variation compared to TPP 2017~2018:				-300	-150	126

- Solar generation unavailable at HE19:00 PST as base scenario

- Newly implemented RAS along with operational actions eliminates the P6 overload concern on TL23054/TL23055

Detailed Discussions on the Identified Reliability Concerns and Potential Mitigation Solutions

No.1 - Talega-San Onofre 230 kV Line



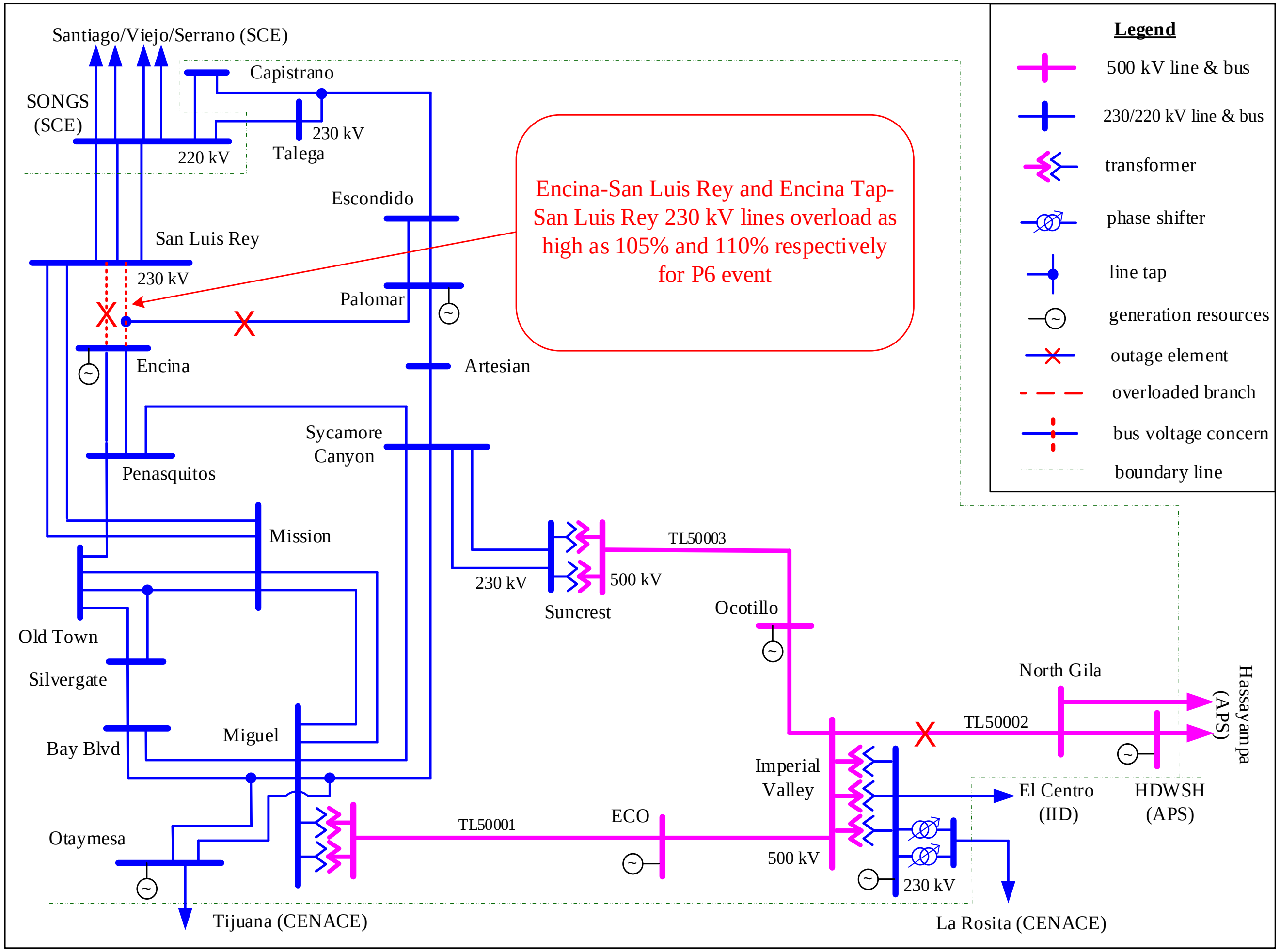
Reliability Concern

- Thermal overloads for P6 contingencies

Potential Mitigation

- OP to reduce reactive power output of the synchronous condensers at Talega within 30 minutes after the 2nd contingency

No.2 - Encina-San Luis Rey 230 kV path



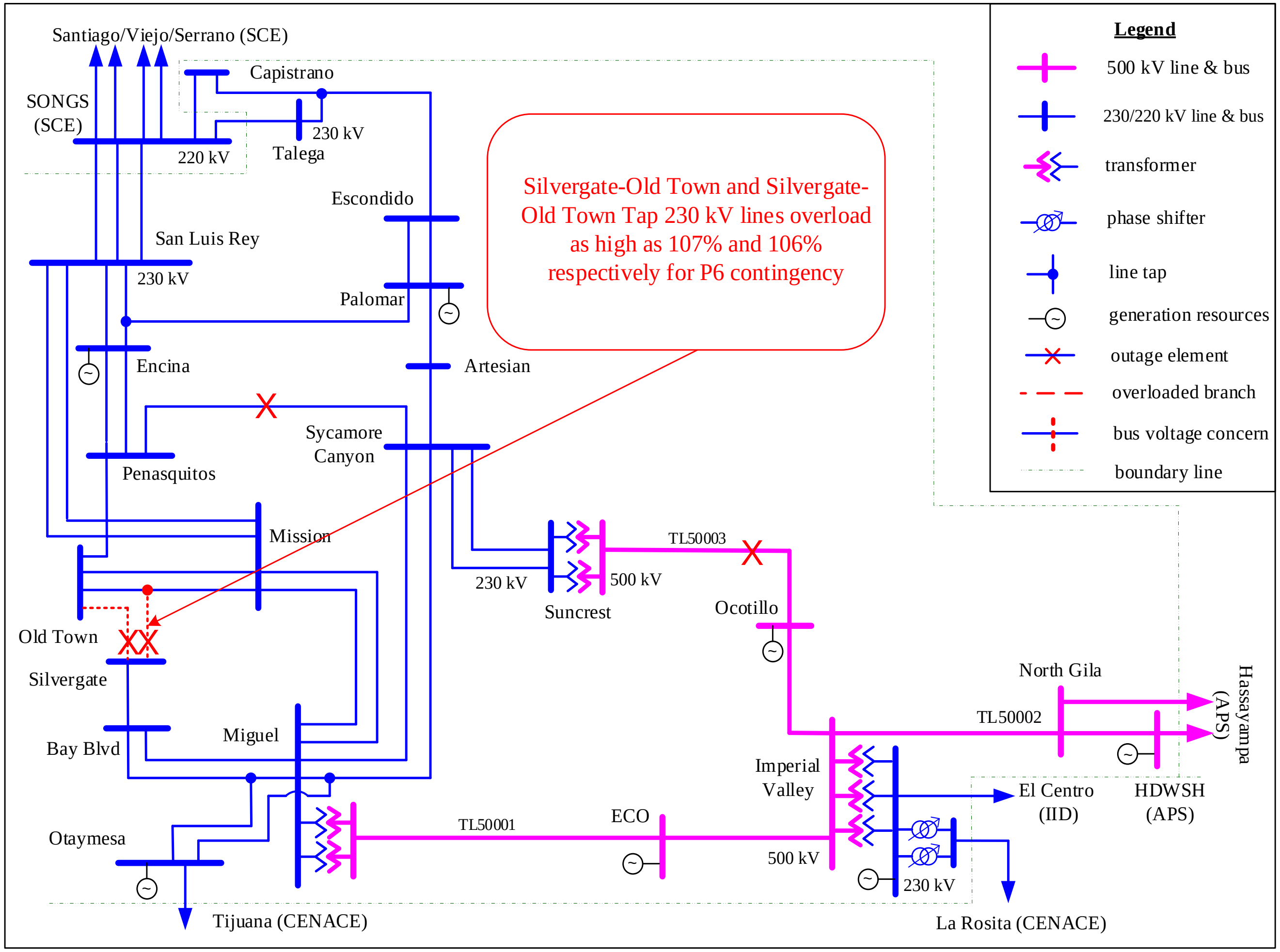
Reliability Concern

- Thermal overloads for P6 contingency with heavy northbound flow via the SONGS switchyard

Potential Mitigation

- OP to reduce the northbound flow after the 1st contingency

No.3 - Silvergate-Old Town 230 kV path



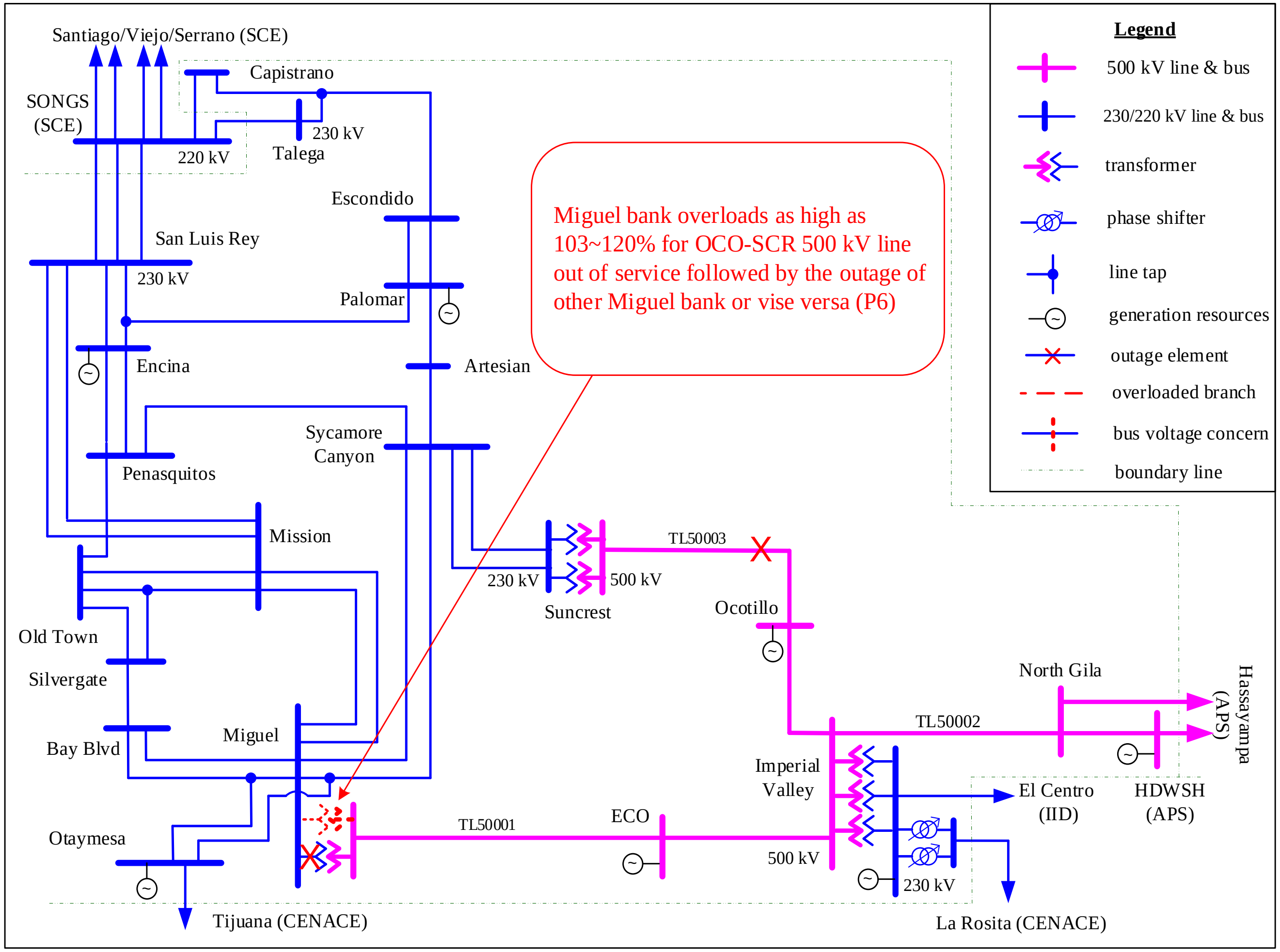
Reliability Concern

- Thermal overloads for P2/P4/P6 events

Potential Mitigation

- OP to re-dispatch generation in the Otay Mesa area after the 1st contingency

No.4 - Miguel BK80 and BK81



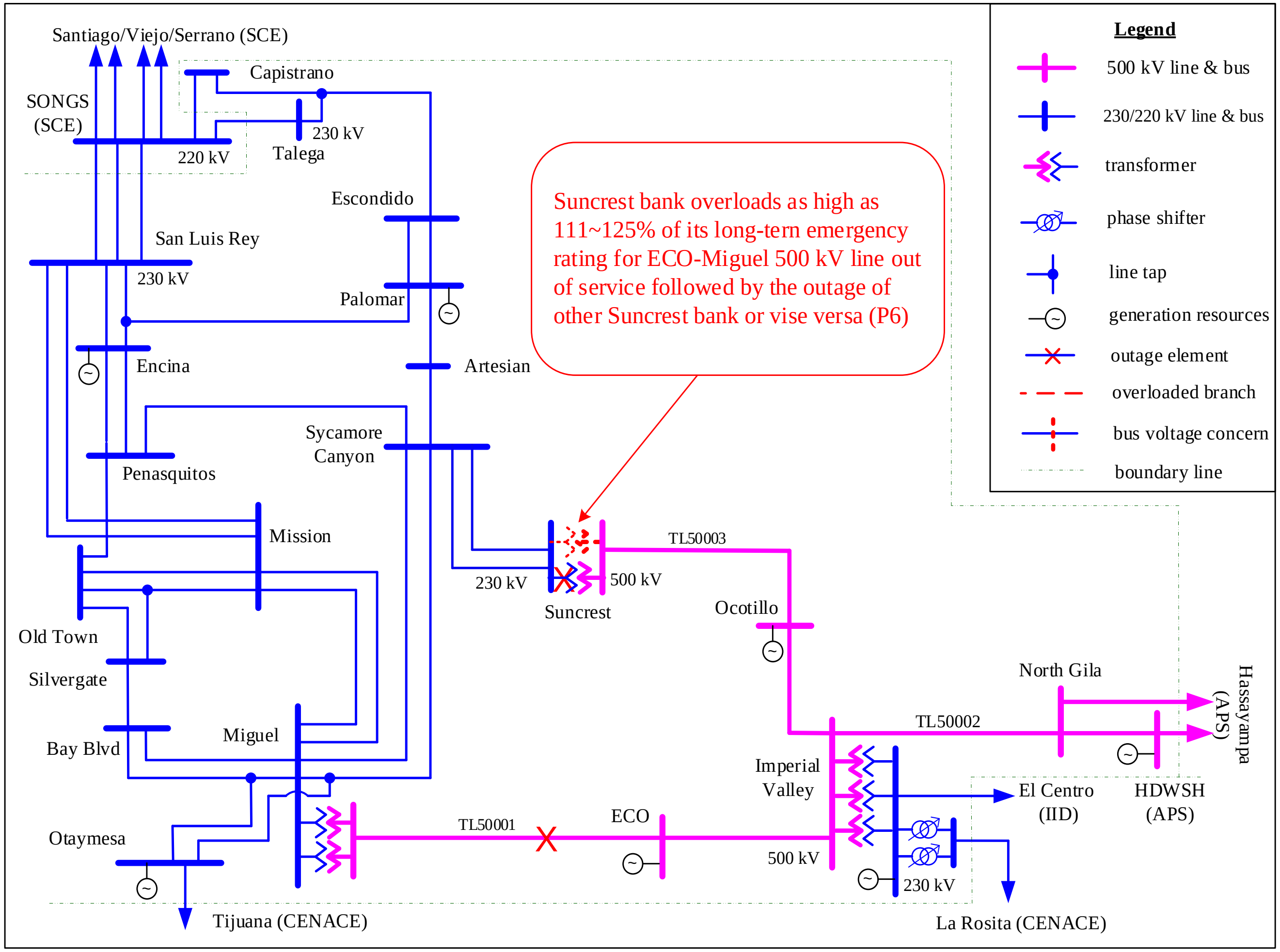
Reliability Concern

- Thermal overloads for P6 contingency

Potential Mitigations

- OP to redispatch generation and/or adjust the IV phase shifters within 30 minutes after the 2nd contingency
- Procure PR and ES up to 300 MW in the San Diego area

No.5 - Suncrest BK80 and BK81



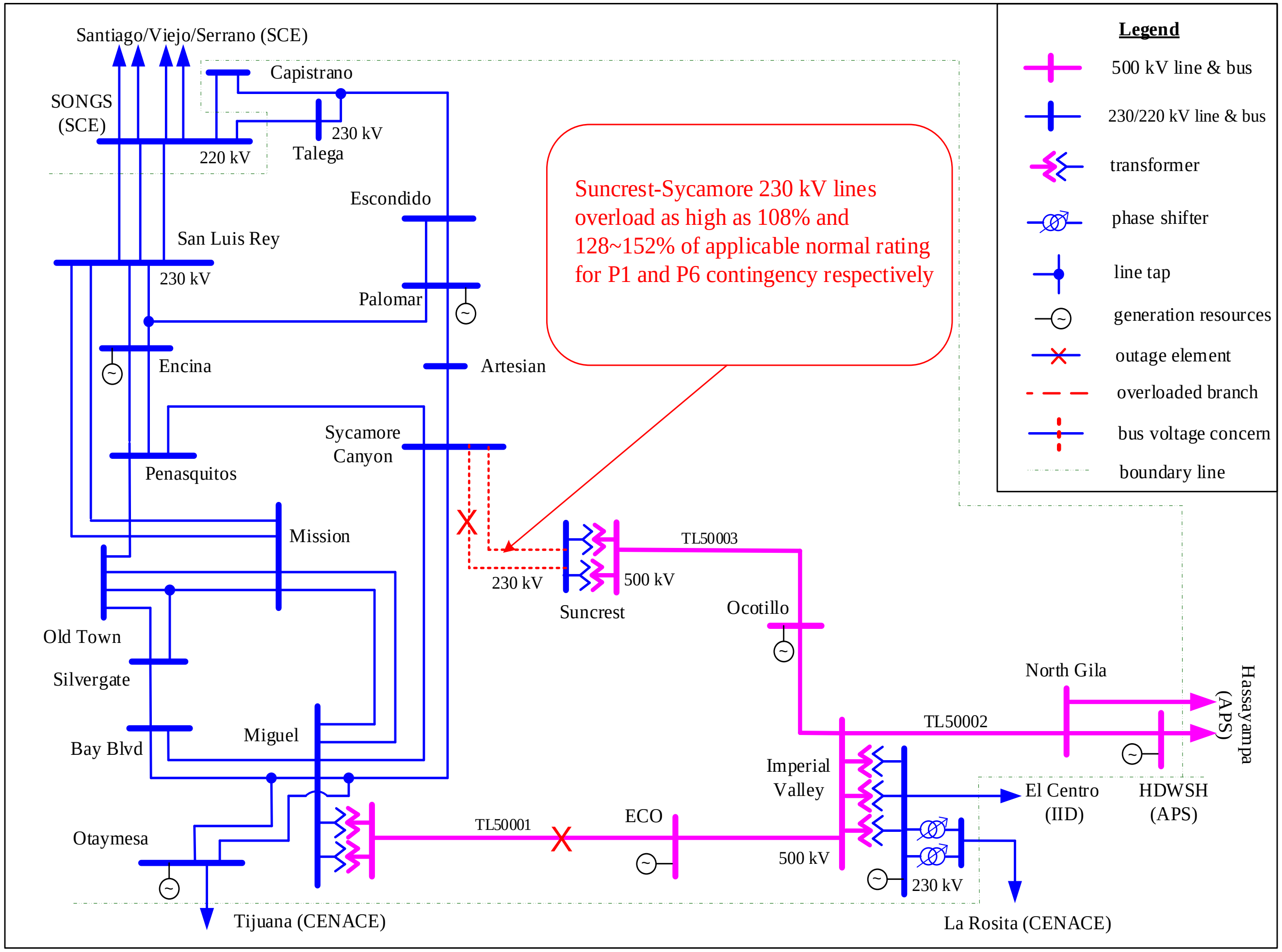
Reliability Concern

- Thermal overloads for P6 contingencies

Potential Mitigations

- OP to re-dispatch generation and/or adjust the IV phase shifters within 30 minutes after the 2nd contingency
- Procure PR and ES up to 300 MW in the San Diego area

No.6 - Suncrest-Sycamore 230 kV path



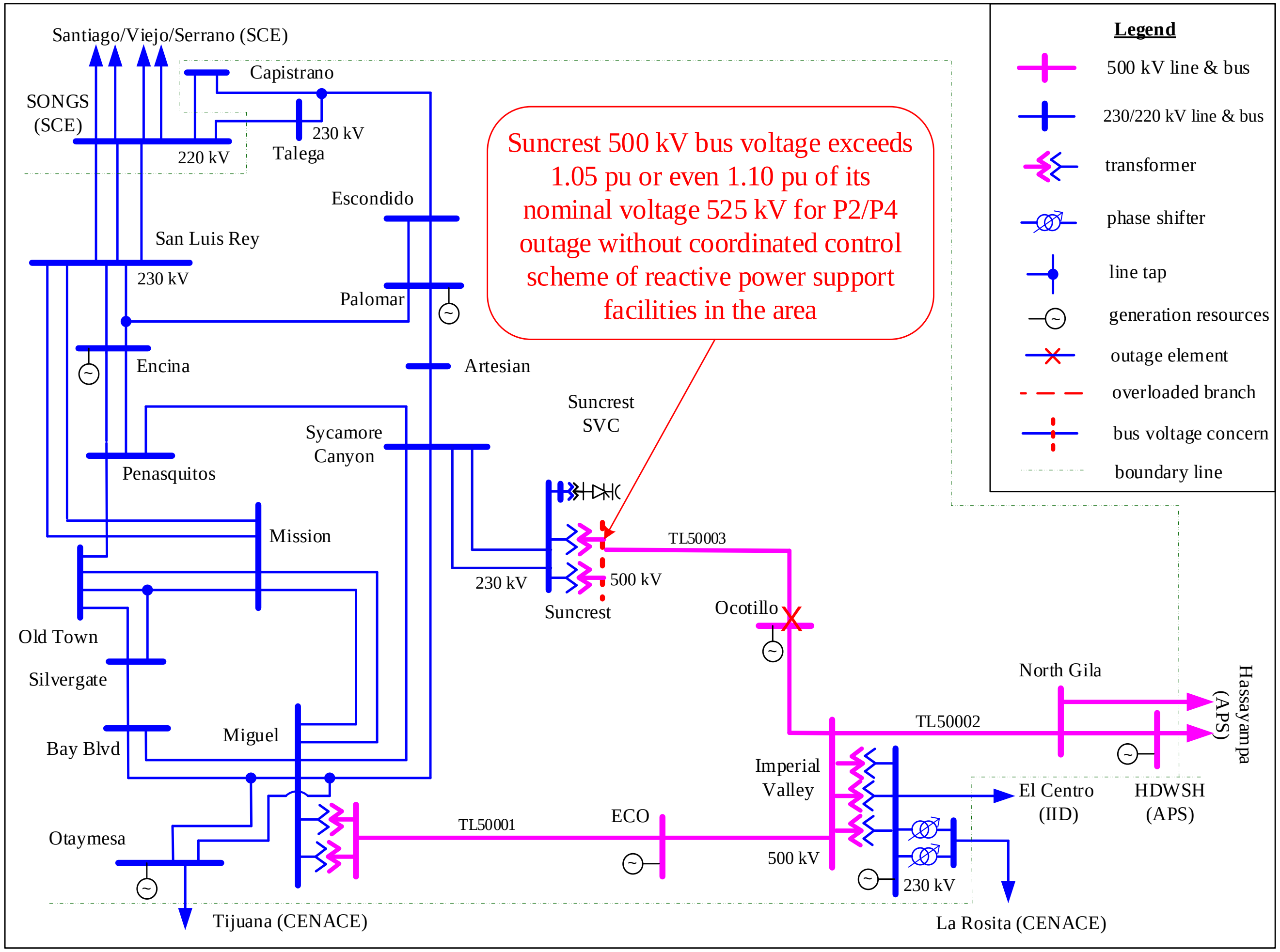
Reliability Concern

- Thermal overloads for P6 contingencies

Potential Mitigation

- OP to re-dispatch generation and adjust the IV phase shifters within 30 minutes after the 2nd contingency
- Other operational mitigation as needed

No.7 – Suncrest 500 kV bus



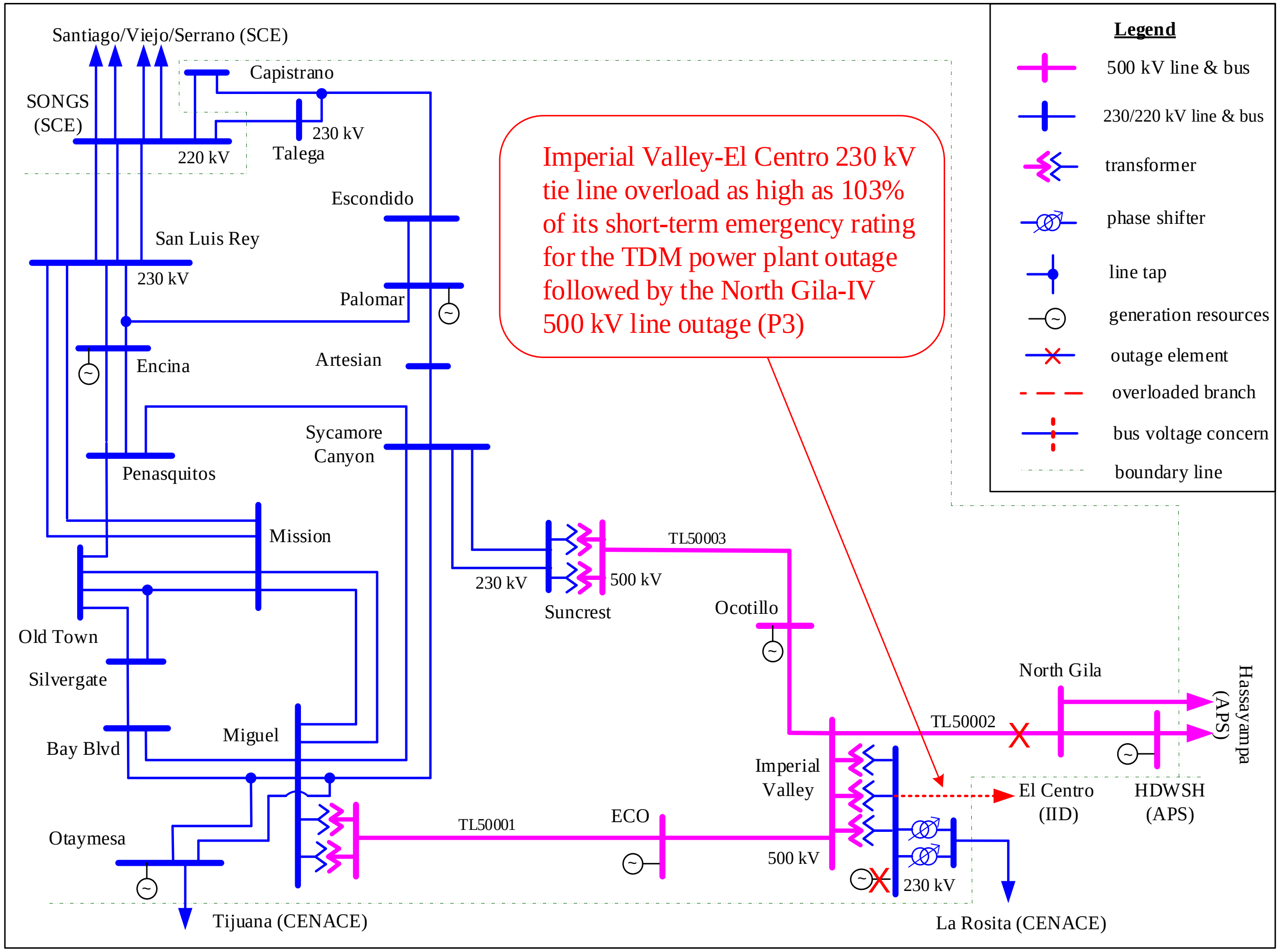
Reliability Concern

- Potential high voltage for P2/P4 events without a coordinated control scheme of the planned and existing reactive power support facilities in the Suncrest area

Potential Mitigation

- Develop a coordinated control scheme among the reactive power support facilities

No.8 - IID S-Line 230 kV tie line



Reliability Concern

- Thermal overload for P3 contingency

Interim Mitigation

- rely on the ISO market congestion management and operation procedure to dispatch all available generation including preferred resources in the SD-IV area and adjust the IV phase shifting transformers after 1st contingency

San Diego Gas & Electric Area Sub-Transmission
Preliminary Reliability Assessment Results

Charles Cheung

Senior Regional Transmission Engineer

2018-2019 Transmission Planning Process Stakeholder Meeting

September 20-21, 2018

SDGE Area Sub-Transmission Study Scenarios

- Base scenarios

No.	Case	Description
B1	2020 Summer Peak	Summer peak load time (9/3 HE 19 PST)
B2	2023 Summer Peak	Summer peak load time (8/31 HE 19 PST)
B3	2028 Summer Peak	Summer peak load time (8/31 HE 19 PST)
B4	2020 Spring Light Load	Spring minimum net load time (4/12 HE 13 PST)
B5	2023 Spring Off-Peak	Spring shoulder load time (4/17 HE 20 PST)

- Sensitivity scenarios

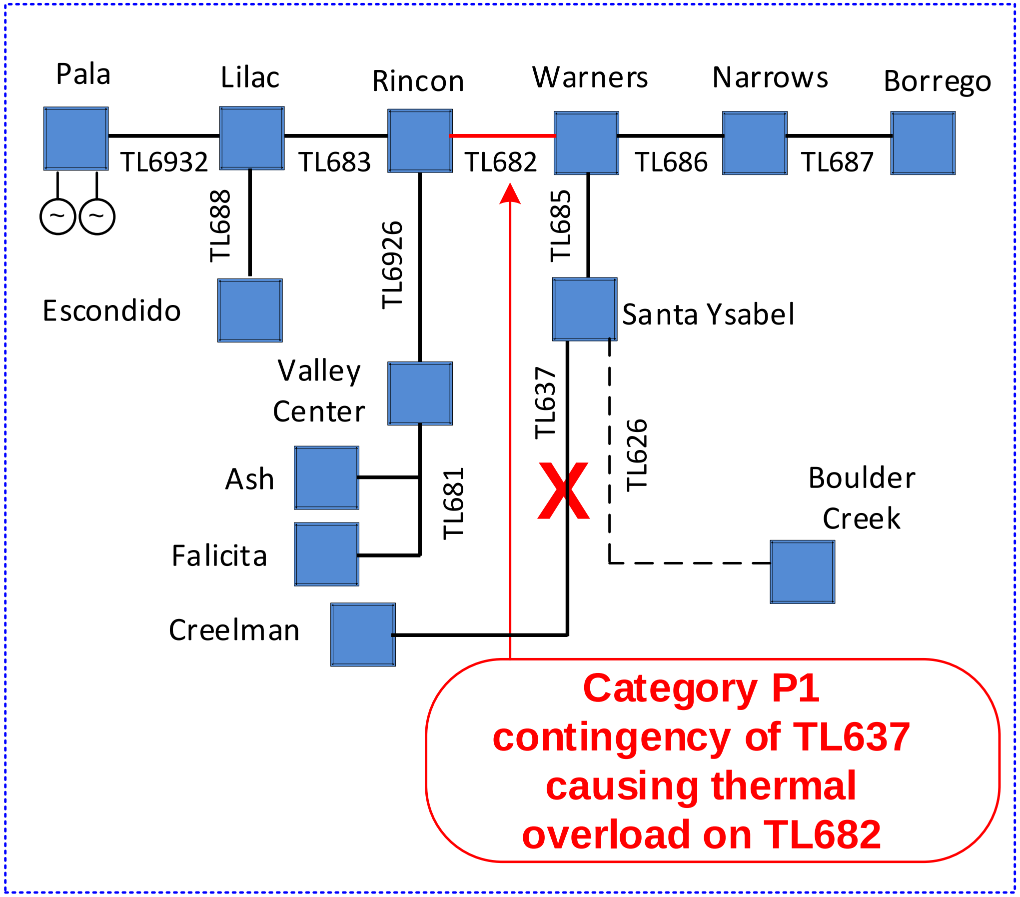
No	Case	Change From Base Assumption
S1	2023 Summer Peak	High CEC forecasted load
S2	2023 Spring Off-Peak	Heavy renewable output and minimum gas generation commitment
S3	2020 Summer Peak	Heavy renewable output and minimum gas generation commitment

Reliability assessment preliminary results summary

Thermal loading Peak Results

Overloaded Facility	Worst Contingencies	Category	Loading (%)					Potential Mitigation Solutions
			B1 2020 SP	B2 2023 SP	B3 2028 SP	S1 2023 SP High Load	S3 2020 SP High RE	
Warners-Rincon 69 kV	Santa Ysabel-Creelman 69 kV	P1	96.7	99.2	97.6	**117**	<90	Monitor Load Growth/ Battery Storage

Borrego Area P1 Contingency Thermal Overload



Thermal Overload:

- In the S1 2023 Peak High Load case, N-1 thermal overload on TL682 (32 MVA) after losing TL637

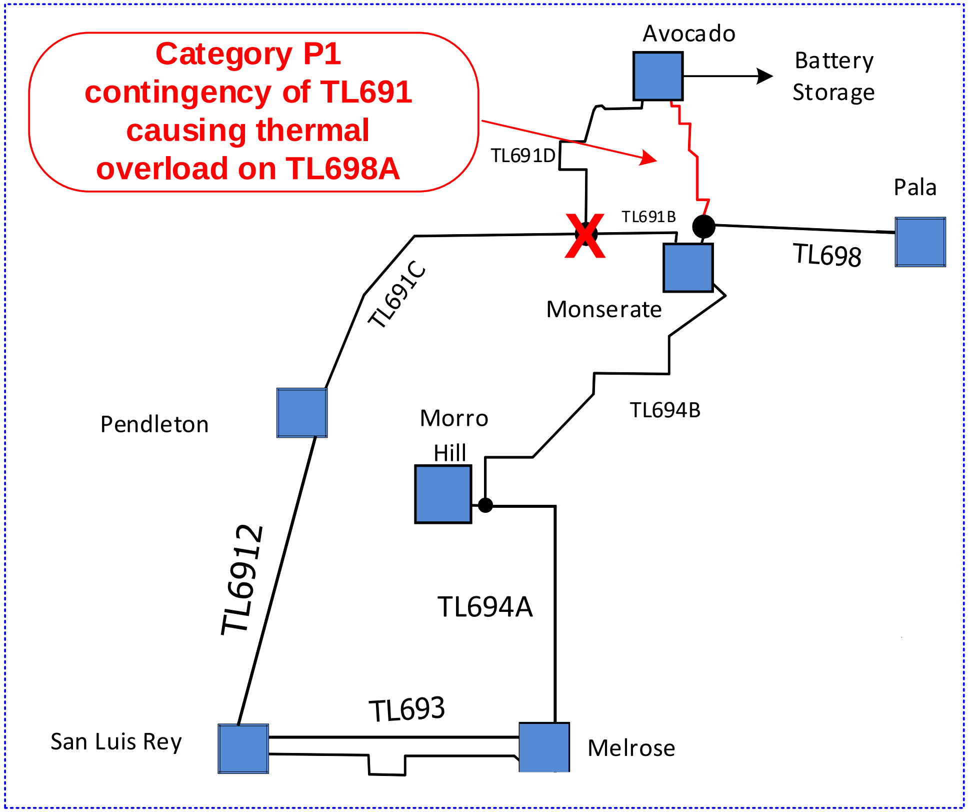
Mitigation:

- Upgrade TL682
- Battery Storage at Borrego

Thermal loading Off-Peak Results

Overloaded Facility	Contingencies	Category	Loading (%)			Potential Mitigation Solutions
			B4 2020 OP	B5 2023 OP	S2 2023 OP High RE	
Avocado-Monstrate Tap 69 kV	Avocado-Monstrate-Pendleton 69 kV	P1	<90	**132.5**	**133.9**	Reduce Battery Charging/ Potential RAS
Avocado-Avocado Tap 69 kV	Avocado-Monstrate-Pala 69 kV	P1	<90	**131.4**	**132.3**	Reduce Battery Charging/ Potential RAS
Avocado-Avocado Tap 69 kV	Avocado-Monstrate Tap 69 kV	P2.1	<90	**129.9**	**131.2**	Reduce Battery Charging/ Potential RAS
Avocado-Monstrate Tap 69 kV	Avocado-Avocado Tap 69 kV	P2.1	<90	**129.3**	**130.6**	Reduce Battery Charging/ Potential RAS
Avocado-Avocado Tap 69 kV	Monstrate-Monstrate Tap 69 kV	P2.1	<90	**101**	<90	Reduce Battery Charging/ Potential RAS

Avocado Area P1/P2.1 Contingency Thermal Overload (1)



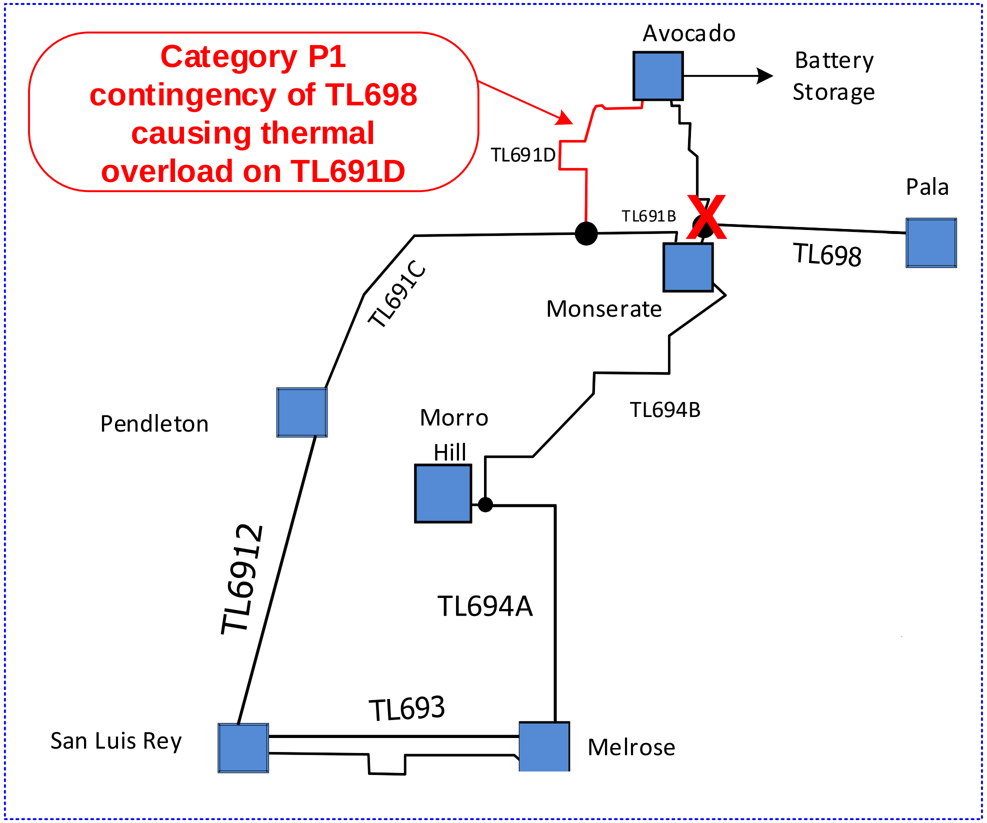
Thermal Overload:

- In the 2023 Off-Peak case, N-1 thermal overload on TL698A (52 MVA) after losing TL691 or TL691D
- 40 MW of Battery at Avocado in charging mode

Mitigation:

- Reduce battery charging to 20 MW
- RAS to trip battery charging

Avocado Area P1/P2.1 Contingency Thermal Overload (2)



Thermal Overload:

- In the 2023 Off-Peak case, N-1 thermal overload on TL691D (52 MVA) after losing TL698 or TL698A or TL698B
- 40 MW of Battery at Avocado in charging mode

Mitigation:

- Reduce battery charging to 20 MW
- RAS to trip battery charging

Consideration of Storage as a Transmission Asset in the 2018-2019 Transmission Planning Cycle

Neil Millar
Executive Director, Infrastructure Development

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20-21, 2018

Topics to discuss

- Consideration of storage as a preferred resource and as transmission asset
  - Past considerations
  - FERC requirements for storage as transmission
  - Local capacity versus transmission asset considerations
- Purpose and status of “Storage As a Transmission Asset” initiative - SATA
- Our path forward in this cycle.

Clarification of transmission planning issues relating to storage

Storage – and other preferred resources - may meet different types of transmission planning needs

- Addressing grid reliability requirements
- Identifying upgrades needed to meet California's policy goals (e.g. Renewable Portfolio Standards)
- Exploring projects that can bring economic benefits to consumers
  - This includes projects alleviating congestion to provide access to lower cost resources, but not a competing resource
  - This does not include functioning as a market resource inside a constrained area replacing other local resources – that is a resource procurement decision
  - Differentiating between the two can be complex

The ISO has routinely assessed non-transmission alternatives as options; preferred resources and storage

- The assessments have been on a case to case basis due to labor-intensive nature of the analysis
- ISO published a methodology document “Consideration of alternatives to transmission or conventional generation to address local needs in the transmission planning process,” to improve ISO’s past approach to evaluating non-conventional transmission solutions
- Methodology proposed a 3 step approach that includes identifying generic resources type, determining an effective mix and monitoring the development of selected mix
- Methodology was advanced and used to establish the Moorpark and Santa Clara sub-area local capacity requirements in the 2017-18 TPP cycle

The ISO provides opportunities for non-transmission resources, such as storage, to serve as the preferred solution

- The ISO does not “approve” non-transmission alternatives in its Transmission Plan
- The ISO works to support regulatory approvals for those projects if they are identified as the preferred alternative solution in the transmission planning process
- Storage has long been recognized as a potential transmission asset or a market resource

The likelihood of storage in meeting different types of transmission planning needs differs

- Addressing grid reliability requirements:
  - The most frequent candidate for storage in the past, as identified by the ISO and stakeholder submissions
- Identifying upgrades needed to meet California's policy goals (e.g. Renewable Portfolio Standards)
  - While possible, no identified opportunities for storage thus far
- Exploring projects that can bring economic benefits to consumers
  - The bulk of all storage market economic benefits identified to date have been as a market resource inside a constrained area

The ISO has considered numerous proposals where storage could provide cost-of-service based transmission services

- Over the past several years, the ISO has studied
  - 27 battery storage proposals, and
  - One pumped hydro storage proposal as potential transmission assets.

- To date, only two proposals have resulted in storage projects moving forward as transmission assets
  - Both in the 2017-2018 Transmission Plan

- The ISO's experience to date is electric storage for reliability needs has best fit as a market resources providing local capacity resource rather than as a transmission asset

The ISO has also had to consider transmission asset versus market (local Resource Adequacy) resource issues

- When would a transmission need for storage move from the local Resource Adequacy framework to being a Transmission Asset?
- Can criteria be definitively developed to identify transmission need that cannot be (or should not be?) addressed by local Resource Adequacy procurement
- Note that the ISO preference is clearly to treat storage consistent with other preferred resources, so there needs to be (1) a reason to move to transmission asset treatment <u>and</u> (2) no restrictions standing in the way

Re (1), to date, the ISO has identified limited compelling reasons for particular storage to be needed to be a transmission asset

- Visibility needed through real time operations (of complete path to device)
- Heavily constrained operations expected - e.g., would otherwise be exceptionally dispatched a great deal of the time
- Procurement as a local capacity resource not considered feasible or much less viable to meet specific need;
  - Resource Adequacy must-offer obligations not consistent with transmission system needs
- Overly complex interconnection as a market resource

Operational Control - Practical meaning of ‘operational control’ of SATA facilities

- Tariff Appendix A defines Operational Control as –

  “*The rights of the CAISO under the Transmission Control Agreement and the CAISO Tariff to direct Participating TOs how to operate their transmission lines and facilities and other electric plant affecting the reliability of those lines and facilities for the purpose of affording comparable non-discriminatory transmission access and meeting Applicable Reliability Criteria.”*

- In considering SATA proposals, the practical meaning of operational control is:
  – A hands-on out-of-market state-of-charge (SOC) control – a new definition may be appropriate
  – Orchestrated in a way that the market system reflects any change in SOC

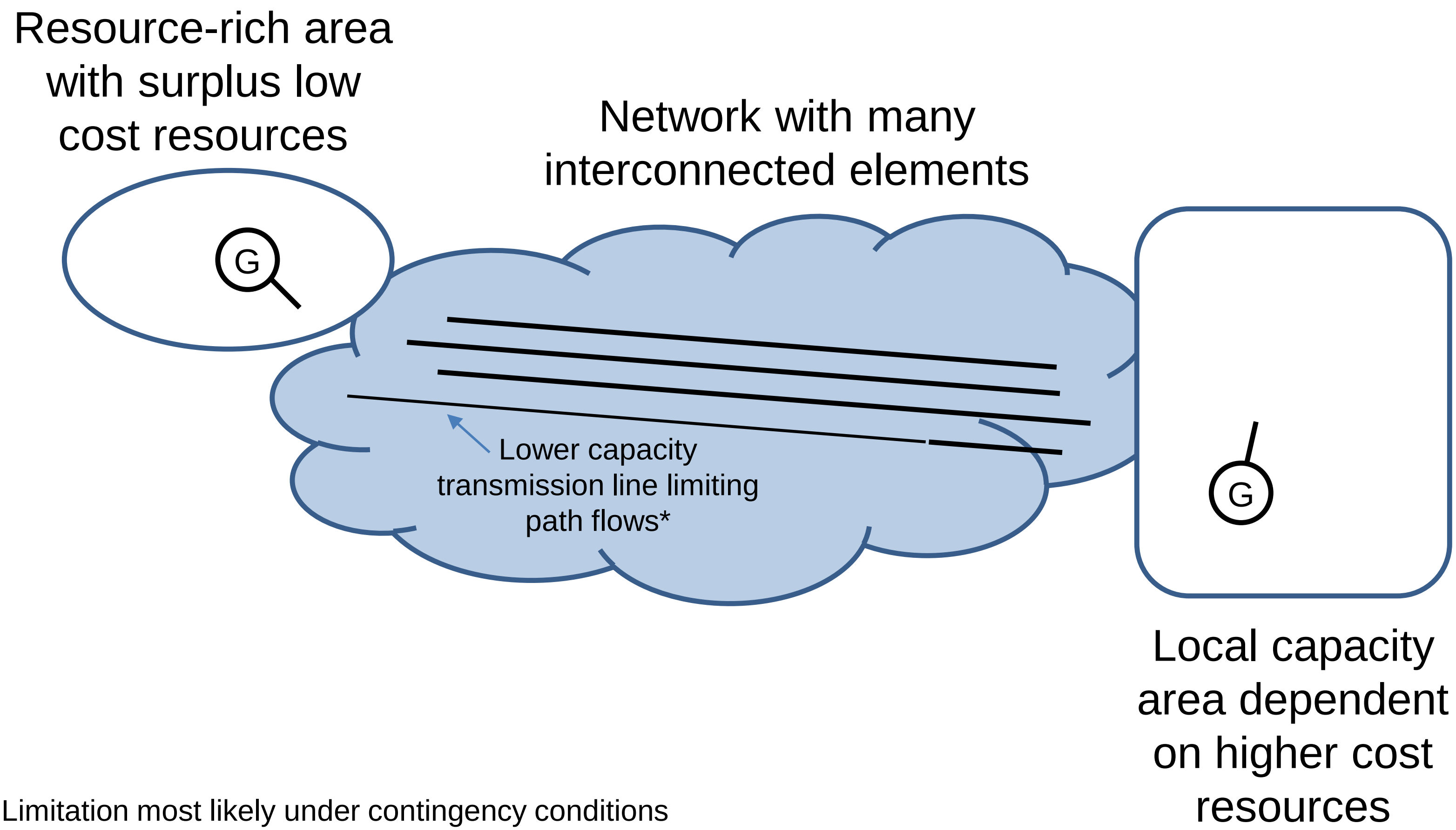
Re (2), considering the Energy Policy Act and past FERC direction, storage, to be a transmission asset, must:

- Provide a transmission service (*e.g*., voltage support, mitigate thermal overloads)
- Meet an ISO-determined need under the tariff (reliability, economic, public policy)
- "Increase the capacity, efficiency, or reliability of an existing or new transmission facility"
- Be the more efficient or cost-effective solution to meet the identified need
- Be subject to competitive solicitation if it is a regional transmission facility

Storage as a transmission asset must *"increase the capacity, efficiency, or reliability of an existing or new transmission facility"*

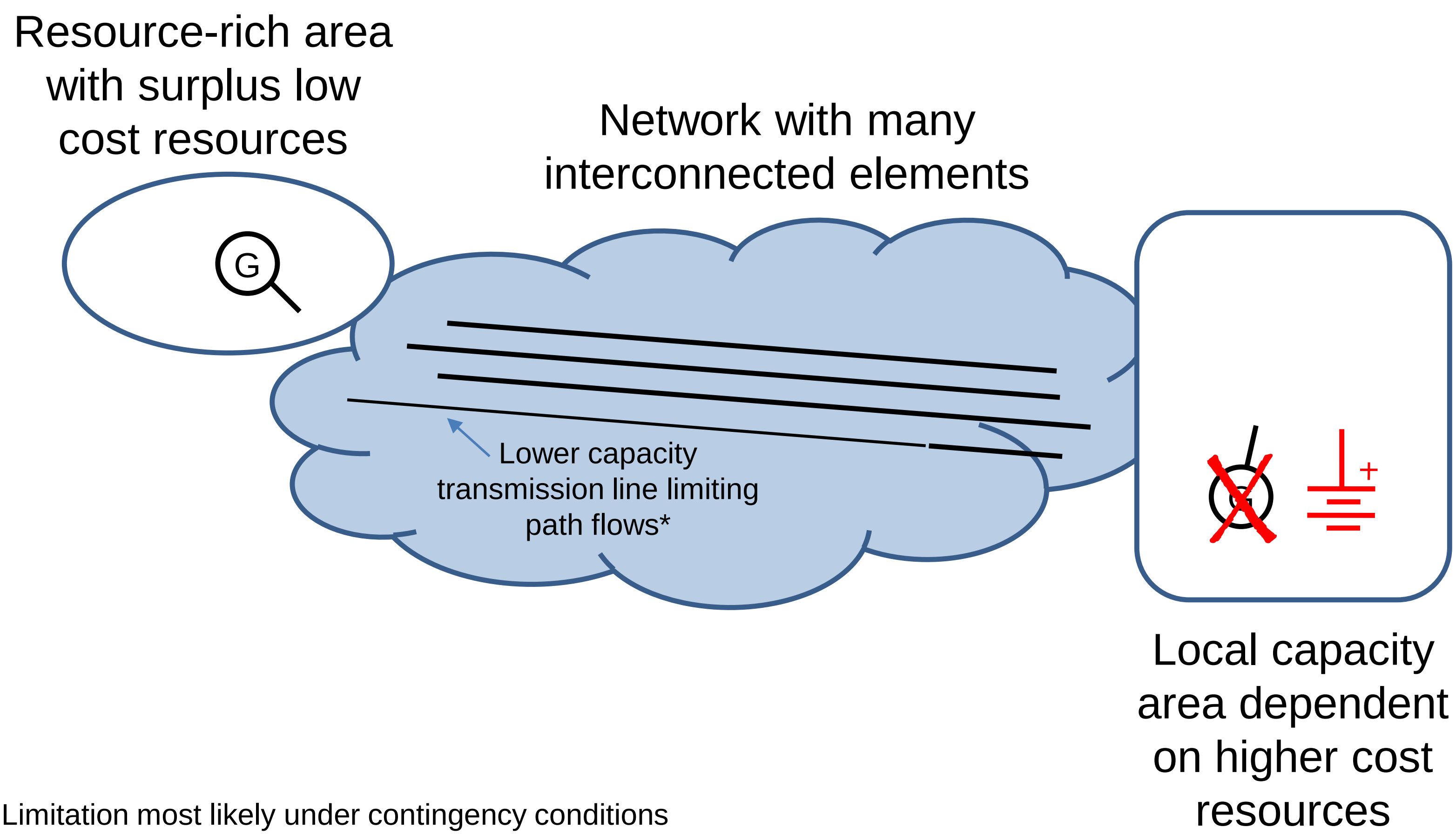
- As noted earlier, the ISO's economic-driven transmission framework is not an alternative to resource planning
- A high level example has been developed to clarify this consideration
- Individual applications will likely be less clear, and need individual consideration.

Consider examples by way of a simplified hypothetical situation:



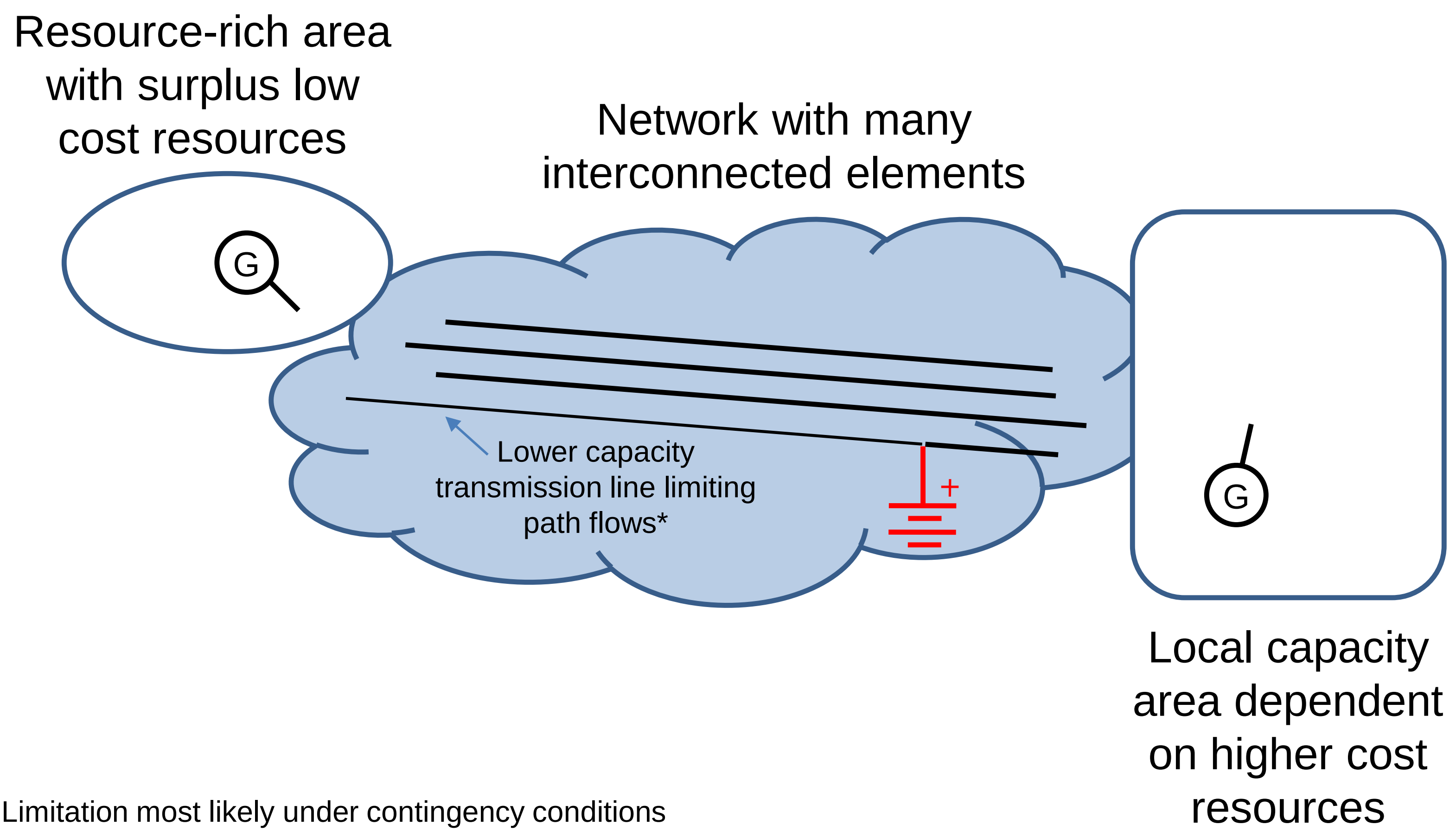
* Limitation most likely under contingency conditions

Replacing the local capacity resource with storage is an example of market resource considerations



* Limitation most likely under contingency conditions

Compare to a storage device “pushing back” on a limiting flow, increasing path flows overall:



* Limitation most likely under contingency conditions

Does storage have to be transmission connected to be a transmission asset?

- Given the circumstances that would lead to selecting storage as a transmission asset rather than market resource, the ISO has noted that connection to distribution will pose unique planning and operating challenges
- Distribution-connected resources raise concerns with visibility of the path between the resource and the transmission grid
- They also create uncertainty about cost responsibility between high voltage and low voltage rates, and between transmission and distribution rates

The ISO's current practice is allocating costs to high or low voltage TAC based on the point of interconnection for storage, consistent with the ISO's tariff

- Transmission connected resources are resources that are connected to the ISO controlled grid
  - Regional resources – greater than 200 kV, and
  - Local resources – lower than 200 kV
- SATA resource may be connected to the transmission system at a level that differs from the transmission issue it has been identified to resolve, just like other transmission assets
  - For example, the ISO may identify a Regional need, but identify a SATA resource connecting at a Local level as the best solution

The ISO's Phase 3 competitive solicitation process accommodates transmission including storage as a transmission asset

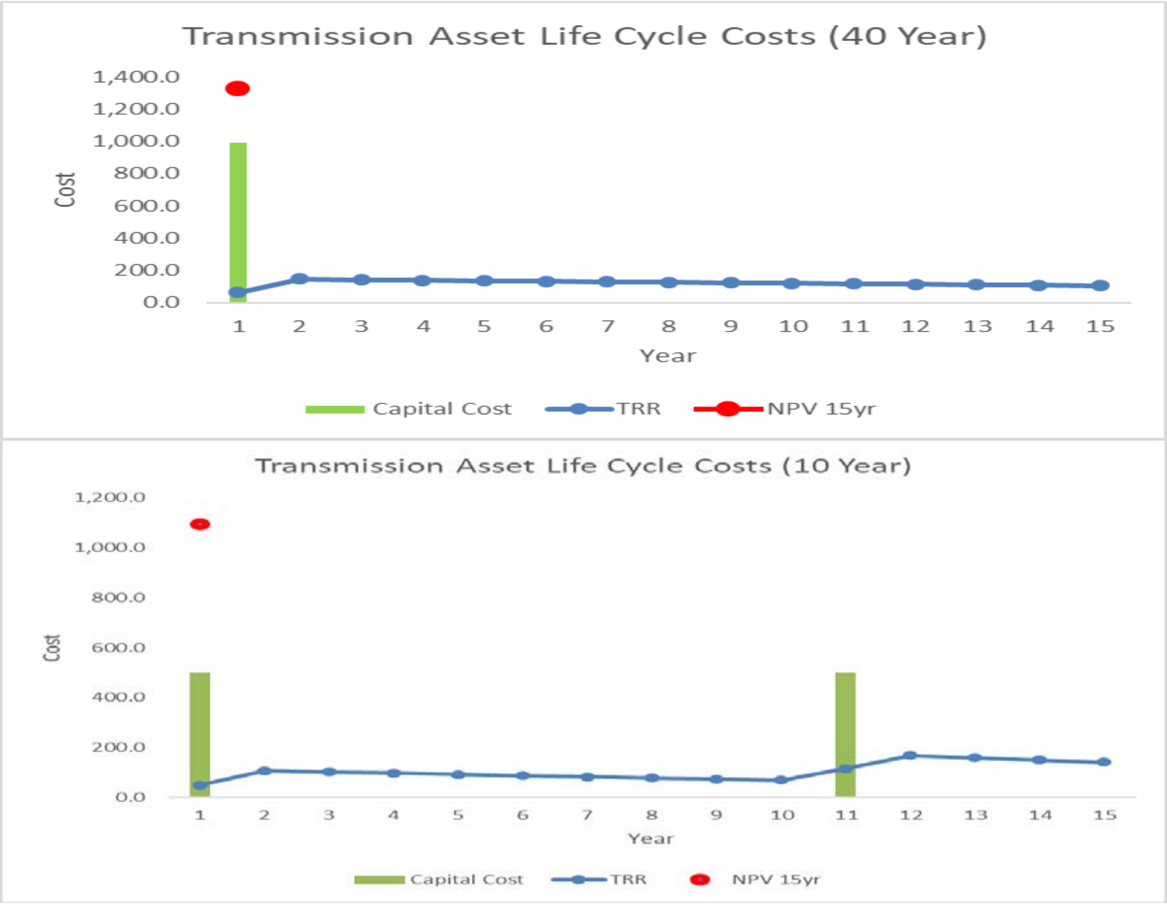
- The ISO's solicitation process does not include preferred (market) resources
  - These projects are coordinated with the local regulatory agency and load serving entity
- The framework can accommodate "Phase 2" approval in the Transmission Plan of multiple transmission alternatives including storage
  - The determination is then based on the criteria established in the ISO's tariff for approved project sponsor selection
- A "greenfield" solution is eligible for competition if it can be met by a local or regional facility, but is not eligible for competition if only a local facility will meet the need

Economic Assessments of Project Alternatives (transmission and preferred resources including storage)

- The ISO is not locked into one single economic evaluation but can consider a range of evaluations as appropriate
- When the ISO compares to similar types of assets delivering the same benefits such as a reliability need, capital costs are the primary economic consideration for simplicity
- More complex analysis is performed with the benefits differ and the cost implications are dissimilar
  - e.g. lifecycle, operations and maintenance costs, etc.
- The value of net benefits considered are the summation
  - e.g. the net present value of the benefits for all market participants who pay for the project less the costs incurred
- Results in complex cases are compared using multiple discount rates and sensitivity analyses

Net-present-value analysis on annualized costs accommodates a range of cost and benefit profiles

- Sensitivities can provide input for risk considerations.



* Charts based on results from the ISO HV TAC estimating model*

Economic considerations for storage as transmission assets have required particular consideration

- To date, benefits from market participation have not been considered in the decision for storage as a transmission asset
  - This will be revisited pending the results of the current SATA initiative, being presented to the ISO Board of Governors in February 2019
- Ratepayer benefits can be included through the TEAM methodology in selecting a preferred solution
  - However, if market-based ratepayer benefits are significant or material in the decision for selecting storage, it does suggest the resource should be pursued as a market resource instead of a transmission asset

Purpose and Status of ongoing “Storage as a Transmission Asset” initiative

The scope of the SATA policy initiative is: If storage is selected for cost-of-service based transmission service, how can that resource also provide market services to reduce costs to end use consumers?

- Direction gleaned from previous FERC rulings led to the ISO not considering a storage device providing regulated cost-based transmission service also being eligible for market participation
- FERC opened the door to revisit this issue by issuing its Policy Statement in Docket No, PL17-2-000 in 2017
- The initiative is in the “revised straw proposal” stage, targeting the February 2019 Board of Governors meeting

In its policy statement, FERC clarified several points regarding energy storage providing transmission and market services

1. Providing services at both cost- and market-based rates is permissible as a matter of policy, and
2. FERC provides guidance on some of the details and allows entities to address issues through stakeholder processes and in filings before the Commission

FERC stated a resource's participation likely would be subject to the following principles:

- Must be cost competitive with transmission,
- Must avoid double recovery for providing the same service,
- Cannot suppress market bids, and
- Cannot jeopardize ISO/RTO independence

Storage facilities providing transmission and market services introduce unique challenges that are being addressed in the stakeholder initiative

- Storage resources providing reliability-based transmission services, economic, and policy projects
- Indifferent to transmission or distribution connection
  - but it was noted connection to distribution will pose unique planning and operating challenges, and those issues are outside the scope and not affected by the issues in the initiative
- Issues outside the scope of the initiative:
  - The TPP evaluation methodologies
  - The framework for competitive solicitation and the applicability of the ISO's current competitive solicitation framework
  - Cost allocation of the cost-based revenue requirements for rate-based assets
  - Resource adequacy value

The planning process and methodologies provide the context for the initiative

- Transmission Planning Process
- Scope of evaluation for storage assets
  - Types of projects considered
  - Interconnecting voltage
- FERC storage resource participation principles
- Assessments of need and technical requirements
- Economic evaluation of project alternatives
  - Focuses more heavily on “ratepayer benefit”, and to a lesser extent to “market revenue” that benefits ratepayers
- Transmission Asset versus Market Local Resource considerations
- ISO operational control of storage assets

Consideration of Storage in 2018-2019 Transmission Plan given status of SATA initiative

Given direction thus far, future planning cycles will continue consideration of preferred resources – including storage

- TPP Phase 2 will produce a subset of identified reliability issues that can potentially be mitigated by preferred resources (EE, DR, and energy storage – and can consider preferred resources and storage whether a resource or transmission asset)
  - ISO will identify the area, need and required performance characteristics
  - Primary identification will be based on in-progress Transmission Planning Process analysis
  - Stakeholders can also propose projects for reliability issues with sufficient lead time, preferably focusing on High Potential Areas where the ISO has identified the issue (reliability, economic, policy) but no solutions were approved in the prior TPP - such as the Oakland area

The 2018-2019 Transmission Plan will have to be completed without the benefit of a FERC decision

- The SATA initiative is targeting a February Board of Governor decision on a SATA framework accessing market revenues
- This will not result in a FERC decision before the late-March decision on the 2018-2019 Transmission Plan
- The 2018-2019 Transmission Plan may therefore need to incorporate some flexibility, given we are expecting a framework that
  - Gives competitive suppliers some flexibility in offering cost caps and receiving some share of revenues
  - Provides full cost of service recovery to incumbents assigned projects, and imposes some obligation to pursue market revenues on behalf of ratepayers

At this time…for the 2018-2019 cycle

- Will continue evaluating storage as possible mitigations
- Will consider “ratepayer benefits” in considering storage mitigation alternatives on a case-by-case basis
  - High reliance on production cost benefits, and, especially, market revenues benefiting ratepayers, will lean to market resource solutions rather than transmission asset solutions
- If viable, we may consider selecting “either a conventional upgrade or storage” to go into competitive solicitation process
  - If potentially competitive, perhaps phase 3 could be delayed until a FERC decision from SATA is received?
- For projects assigned to incumbents, we would expect market participation terms to be manageable even after being assigned (as we are assuming at this time a full cost recovery framework with no owner risk)

Day 1 – Wrap-up
Reliability Assessment and Study Updates

Jody Cross
Stakeholder Engagement and Policy Specialist

2018-2019 Transmission Planning Process Stakeholder Meeting
September 20, 2018

2018-2019 Transmission Planning Process Stakeholder Meeting – Day 2 (September 21) Agenda

Topic	Presenter
GridLiance Proposed Reliability Solutions	GridLiance
SDG&E Proposed Reliability Solutions	SDG&E
PG&E Proposed Reliability Solutions	PG&E
Policy Assessment Update	Sushant Barave
Inter-regional Process Update	Gary DeShazo
Economic Study Assumptions and PCM Development	Yi Zhang
LCR 10-Year Assessments	Regional Transmission Engineers
Economic Valuing of Local Capacity Requirements	Jeff Billinton
Special Study – PNW Study Update	Ebrahim Rahimi
Wrap-up and Next Steps	Jody Cross