California ISO
Shaping a Renewed Future

Agenda – Day 1
Preliminary Reliability Assessment Results

Tom Cuccia
Senior Stakeholder Engagement and Policy Specialist

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

2013/2014 Transmission Planning Process Stakeholder Meeting - Today's Agenda

Topic	Presenter
Introduction & Overview	Neil Millar - ISO
Preliminary Reliability Results Presentations	ISO Regional Transmission Engineers
Applications of Methodology for Non-Conventional Alternatives in 2013-2014 planning cycle	Robert Sparks - ISO
Update on Economic Model Assumptions	Xiaobo Wang - ISO
Wrap-up & Next Steps	Neil Millar - ISO

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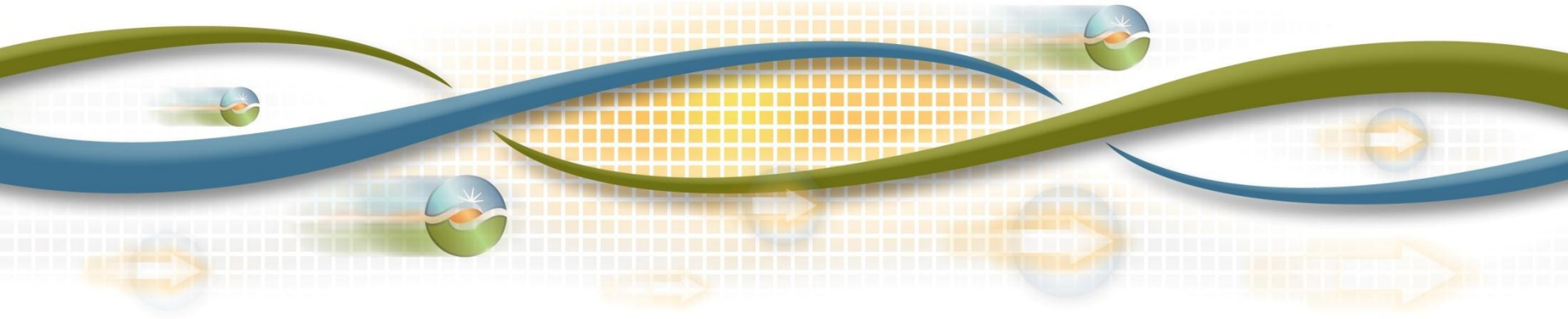
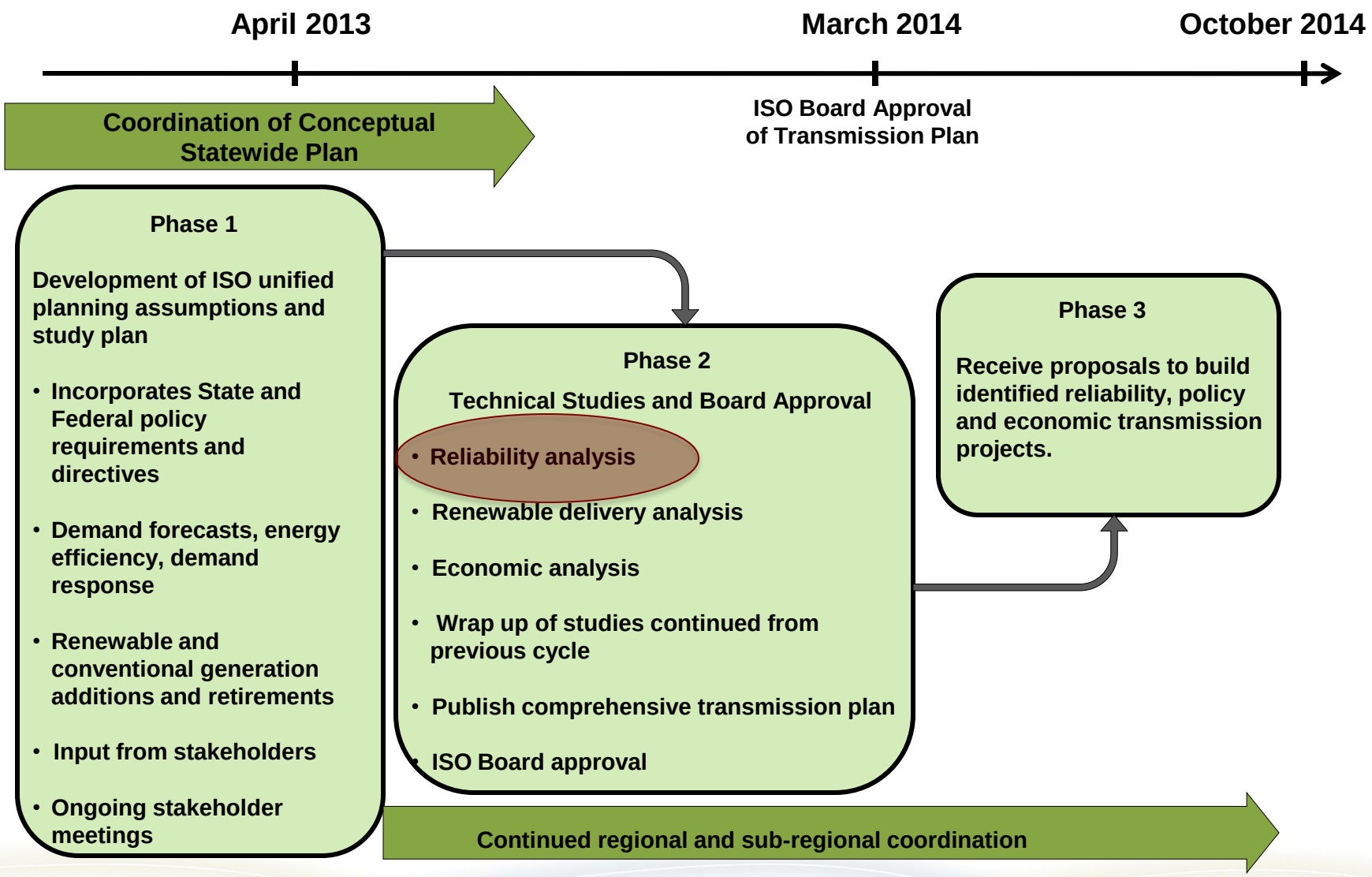
Introduction and Overview
Preliminary Reliability Assessment Results

Neil Millar
Executive Director - Infrastructure Development

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013



2013/2014 Transmission Planning Cycle



2013/2014 Ten Year Reliability Assessment To Date

- Preliminary study results were posted on August 15
  - Based on assumptions identified in Study Plan
  - Satisfy requirements of:
    - NERC Reliability Standards
    - WECC Regional Criteria
    - ISO Planning Standards
- Transmission request window opened August 15
  - Reliability driven projects
- PTO proposed mitigation
  - Submitted to ISO September 14

2013/2014 Ten Year Reliability Assessment going forward

- Request window
  - Closes October 15
- ISO recommended projects
  - Will be included in draft plan to be issued for stakeholder comments by January 31, 2013
- Purpose of today's stakeholder meeting
  - Review the results of the reliability analysis

Critical Energy Infrastructure Information

- The ISO is re-evaluating its CEII practices to ensure they remain sufficient going forward.
- Interim steps include:
  - Continuing to not post category D contingency discussions in general
  - Category D information is only shared on an exception basis where mitigations are being considered:
    - Details on secure web site
    - Summaries on public site
  - Migrating planning material over 1 year old and select 2012/2013 material less than 1 year old to the secure website.
- One “bulk system” presentation for today has also been posted on the secure site.

Studies continuing from 2012/2013 TPP Cycle – San Francisco Peninsula Reliability Project

- The studies underway focus on category D (or beyond) extreme contingencies – not posted with reliability results for category A, B, or C in August 2013.
- Category D contingencies are not required to be mitigated - they will continue to be addressed on an exception basis, but utilizing TPP stakeholder processes.
- Will discuss study results in December (may be a standalone session), moving toward March Board of Governors meeting
- Study work to date is summarized on our public website, and more detailed information available on the secure website.

Studies continuing from 2012/2013 TPP Cycle - Delaney-Colorado River Economic Project

- Continuing the studies in progress, transitioning to the stakeholder consultation opportunities in 2013/2014 process:
  - Will present Production Simulation Model enhancements developed since March, 2013 in September session.
  - Will present results at December stakeholder session and preliminary recommendation
  - Will review feedback in February session
  - Recommendation will be made at March Board of Governors meeting.

Studies continuing from 2012/2013 TPP Cycle – Studies informing CPUC Coolwater-Lugo proceeding

- Based on CPUC's request for ISO to be prepared to discuss alternatives (e.g. AV Clearview) to the GIP-driven project in the CPCN proceeding.
- Initial study results developed in parallel with the 2012/2013 TPP and utilizing study process and consultation opportunities – and documented as a special study in the 2012/2013 transmission plan.
- Further study on revised alternatives have been continuing since then as "further study".
- Analysis to finalize ISO testimony will continue as "further study" as the CPUC process may not align with the 2013/2014 TPP.

Conceptual Statewide Plan

- Previous years have primarily relied upon CTPG annual report
  - CTPG activities currently on hold with FERC Order 1000
- This year will be based on last year's CTPG report updated with publicly available information
- To be posted on September 30th
  - Comment period from October 1st to October 20th

Transmission Plan coordination with CPUC's Long Term Procurement Planning proceeding

- CPUC LTPP Track 4 proceeding is focuses on the LA Basin and San Diego areas.
- In keeping with the CPUC's recent ruling in Track 4, the ISO will provide testimony in the Track 4 based on current information.
- The assumptions for those areas have been aligned with the LTPP Track 4 study assumptions, resulting in some changes from the original 2013/2014 TPP study plan.
- We expect the 2013/2014 TPP results will be considered in future LTPP proceedings.

Background on Alternative to Transmission or Conventional Generation Methodology

- ISO paper was posted on September 4 and a stakeholder call was held on September 18
- Methodology describes the process the ISO intends to take in future cycles to help develop preferred resource alternatives to transmission reinforcement or conventional generation.
- In this 2013/2014 cycle
  - the focus is on identifying the necessary characteristics as part of a basket of resources in the LA Basin and San Diego areas.
  - Must recognize that the necessary characteristics may evolve at different levels of reliance on preferred resources.

High Voltage Transmission Access Charge Estimating Model

- ISO intending to post the model and hold a stakeholder call in October.
- High level estimating model provided results in the 2012/2013 plan
- The model will be updated in late 2013 for January 2014 posting of draft transmission plan

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Humboldt, North Coast & North Bay Areas Preliminary Reliability Assessment Results

Rajeev Annaluru
Senior Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Humboldt Area

- 3000 sq. miles. NW corner of PG&E
- Cities: Eureka, Arcata, Garberville
- Generation - Humboldt Bay Power Plant , QFs, total 258 MW
- Voltage 115 kV – from Cottonwood, 60 kV – from Mendocino
- Winter peak 205 MW in 2022, summer peak 194 MW in 2022

Humboldt Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category C - 10
  - Low voltage due to Category C – 2
  - Voltage deviations due to Category C - 2
- Compared to last year results:
  - All the major issues identified in this years analysis are similar to the issues identified last year.

Humboldt Area Potential Solutions

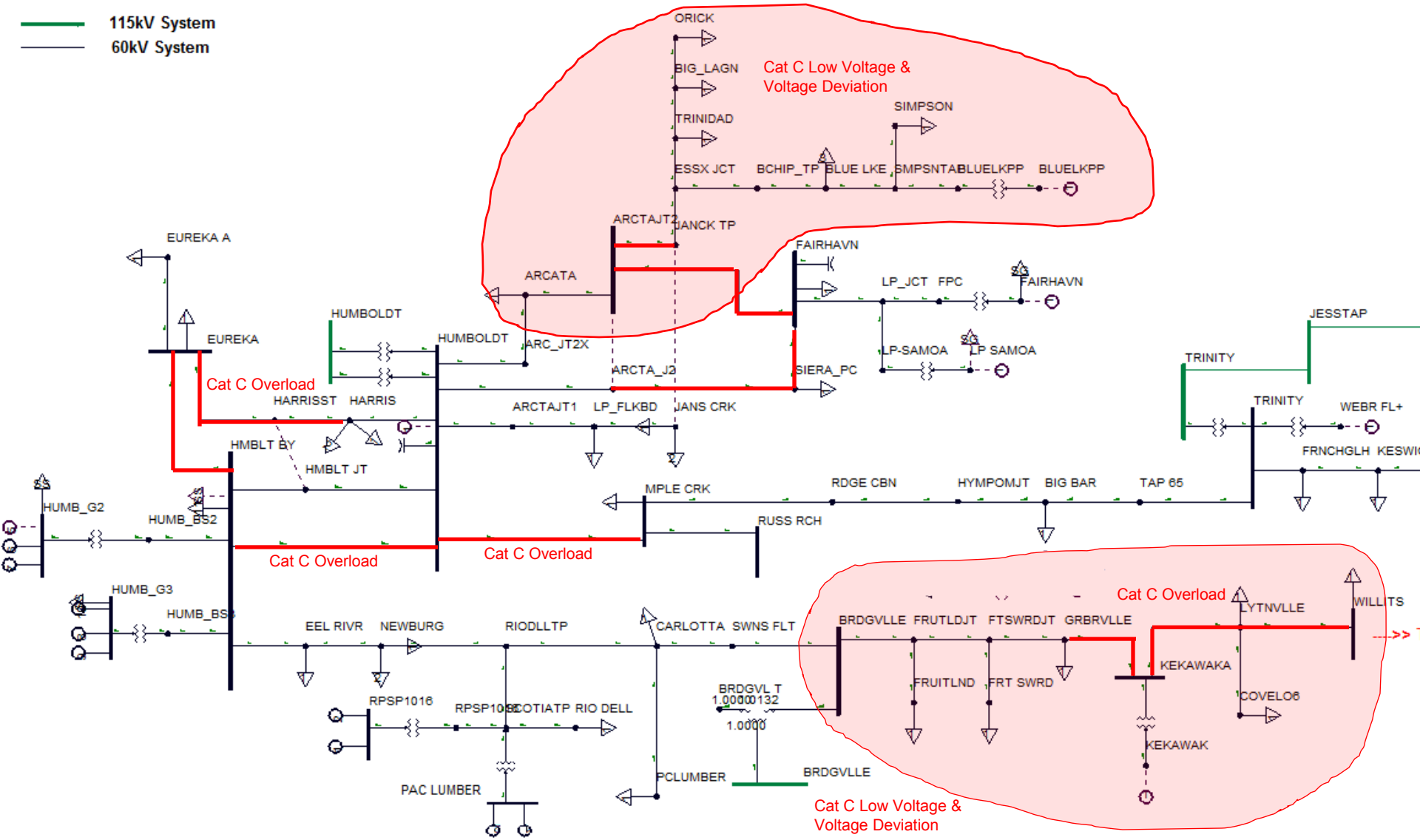
- Potential Mitigation Solutions
  - PG&E Operating Procedures (such as load transfers and adjusting generation from Humboldt Bay) for Category B and C
  - Interim operating solutions until previously approved projects get implemented.

Humboldt Area – Results (Category A & B)

- Thermal Overloads
  - No Cat A or Cat B thermal violations
- Low Voltage
  - No Cat A or Cat B Voltage violations
- Voltage Deviation
  - Bridgeville, Swans Flat 60kV (Cat B)
    - Adjust Humboldt 60kV generation
  - Orick 60kV, Big Lagoon 60kV, Trinidad 60kV, Essex 60kV, Arcata 60kV (Cat B)
    - Mitigation – Adjust generation at Blue Lake, Fair haven

Category C problems will be discussed in the area diagram in next slide

Humboldt Area – Results (cont'd)



North Coast and North Bay Areas

- North of the Bay Area and south of Humboldt
- Sonoma, Mendocino, Lake, Marin and part of Napa and Sonoma counties – 10,000 sq. miles
- Cities – Laytonville, Petaluma, San Rafael, Novato, Benicia, Vallejo
- Generation- Geysers Power Plants and QFs, total 1620 MW
- 60kV, 115kV and 230 kV facilities
- Summer peak 1773 MW in 2023

North Coast / North Bay Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category B – 6 and Category C - 37
  - Low voltages due to Category B – 2 and Category C - 5
  - Voltage deviations due to Category B - 5 and Category C - 6
- Compared to last year results:
  - Summer Peak Load forecast in 2023 went up as compared to last years 2022 forecast
  - All the major issues identified in this years analysis are similar to the issues identified last year.

North Coast / North Bay Area Potential Solutions

- Potential Mitigation Solutions
  - PG&E Operating Procedures (such as load transfers and adjusting generation from Humboldt Bay) for Category B and C
  - Interim operating solutions until previously approved projects get implemented.
  - Install reactive support to mitigate voltage issues
  - Reconductor one 60kV lines

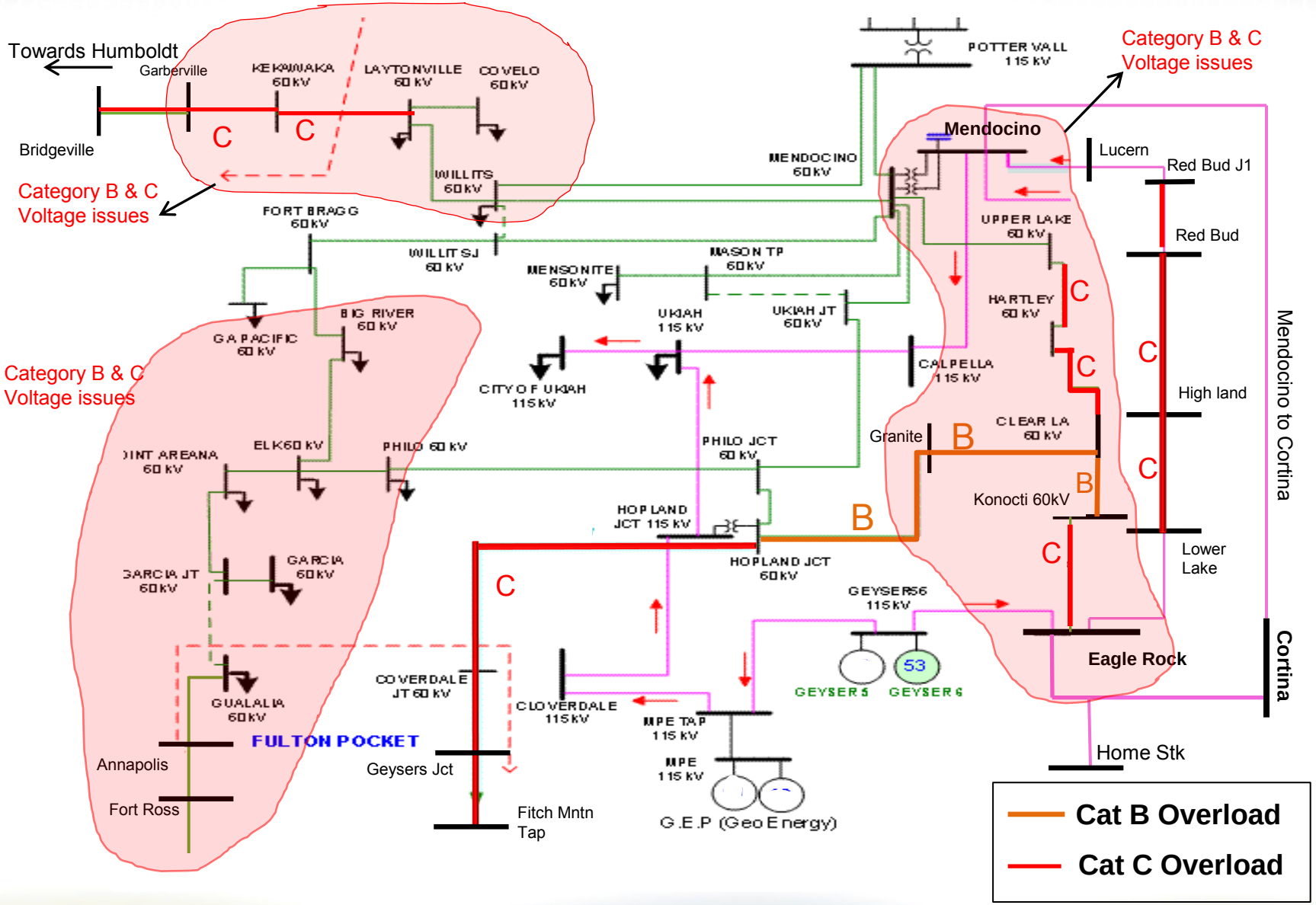
North Coast / North Bay Area – Results (Category B)

- Thermal Overloads
  - Clear Lake – Konocti 60kV line (Cat B)
    - Mitigation – Reconductor the line by 2021/2023
  - Clear Lake – Hopland 60kV line (Cat B)
    - Mitigation – Middletown 115kV project
  - Monte Rio – Fulton 60kV line (Cat B)
    - Mitigation – PG&E Operating procedure
  - Tulucay – Napa 60kV line #1 (Cat B)
    - Mitigation – Reconductor the line

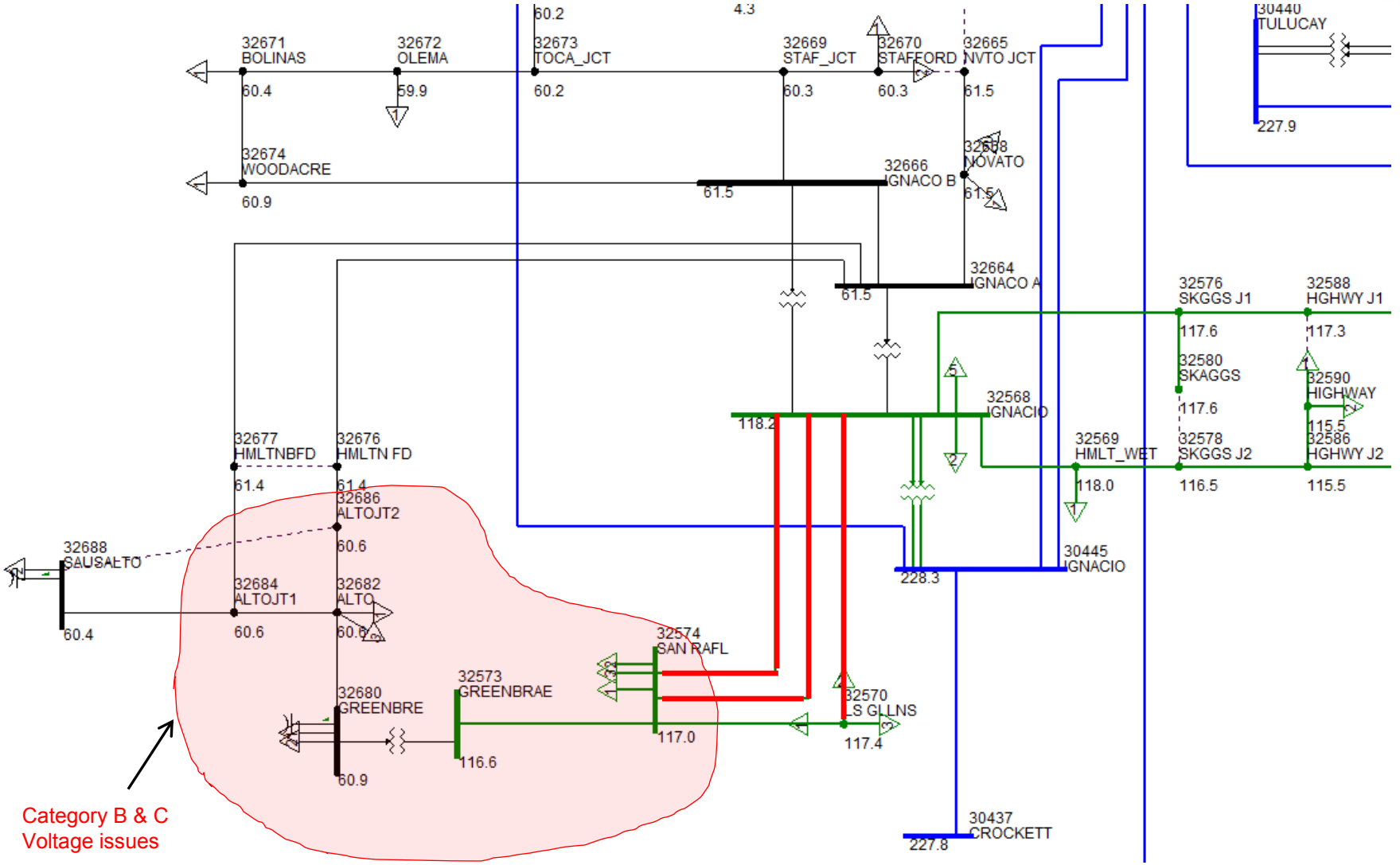
North Coast / North Bay Area – Results (Category B)

- Low Voltage
  - Clear Lake, Lower Lake, Konocti, Middle town (Cat B)
    - Mitigation – Middle town 115kV project
  - Fort Seward, Fruitland, Garberville (Cat B)
    - Mitigation – Bridgeville – Garberville 115kV line project
- Voltage Deviation
  - Clear Lake, Lower Lake, Konocti, Middle town, Calistoga, Dunbar, St. Helna (Cat B)
    - Mitigation – Middle town 115kV project
  - Fort Seward, Fruitland, Garberville (Cat B)
    - Mitigation – Bridgeville – Garberville 115kV line project
  - Ignacio – Alto 60kV area (Cat B)
    - Mitigation – Ignacio Alto Voltage conversion project
  - Mendocino – Willits – Potter valley area (Cat B)
    - Mitigation – Install additional reactive support in the Mendocino area
  - Eagle Rock – Geyserville - Clear Lake 60kV area
    - Mitigation – Generation adjustment at Geysers and Middle town 115kV project

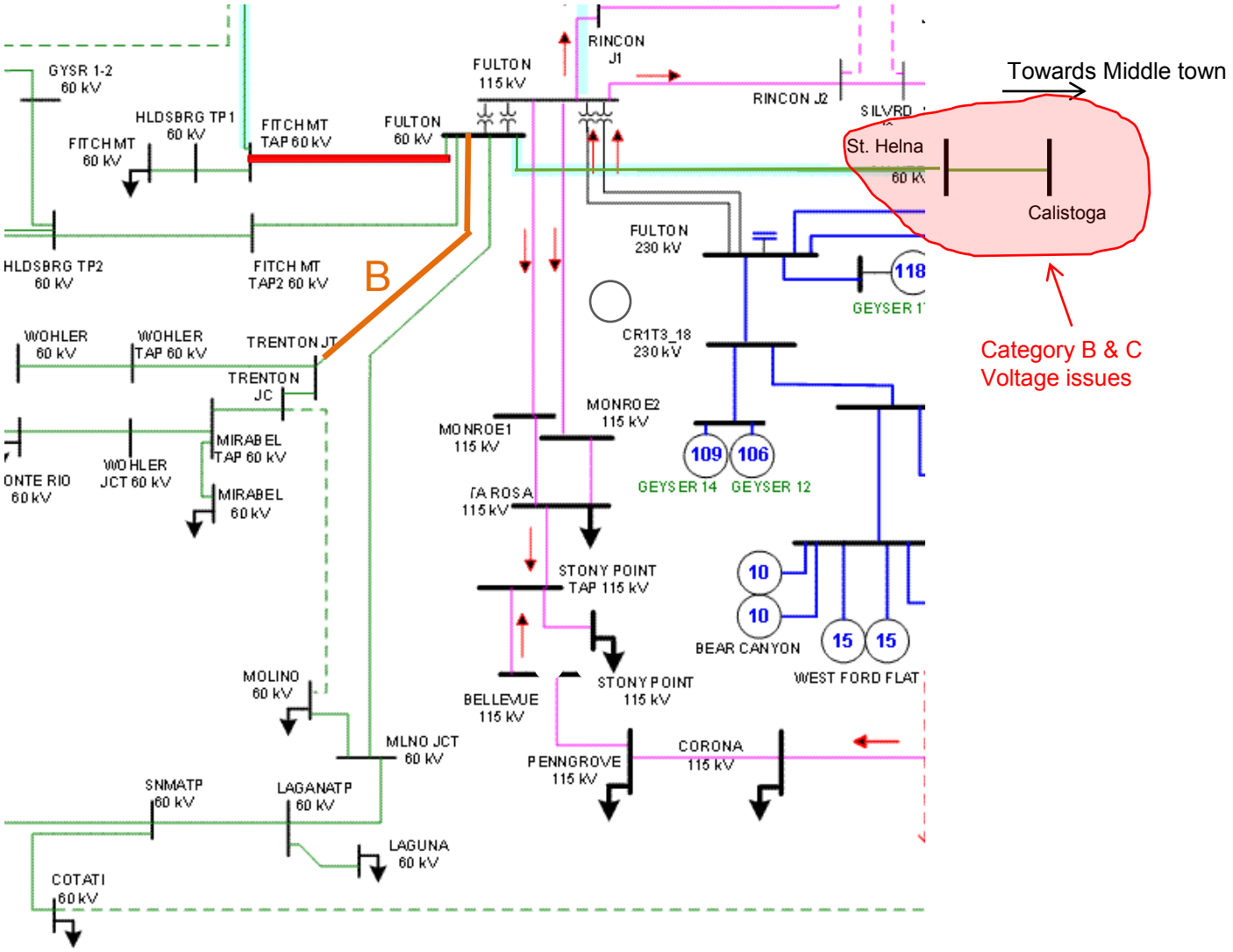
Mendocino - Eagle Rock Area issues



Ignacio – Alto area issues



Fulton area issues



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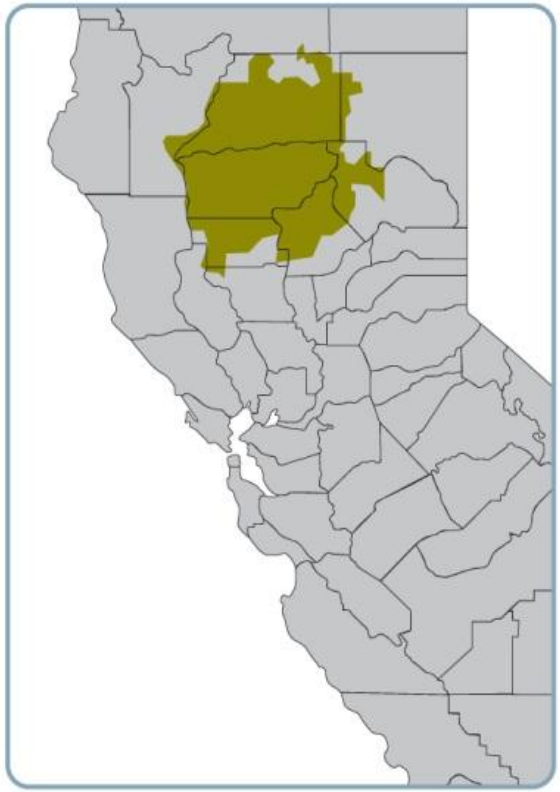
North Valley & Central Valley Areas Preliminary Reliability Assessment Results

Binaya Shrestha
Sr. Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

North Valley Area



- 15,000 sq. miles NE corner of PG&E
- Cities: Chico, Redding, Red Bluff, Paradise
- Generation: Over 2,000 MW of hydro. Colusa is the largest generation facility (717 MW).
- Comprised of 60, 115, 230 & 500 kV transmission facilities.
- Summer Peak 1,031 MW in 2023

North Valley Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category A - 1, Category B - 1 and Category C – 16
  - Low voltages due to Category A - 2 and Category C - 22
  - Voltage deviations due to Category B - 13 and Category C – 5
  - Area-wide high voltage under normal condition (off-peak)
  - Two Category C contingencies resulted in divergence
- Compared to last year results:
  - 1 new overload under normal condition
  - Last year there was no project approved in this area

North Valley Area Potential Solutions

- Potential Mitigation Solutions
  - Operating solution
  - Interim operating solutions until previously approved projects get implemented
  - Upgrade bus configuration or add bus-tie breaker
  - 115/60 kV transformer addition
  - Voltage support

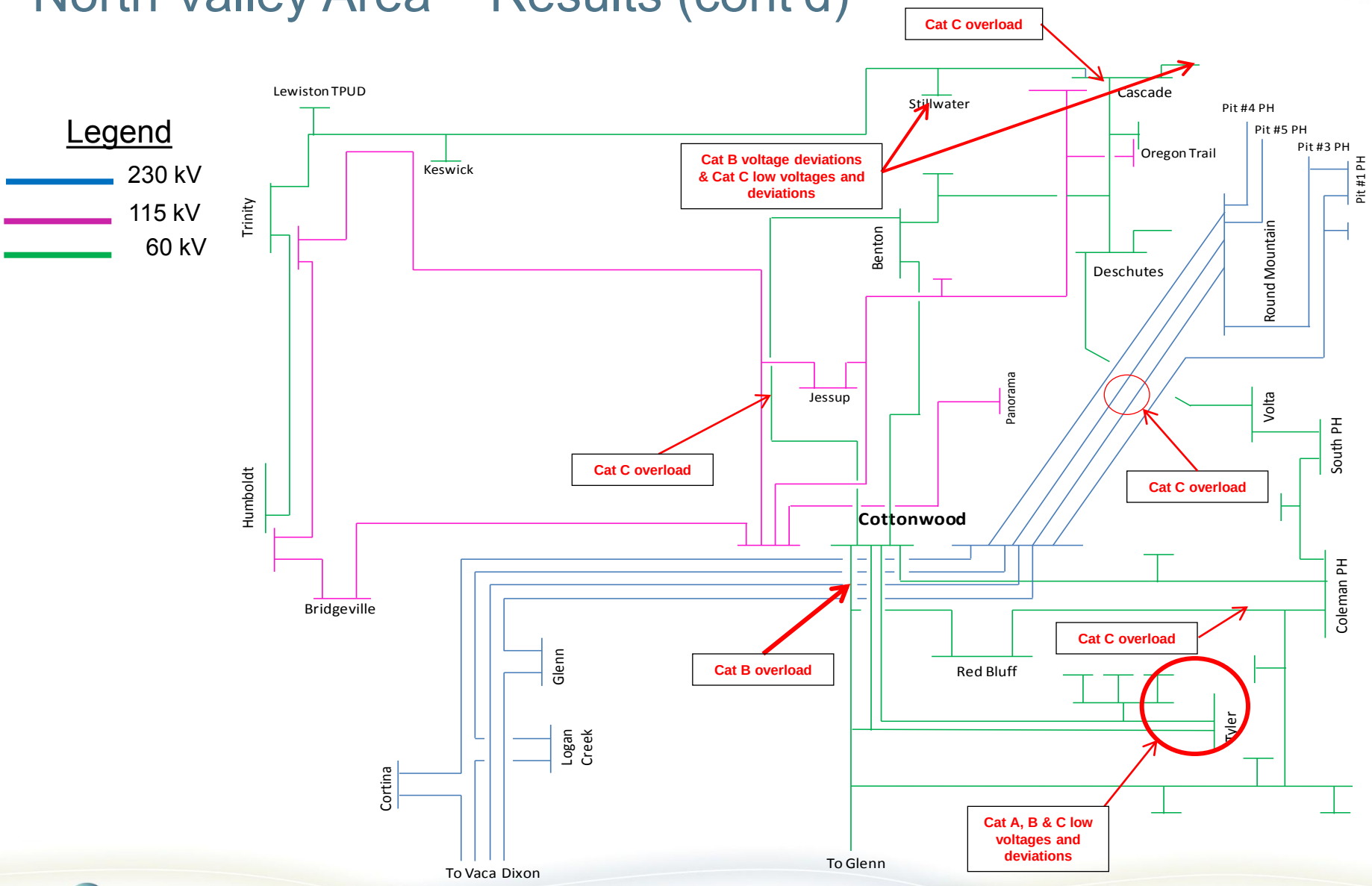
- Previously Approved Projects
  - Glenn #1 60 kV reconductoring (2015)
  - Table Mountain-Sycamore 115 kV line (2017)
  - Cascade 115/60 kV #2 transformer and Cascade-Benton 60 kV line project (2017)
  - Cottonwood-Red Bluff #2 60 kV line and Red Bluff area new 230/60 kV substation project (2018)

North Valley Area – Results (Category A & B)

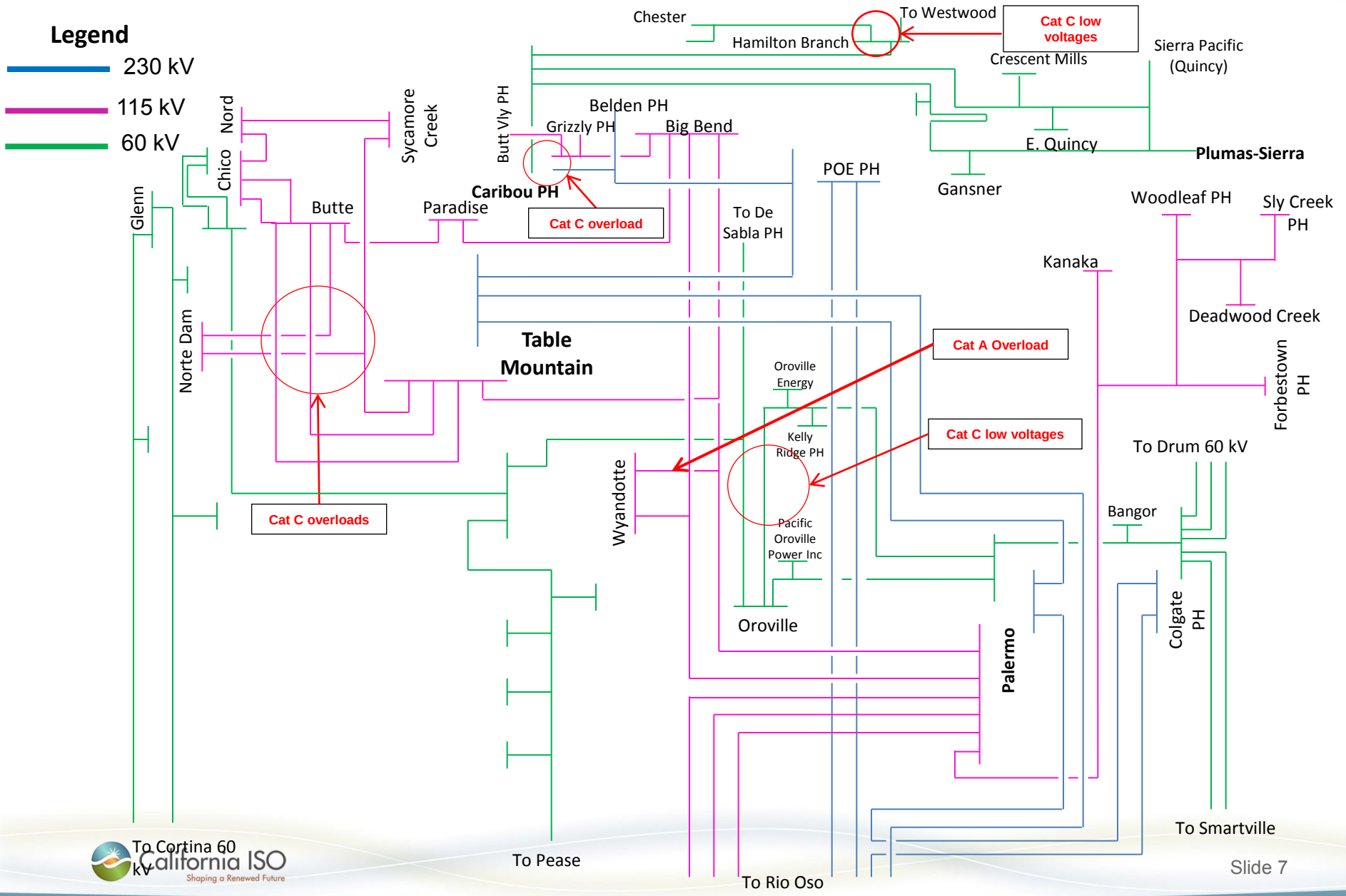
- Thermal Overloads
  - Palermo-Wyandotte 115 kV Line (Cat A / 2023)
    - Mitigation - Reconductor.
  - Cottonwood-Red Bluff 60 kV Line (Cat B / 2023)
    - Mitigation – Dispatch local generator.
- Low Voltage
  - Red Bluff Area 60 kV (Cat A / 2015)
    - Mitigation – Interim operating solution
- Voltage Deviation
  - Cascade and Red Bluff Areas 60 kV (Cat B / 2015)
    - Mitigation – Interim operating solution / Dispatch local generator

Category C problems will be discussed in the area diagram in next slide

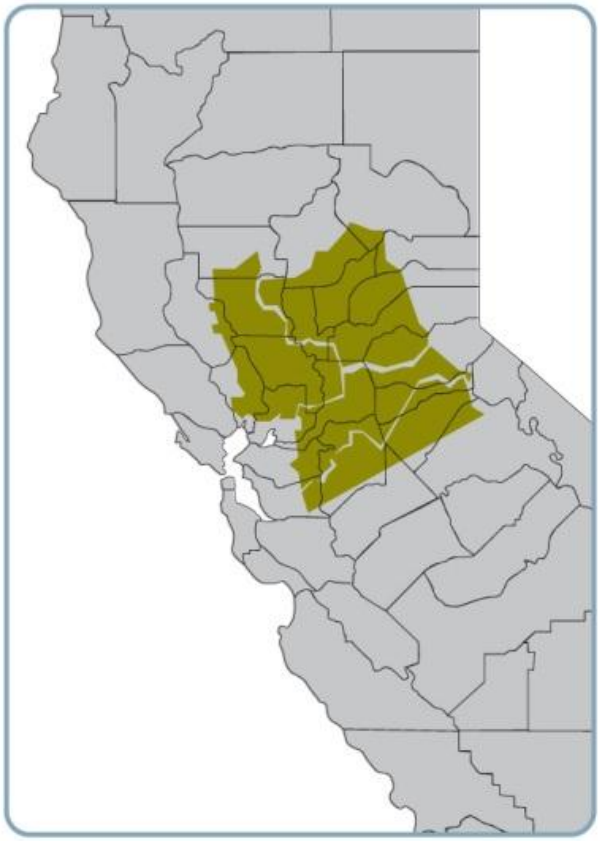
North Valley Area – Results (cont'd)



North Valley Area – Results (cont'd)



Central Valley Area



- Includes Sacramento, Sierra, Stockton & Stanislaus divisions
- Generation: Over 3,500 MW of generation
- Comprised of 60, 115, 230 & 500 kV transmission facilities.
- Summer Peak 4,366 MW in 2023

Sacramento Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category B – 3 and Category C - 14
  - Low voltages due to Category B – 1 and Category C – 2 (area-wide: West Sac/Davis 115 kV & Cortina 60 kV)
  - Voltage deviations due to Category B – 1 (area-wide: West Sac/Davis 115 kV) and Category C – 1 (area-wide: West Sac/Davis 115 kV)
  - Area-wide high voltage under normal condition (off-peak)
- Compared to last year results:
  - 1 new Category B thermal overload
  - Last year there was no project approved in this area

Sacramento Area Potential Solutions

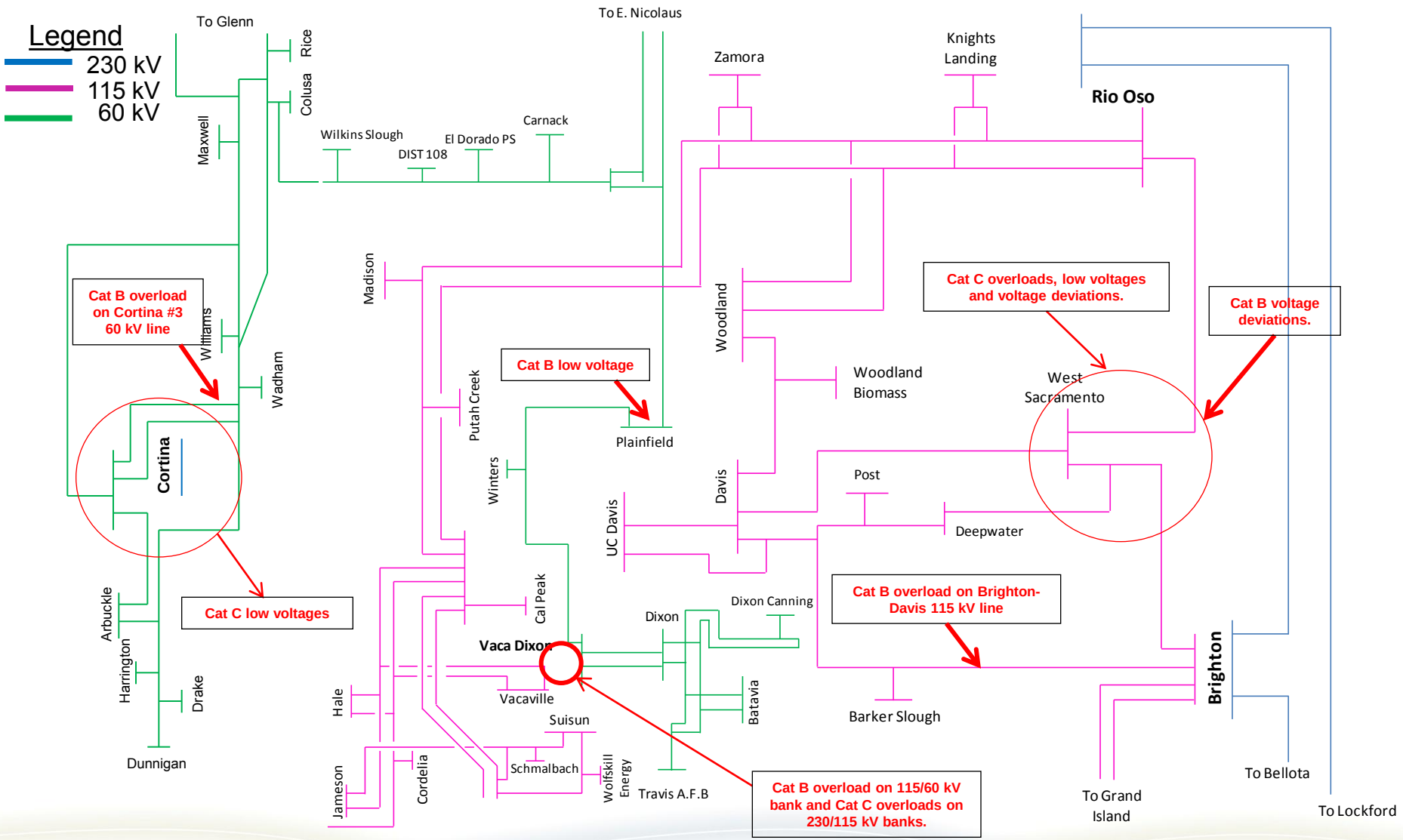
- Potential Mitigation Solutions
  - Operating solution.
  - Interim operating solutions until previously approved projects get implemented.
  - Voltage support.
- Previously Approved Projects
  - Cortina 60 kV reliability (2014)
  - Cortina #3 60 kV line reconductoring (2016)
  - Vaca-Davis voltage conversion (2018)

Sacramento Area – Results (Category A & B)

- Thermal Overloads
  - Brighton-Davis 115 kV line (Cat B / 2015)
  - Vaca Dixon 115/60 kV Transformer Bank #5 (Cat B / 2015)
  - Cortina 60 kV line #3 (Cat B / 2015)
    - Mitigation – Interim operating solution
- Low Voltage
  - Plainfield 60 kV (Cat B / 2015)
    - Mitigation – Interim operating solution
- Voltage Deviation
  - West Sac/Davis area 115 kV system (Cat B / 2015)
    - Mitigation – Interim operating solution

Category C problems will be discussed in the area diagram in next slide

Sacramento Area – Results (cont'd)



Sierra Area Assessment Summary

- The assessment identifies:
  - Thermal overloads due to Category B - 4 and Category C - 17
  - Low voltages due to Category A - 3, Category B - 4 and Category C – 2 (area-wide: Placer 115/60 & Atlantic 115/60)
  - Voltage deviations due to Category B - 1 and Category C – 1 (area-wide: Placer 115/60)
  - Area-wide high voltage under normal condition (off-peak)
  - Two Category C contingencies resulted in divergence
- Comparing to last year results:
  - 2 new projects eliminated 2 Category B and 3 Category C overloads
  - 1 new Category B thermal overload
  - Last year there were 2 projects approved in this area
    - Atlantic-Placer 115 kV line project
    - Pease 115/60 kV transformer and bus upgrade project

Sierra Area Potential Solutions

- Potential Mitigation Solutions
  - Operating solution.
  - Interim operating solutions until previously approved projects get implemented.
  - Bus upgrade.
  - Distribution load transfer / disable automatics.
- Previously Approved Projects
  - Palermo-Rio Oso 115 kV line reconductor (2013)
  - East Nicolaus 115 kV area reinforcement (2014)
  - Missouri Flat-Gold Hill 115 kV lines reconductor (2017)
  - South of Palermo 115 kV reinforcement (2017)
  - Rio Oso 230/115 kV transformers upgrade (2017)
  - Rio Oso 230 kV voltage support (2017)
  - Rio Oso-Atlantic 230 kV line (2018)
  - Pease-Marysville #2 60 kV line (2018)

Sierra Area – Results (Category A & B)

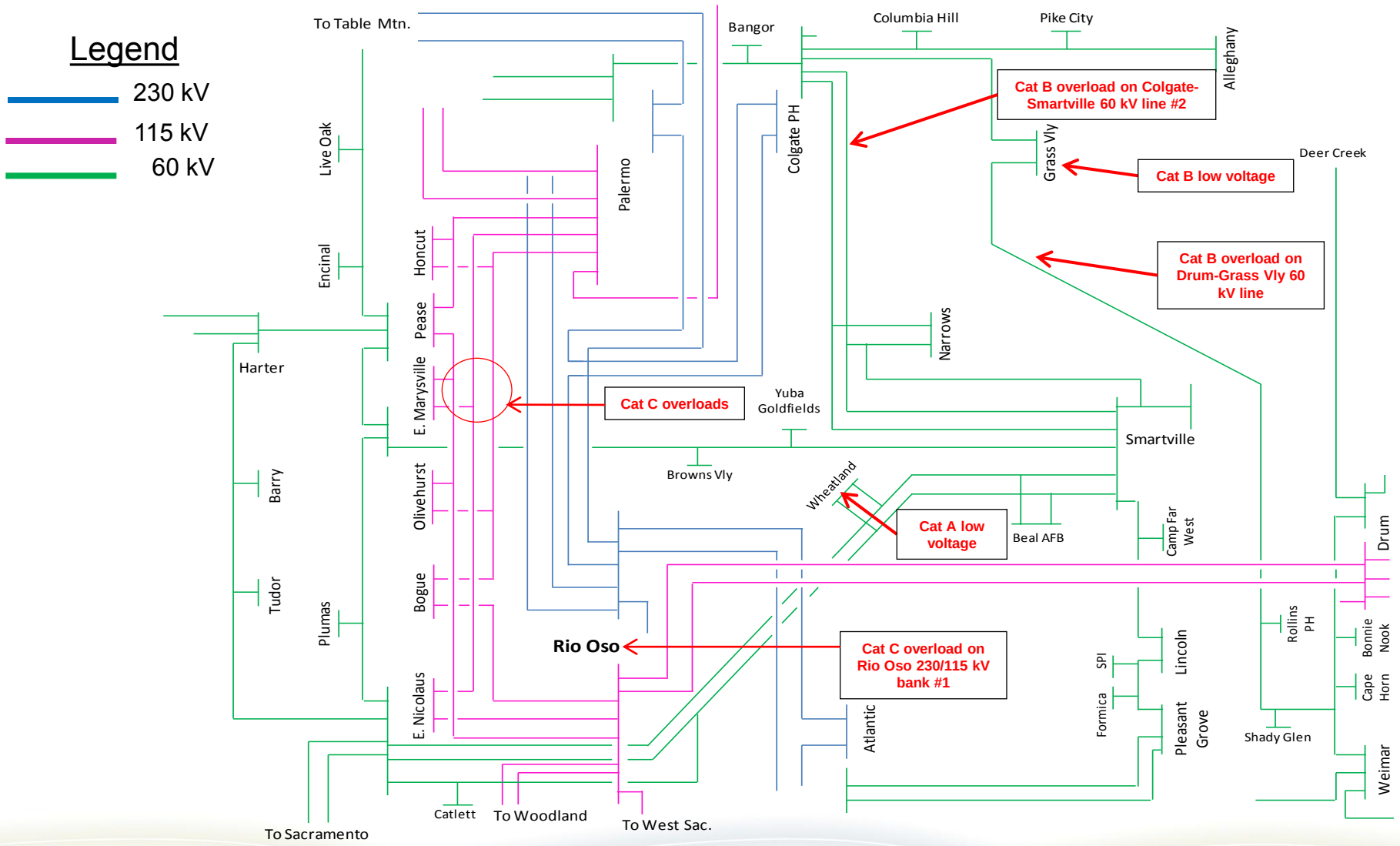
- Thermal Overloads
  - Drum-Higgins 115 kV Line (Cat B / 2015)
    - Mitigation – Interim operating solution
  - Colgate - Smartville 60 kV Line #2 (Cat B / 2015)
    - Mitigation – Transfer Wheatland to alternate source
  - Drum-Grass Valley-Weimer 60 kV line (Cat B / 2015)
    - Mitigation – Distribution load transfer / disable automatics
- Low Voltage
  - Atlantic Area 60 kV (Cat A / 2015)
    - Mitigation – Interim operating solution
  - Wheatland 60 kV (Cat A / 2018)
    - Mitigation – Transfer Wheatland to alternate source
  - Grass Valley Area 60 kV (Cat B / 2023)
    - Mitigation – Distribution load transfer / disable automatics

Sierra Area – Results (Category A & B) (cont'd)

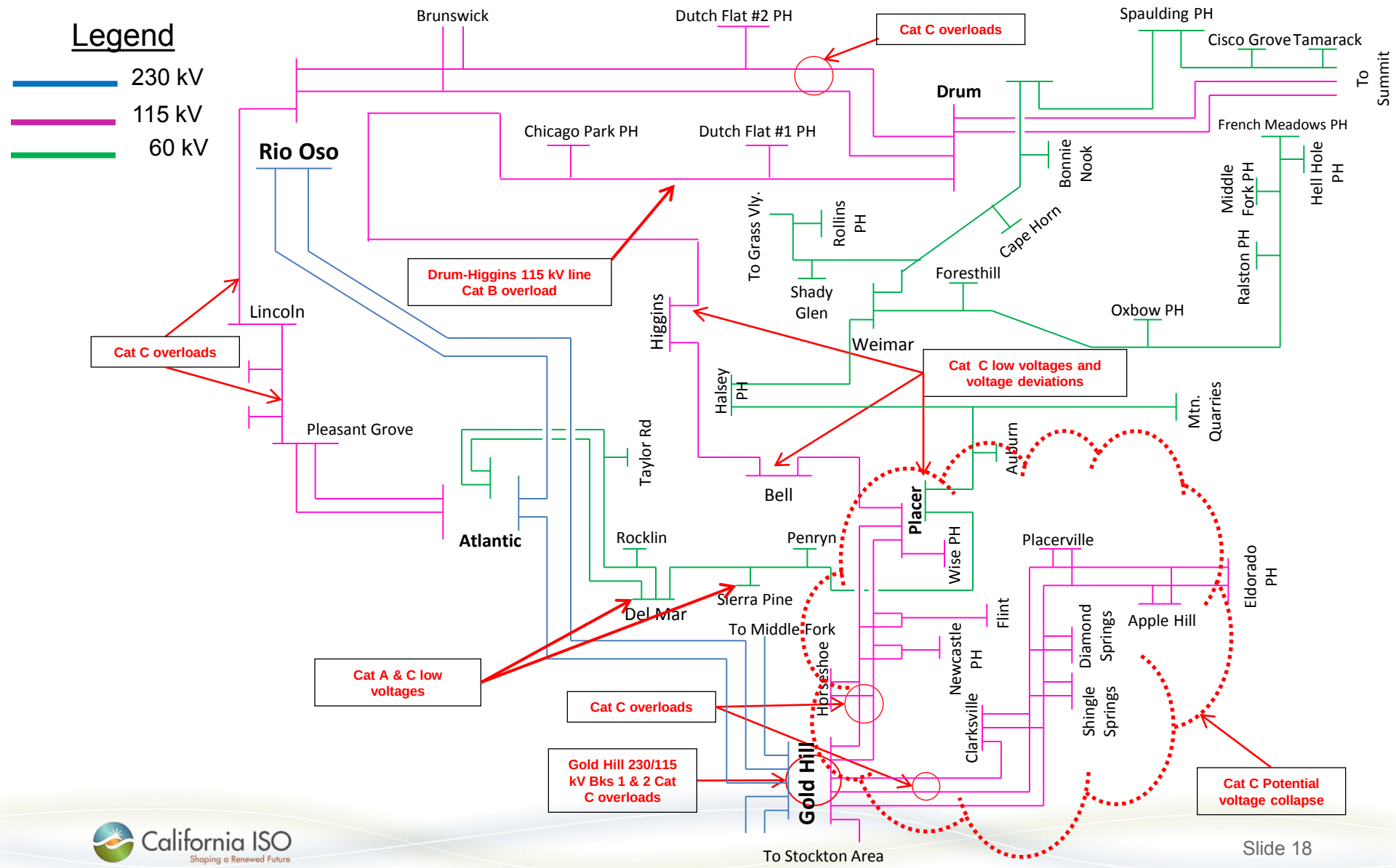
- Voltage Deviation
  - Higgins 115 kV (Cat B / 2015)
    - Mitigation – Interim operating solution

Category C problems will be discussed in the area diagram in next slide

Sierra Area – Results (cont'd)



Sierra Area – Results (cont'd)



Stockton/Stanislaus Area Assessment Summary

- The assessment identifies:
  - Thermal overload due to Category B - 2 and Category C - 21
  - Low voltages due to Category C – 1 (area-wide: Lodi 60 kV)
  - Voltage deviations due to Category B - 2
  - Area-wide high voltage under normal condition (off-peak)
- Comparing to last year results:
  - 1 thermal overload under normal condition eliminated due to decrease in load forecast
  - Last year there were 3 projects approved in this area
    - Lockeford-Lodi area 230 kV development
    - Ripon 115 kV line
    - Salado 115/60 kV transformer addition

Stockton/Stanislaus Area Potential Solutions

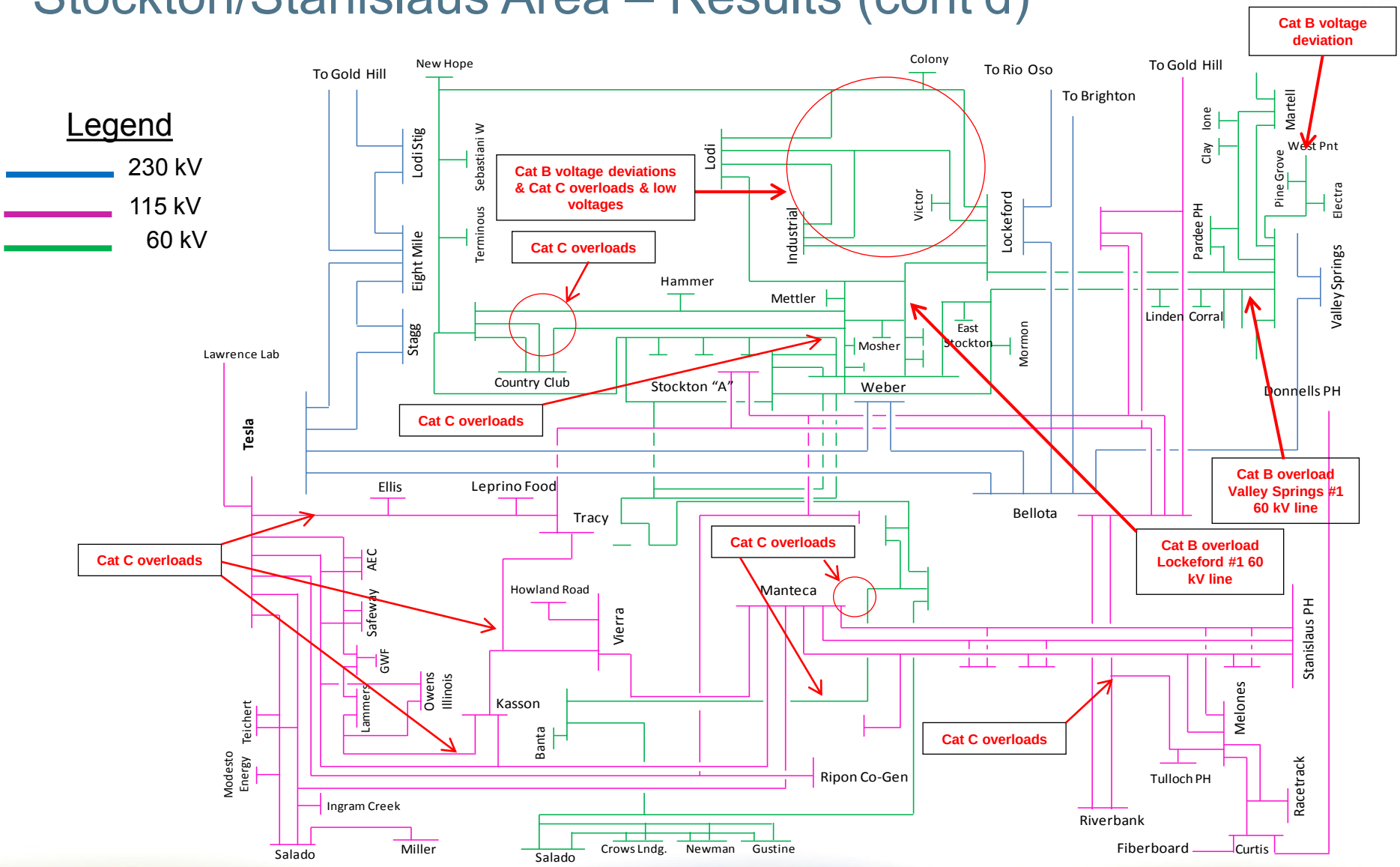
- Potential Mitigation Solutions
  - Operating solution.
  - Interim operating solutions until previously approved projects get implemented.
  - Disable automatics
  - Bus configuration upgrade
  - Rerate / Reconductor
- Previously Approved Projects
  - Valley Spring 230/60 kV transformer addition (2013)
  - Stockton ‘A’-Weber 60 kV line #1 & 2 reconductor (2014)
  - Weber 230/60 kV transformer 2 & 2A replacement (2014)
  - Tesla 115 kV capacity increase (2014)
  - Stagg-Hammer 60 kV line (2016)
  - Vierra 115 kV looping project (2016)
  - West Point-Valley Springs 60 kV line (2017)

Stockton/Stanislaus Area – Results (Category A & B)

- Thermal Overloads
  - Valley Springs No. 1 60 kV Line (Cat B / 2015)
  - Lockeford No. 1 60 kV Line (Cat B / 2015)
    - Mitigation – Disable automatics during peak loading conditions
- Low Voltage
  - No Categories A or B low voltages identified
- Voltage Deviation
  - MSHR 60V (Cat B / 2015)
    - Mitigation – Disable automatics during peak loading conditions
  - WEST PNT 60 kV (Cat B / 2015)
    - Mitigation – Adjust West Point gen terminal voltage (interim)

Category C problems will be discussed in the area diagram in next slide

Stockton/Stanislaus Area – Results (cont'd)



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Greater Bay Area (GBA)
Preliminary Reliability Assessment Results

Bryan Fong
Sr. Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Greater Bay Area

- Service areas cover Alameda, Contra Costa, Santa Clara, San Mateo and San Francisco counties
- 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

Greater Bay Area

- Major substations: Vaca Dixon, Tesla and Metcalf
- Supply sources: Vaca Dixon, Tesla and Metcalf
- Generation: Over 7,000 MW of generation capacity.
- Comprised of 60, 115 & 230 & kV transmission facilities.
- Summer Peak 9,506 MW in 2023

GBA Assessment Summary

- The assessment identified:
  - Thermal overloads (summer peak) due to Category A - 1 Category B - 12 and Category C - 117
  - Thermal overloads (winter peak) due to Category B - 5 and Category C - 30
  - High voltages (summer peak) due to Category B - 1 and Category C - 0
  - High voltage (winter peak) due to Category B - 1 and Category C – 3
  - Low voltages (summer peak) due to Category B - 0 and Category C - 0
  - Low voltage (winter peak) due to Category C - numerous
  - Voltage deviations (summer & winter) due to Category B - 10 and Category C – 35

GBA Assessment Summary

- Compared to last year results:
  - No Category A overload
  - 14 Category B overloads and numerous Category C overloads
  - Low voltages on 60 kV substations caused by Category C contingencies
  - 6 new approved projects (effectively) eliminated multiple Category B and Category C overloads

GBA Potential Solutions

- Potential Mitigation Solutions
  - Operating solution, SPS (Overload, voltage issues mostly Category C)
  - Interim operating solutions until previously approved projects get implemented.
  - Voltage support.

San Francisco Area – Results (Category A & B)

- Thermal Overloads
  - Potrero - Larkin #2 (AY-2) 115 kV Cable (Cat B / 2016)
    - Reduce TBC output or Modify TBC DC Runback Scheme
  - Potrero - Mission (AX) 115 kV Cable (Cat B / 2014)
    - Existing TBC DC Runback Scheme
- High Voltage
  - Martine 60kV (Cat B / 2015)
    - Under review for possible exemption or reactive device
- Low Voltage
  - No Category A nor B low voltage identified

Category C problems will be discussed in the area diagram in next slide

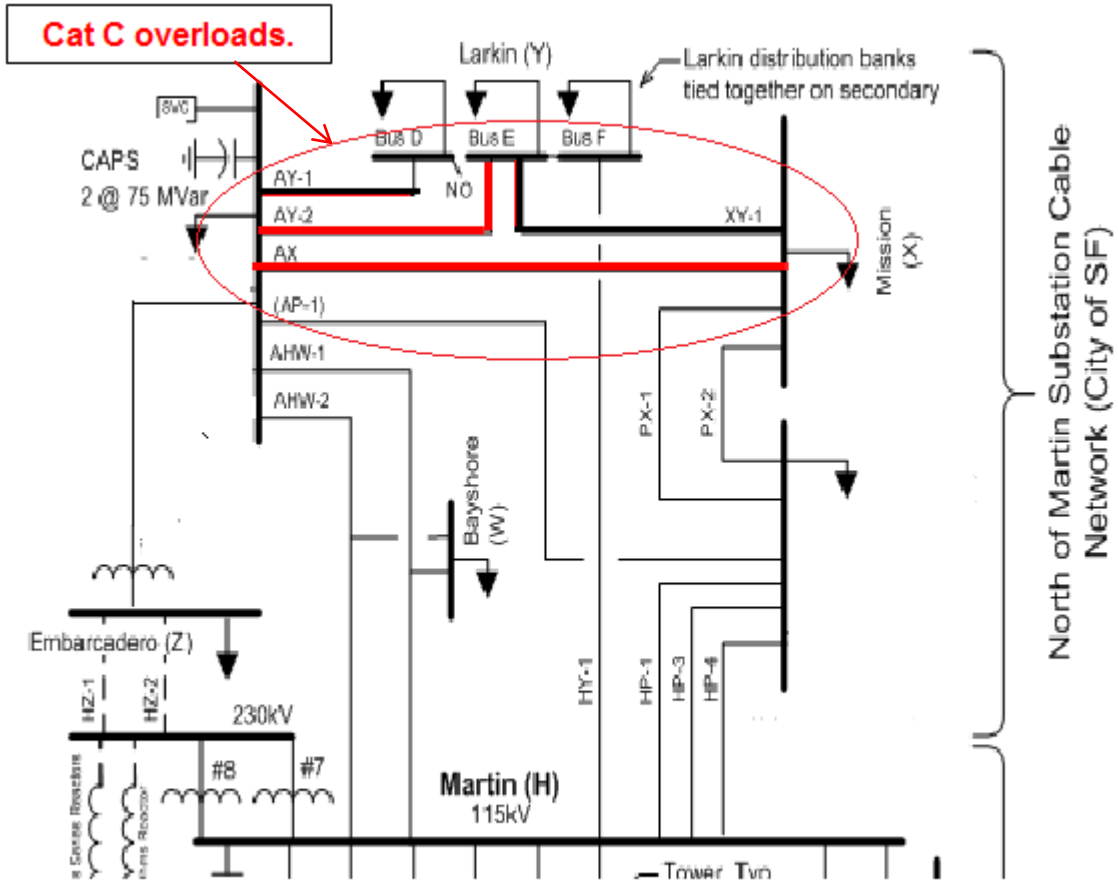
San Francisco Area – Results (Category A & B)

- Voltage Deviation
  - Martin 60kV Bus (Cat B / 2015)
    - Add reactive device

Category C problems will be discussed in the area diagram in next slide

San Francisco Area – Results (cont'd)

Overloaded Line under Cat A or B



San Jose Area – Results (Category A & B)

- Thermal Overloads
  - Piercy-Metcalf 115 kV Line (Cat B / 2014)
    - Action Plan before Mabury Voltage Conversion Project is completed
  - Monta Vista-Los Gatos 60 kV Line
    - Action Plan before Monta Vista-Los Gatos-Evergreen 60kV Line Reconductor Project is completed
  - NRS-Scott No. 1 115 kV Line (Cat B / 2014)
    - Action Plan before NRS-Scout #1 115kV Line Reconductor Project is completed

Category C problems will be discussed in the area diagram in next slide

San Jose Area – Results (Category A & B)

- Low Voltage
  - ALMADEN 60kV (Cat B / 2015)
    - Action Plan before Monta Vista-Los Gatos-Evergreen 60kV Line Reconductor Project is completed
- High Voltage
  - ALMADEN 60kV (Cat B / 2015)
  - EVRGRN&1 115kV (Cat B / 2018)
  - MORGN J1 115kV (Cat B / 2018)
    - Under review for possible exemption or reactive device

Category C problems will be discussed in the area diagram in next slide

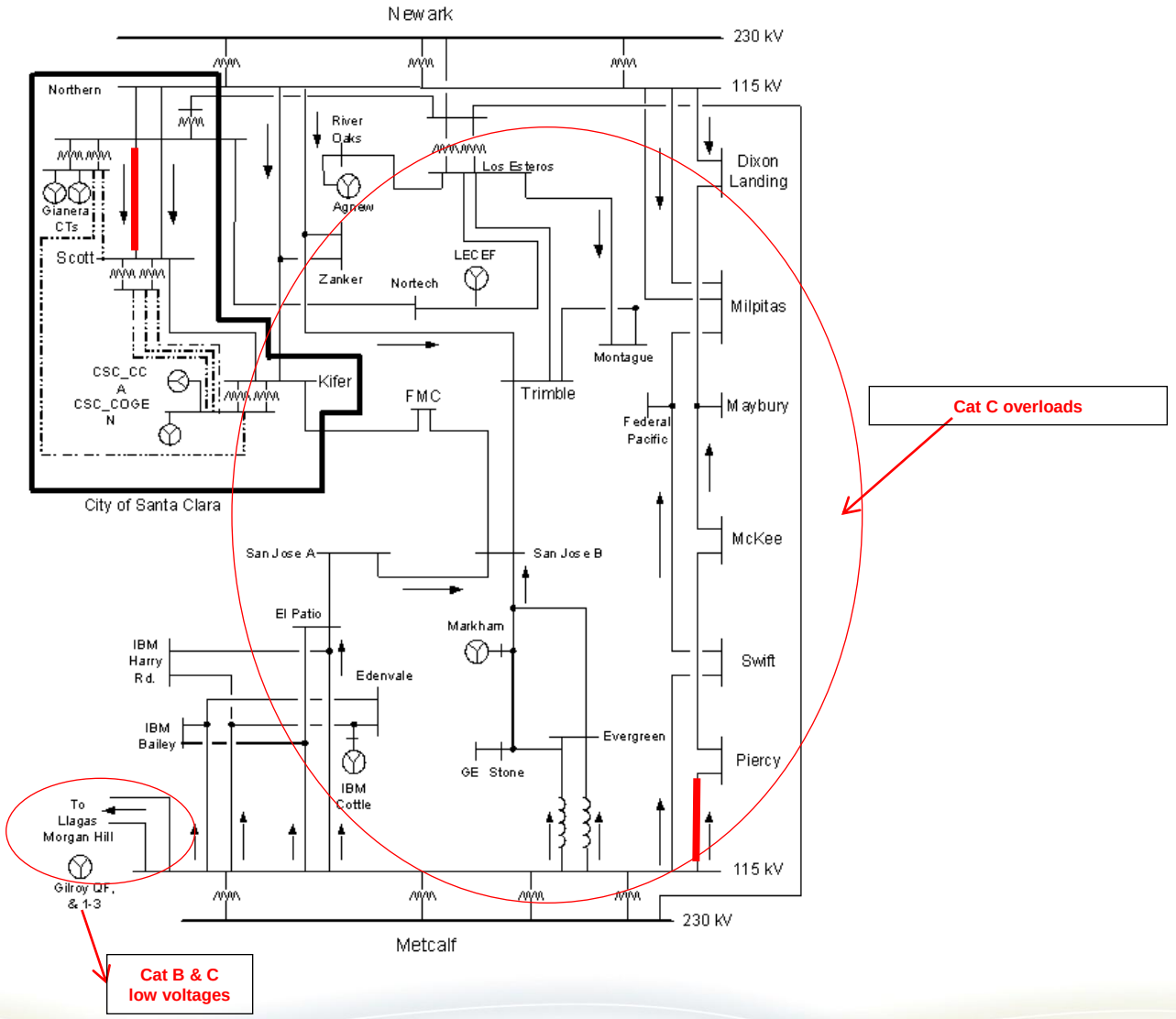
San Jose Area – Results (Category A & B)

- Voltage Deviation
  - ALMADEN 60kV (Cat B / 2015)
    - Action Plan before the Almaden Shunt Capacitor Project is completed
  - PIERCY 115kV (Cat B / 2015)
  - SWIFT 115kV (Cat B / 2018)
    - Mitigation – Reactive Support
  - DIXON LD 60kV (Cat B / 2015)
  - MABURY 115kV (Cat B / 2015)
  - MCKEE 115kV (Cat B / 2015)
    - Action Plan before the Marbury Voltage Conversion Project is completed

Category C problems will be discussed in the area diagram in next slide

San Jose Area – Results (cont'd)

Overloaded Line under Cat A or B

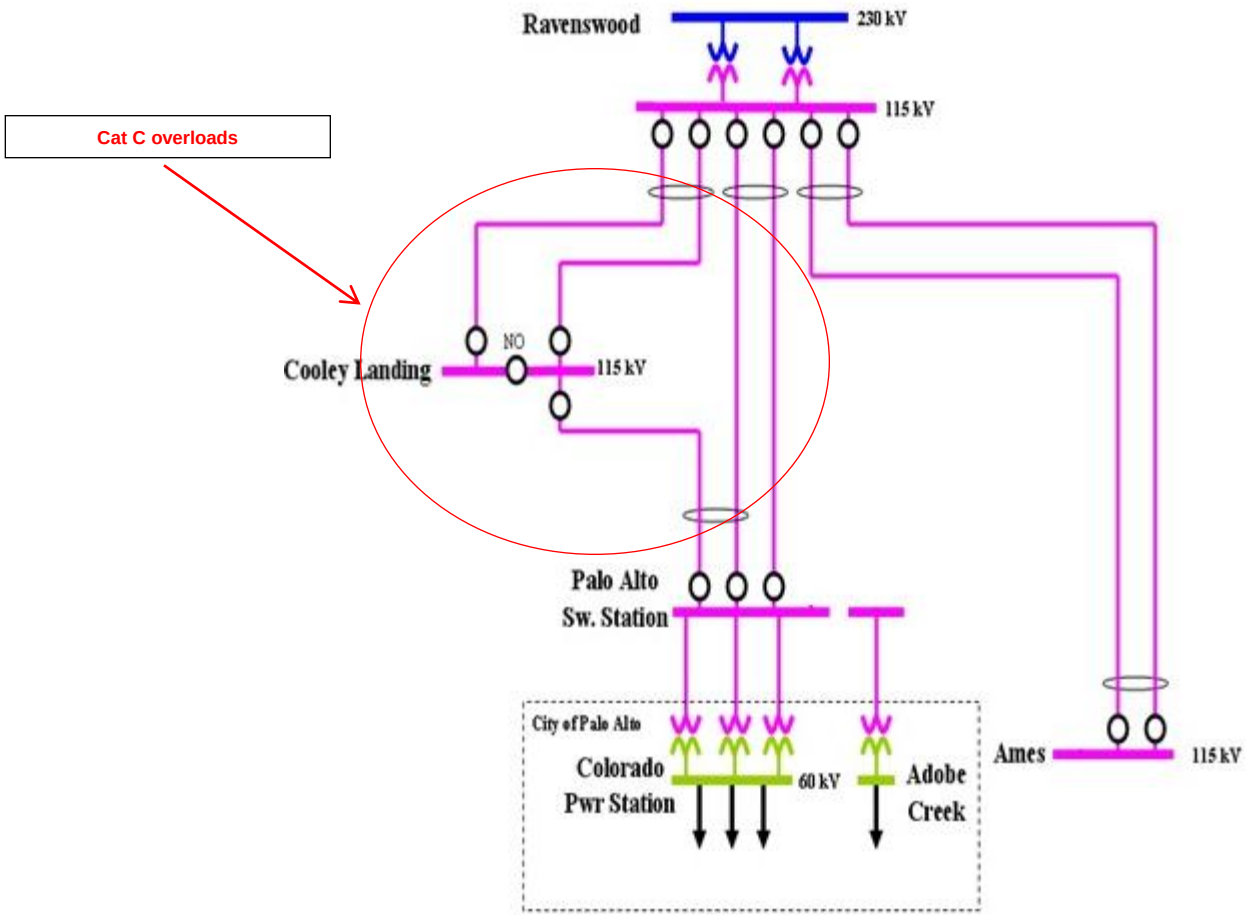


Peninsula Area – Results (Category A & B)

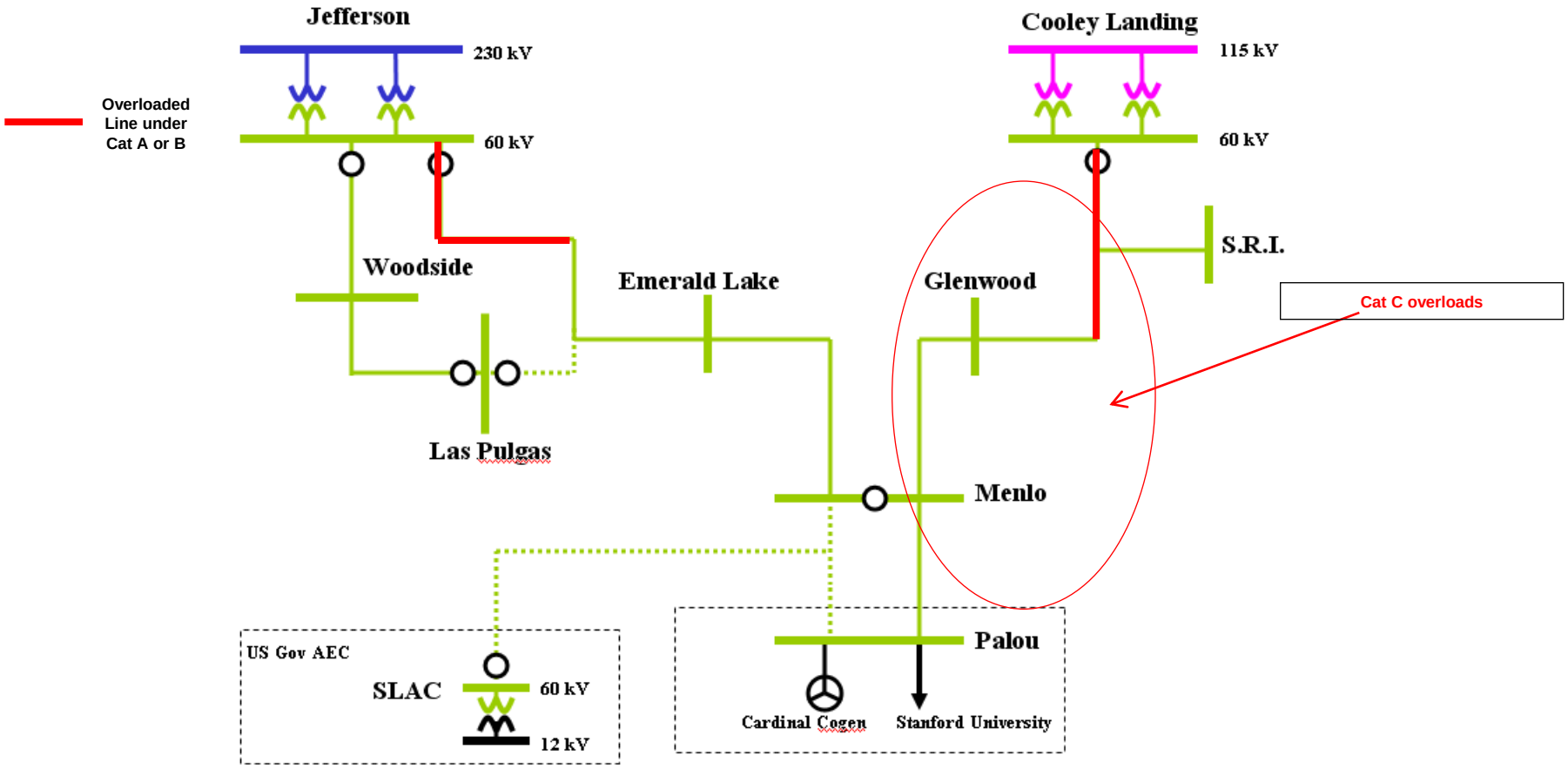
- Thermal Overloads
  - Jefferson - Stanford 60 kV Line (Cat B / 2015)
  - Cooley Landing - Stanford 60 kV Line (Cat B / 2015)
    - Action Plan until Jefferson-Stanford No. 2 60 kV Line addition complete
- High/Low Voltage
  - No Category A nor B high/low voltage identified
- Voltage Deviation
  - No Category A nor B voltage deviations identified

Category C problems will be discussed in the area diagram in next slide

Peninsula Area – Results (cont'd)



Peninsula Area – Results (cont'd)



Mission Area – Results (Category A & B)

- Thermal Overloads
  - North Dublin - Cayetano 230 kV Line (Cat B / 2018)
  - Lone Tree - Cayetano 230 kV Line (Cat B / 2018)
    - Mitigation – Reduce Contra Costa Area Generation
- High Voltage
  - VASCO 60kV (Cat B / 2018)
    - Mitigation – Under review for possible exemption or reactive device
- Low Voltage
  - No Category A nor B low voltage identified

Category C problems will be discussed in the area diagram in next slide

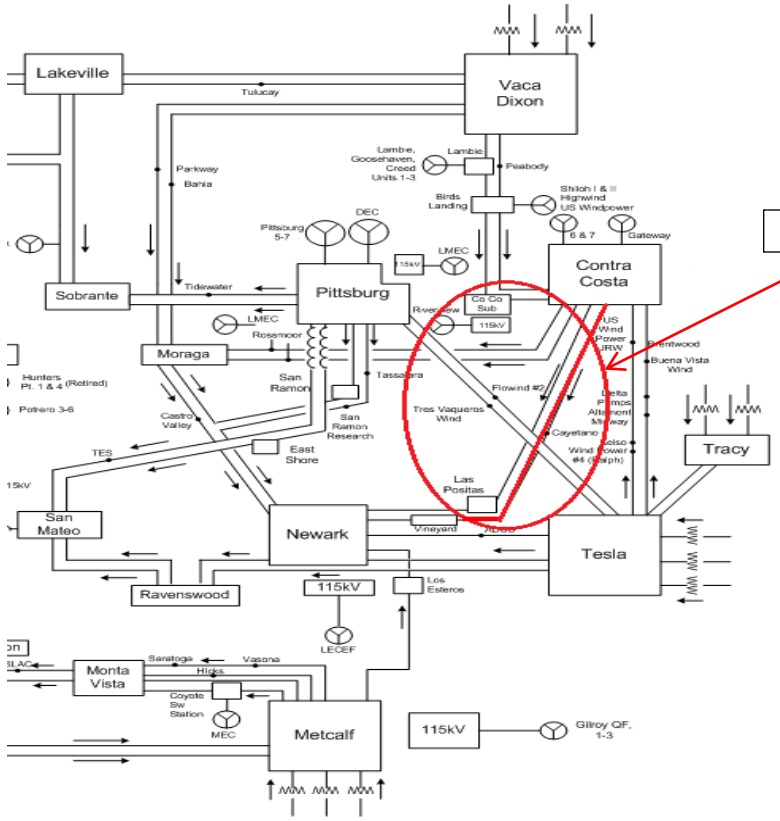
Mission Area – Results (Category A & B)

- Voltage Deviation
  - No Category A nor B voltage deviation identified

Category C problems will be discussed in the area diagram in next slide

Mission Area – Results (Category A & B)

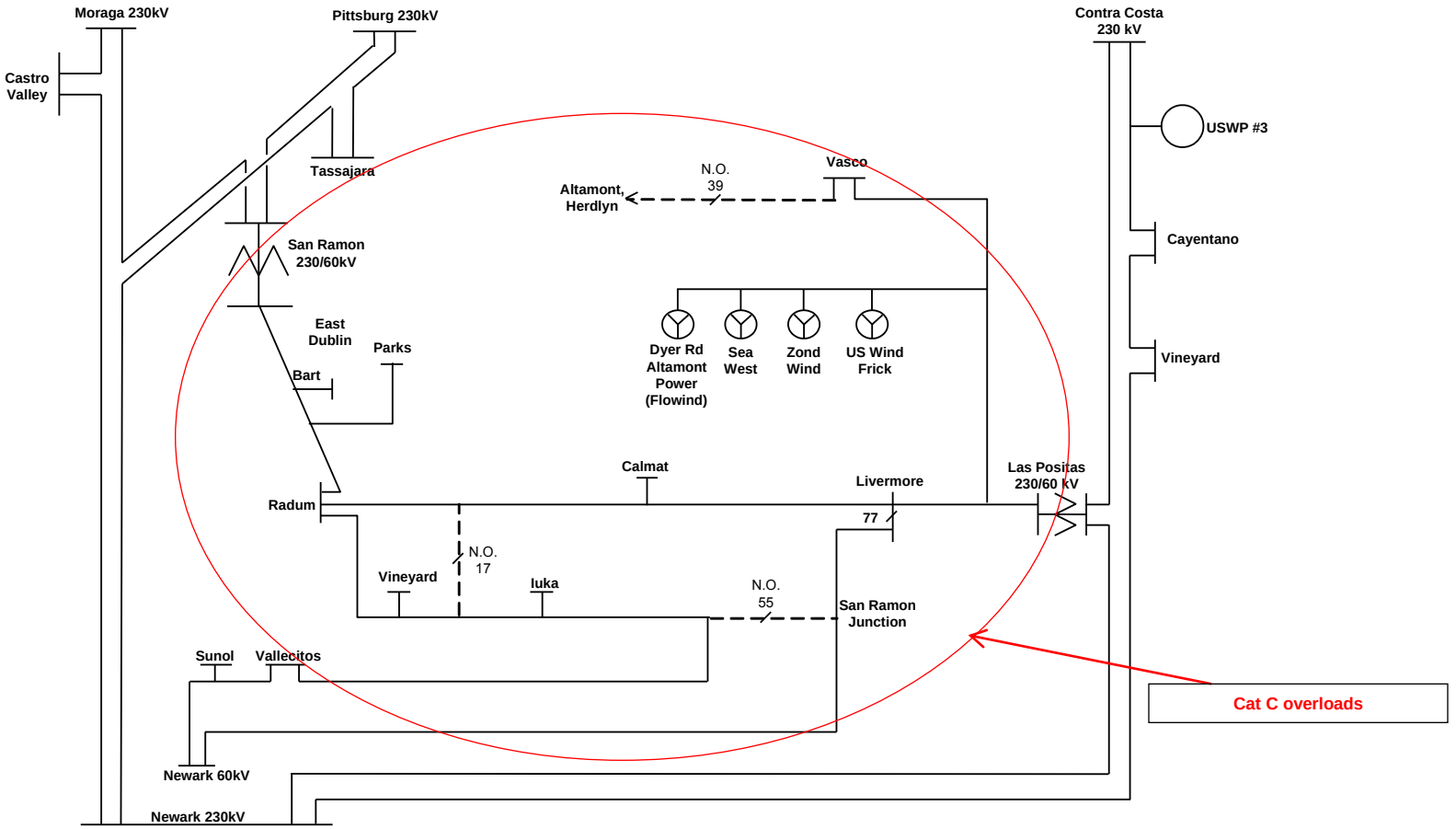
Overloaded Line under Cat A or B



Cat C overloads

Category C problems will be discussed in the area diagram in next slide

Mission Area – Results (cont'd)



East Bay Area – Results (Category A & B)

- Thermal Overloads
  - Lone Tree - Cayetano 230 kV Line (Cat A / 2018)
    - Mitigation – Reduce generation in the Contra Costa Area including Oakley and/or Marsh Landing Generation
  - Oleum - North Tower - Christie 115 kV Line (Cat B / 2023)
    - Mitigation – Action Plan before the North Tower 115 kV Looping Project completion
  - Moraga – Claremont #1 or #2 115 kV Line (Cat B / 2023)
    - Mitigation – Increase generation in the Oakland Area
  - Moraga - Oakland "J" 115 kV Line (Cat B / 2018)
    - Mitigation – Action Plan before the permanent solution is completed, such as reconductoring Moraga - Oakland "J" 115 kV Line

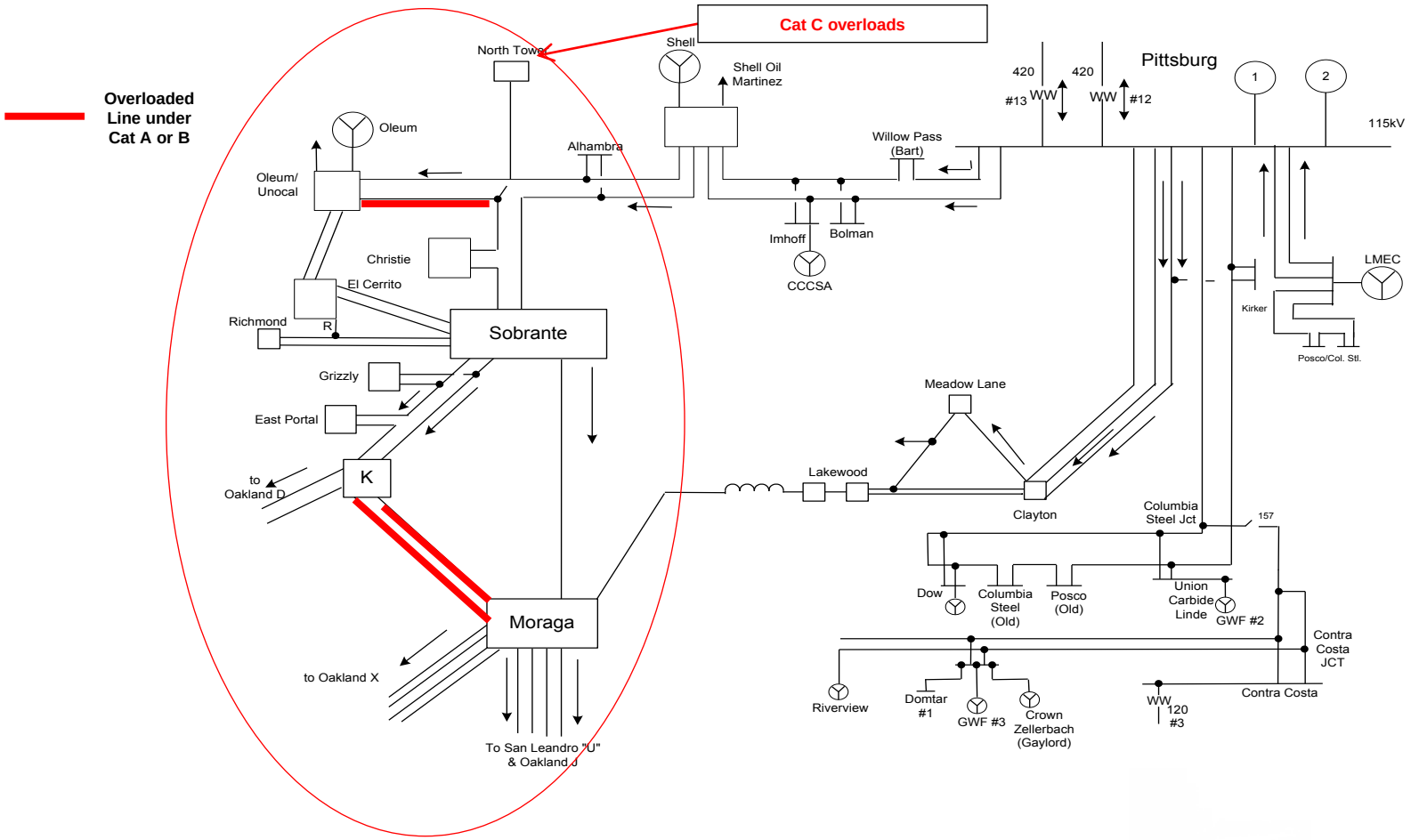
Category C problems will be discussed in the area diagram in next slide

East Bay Area – Results (Category A & B)

- High Voltage
  - Christie 60kV (Cat A / 2015)
    - Mitigation – Under review for possible exemption or reactive device
- Low Voltage
  - Std Oil 60kV (Cat C / 2018)
    - Mitigation – Add reactive support
- Voltage Deviation
  - No Category A nor B overloads identified

Category C problems will be discussed in the area diagram in next slide

East Bay Area – Results

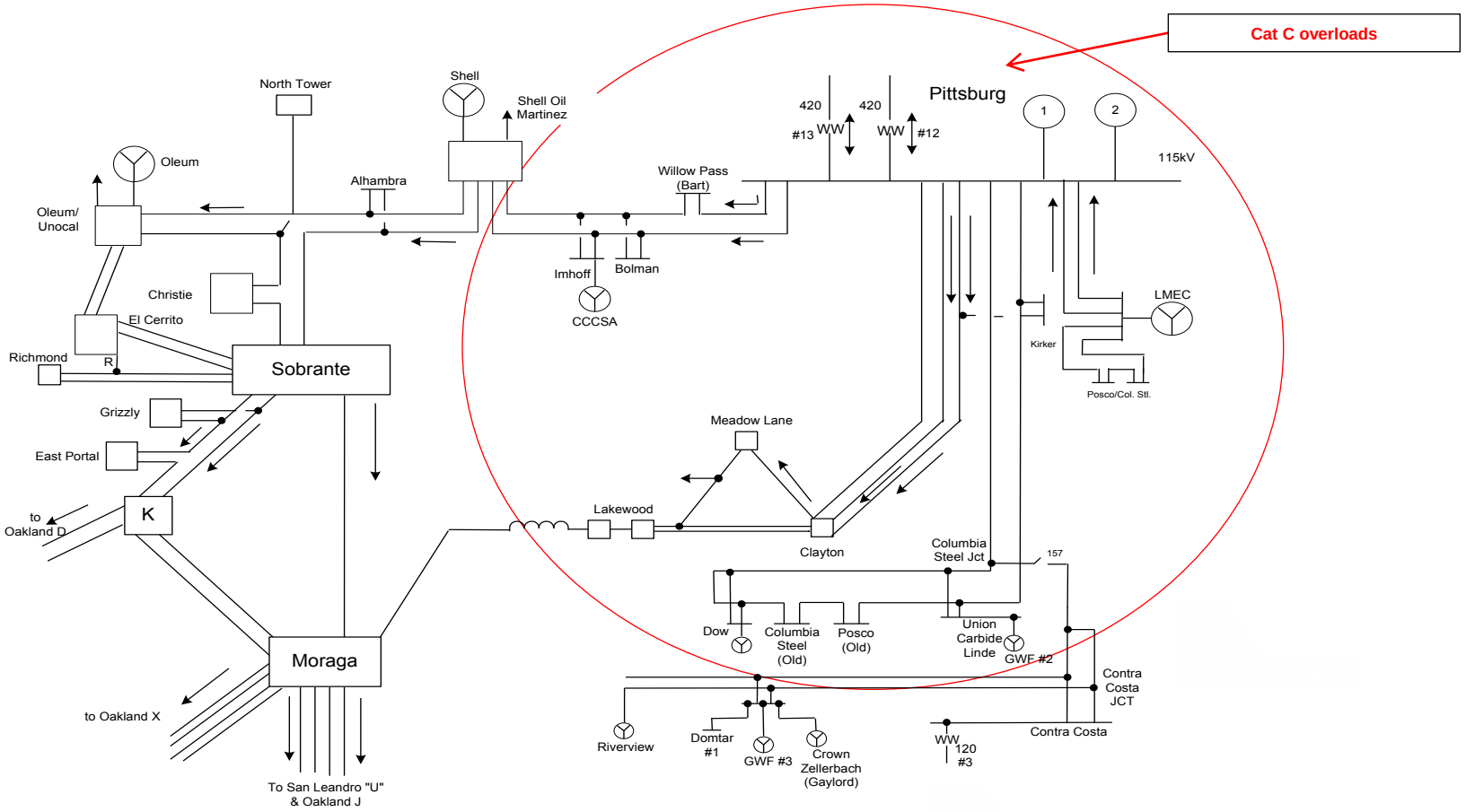


Diablo Area – Results (Category A & B)

- Thermal Overloads
  - No Category A nor B overloads identified
- High Voltage
  - MARSH 60kV (Cat B / 2018)
    - Under review for possible exemption or reactive device
- Low Voltage
  - No Category A nor B low voltage identified
- Voltage Deviation
  - No Category A nor B voltage deviation identified

Category C problems will be discussed in the area diagram in next slide

Diablo Area – Results (cont'd)



De Anza Area – Results (Category A & B)

- Thermal Overloads
  - No Category A nor B overloads identified
- High Voltage
  - LOS GATS 60kV (Cat B / 2015)
    - Mitigation – Add reactive support
- Low Voltage
  - No Category A nor B low voltage identified

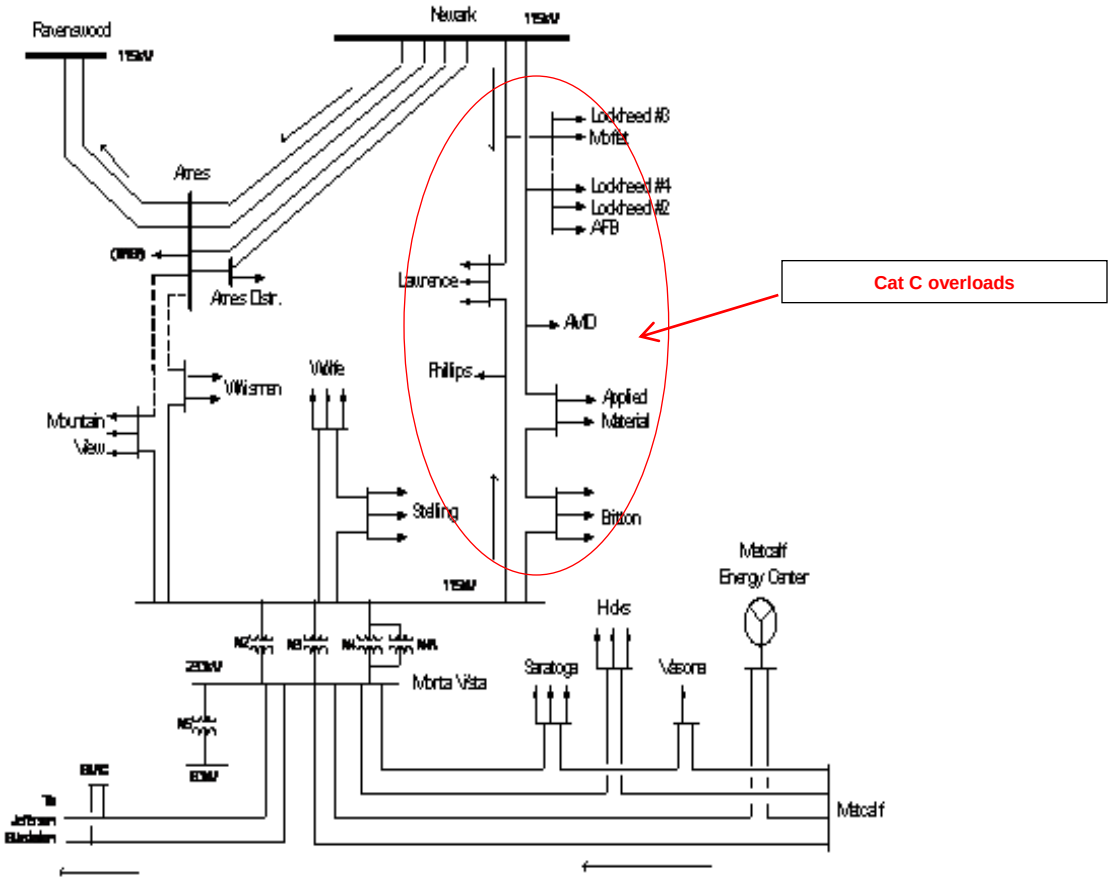
Category C problems will be discussed in the area diagram in next slide

De Anza Area – Results (Category A & B)

- Voltage Deviation
  - LOYOLA 60kV (Cat B / 2015)
  - LOS GATS 60kV (Cat B / 2015)
    - Mitigation – Add reactive support

Category C problems will be discussed in the area diagram in next slide

De Anza Area – Results (cont'd)



California ISO
Shaping a Renewed Future

Fresno & Kern Areas
Preliminary Reliability Assessment Results

Joseph E Meier, P.E.
Senior Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Greater Fresno Area

- Includes the San Joaquin Division
- Generation: Over 3,300 MW of generation
- Comprised of 60, 115, 230 & 500 kV transmission facilities.
- Summer Peak 3,705 MW in 2023

Fresno Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category A – 1, Category B - 9 and Category C - 134
  - Low voltages due to Category B - 5 and Category C - 27
  - Voltage deviations due to Category B - 13 and Category C - 29
- Compared to last year results:
  - 1 Category A problem not previously identified
    - Oro Loma #2 115/70kV transformer
      - Mitigated by new Mercy Springs substation in 2017

Fresno Area Proposed Solutions

- Potential Mitigation Solutions
  - Operating Procedures, SPS (Overload, voltage issues mostly Category C)
  - Upgrade SPS to reduce generation from Exchequer PH
    - Current SPS drops Exchequer PH for loss of Exchequer-Le Grand 115kV line
  - Modify existing Helms RAS to account for new North Fresno 230/115kV substation
  - Transmission line reconductor
  - Add or replace transformers

Fresno Area – Results (Category A & B)

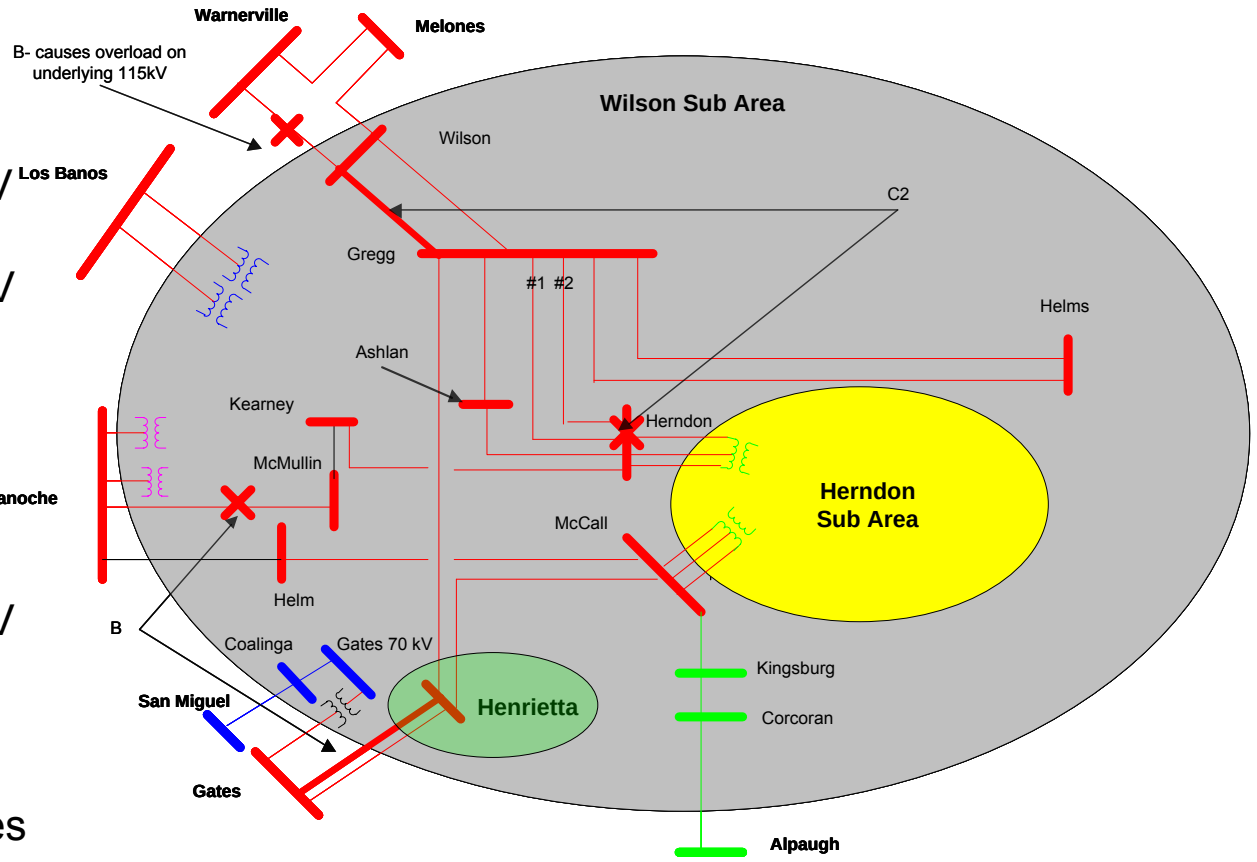
- Thermal Overloads (Category A)
  - Oro Loma #2 115/70kV
- Thermal Overloads (Category B)
  - Oro Loma #2 115/70kV (2015 Peak)
  - Kearney-Kerman 70kV (All Peak)
  - Gates-Gregg 230kV (2018 PPk)
  - Panoche-Oro Loma 115kV (2018 PPk)
  - Wilson-Oro Loma 115kV (2018 PPk)

Fresno Area – Results (Category A & B)

- Low Voltage (Category B)
  - Firebaugh 70kV (2015 Peak only)
  - Mendota 115kV Area (2015 Peak only)
  - Exchequer 70kV Area (2018 Partial Peak)
  - Coalinga 70kV Area (2018 Partial Peak)
- Voltage Deviation (Category B)
  - Mendota 115kV Area (2015 Peak)
  - Exchequer 70kV Area (All Peak cases)
  - Oro Loma 70kV Area (2015 Peak)
  - Kerman 70kV Bus (2023 Peak)
  - Reedley 70kV Area (2015 Peak)

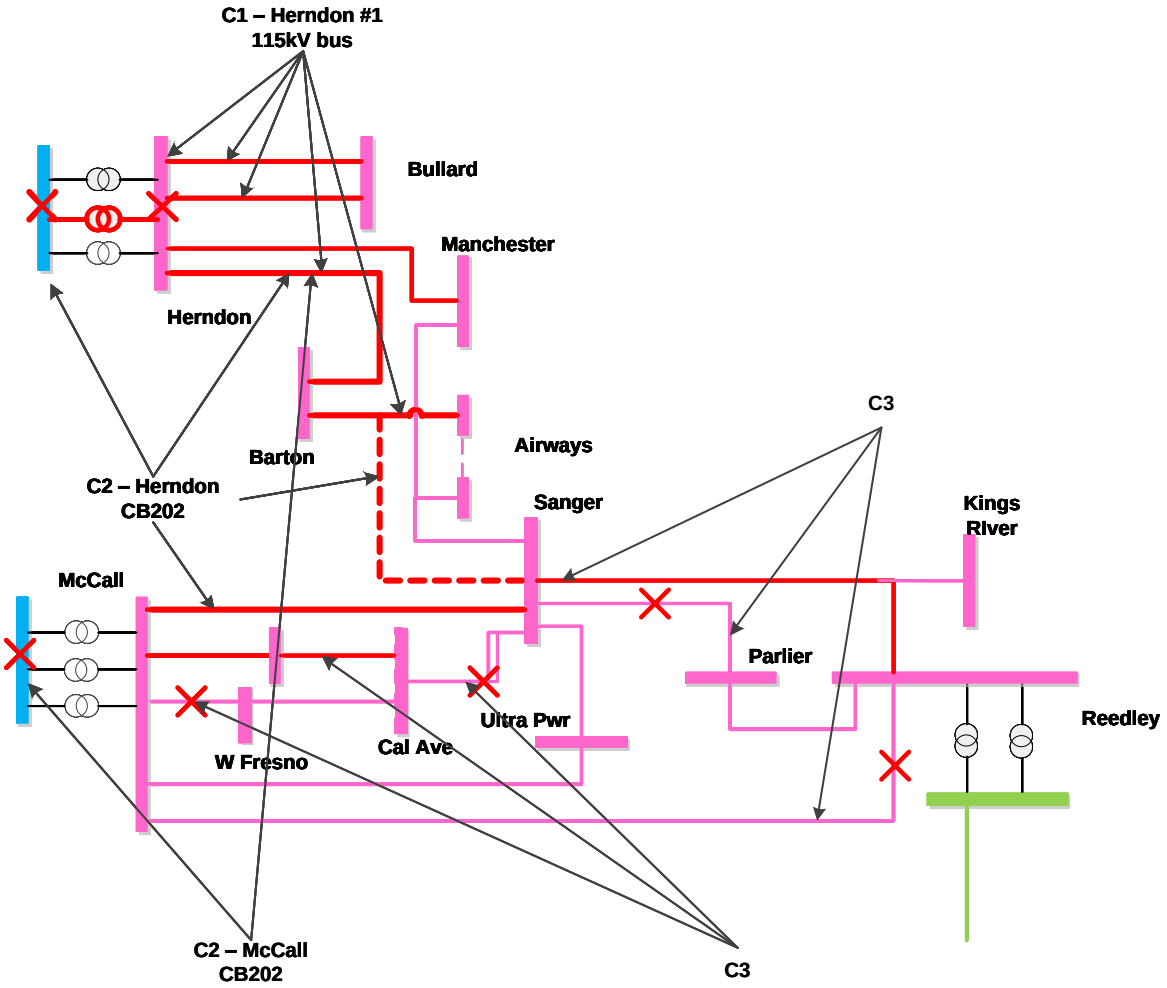
Fresno Area – Results

- Thermal Overloads
  - Gates-Gregg 230kV (2018 PPk)
  - Borden-Gregg #1 230kV (2015 Peak)
  - Wilson-Oro Loma 115kV (2018 PPk)
- Voltage Deviation
  - System wide (47% at Henrietta in 2018 PPk)
- Potential Mitigation
  - Approved Borden 230kV Voltage Support project that includes looping Wilson-Gregg 230kV through Borden mitigates later years – Action Plan
  - INC Helms PGP in PPk
  - New Gates-Gregg 230kV in 2022



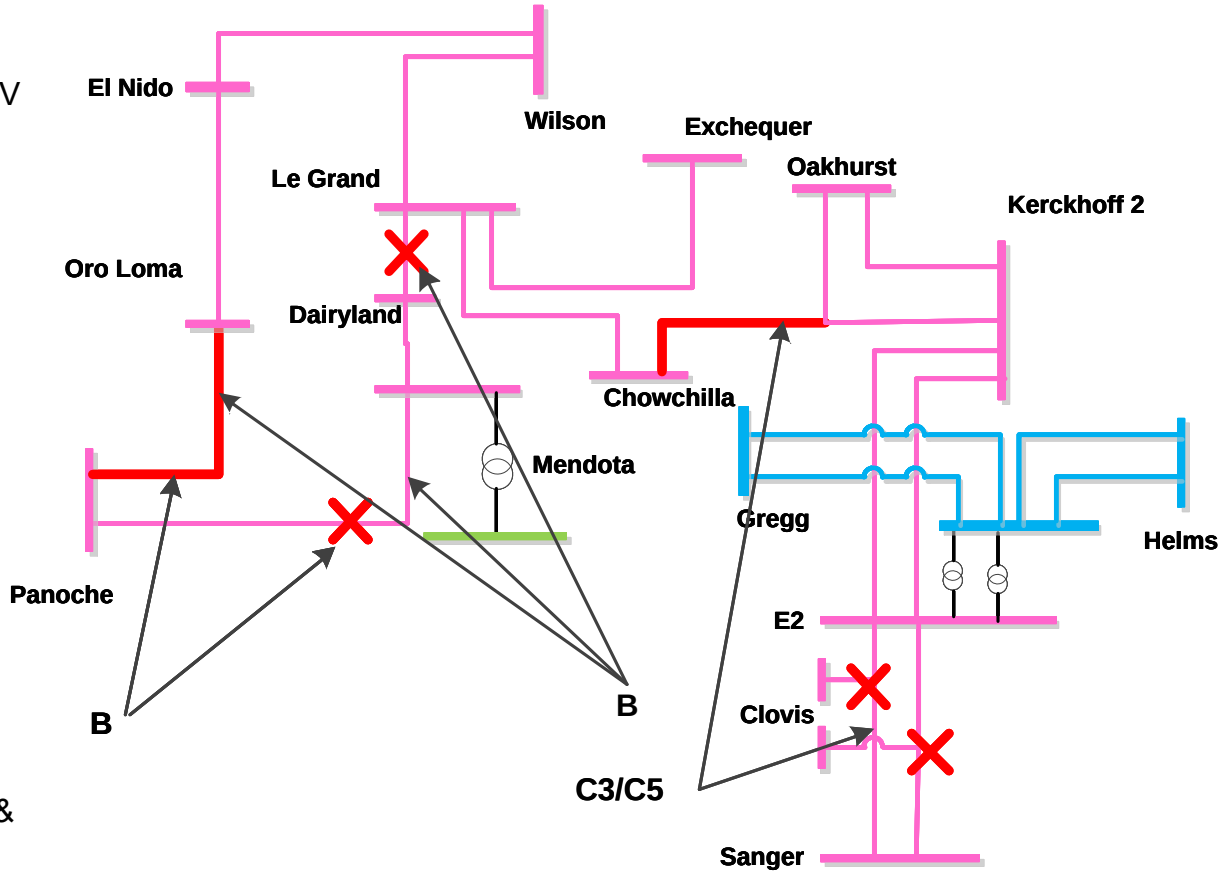
Fresno Area – Results

- Thermal Overloads
  - Herndon-Bullard #1 or #2 115kV (All years peak)
  - McCall-Sanger #3 115kV (2015 Peak)
  - Herndon-Barton 115kV (2015 Peak)
  - Barton-Airways-Sanger 115kV (2015 Peak)
  - Kerckhoff-Clovis-Sanger #1 or #2 115kV lines (2015 Peak)
  - McCall-Cal Ave 115kV (>=2018 Peak)
  - Kings River-Sanger-Reedley 115kV (All Peak)
- Voltage Deviation
  - Pinedale 115kV (38% 2023 Peak)
- Potential Mitigation
  - SPS to drop Bullard or Pinedale load for Herndon 115kV bus fault
  - Approved North Fresno 115kV Reinforcement (ISD 2017) mitigates McCall CB202 or Herndon CB202 failure in later years – Action Plan.
  - Reconductor lines



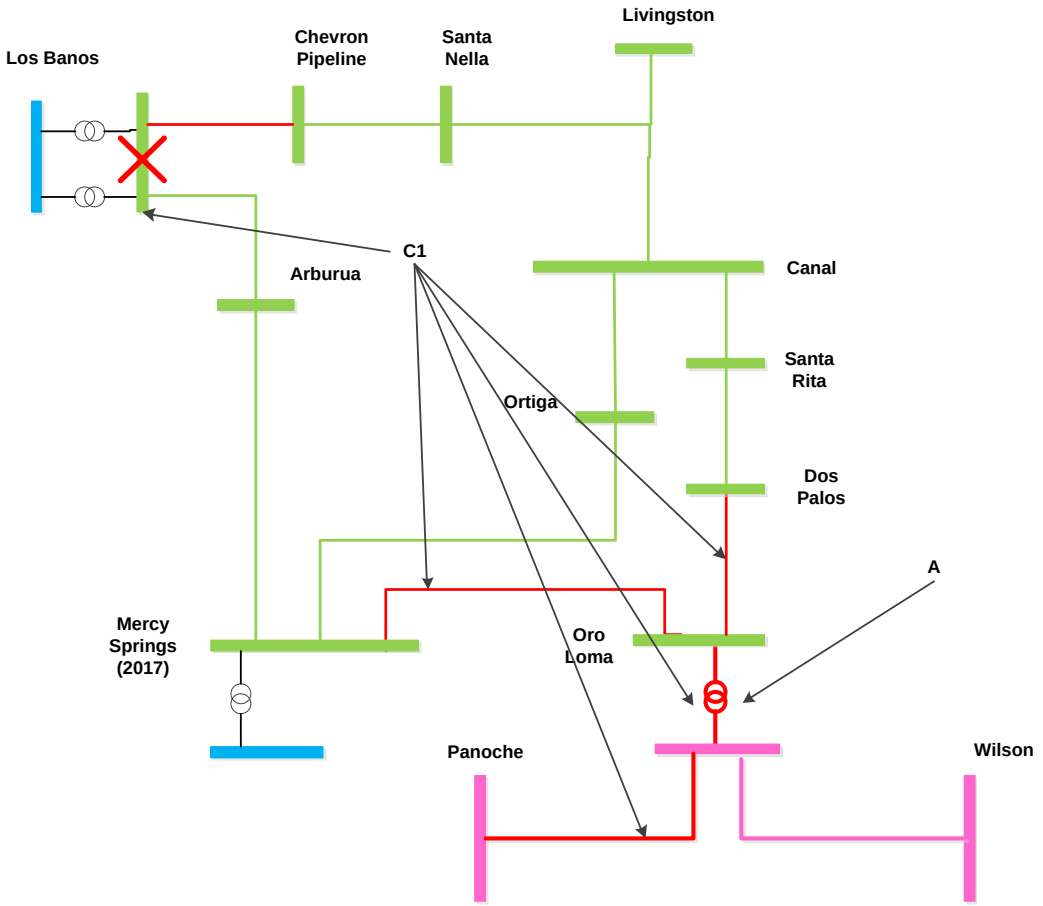
Fresno Area – Results

- Thermal Overloads
  - Chowchilla-Kerckhoff 2 115kV (2018 Peak & 2023 Peak)
  - Panoche-Oro Loma 115kV (2018 Peak & PPk)
- Voltage Deviation
  - Mendota 115kV (23% 2015 Peak only)
- Potential Mitigation
  - INC Helms PGP in PPk
  - Modify Kerckhoff 2 RAS
  - Reconductor Panoche-Oro Loma 115kV
- Major Projects
  - New 230/115kV substation looping on Helms-Gregg #1 & #2 230kV lines



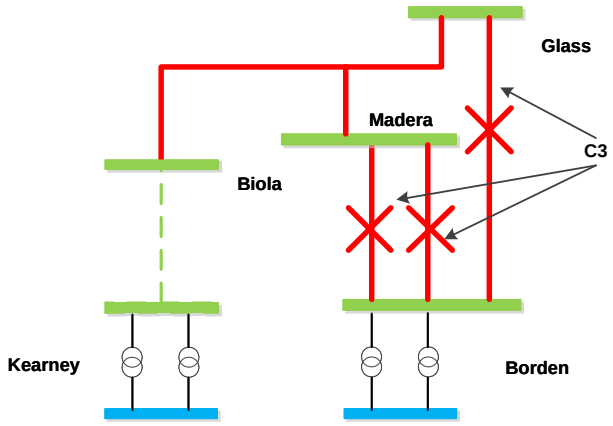
Fresno Area – Results

- Thermal Overloads
  - Oro Loma #2 115/70kV
  - Oro Loma-Canal #1 70kV
  - Los Banos-Canal-Oro Loma #1 70kV
  - Panoche-Oro Loma 115kV
  - Los Banos-Livingston Jct-Canal 70kV
  - Many caused by N-1-1 in this are
- Voltage Deviation
  - Los Banos 70kV Area (24% in 2015 Peak)
- Potential Mitigation
  - New Mercy Springs 230/70kV substation (ISD 2017) mitigates most contingencies – Action Plan until 2017



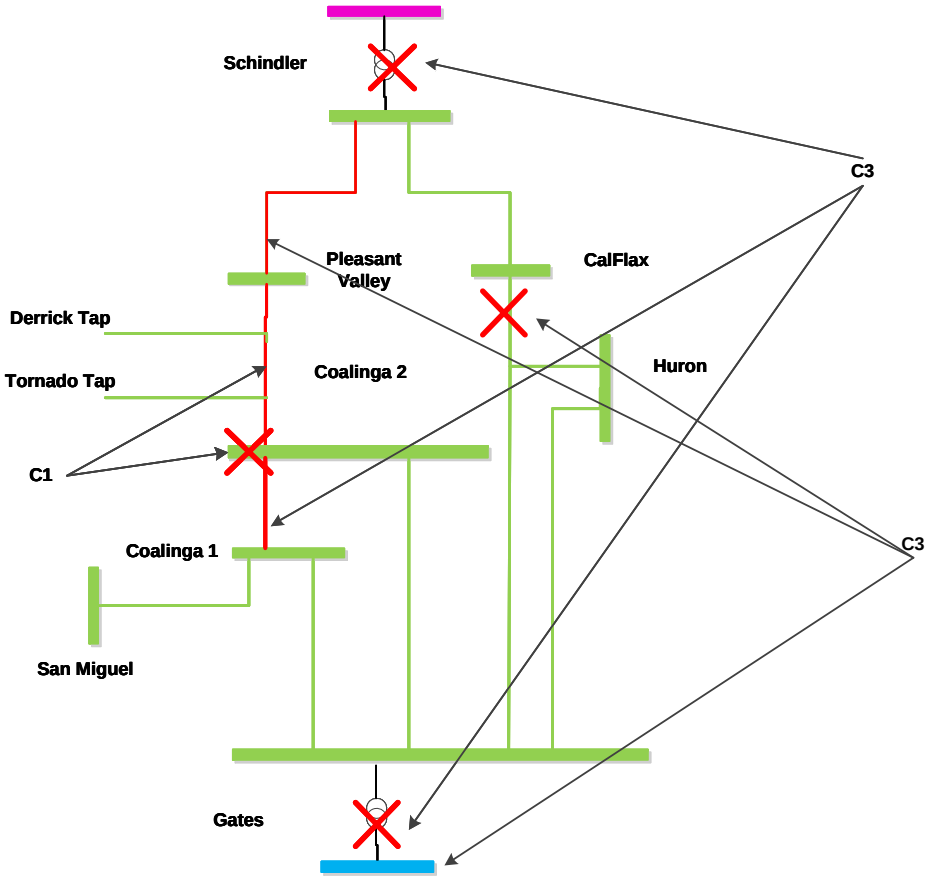
Fresno Area – Results

- Thermal Overloads
  - Borden-Glass 70kV
  - Borden-Madera #1 OR #2 70kV
- Voltage Deviation
  - Borden 70kV Area (18% in 2018 PPk)
- Potential Mitigation
  - Reconductor Borden-Glass 70kV
  - Reconductor Borden-Madera #1 & #2 70kV
  - Transfer Biola to Kearney 70kV source after first contingency
  - Upgrade Borden 70kV bus
  - INC Helms for deviation in 2018 PPk



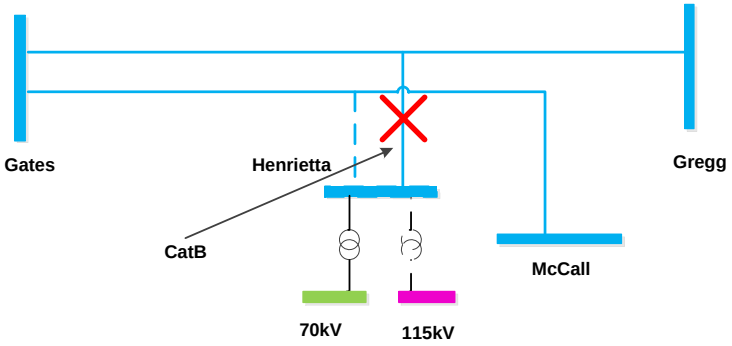
Fresno Area – Results

- Thermal Overloads
  - Coalinga 1-Coalinga 2 70kV
  - Schindler-Coalinga 2 70kV
- Voltage Deviation
  - Coalinga 1 (19% in 2023 Peak)
- Potential Mitigation
  - BAAH at Coalinga 1 70kV
  - SPS for loss of Gates #5 230/70kV, Schindler #1 115/70kV, or Schindler-Huron-Gates 70kV

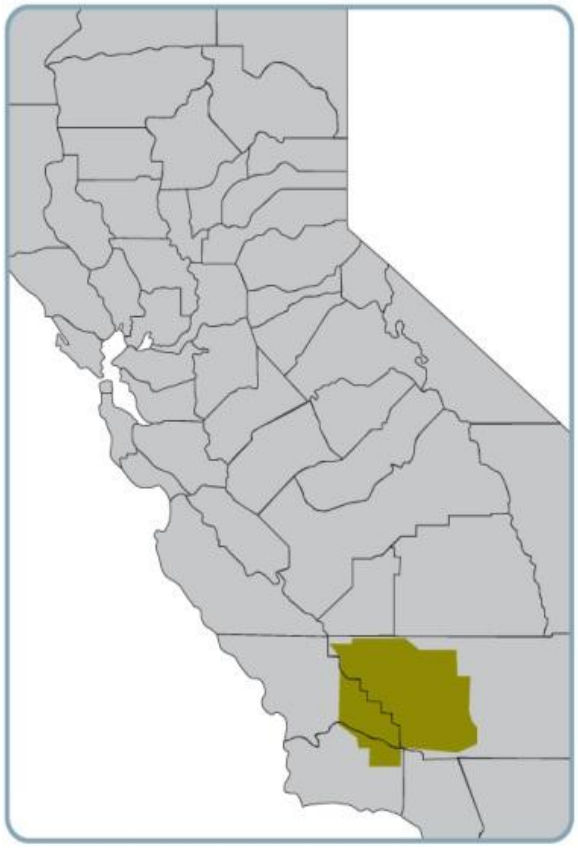


Fresno Area – Results

- Thermal Overloads
  - Collapse in 2015 with no GWF
- Voltage Deviation
  - Collapse in 2015 with no GWF
- Load Drop
  - 115MW per Henrietta RAS document
  - For Cat B or Gates-Gregg 230kV, Henrietta RAS will operate before Gates-McCall 230kV tap closes in.
  - Weak 115kV supplying 70kV
  - NAS Lemoore on 70kV
  - Worse when GWF Henrietta offline
- Potential Mitigation
  - BAAH at Henrietta 230kV
  - Eliminates load drop for Cat B contingency



Kern Area



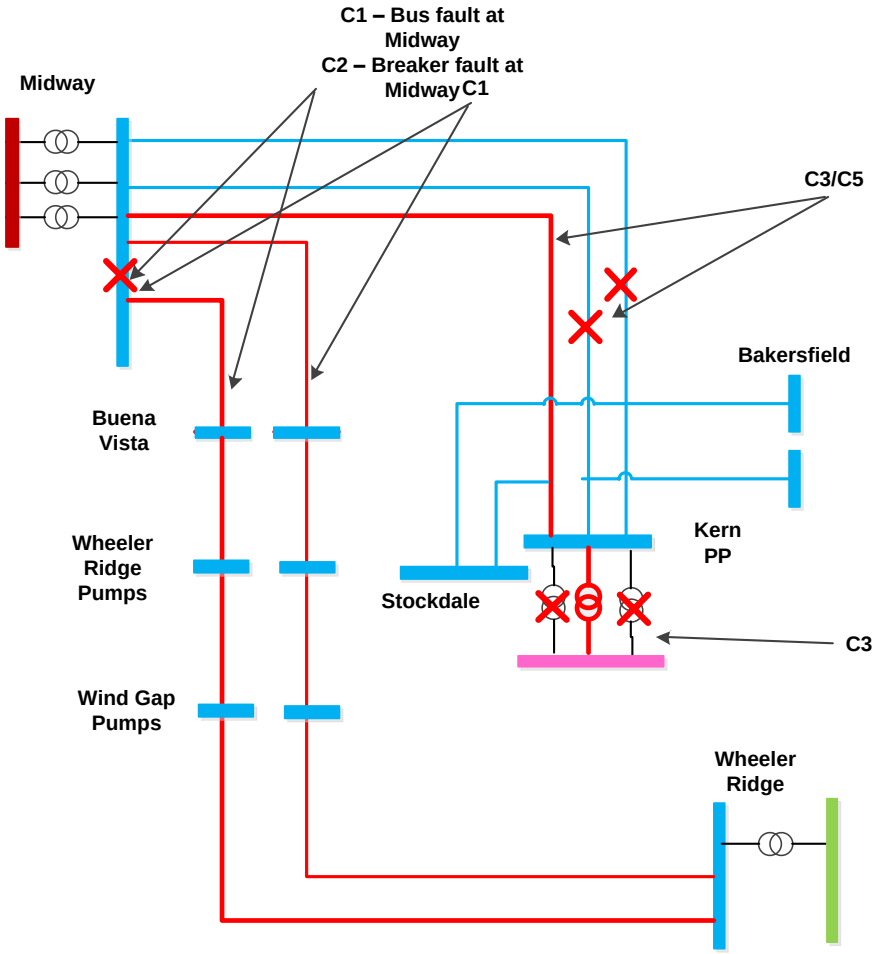
- Includes Southern portion of San Joaquin Division
- Generation: Over 3,100 MW of generation
- Comprised of 60, 115, & 230 kV transmission facilities.
- Summer Peak 2,025 MW in 2023

Kern Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category B - 2 and Category C - 12
  - Low voltages due to Category A - 2, Category B - 2 and Category C - 4
  - Voltage deviations due to Category B - 3 and Category C - 5
- Compared to last year results:
  - One new Category A problems (Voltage)
  - One fewer Category B overloads
  - Nine fewer Category C overloads

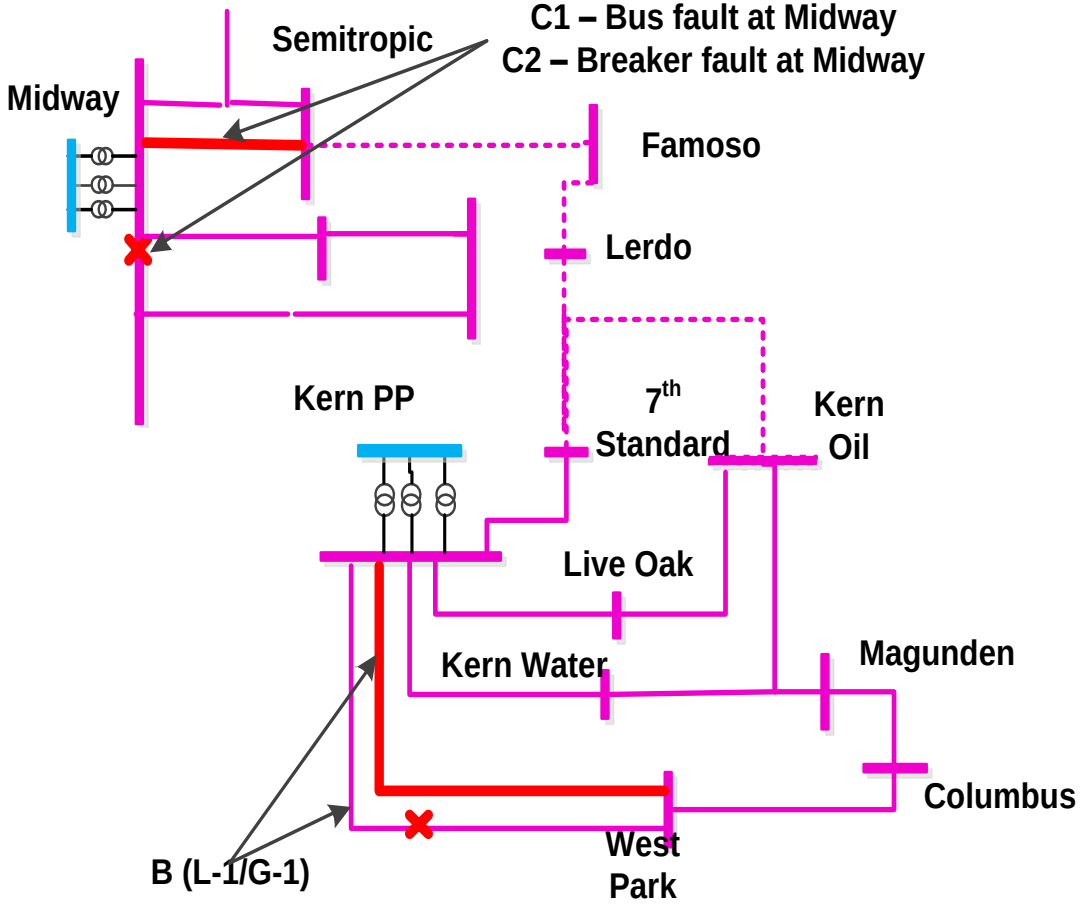
Kern Area – Results

- Thermal Overloads
  - Midway-Wheeler Ridge #1 & #2 230kV
  - Midway-Kern PP #1 & #3 230kV
  - Kern PP #3 230/115kV
- Voltage Deviation
  - Buena Vista (25%)
- Potential Mitigation
  - Trip CDWR Pumps
  - Unbundle Midway-Kern PP #1 230kV and reconductor as two separate circuits
  - Kern PP 230kV Area Reinforcement mitigates #4 xfmr, but #3 is limiting >=2018 (Working with PG&E to upgrade #3 & #5 limiting terminal equipment)
  - Also working with PG&E to use Kern coincident peak case, instead of Fresno/Kern coincident peak case.
    - Combined peak masks Kern problems
    - Areas aren't strongly linked.



Kern Area – Results

- Thermal Overloads
  - Kern PP-Westpark #1 or #2
  - Midway-Shafter 115kV (145% in 2015)
- Voltage Deviation
  - Rio Bravo Tomato 115kV (12%)
- Potential Mitigation
  - Kern PP 115kV Reinforcement mitigates Kern PP-Westpark 115kV lines in later years – Action Plan
  - Reconductor Midway-Shafter 115kV



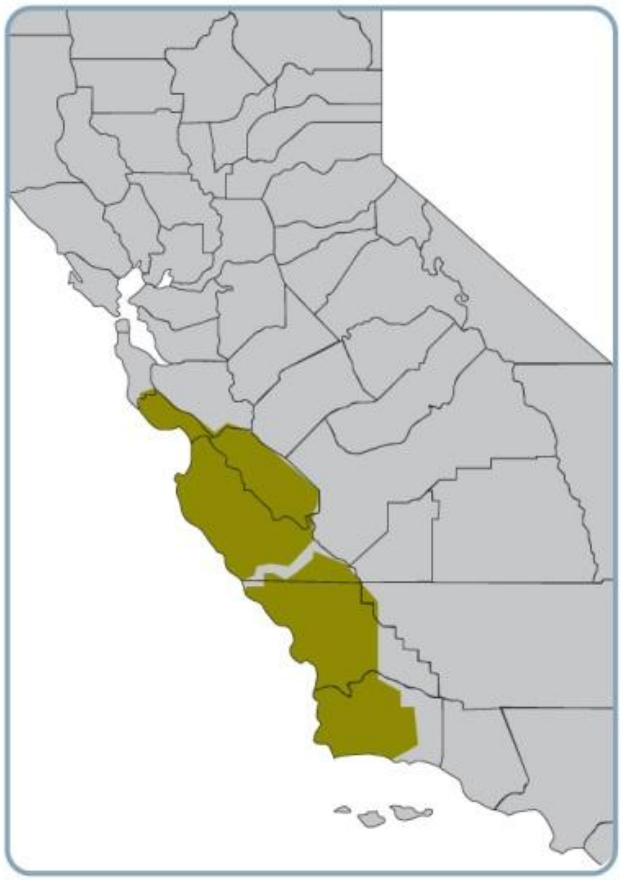
California ISO
Shaping a Renewed Future

Central Coast and Los Padres Areas Preliminary Reliability Assessment Results

Chris Mensah-Bonsu, Ph.D.
Senior Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Central Coast Area



- Located south of the Greater Bay Area, it extends along the central coast from Santa Cruz to King City
- Major substations: Moss Landing, Green Valley, Paul Sweet, Salinas, Watsonville, Monterey, Soledad and Hollister
- Supply sources: Moss Landing, Panoche, King City and Monta Vista
- Generation: Over 2800 MW
- Transmission system includes 60, 115, 230 and 500 kV facilities
- 2023 Winter Peak: 679 MW
- 2023 Summer Peak: 803 MW

Central Coast Area Assessment Summary

- The assessment identified:
  - Thermal overloads (summer peak) due to Category C - 6
  - Thermal overloads (winter peak) due to Category C - 4
  - Low voltages (summer peak) due to Category C -10
  - Low voltages (winter peak) due to Category C - 3
  - Voltage deviations (summer & winter) due to Category C - 3

- Compared to last year results:
  - There are no new concerns identified
  - Crazy Horse 115 kV Substation and Moss Landing 115/230 kV Bank #1 & 2 Replacement projects mitigate previously identified Category B and C thermal and voltage concerns.
  - The Watsonville 115 kV Voltage Conversion project introduces new thermal and voltage concerns under Category C3/C5 contingency conditions

Central Coast Area Potential Solutions

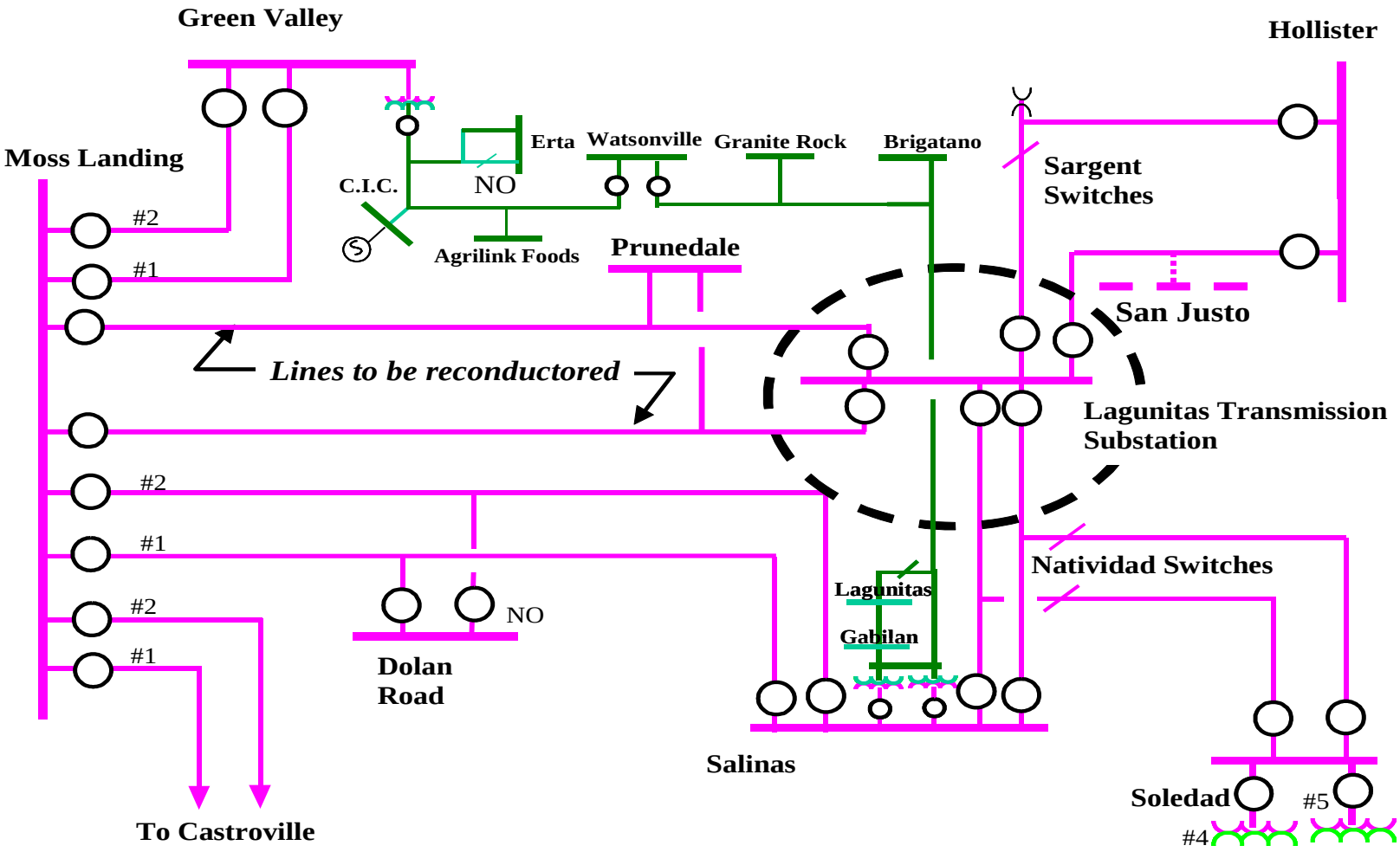
- Potential Mitigation Solutions
  - Operating solutions
  - Interim operating solutions until approved projects get implemented
  - Monitor facility loading due to longer lead time
  - Expedite already approved project
  - Reconductor/Resize approved project and add reactive support
  - Add reactive support

Central Coast Area – Results (Category A & B)

- Thermal Overloads
  - No thermal overloads due to Category A contingency conditions
  - 2 thermal overloads in Winter due to Category B contingency conditions only in 2015 at 101.3%
    - Green Valley-Moss Landing 115 kV #1 or #2 Line following either line outage
- Low Voltage – None
- Voltage Deviation – None

Category C problems will be discussed using the area diagram in the next slide

Central Coast Area – Results



Los Padres Area

- Located south of the Central Coast Division
- Major substations : Paso Robles, Atascadero, Morro Bay, San Luis Obispo, Mesa, Divide, Santa Maria and Sisquoc
- Key supply sources include Gates, Midway and Morro Bay
- Generation: Over 1600 MW
- Diablo Canyon nuclear power plant (2400 MW) is located in Los Padres but does not serve the area
- Transmission system includes 70, 115, 230 and 500 kV facilities
- 2023 Summer Peak: 605 MW

Los Padres Area Assessment Summary

- The assessment identified:
  - No thermal overloads due to Category A or B contingency conditions
  - Thermal overloads due to Category C - 2
  - Low voltages due to Category C - 3
  - Voltage deviation due to Category B - 4 and Category C - 3
- Compared to last year results:
  - No new voltage deviations due to Category A or B conditions
  - Last year, transmission projects were approved in this area

Los Padres Area Potential Solutions

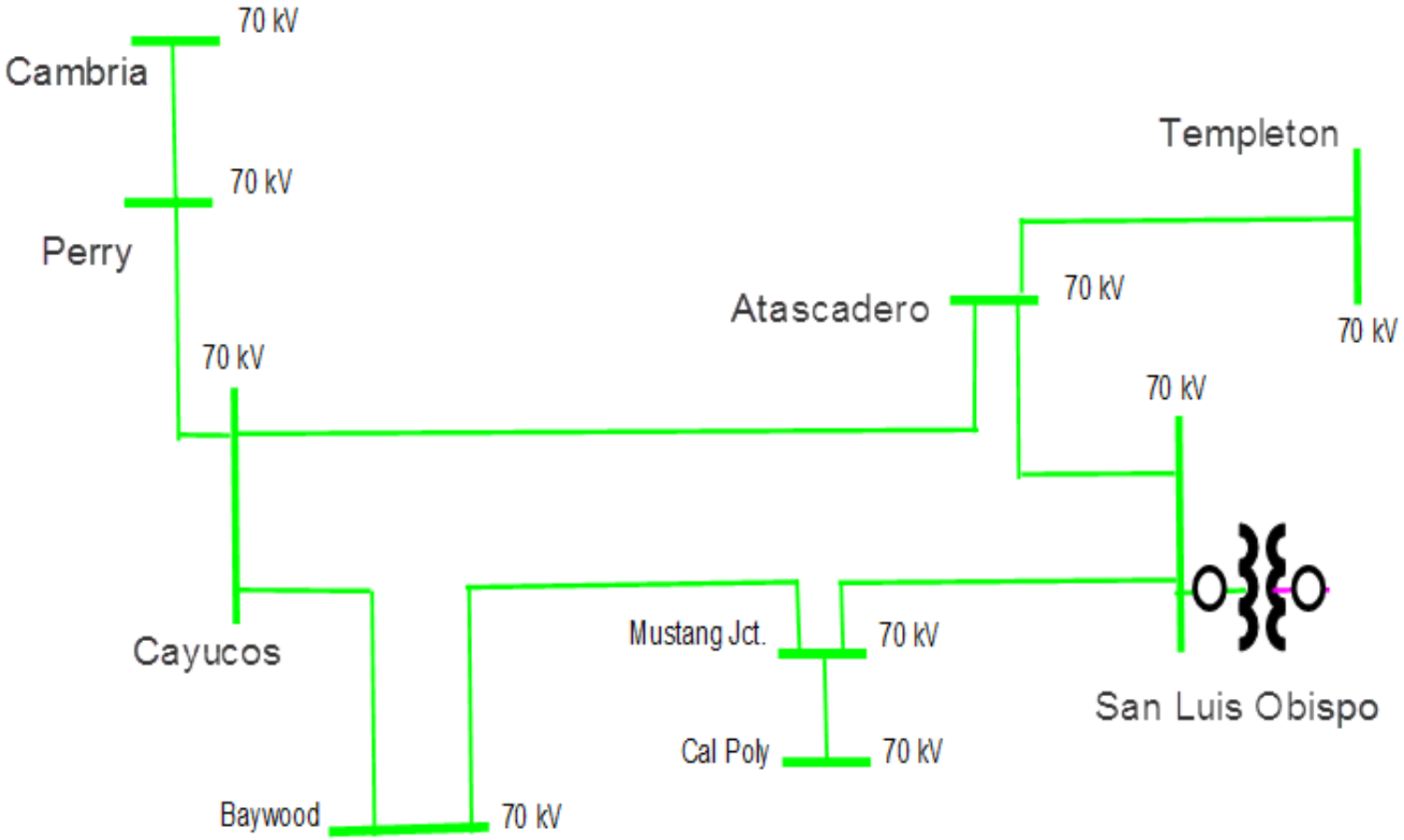
- Potential Mitigation Solutions
  - Operating solutions
  - Activate existing voltage support devices
  - Adjust equipment voltage settings
  - Voltage support
  - Monitor voltage conditions
  - Monitor facility loading/Rerate/Reconductor

Los Padres Area – Results (Category A & B)

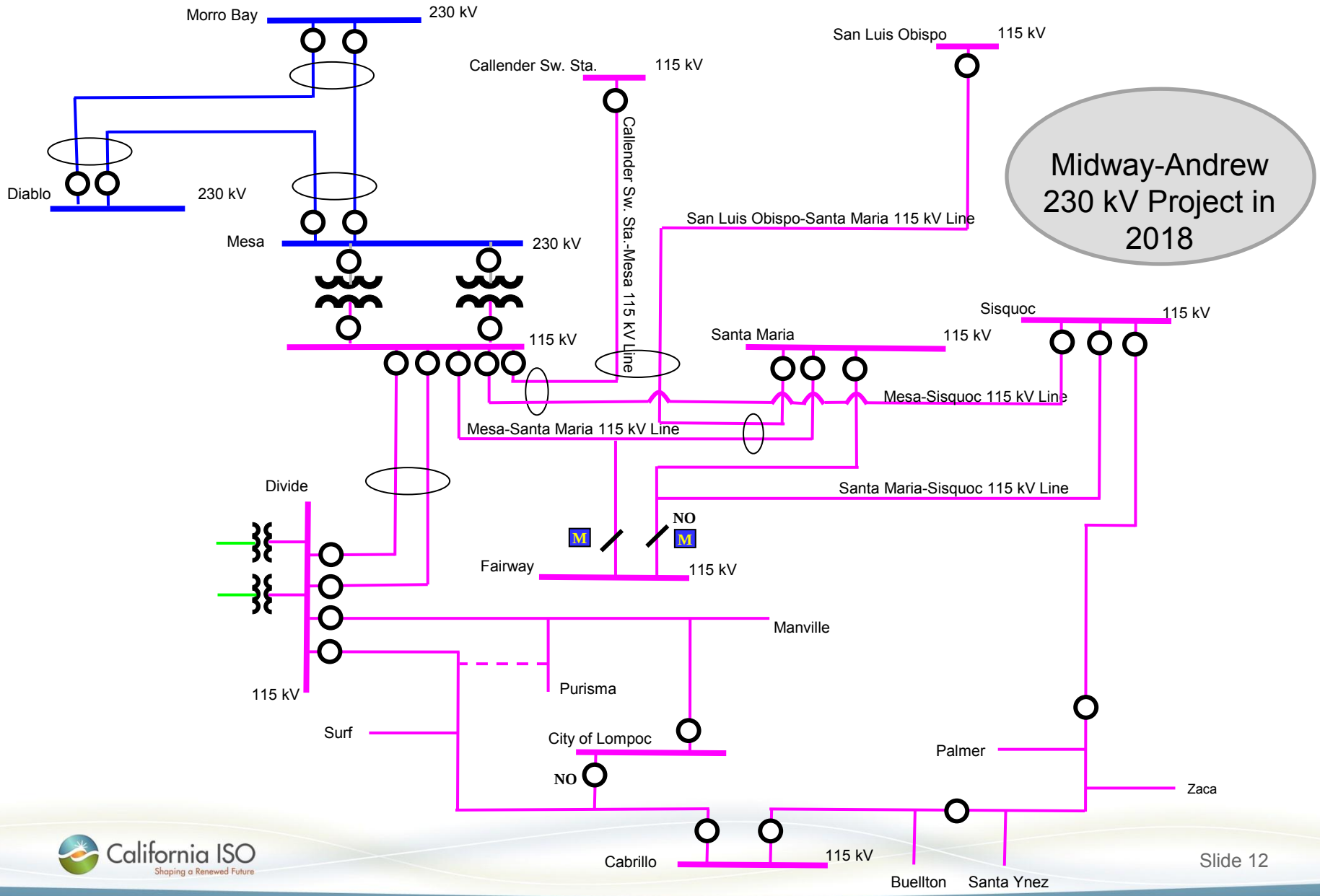
- Thermal Overloads
  - No thermal overloads due to Category A or B conditions
- Low Voltage – None
- Voltage Deviation – None

Category C problems will be discussed using the area diagram in the next slides

Los Padres Area – Results



Los Padres Area – Results



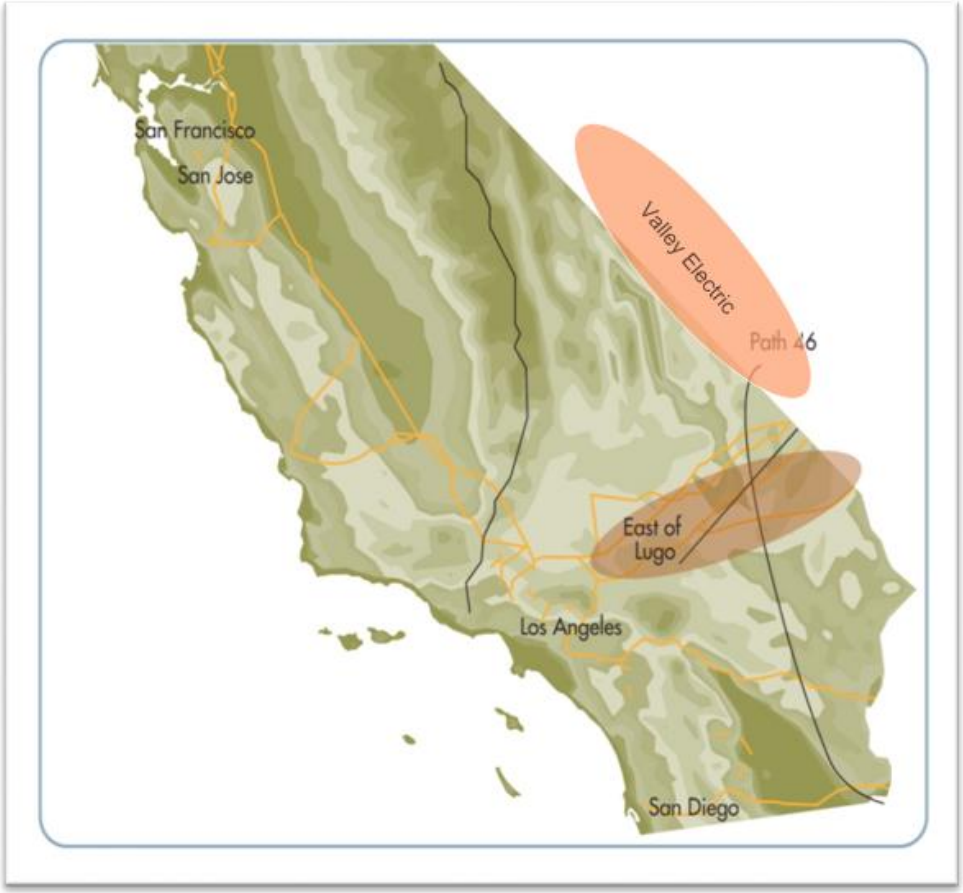
California ISO
Shaping a Renewed Future

Valley Electric Area
Preliminary Reliability Assessment Results

Sushant Barave
Sr. Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Valley Electric Area



- VEA system is fed from WAPA's Mead 230kV substation, WAPA's Amargosa 138kV substation, NV Energy's Northwest 230kV and Jackass 138kV substation
- Generation Modeled:
  - 0 MW in 2015 and 2018
  - 407 MW renewables modeled in 2023
- Comprised of 138 and 230 KV transmission facilities.
- Summer Peak load of 119.6 MW in 2015

Valley Electric Area Assessment Summary

- The assessment identified:
  - 5 buses with high voltages under N-0 condition (non-peak)
  - 2 buses with voltage deviation issues due to category B outages (peak)
  - 19 buses with high/low voltage and deviation concern for Category C outages (peak and off-peak)
  - 8 facility overloads due to Category C outages (peak)
  - Load flow divergence due to Category C outages (peak)

- Compared to last year results:
  - Innovation substation was not modeled in the last year's preliminary studies
  - Several issues reported last year were eliminated by the existing UVLS in VEA area

Valley Electric Area Potential Solutions

- Potential Mitigation Solutions
  1) Operate VEA 138 kV system radially after the first N-1 for Category C3 issues
  2) Open Charleston - Thousandaire 138kV line after the first N-1 for Category C3 issues
  3) Work with WAPA to adjust taps on Amargosa 230/138kV transformer
  4) Work with SCE and adjust Eldorado 500/230kV transformer taps
  5) Review existing UVLS to cover Category C low voltage issues OR Lock LTCs of VEA transformer banks

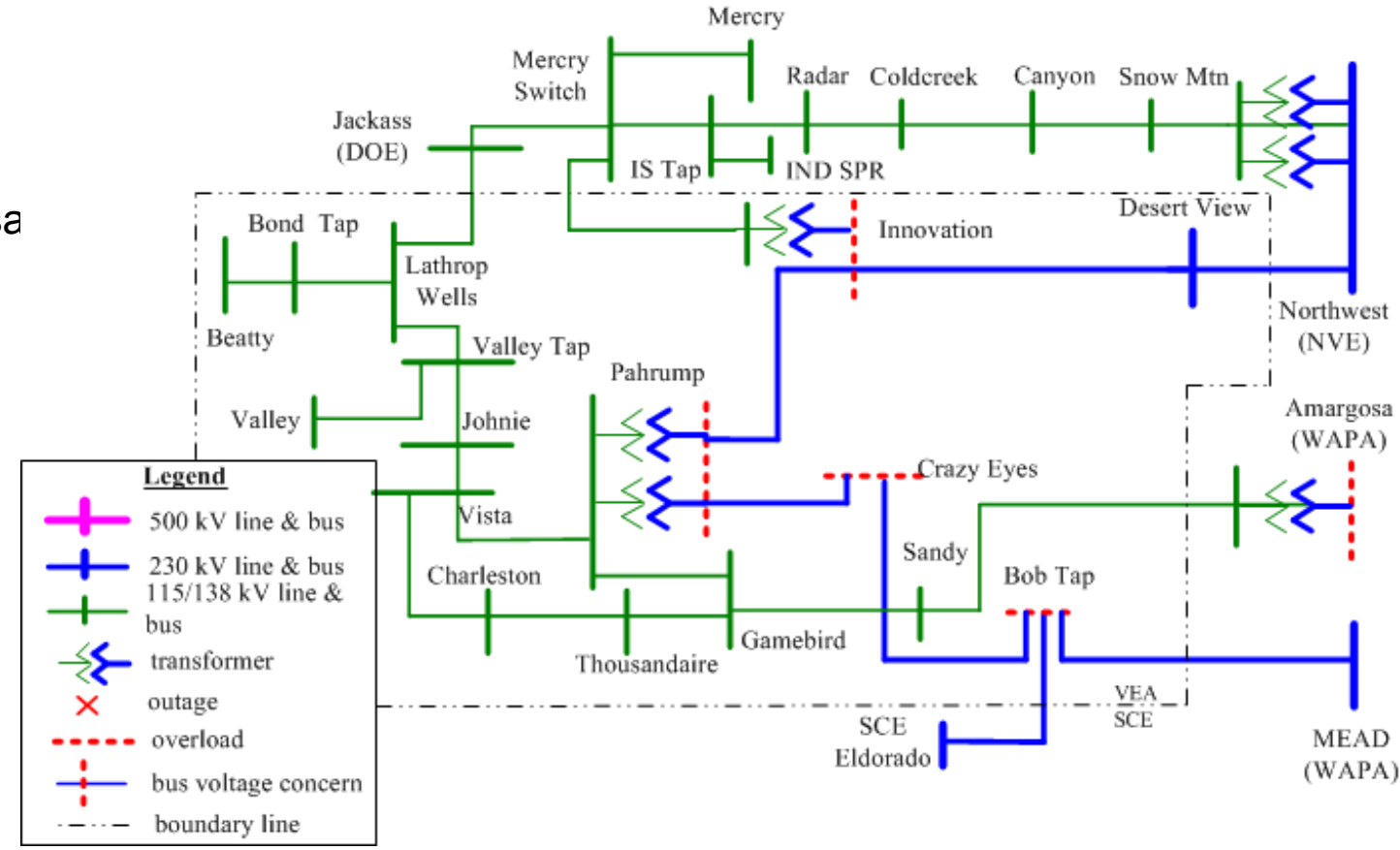
Valley Electric Area – N-0 issue (1)

- Voltage Issue

  High voltage at Pahrump, Innovation, Crazy Eyes and Amargosa 230kV (2018 light load)

- Potential Mitigation

  Adjust taps on Eldorado and Amargosa transformers



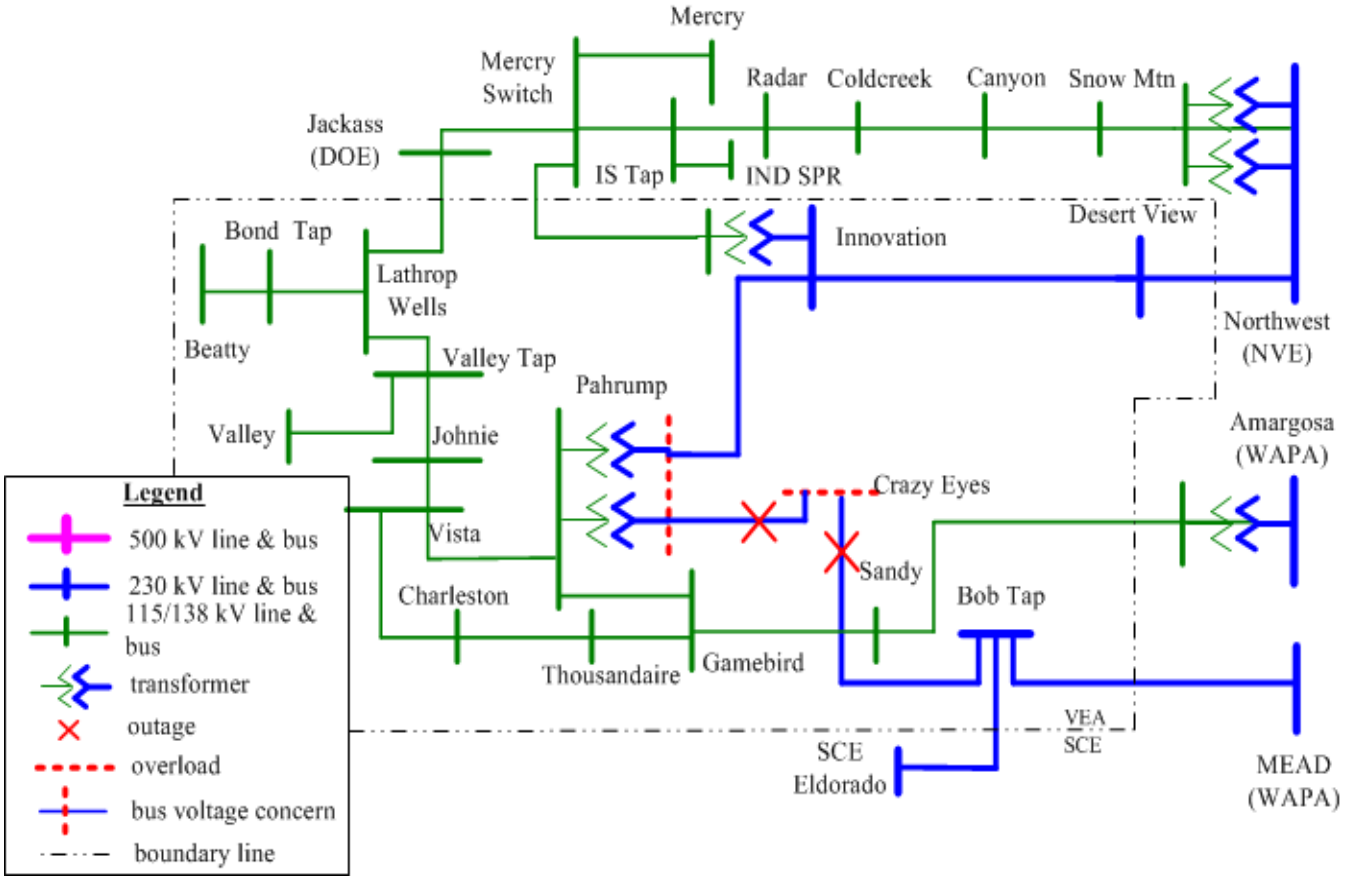
Valley Electric Area – N-1 Issue (1)

- Voltage deviation

  Over 5% voltage drop at Pahrump and Crazy Eyes 230kV (2015, 2018, 2023)

- Potential Mitigation

  An exception OR dynamic reactive support



Valley Electric Area – N-1-1 Issue (1)

- Overloads

  Northwest-Mercury138 kV lines (2015)

- Voltage Concerns

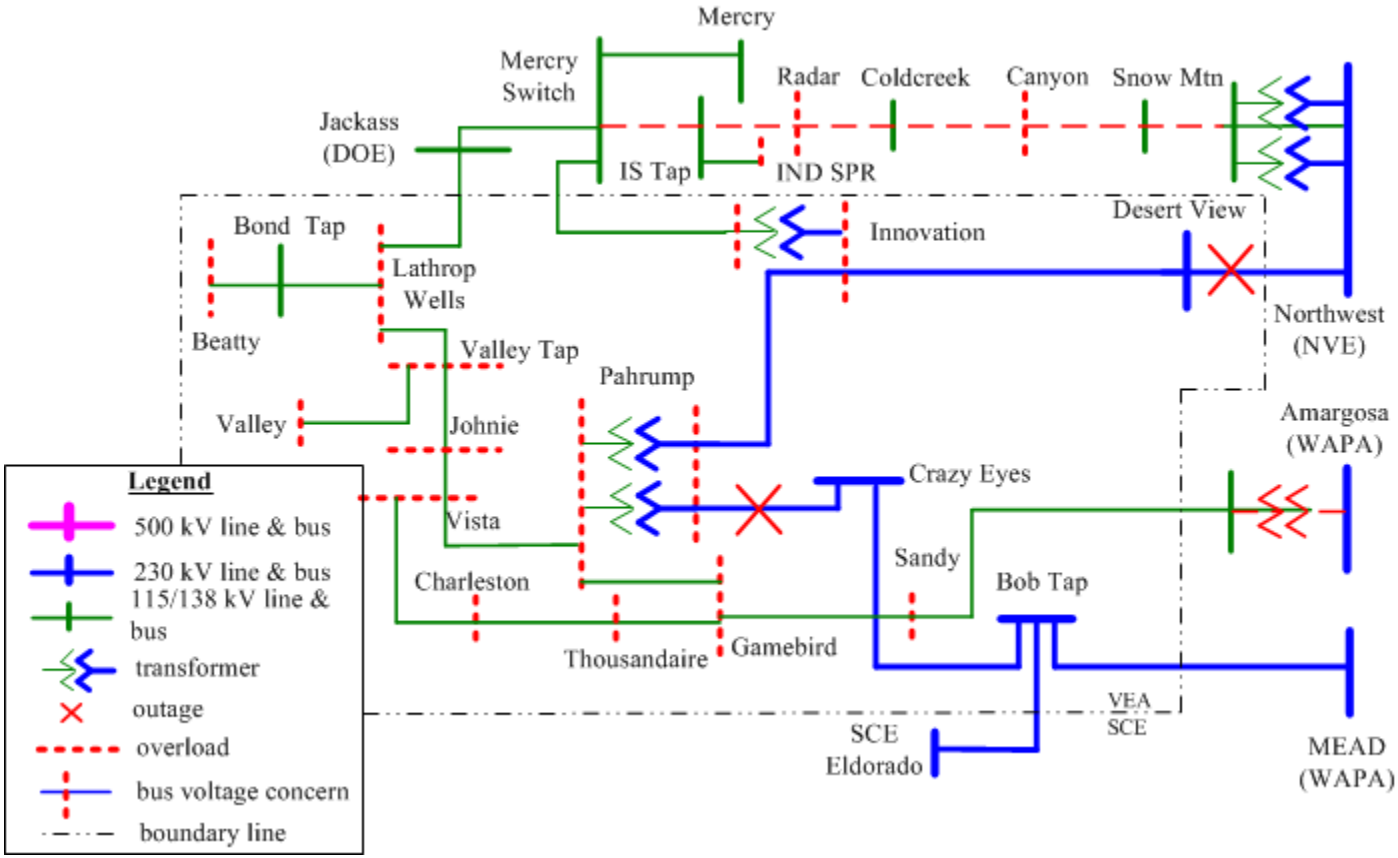
  Deviations and low votlages in Northern VEA & nearby NVE 138 kV areas (2015)

- Voltage collapse (2018 and 2023)

- Potential Mitigation

  Till 2015 - Existing UVLS is sufficient.

  Beyond 2015 - Radially serve VEA 138 kV system after 1st outage



Valley Electric Area – N-1-1 Issue (2)

- Overload

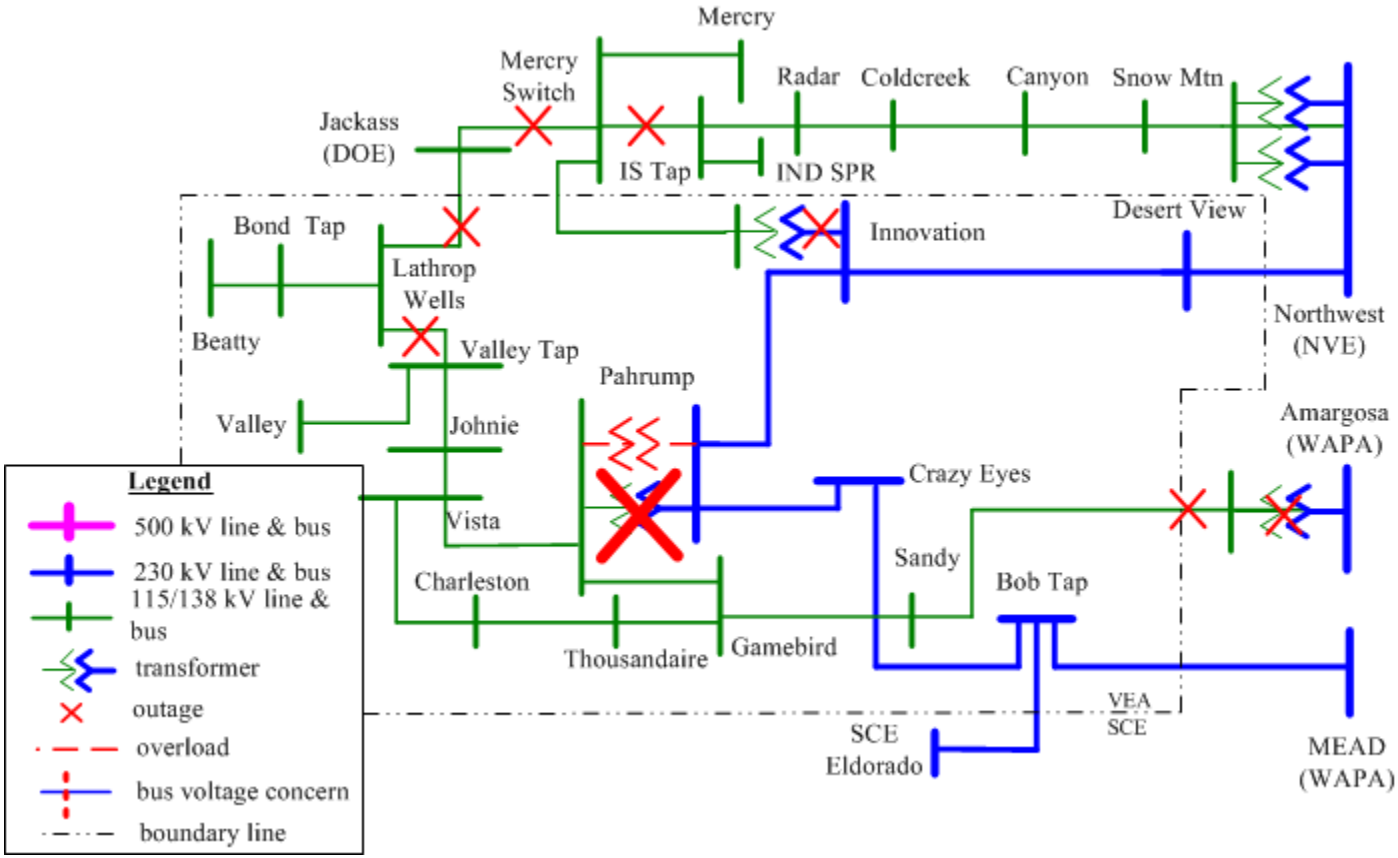
  Pahrump 230/138kV Bank (2018)

- Potential Mitigation

  Radialize 138kV system after the first N-1 to limit the amount of load being served from Pahrump

  OR

  A short-term rating on Pahrump banks and radialize the 138kV system or drop load after the second N-1



Valley Electric Area – N-1-1 Issue (3)

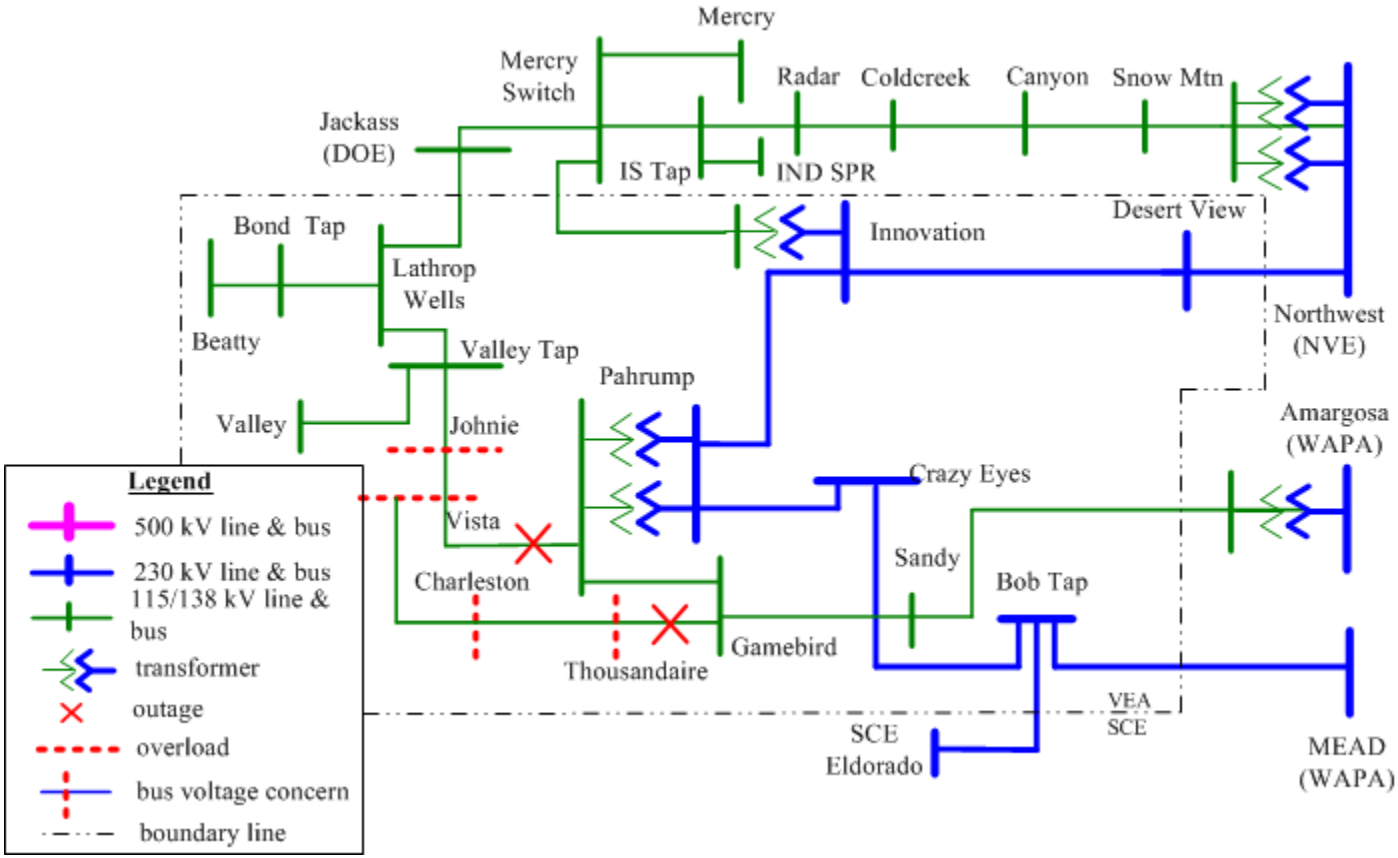
- Voltage deviation and low voltage

  Vista, Thousandaire, Charleston and Johnnie 138kV (2015 and 2018)

- Voltage collapse (2023)

- Potential Mitigation

  Open Charleston – Thousandaire 138kV line after the first N-1



Valley Electric Area – N-1-1 issue (4)

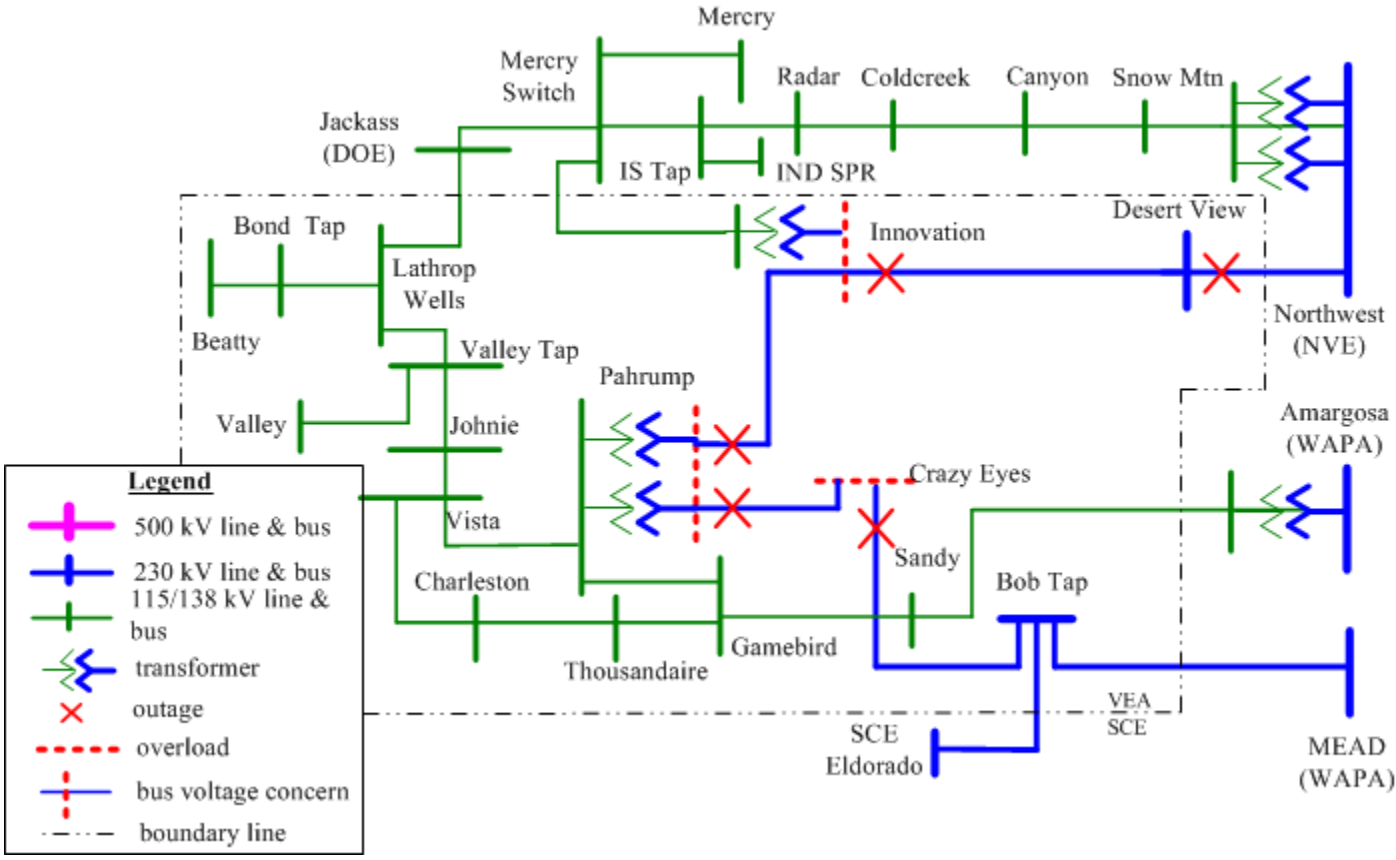
- Voltage Deviations Innovation, Pahrump and Crazy Eyes 230kV (2015 and 2018 non-peak)
- Low Voltages Innovation, Pahrump and Crazy Eyes 230kV (2015 non-peak)

- Potential Mitigation

  Lock/adjust the 230/138kV and 138/24kV taps after the first N-1

  OR

  UVLS to monitor the HV side



SCE Area
Preliminary Reliability Assessment Results

Nebiyu Yimer
Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

SCE Area

Study Area	Engineer
LA Metro & Eastern Areas	Nebiyu Yimer
Tehachapi, Big Creek & Antelope Bailey Areas	Sanjay Patil
North of Lugo & East of Lugo Areas	Sushant Barave

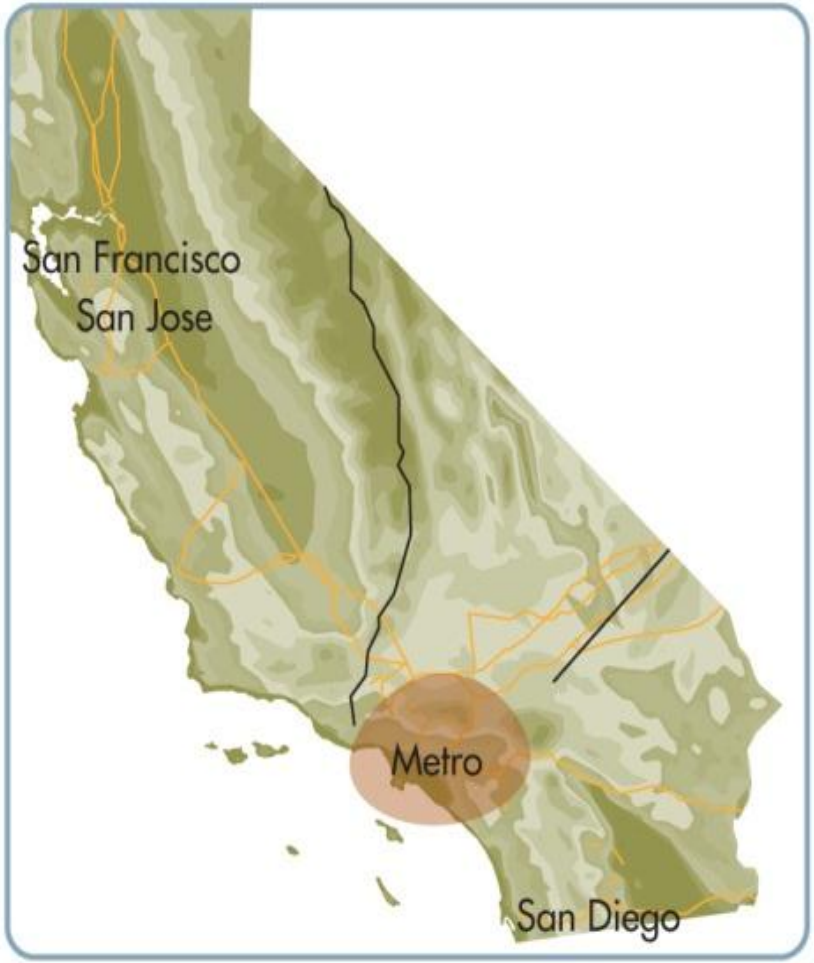
- No presentations for the Tehachapi, Big Creek & Antelope Bailey Areas today since no issues were identified

SCE Metro Area
Preliminary Reliability Assessment Results

Nebiyu Yimer
Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Metro Area



- Includes Los Angeles, Orange, Ventura and Santa Barbara counties, and parts of Riverside and San Bernardino counties
- Over 12,000 MW of existing generation
- Comprised of 500 and 230 kV transmission facilities
- 1-in-10 Summer Peak load of 23,321 MW in 2023
- SONGS retired

Metro Area Assessment Summary

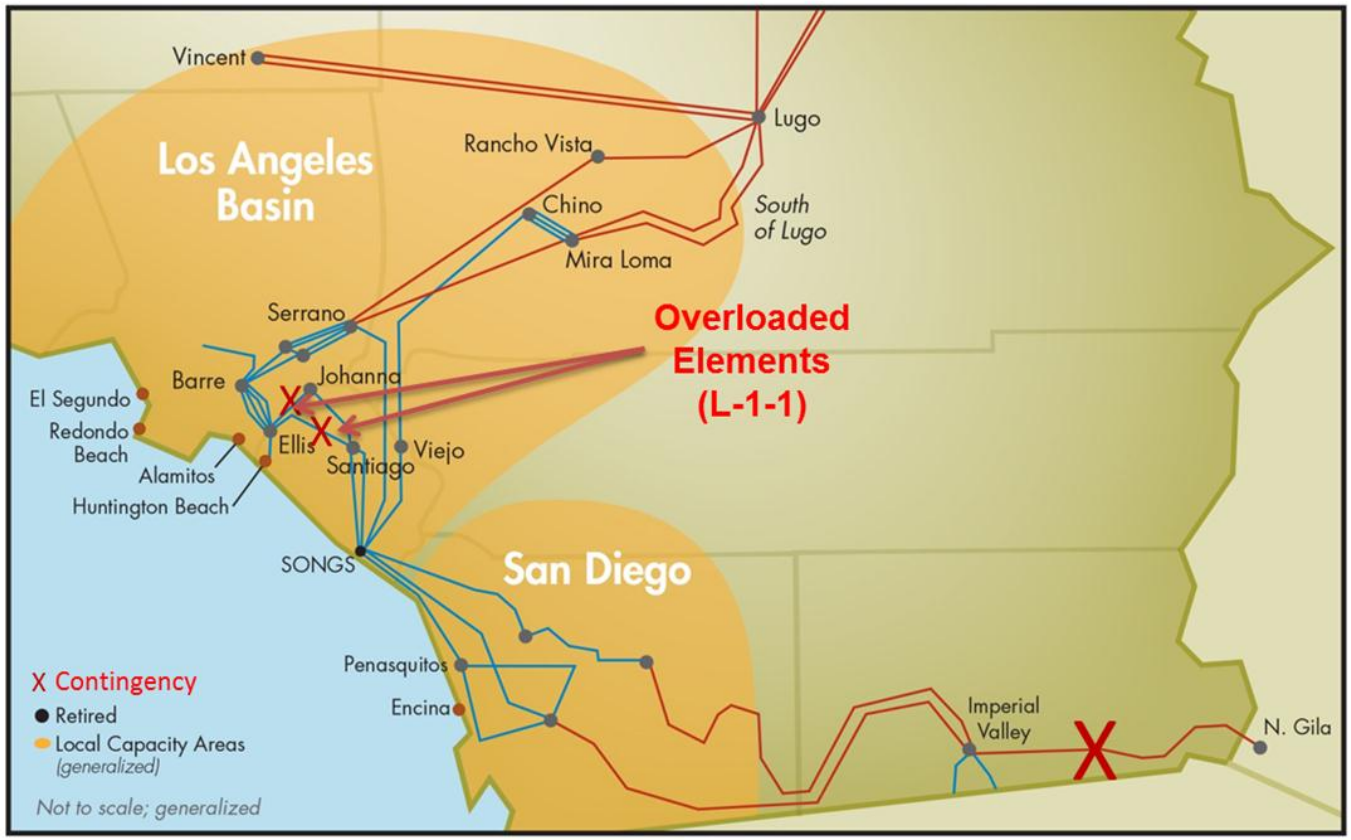
- The assessment identified:
  - Thermal overload due to Category C - 5
- Compared to last year results:
  - The above issues were not identified in last year's analysis with SONGS

Metro Area Potential Solutions

- Potential Mitigation Solutions
  - Dispatch all available generation in LA Basin/San Diego areas (SONGS study area) to full capacity, add and dispatch preferred resources
  - Increase ratings of Ellis–Santiago & Ellis–Johanna 230 kV lines
  - New 500 kV source(s) in the SONGS study area
  - Operating solutions
  - Selection of preferred mitigations will be closely coordinated with the CPUC LTTP process and the mitigations identified for the SDGE area
  - May not happen prior to March 2014 and could extend into the next planning cycle

Metro Area – Results

- Thermal overload
  - Ellis–Johanna 230 kV line (2015)
  - Ellis–Santiago 230 kV line (2015)
- Potential Mitigation
  - Increase the ratings of the lines to the full rating of the conductors or
  - Dispatch all available generation, add/dispatch preferred resources



Metro Area – Results

- Thermal overload
  - Vincent 500/230 kV #1 bank (~ 2017)
  - Serrano 500/230 kV banks (2015)
  - Chino–Mira Loma #3 230 kV line (2015)
- Potential Mitigations
  - Dispatch all available local generation to maximum capacity, add/dispatch preferred resources
  - New 500 kV source(s) in the SONGS study area
  - Operating solutions

North of Lugo Area
Preliminary Reliability Assessment Results - Draft

Sushant Barave
Sr. Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

North of Lugo Area

- Comprised of 55, 115, and 230 kV transmission facilities.
- Over 2,599 MW of existing generation.
- Summer Peak load of 1,445 MW in 2023.

North of Lugo Area Assessment Summary

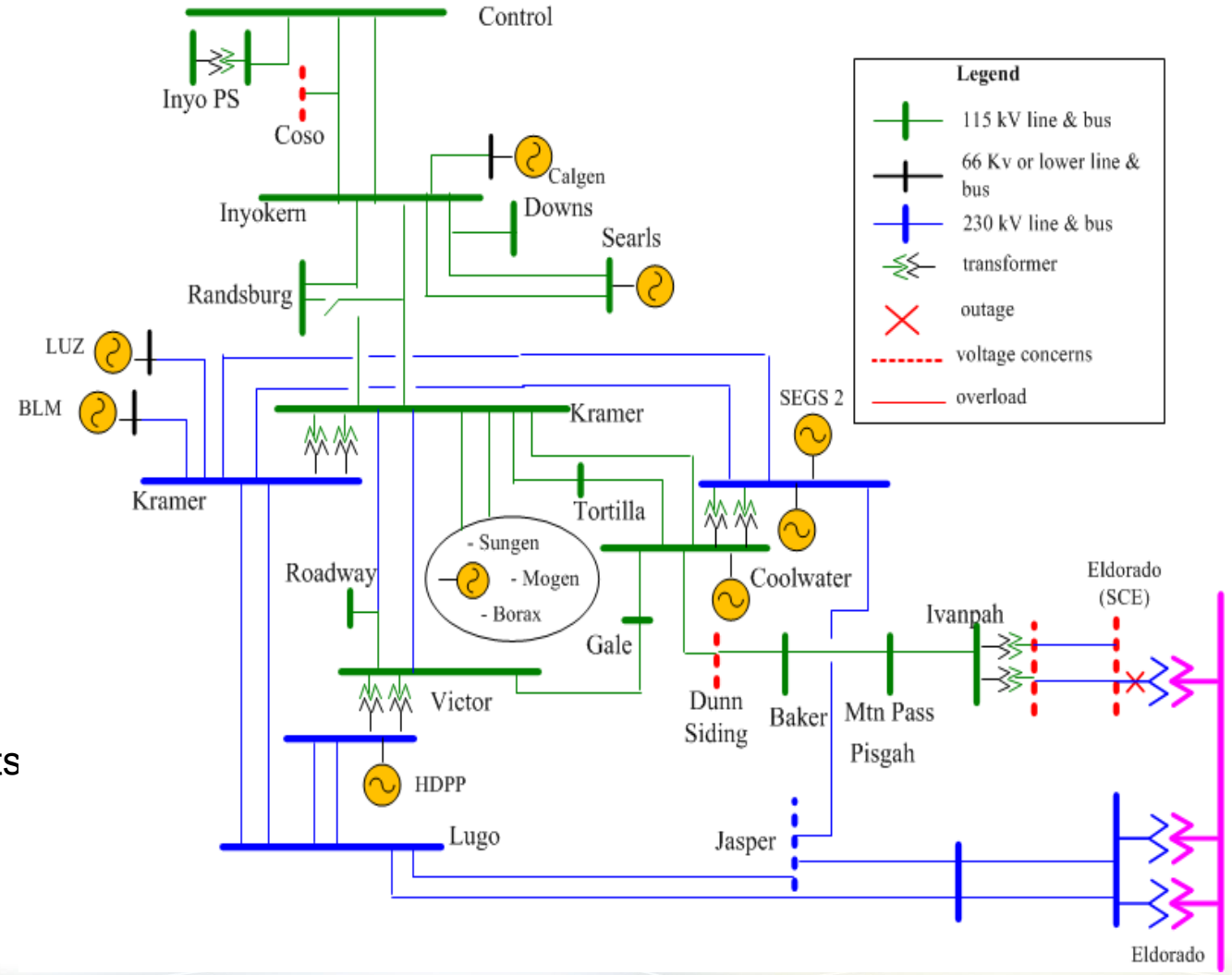
- The assessment identified:
  - Voltage issues under normal condition (N-0) – 4 (peak)
  - Thermal overloads due to Category B – 1 (non-peak)
  - Thermal overloads due to Category C3 – 3 (peak)
  - Voltage issues due to Category B – 4 (peak and off-peak)
  - Voltage issues due to Category C3 – 17 (peak and non-peak – triggered by 6 C3 combinations)
  - Transient stability issue due to Category C5 - 1
- Compared to last year results:
  - Load in this generation export area went down by 62 MW
  - 2018 summer light-load scenario was studied and resulted in some new issues
  - Additional generation modeled North of Control caused some issues under N-1-1 (C3) situations

North of Lugo Area Potential Solutions

- Potential Mitigation Solutions
  - Tap adjustment at Eldorado and Ivanpah transformers
  - Exceptions for some voltage issues
  - Maintain generation below a certain level under pre-contingency condition
  - System readjustments (curtail generation, reactive device switching) after the first N-1 contingency for category C3 issues.
  - Kramer RAS modification to curtail generation North of Kramer-Inyokern lines
  - Victor loop-in into Kramer-Lugo 230kV line

North of Lugo Area – N-0 Issues (1)

- High Voltage
  - Eldorado, Ivanpah 230kV (2015 peak), Dunn Siding 115kV (2023 peak)
- Low Voltage
  - Coso 115kV (2023 peak)
- Potential Mitigation
  - Tap adjustment at Eldorado 500/230 kV transformer and at Ivanpah 230/115 kV transformer
  - Boost voltage set points of gen connected to Inyokern

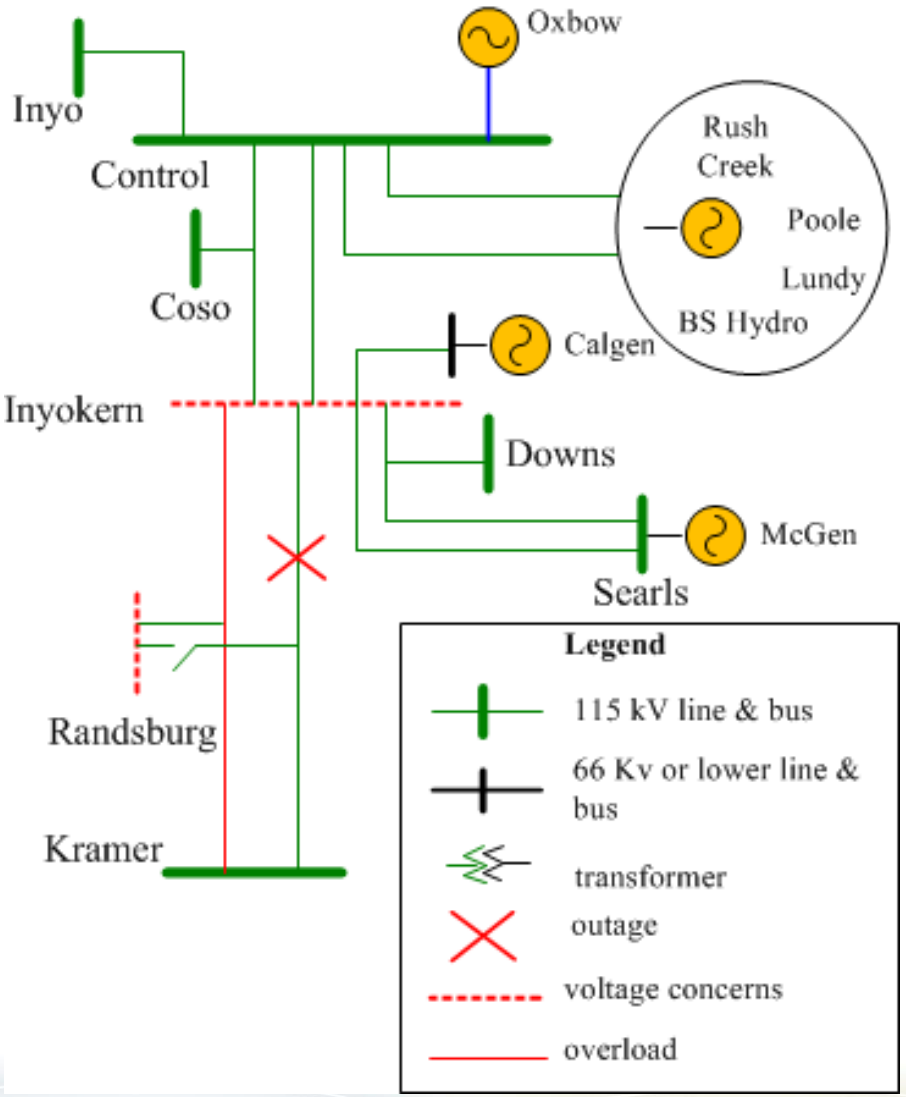


North of Lugo Area – N-1 Issues (1)

- Thermal Overload
  - Inyokern – Kramer 115kV line #1 (2015 non-peak)
- Voltage Deviation >5%
  - Inyokern and Randsburg 115kV (2015, 2018, 2023 peak/non-peak)
- Potential Mitigation
  - An exception for voltage deviation issue

  OR
  - Re-dispatch generation pre-contingency (expected curtailment is less than a few hours per year)

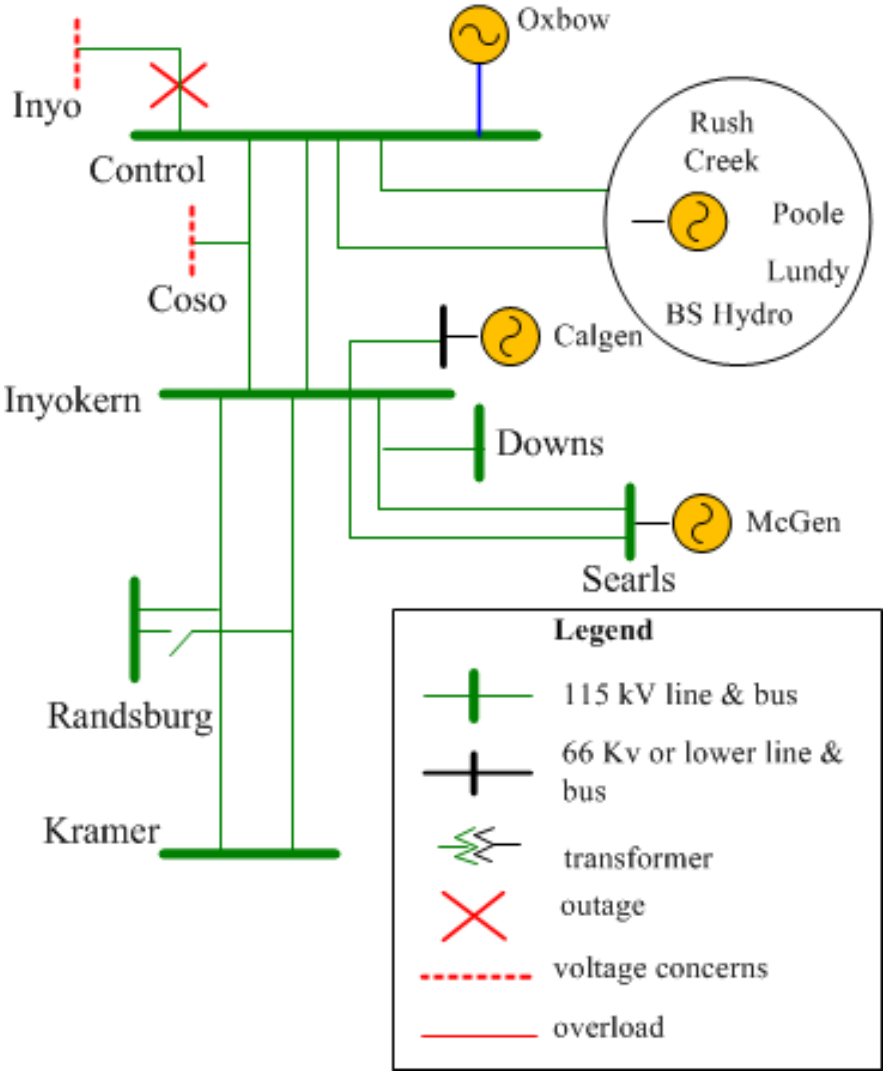
  OR
  - Modify Kramer RAS



North of Lugo Area – N-1 Issue (3)

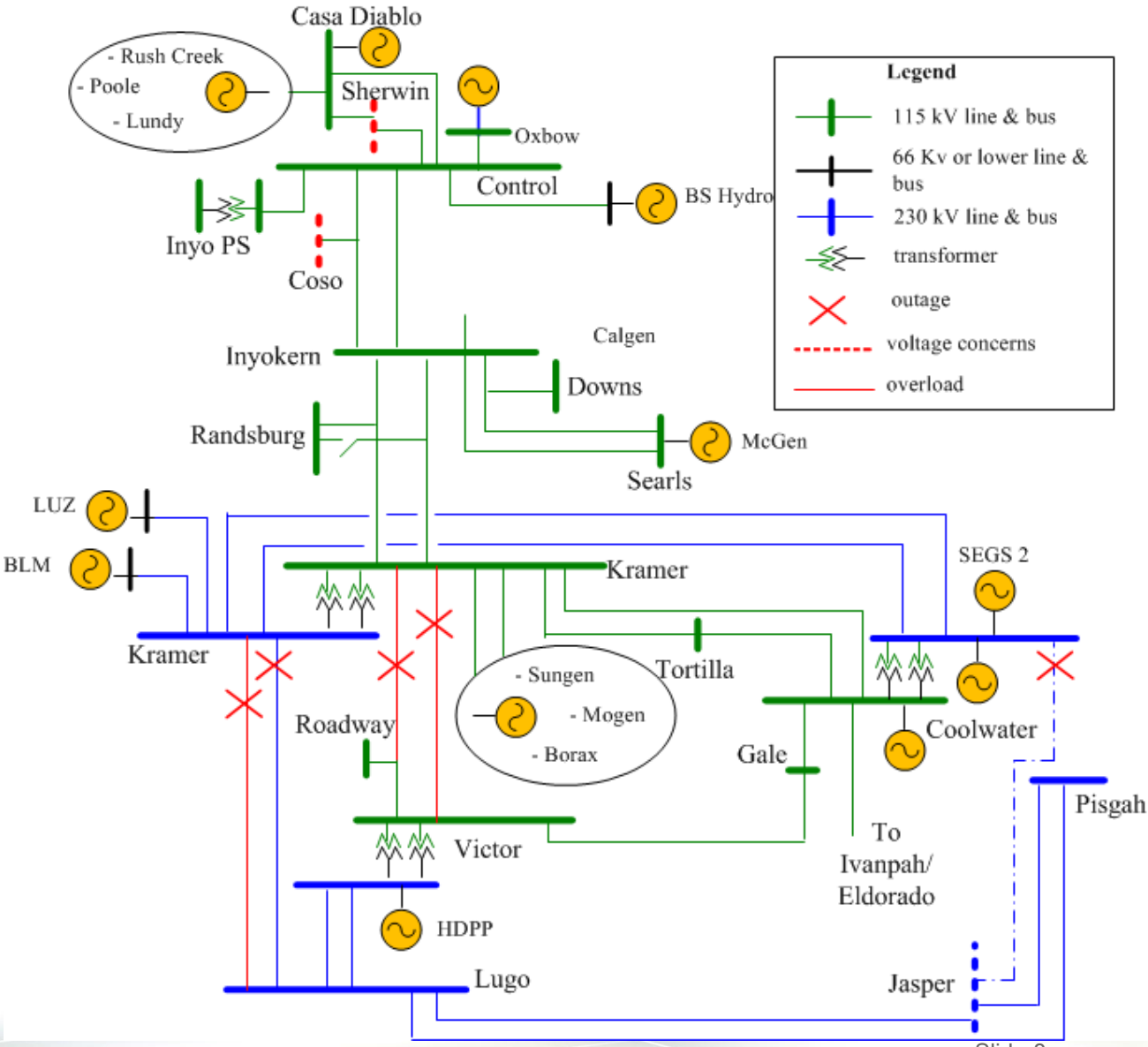
- Voltage Deviation >5%
  - Inyo 115kV (2018 light-load)
- Low Voltage
  - Coso 115kV (2023 peak)
- Potential Mitigation
  - An exception

  OR
  - RAS modification to trip generation North of Inyokern and Control



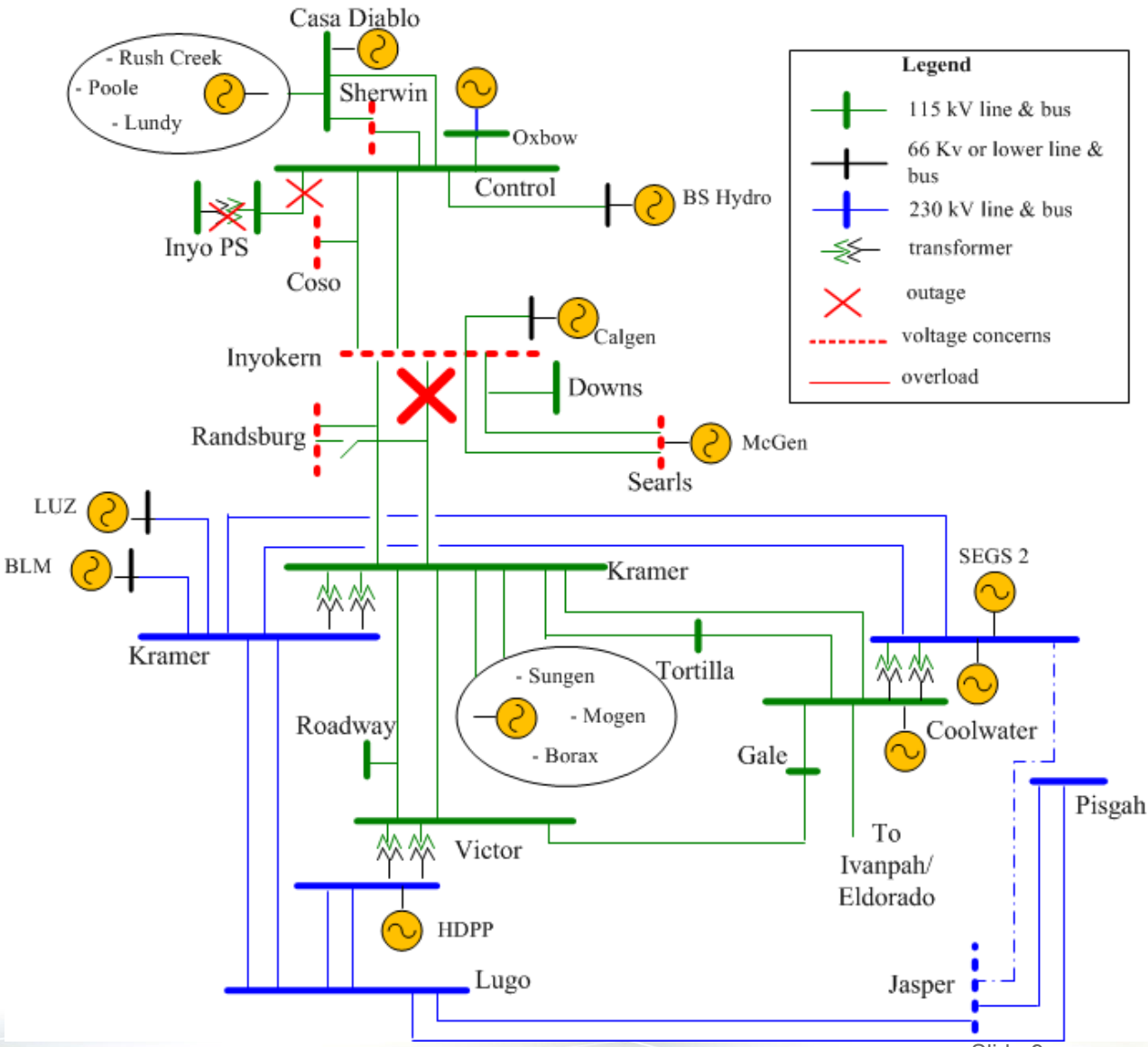
North of Lugo Area – N-1-1 Issue (1)

- Thermal Overload (peak)
  - Victor – Kramer 115kV line (2015, 2023)
  - Roadway – Kramer 115kV line (2015, 2023)
  - Kramer – Lugo 230kV line (2023)
- Potential Mitigation
  - Curtail generation after the first N-1 contingency



North of Lugo Area – N-1-1 Issue (2)

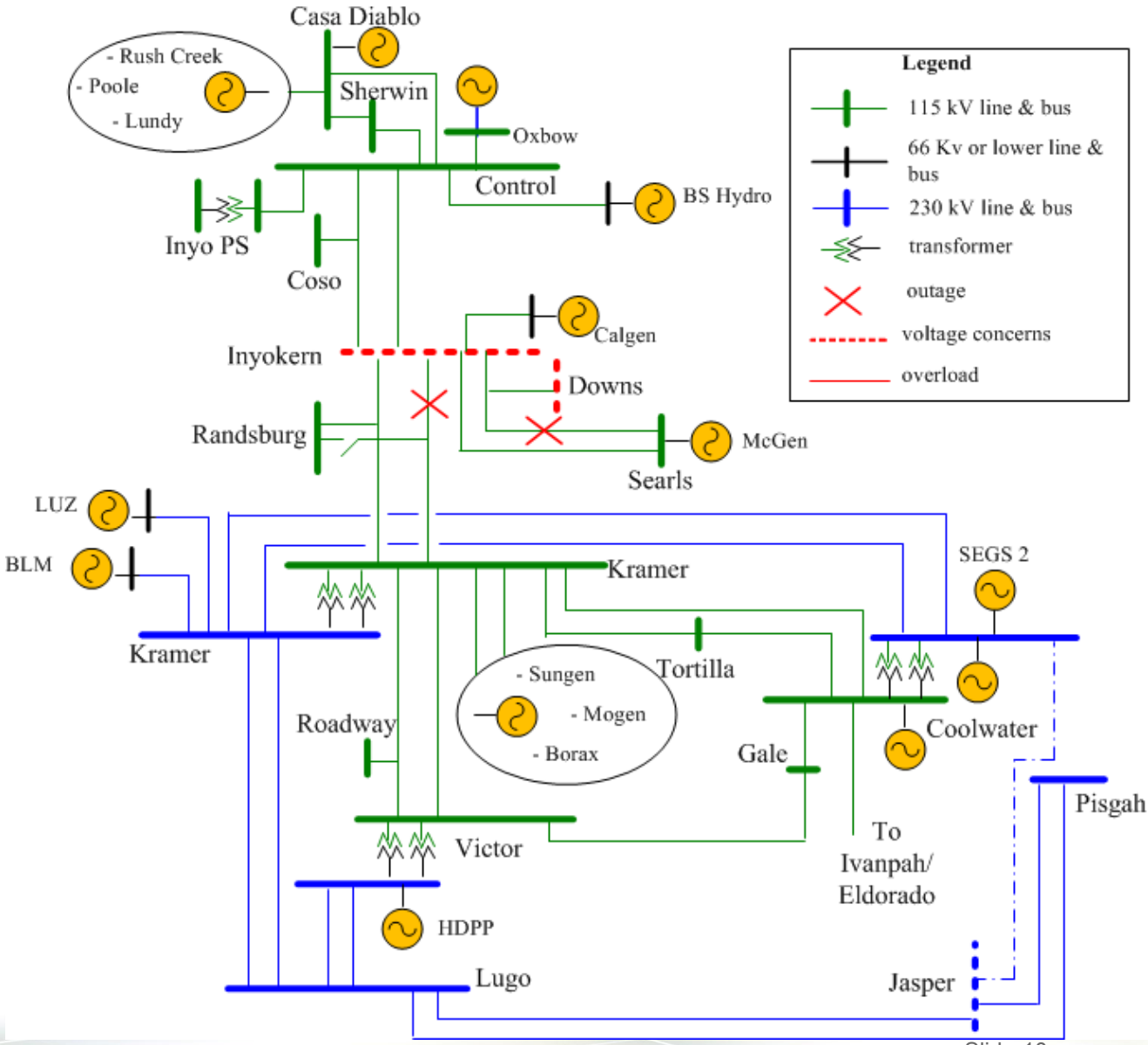
- Voltage Deviation > 10%
  - Inyokern, Randsburg,(2023 peak, 2015 off-peak)
  - Coso, Downs 115kV (2023 peak)
- Low Voltage
  - Downs, Inyokern 115kV (2023 peak)
  - Sherwin 115kV (2018 light-load)
- Potential Mitigation
  - Curtail generation North of Control / Inyokern after the first N-1
    OR
    Modify Kramer RAS to drop gen after the second N-1
  - Under light-loads, ensure that QFs are ON.



North of Lugo Area – N-1-1 Issue (3)

- Voltage Deviation > 10%
  - Inyokern and Downs 115kV (2023 peak)
- Low Voltage
  - Downs 115kV (2018, 2023 peak)
- Potential Mitigation
  - Curtail generation North of Control / Inyokern after the first N-1
    OR
    Modify Kramer RAS

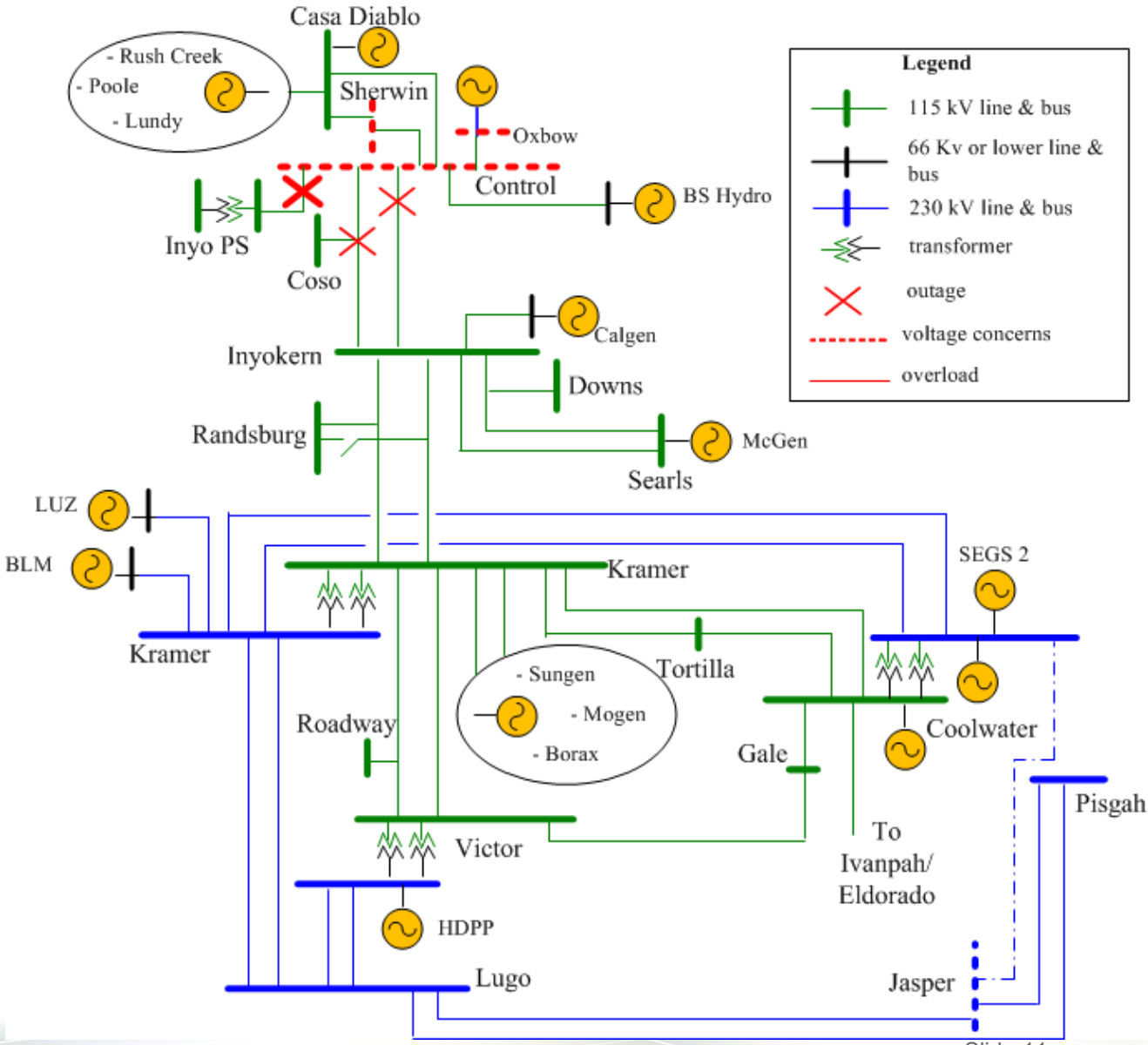
  (If Inyokern-Kramer is the first N-1 then existing procedure will balance load and gen in this area)



North of Lugo Area – N-1-1 Issue (4)

- Voltage Deviation > 10%
  - Control, Oxbow 115kV (2018 light-load)
- Low Voltage
  - Sherwin 115kV (2018 light-load)
- Potential Mitigation
  - Adjust line shunt reactors and voltage schedules North of Control after the first contingency

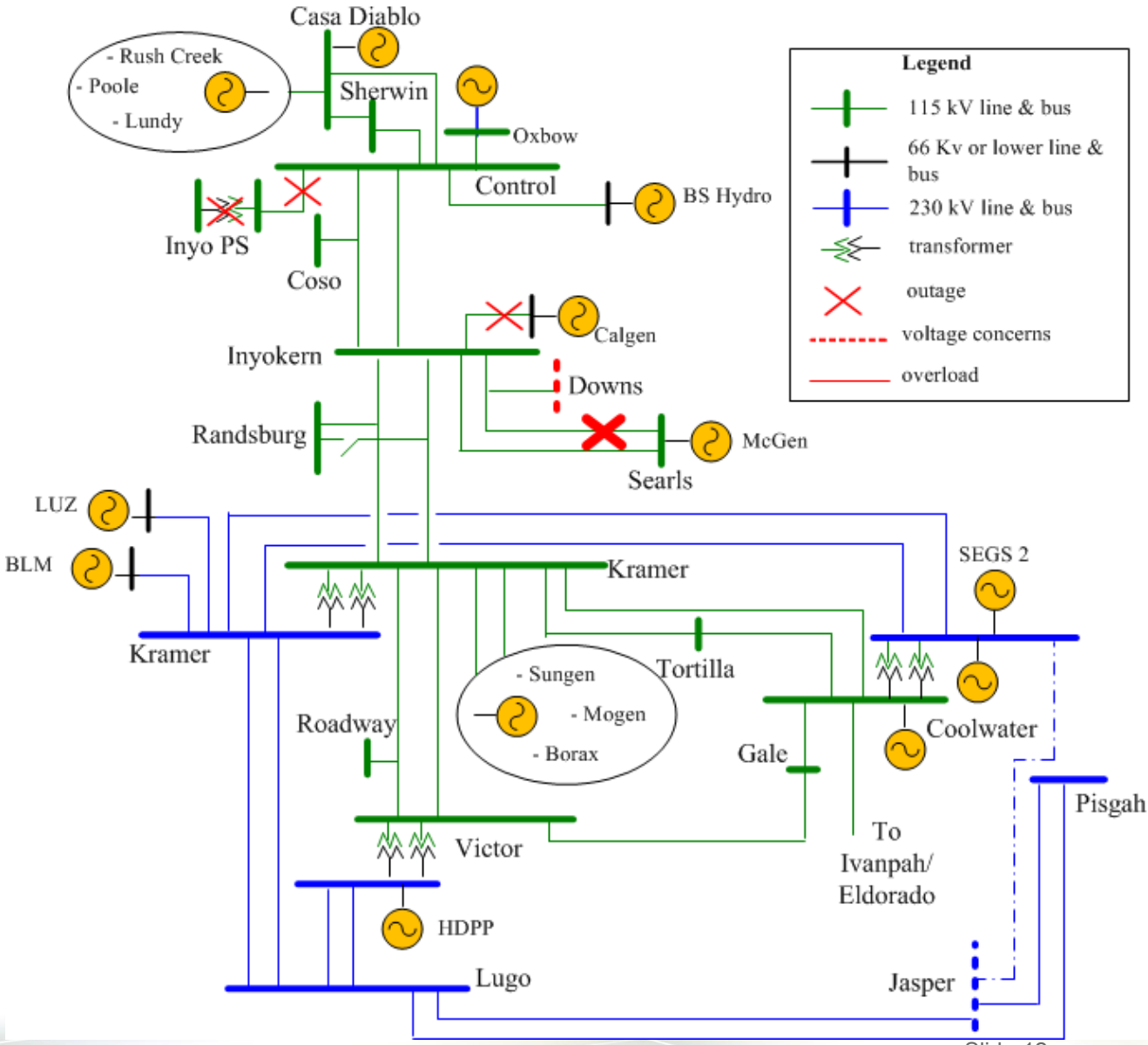
  OR
  - Under light load condition, ensure that some generation resources are on-line.



North of Lugo Area – N-1-1 Issue (5)

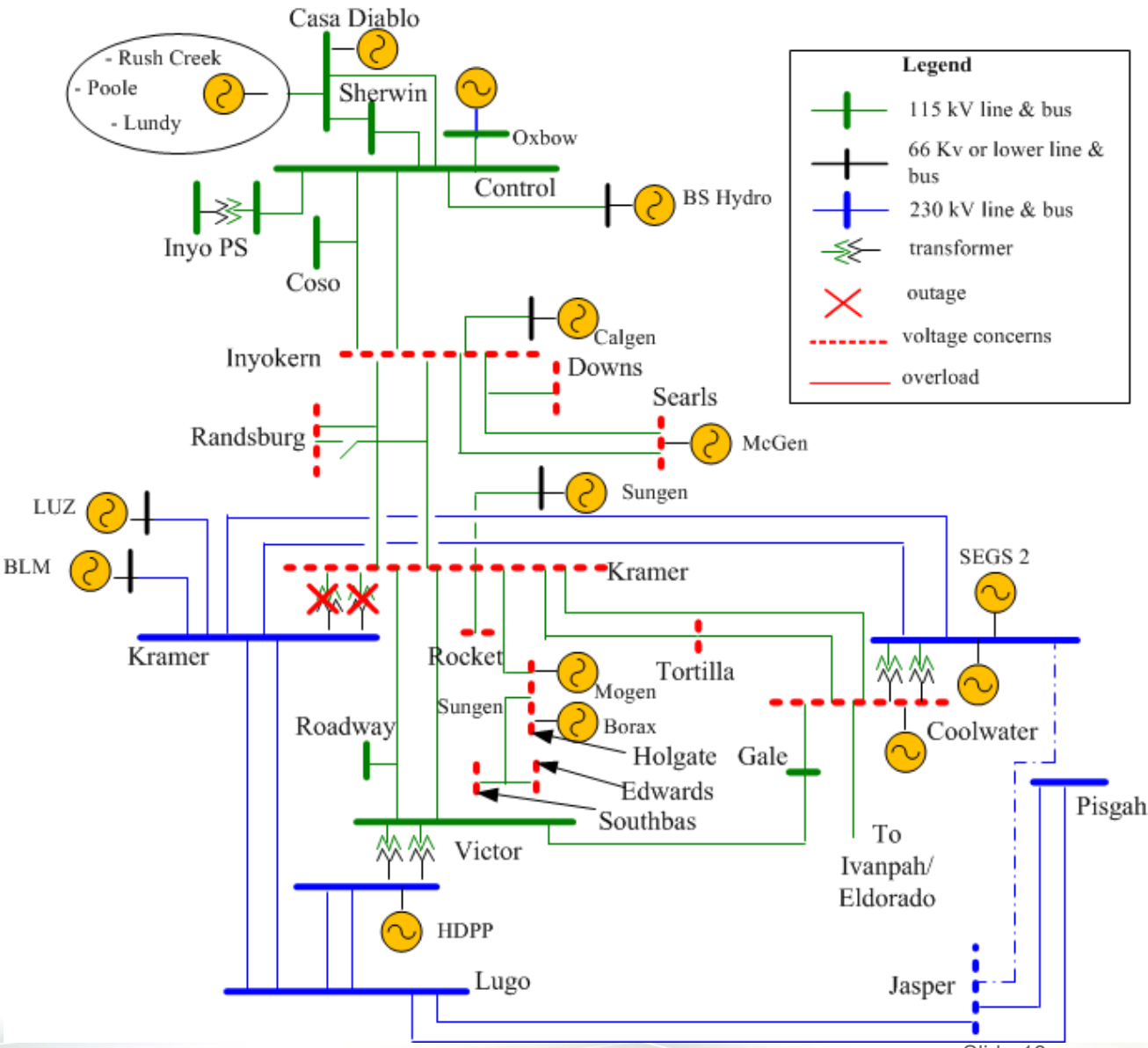
- Low Voltage
  - Downs 115kV (2023 peak)
- Potential Mitigation
  - Curtail McGen after the first N-1

  OR
  - Add reactive support



North of Lugo Area – N-1-1 Issue (6)

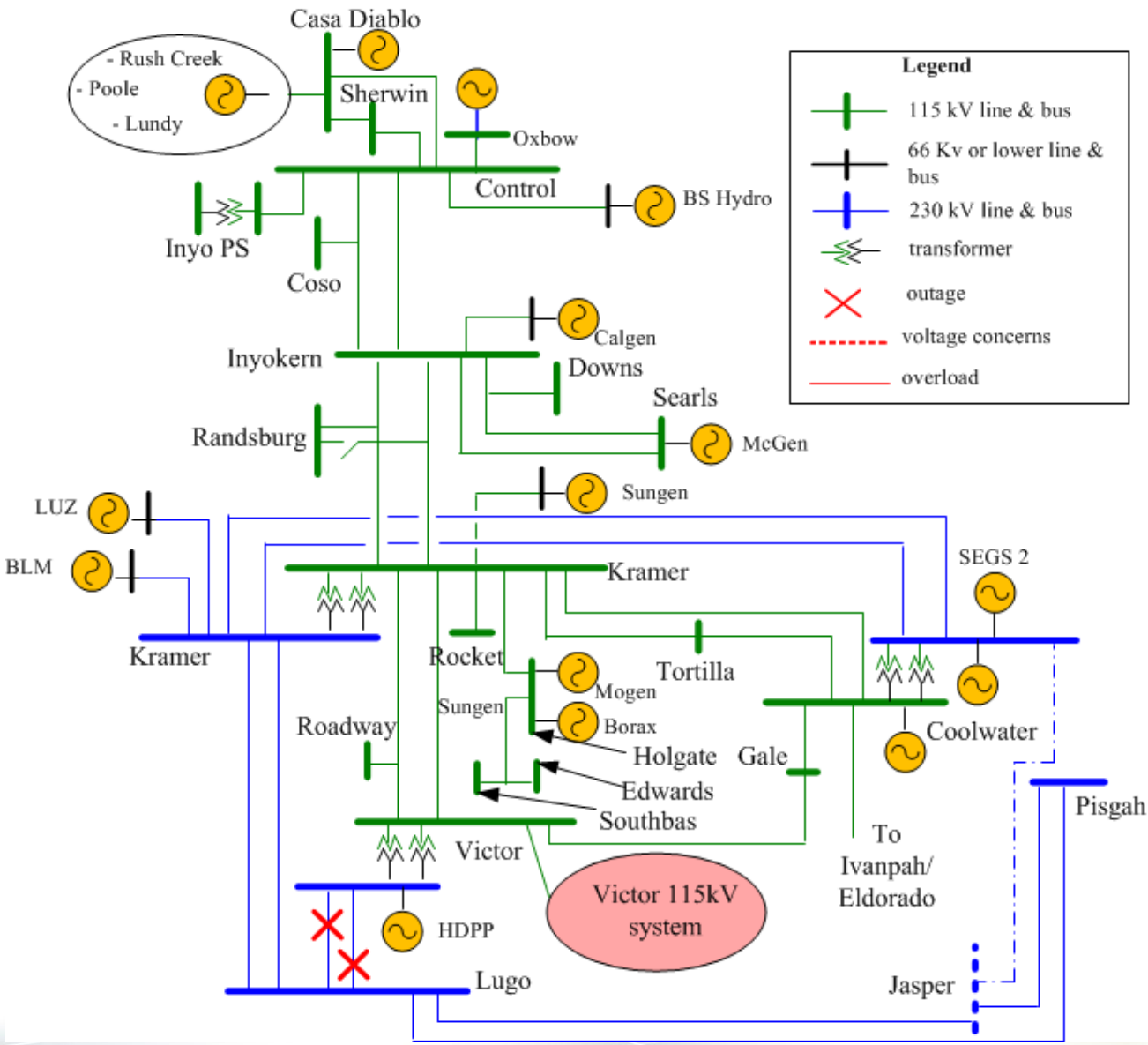
- Voltage Deviation >10% and low voltage
  - Kramer, Coolwater, Holgate, Inyokern, Searles, Downs, Randsburg, Rocket, Edwards, Southbas, Tortilla, Tiefort, Gale, 115kV (2018 light-load)
- Potential Mitigation
  - Reactive device adjustment (caps at Tortilla and Kramer) after the first contingency. Make sure that some generation is on-line during light-load condition for voltage regulation purpose.



North of Lugo Area – N-2 Issue (1)

- Transient Voltage Dip
  - Kramer 115kV area (starts in 2015 peak)
- Potential Mitigation
  - Modify existing HDPP RAS to drop load

  OR
  - Loop-in Victor into Kramer – Lugo 230kV line



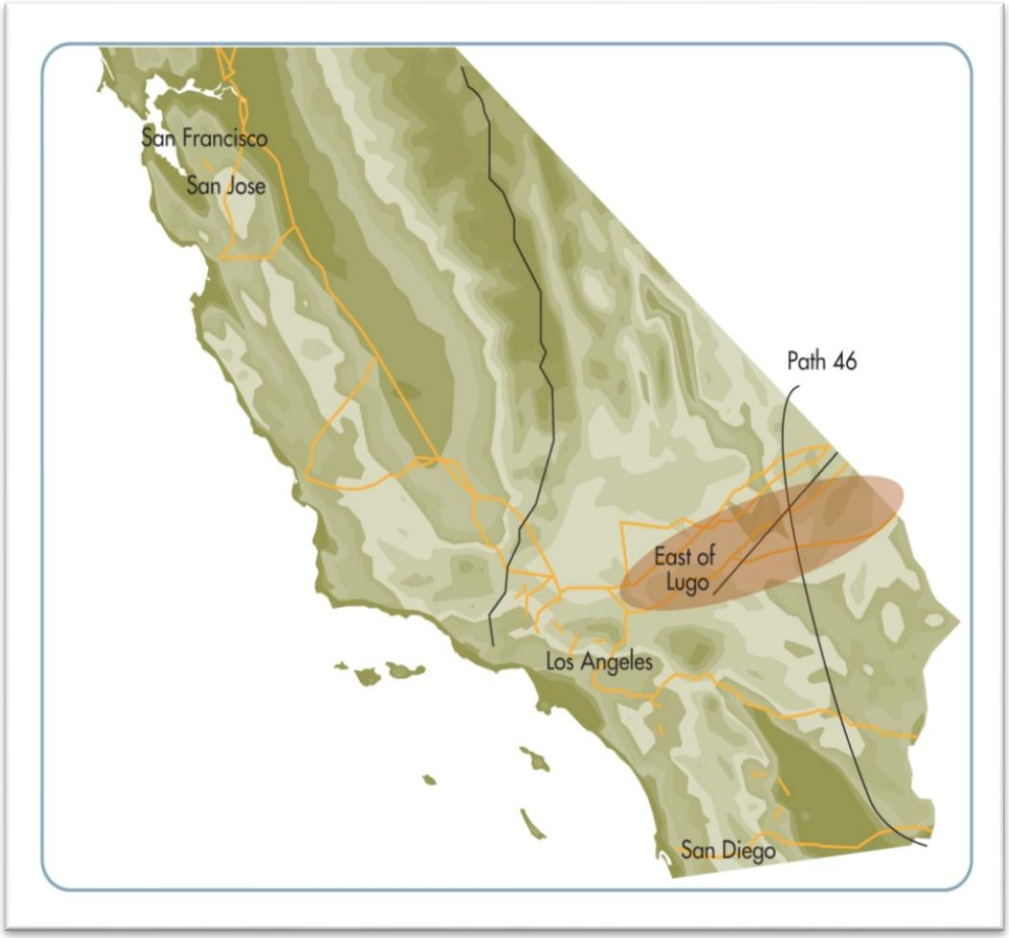
California ISO
Shaping a Renewed Future

East of Lugo Area
Preliminary Reliability Assessment Results

Sushant Barave
Sr. Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

East of Pisgah Area



- Includes Eldorado, Mohave, Merchant, Ivanpah, CIMA, Pisgah Mountain Pass, Dunn Siding and Baker substations
- Generation:
  - 1,061 MW in 2015
- Comprised of 115, 230 & 500 kV transmission facilities.
- Summer Peak load of 14 MW in 2022

East of Pisgah Area Assessment Summary

- The assessment identified:
  - 1 overload due to Category C outages
- Compared to last year results:
  - 1 branch overloaded due to Category C outage
  - Approved policy-driven project to upgrade Lugo-Eldorado 500kV series cap mitigated some 230 kV and 500 kV issues reported last year
  - Generation drop SPSs identified under GIP/GIDAP were modeled (Ivanpah area SPS and gen-drop for the loss of Eldorado 500/230kV bank)

East of Pisgah Area Proposed Solutions

- Potential Mitigation Solutions

  - Curtail West of the River path flow after the first contingency

  AND/OR

  - Curtail East of Pisgah generation after the first contingency
  - Policy-driven transmission project mitigates the overload in later years.

East of Pisgah Area – N-1-1 issue (1)

- Thermal Overload

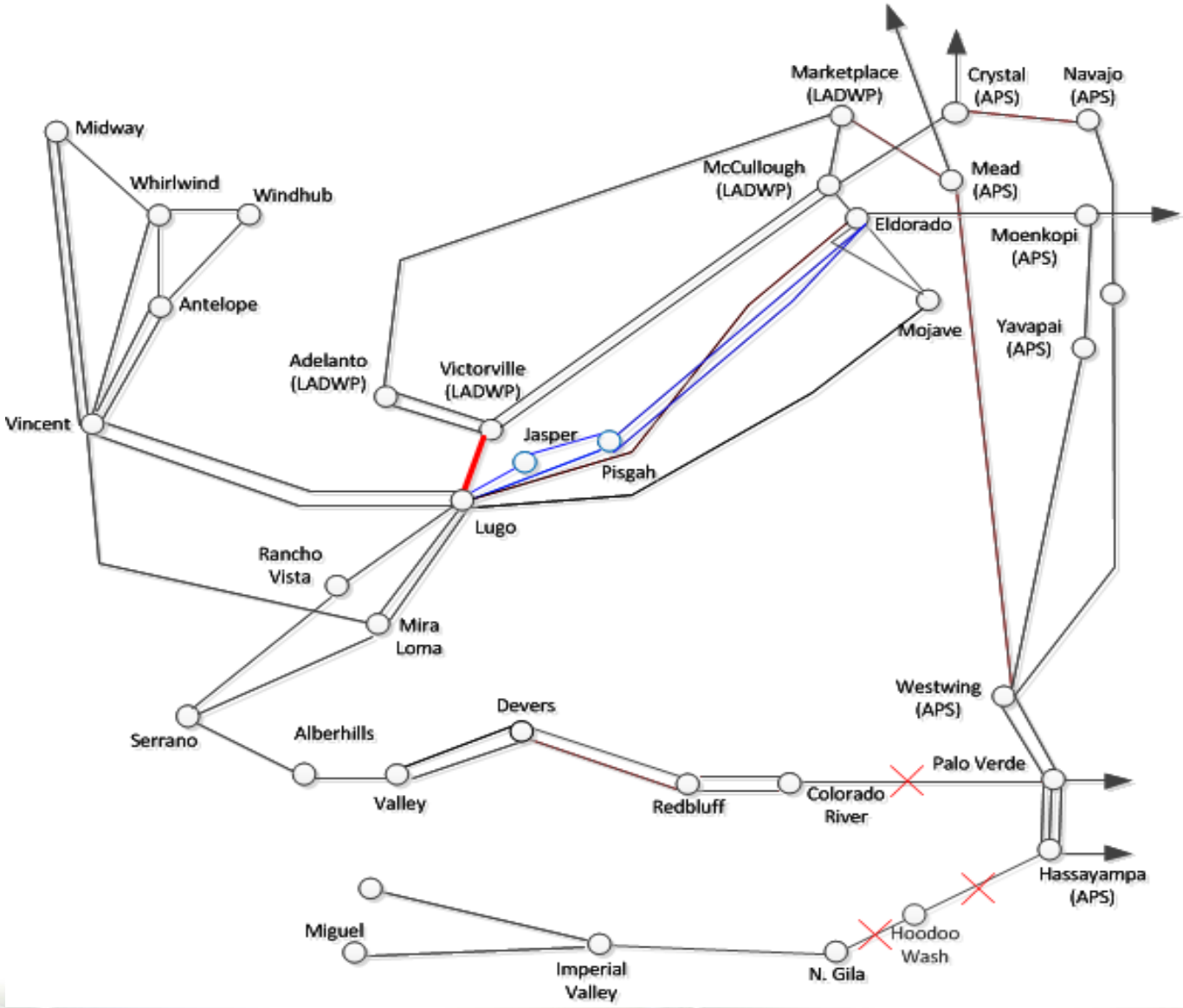
  Lugo – Victorville 500kV (2015)

- Potential Mitigation

  Curtail WOR flow after the first contingency

  OR

  Curtail generation in the East of Pisgah area after the first contingency

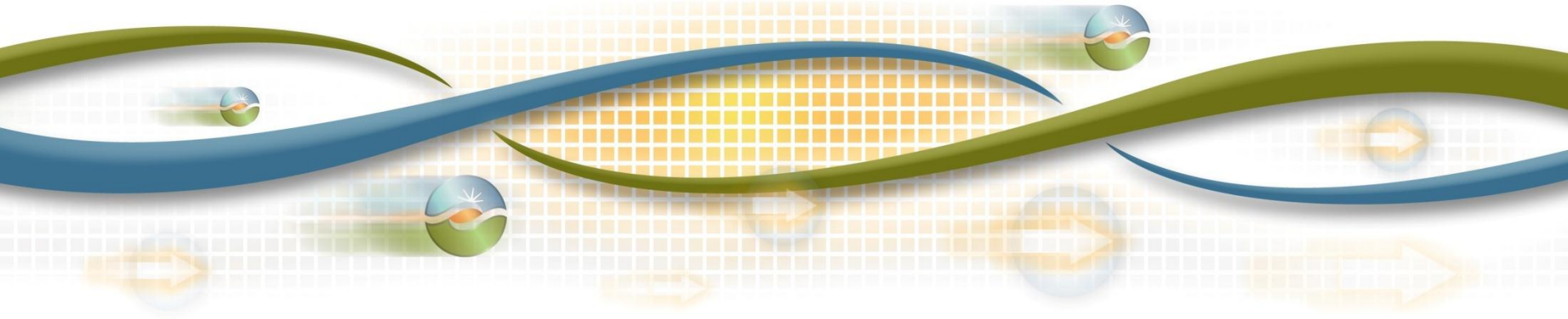


California ISO
Shaping a Renewed Future

SCE Eastern Area
Draft Preliminary Reliability Assessment Results

Nebiyu Yimer
Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013



SCE Eastern Area

- Includes the SCE owned transmission system in the Riverside County around and west of the Devers Substation
- Generation: over 2,000 MW of generation
- Comprised of 500, 230 and 161 kV transmission facilities.
- Summer Peak load of 1100 MW in 2023

SCE Eastern Area Assessment

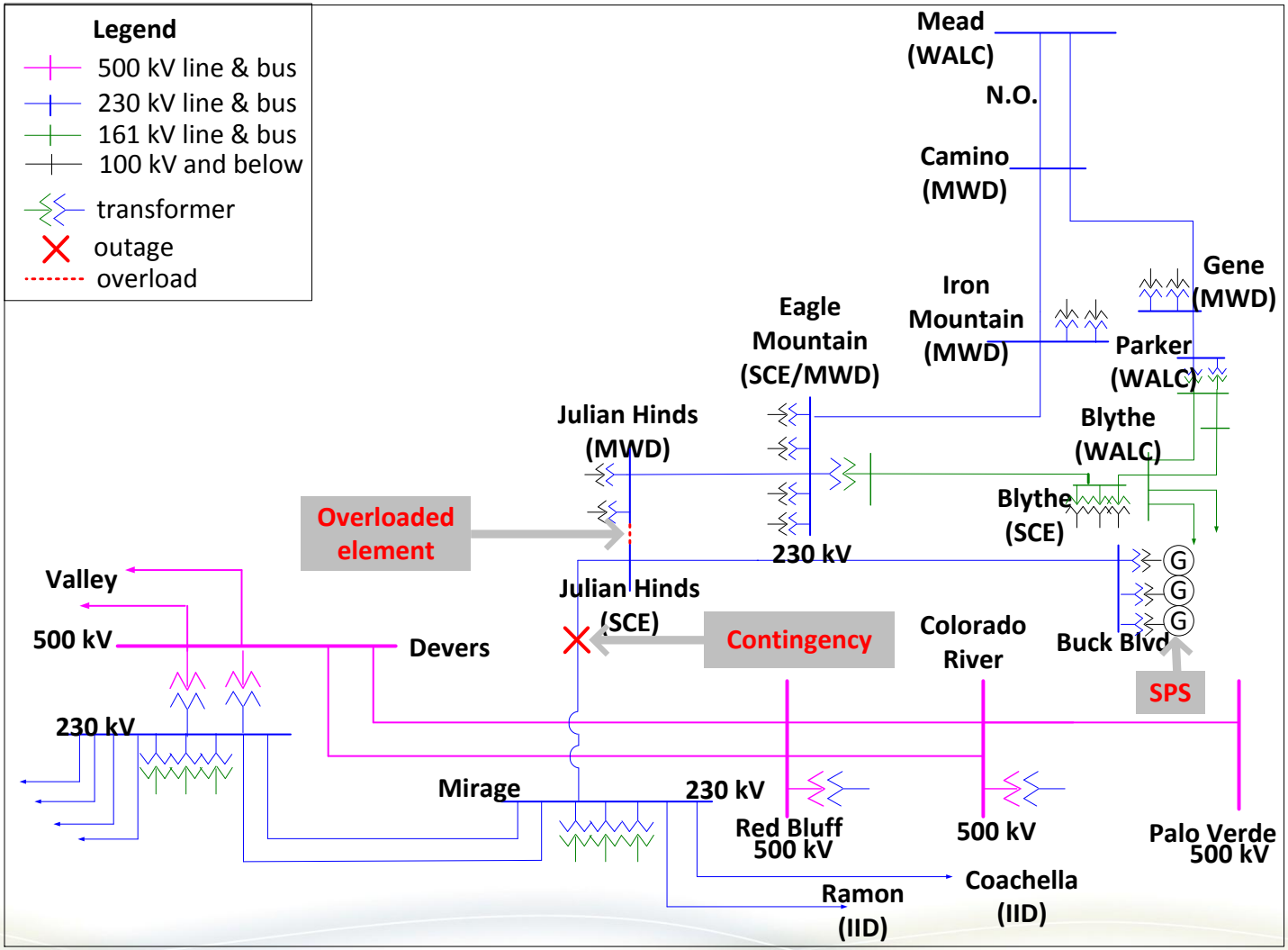
- The assessment identified:
  - 1 Category B and 2 Category C overloads
  - 3 Category C low voltage/voltage stability problems
- Compared to last year results:
  - 1 new low voltage/voltage stability problem
  - Revised potential mitigations are identified

SCE Eastern Area Proposed Solutions

- Potential Mitigation Solutions
  - 1 facility rating increase (bus-tie, 2014)
  - SPS modification (2014)
  - Operating solutions (2014)

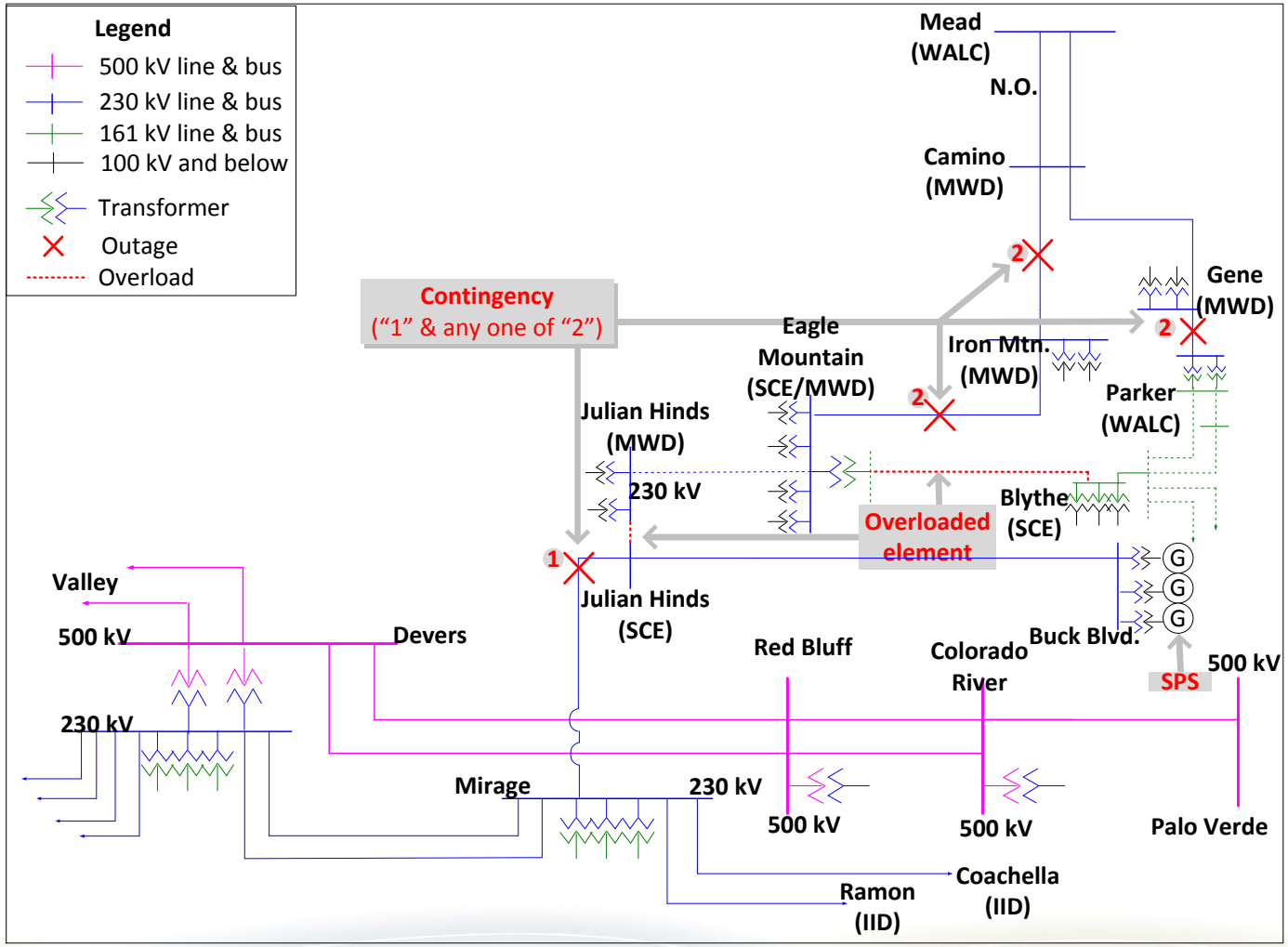
SCE Eastern Area – Results

- Thermal overload (1st stage of SPS activated) (2014)
  - Julian Hinds 230 kV bus-tie
- Potential Mitigation:
  - Increase bus-tie rating
  - Modify SPS (to prevent second stage of SPS from being activated)



SCE Eastern Area – Results

- Thermal overload (1st stage of SPS activated) (2014)
  - Julian Hinds 230 kV bus-tie
  - Eagle Mtn.–Blythe 161 kV line
- Low voltage/instability if 2nd stage of SPS is activated or local gen. unavailable (2014)
- Potential Mitigation:
  - Increase bus-tie rating and modify SPS
  - Close Mead-Camino West line
  - Open Eagle Mtn.–Blythe (post N-1)

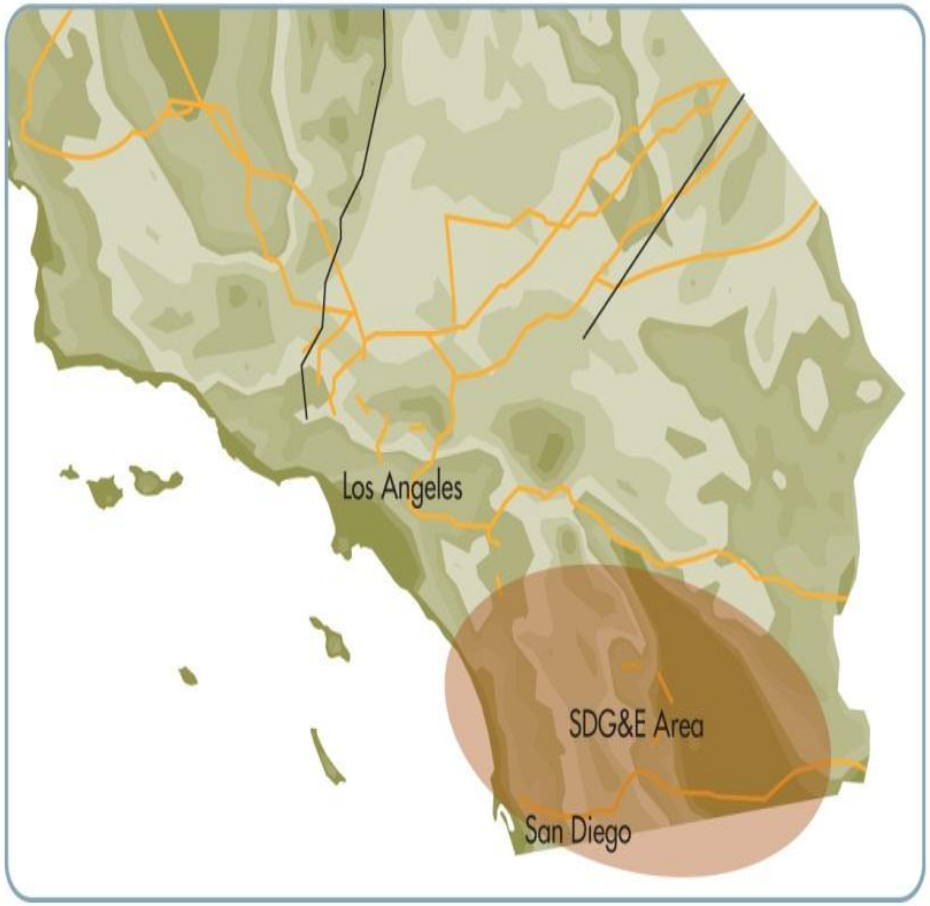


San Diego Gas & Electric Area
Preliminary Reliability Assessment Results

Frank Chen
Sr. Regional Transmission Engineer

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

SDG&E Area



- Consisted of main transmission facilities (230/500kV) and sub-transmission facilities(69/138kV)
- Generation: Over 4,700 MW of qualifying capacity by 2014
- SONGS Nuclear Plant retirement and OTC assumptions
- Summer Peak load of 5,784 MW with Energy Efficiency load reduction in 2023

SDG&E Area Assessment Summary

- The assessment identified:
  - 9 branches overloaded due to Category B outages
  - Various branches overloaded due to Category C outages
  - 5 buses with voltage concern for Category B outages
  - Various buses with voltage concern for Category C outages
  - 2 post-transient voltage instability concerns due to Category B and C outages
- Compared to last year results:
  - A few thermal violations in the main transmission system due to the SONGS retirement
  - Various thermal violations in the sub-transmission system
  - Previous approved projects eliminated multiple Category B and C overloads

SDG&E Area Potential Solutions

- Potential Mitigation Solutions

  SDG&E 500/230 kV Main Transmission System

  - Post-SONGS Transmission Strengthen Plan with various alternatives under investigation
  - SPS, generation dispatch, Operational Procedures, or load shed to address Category B & C issues in the short term

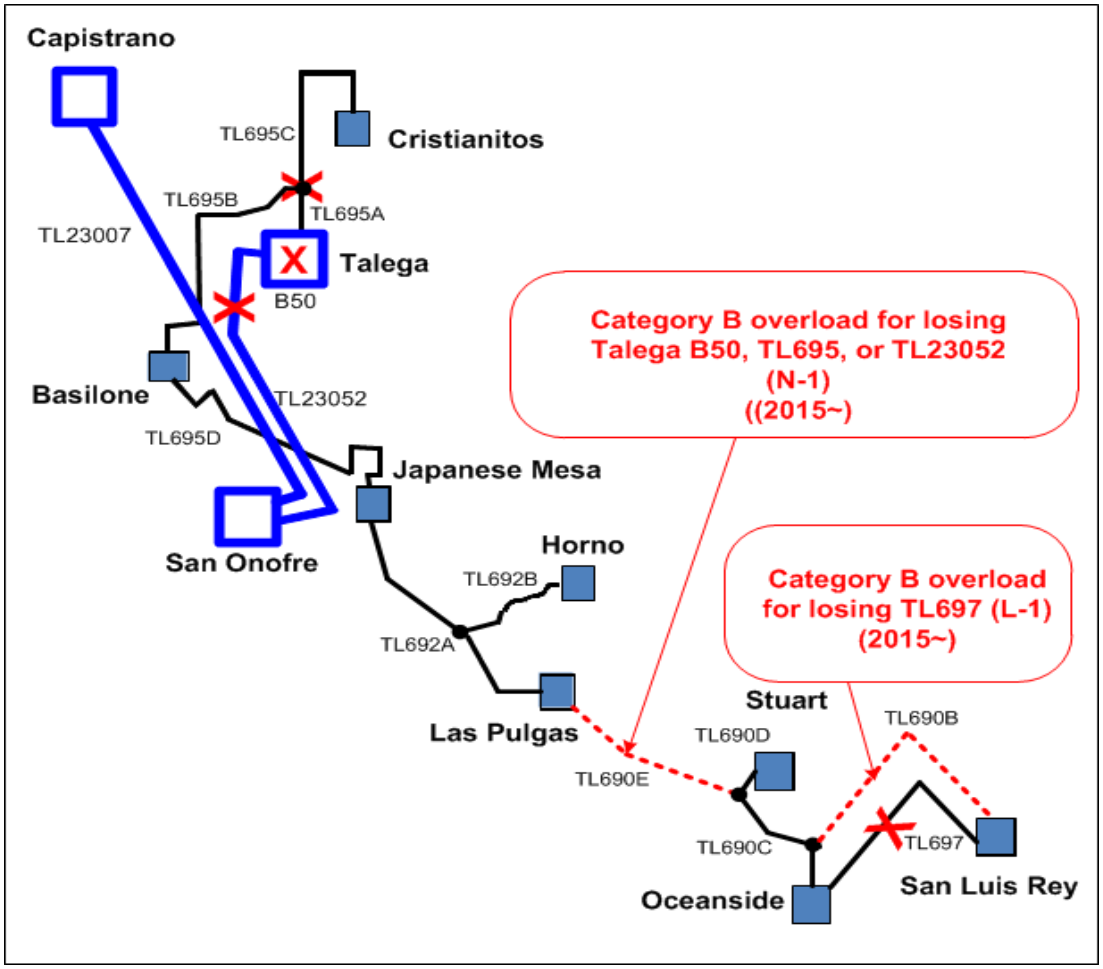
  SDG&E 138/69 kV Sub-Transmission System

  - 3 Network upgrades to address Category B issues, and 6 Network upgrades, generation dispatch, SPS, or Operational Procedures to address Category C issues in the Sub-Transmission System

  Energy Efficiency, DG, Demand Response as part of mitigations

SDG&E Sub-Transmission 138/69 kV System

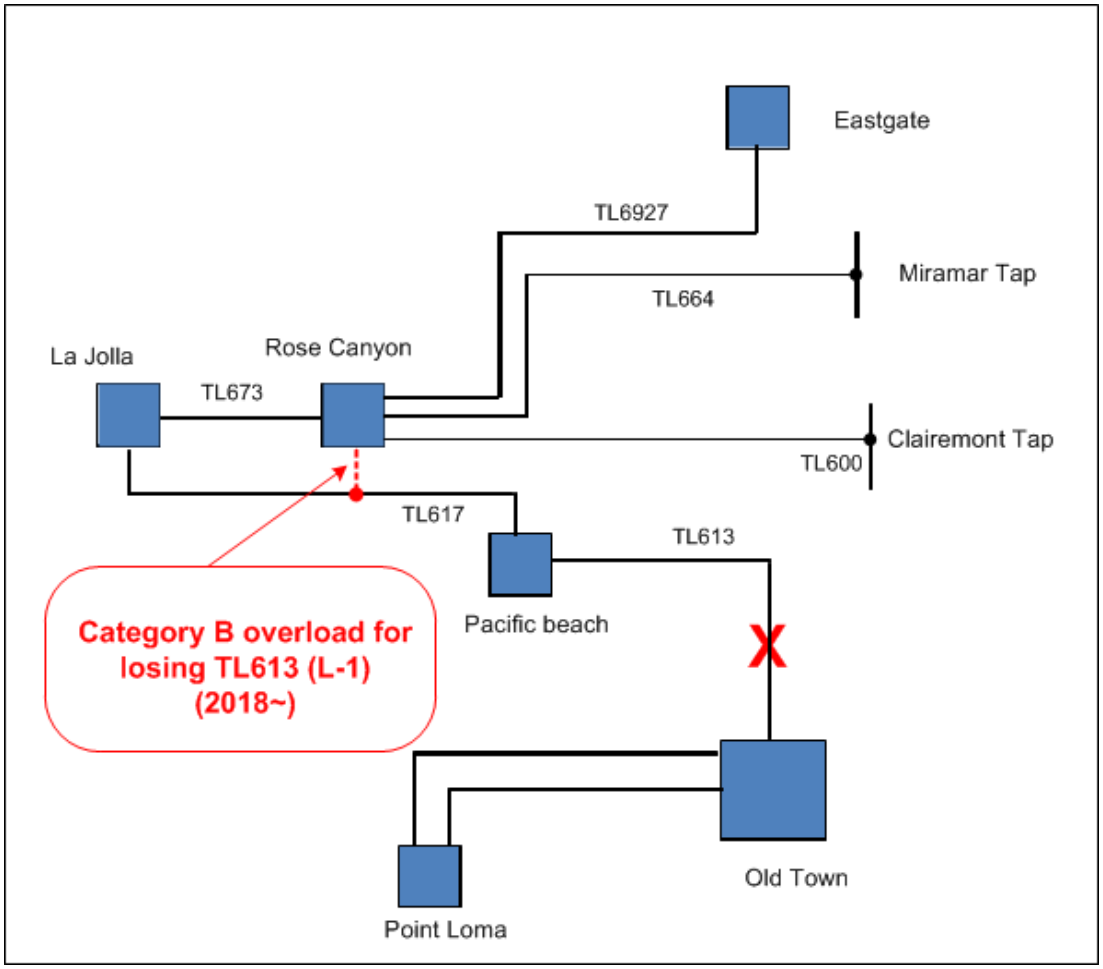
Category B Thermal Violation – (1)



SanLuisRey-Talega 69kV T/Ls

- Thermal overload
  - TL690B section overload for losing Talega Bank50, TL695, or TL23052 (2015~)
  - TL690E section overload for losing TL697(2015~)
- Potential Mitigation
  - Re-conductor TL690B and TL690E sections

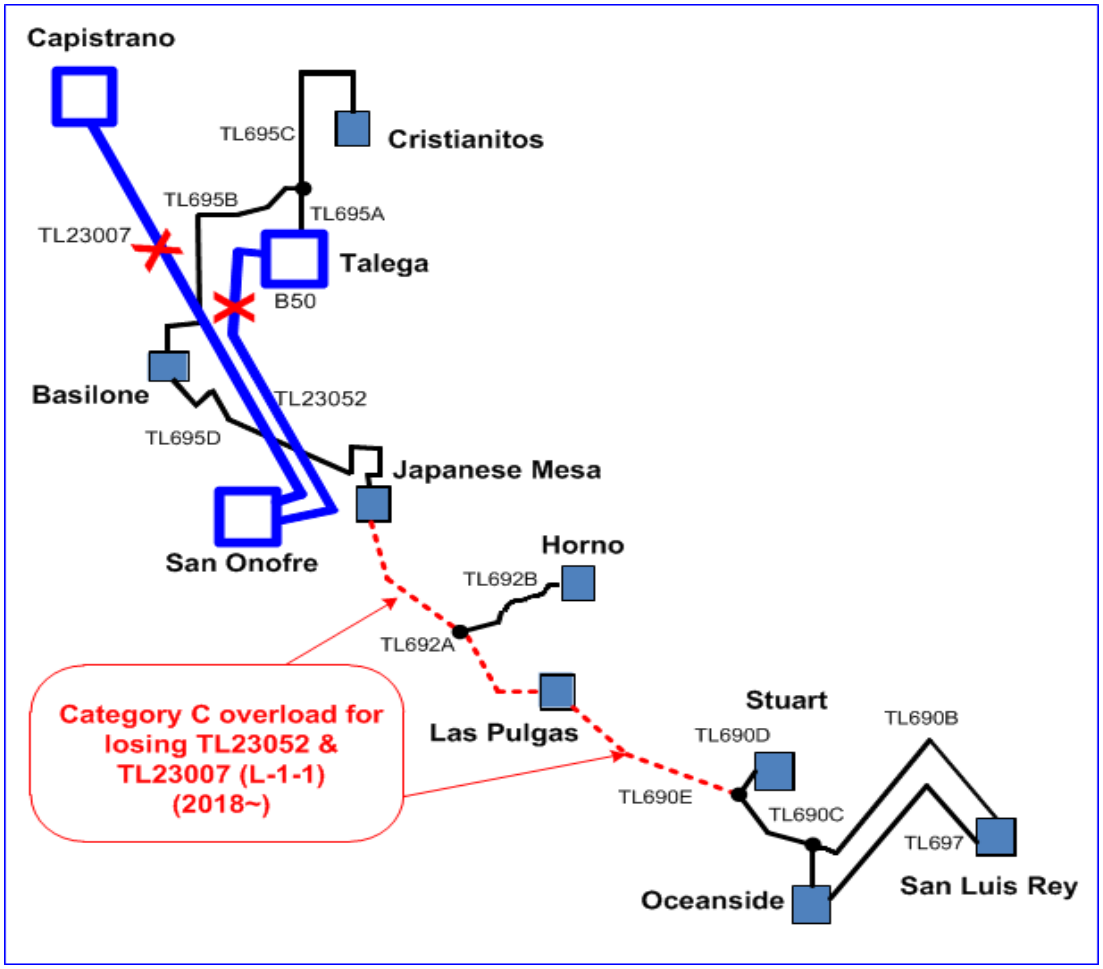
Category B Thermal Violation – (2)



RoseCanyon-LaJolla 69kV T/L

- Thermal overload
  - Rose Canyon-Rose Canyon Tap 69 kV section overload for losing TL613 (2018~)
- Potential Mitigation
  - Get rid of Rose Canyon Tap and create new Rose Canyon-La Jolla and Pacific Beach-Rose Canyon 69 kV lines

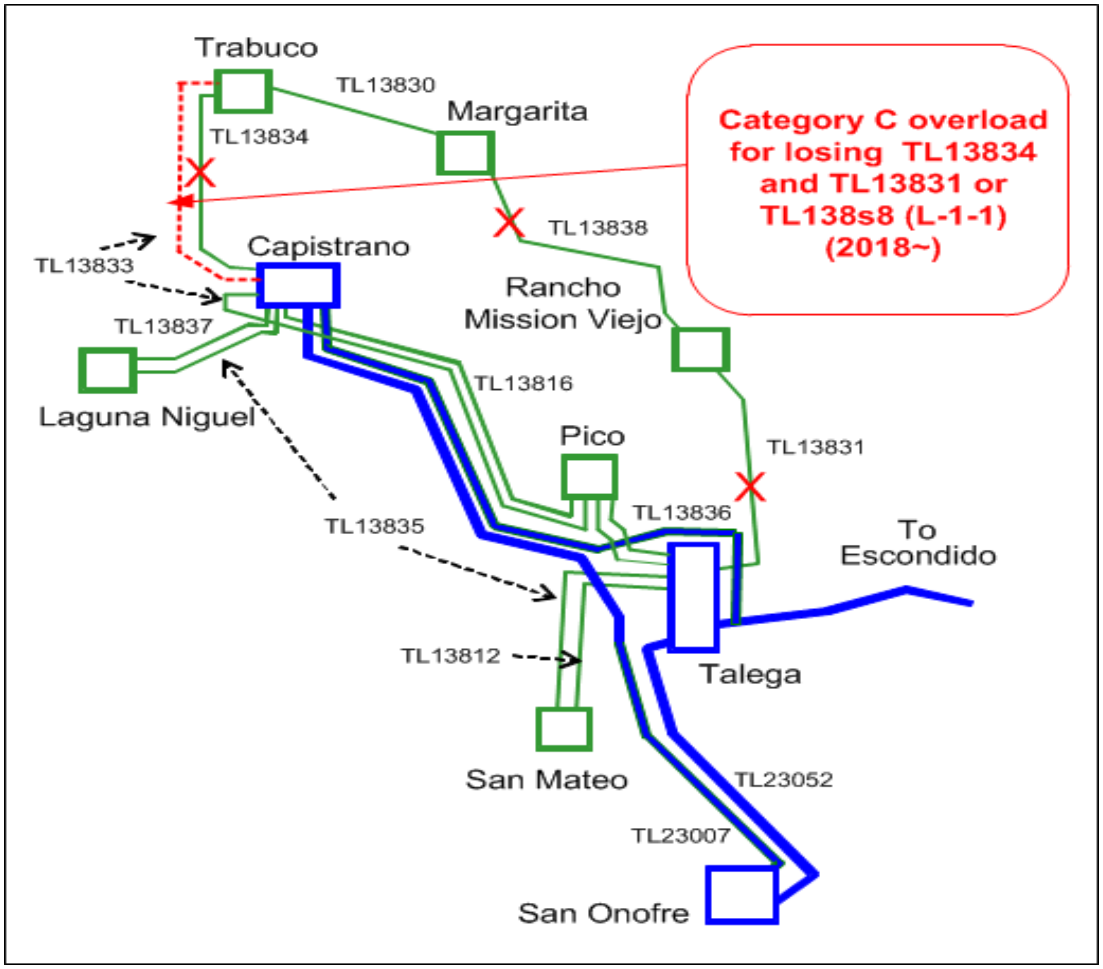
Category C Thermal Violation – (3)



SanLuisRey-Talega 69kV T/Ls

- Thermal overload
  - TL692A section overload for losing TL23007 & TL230052 (2018~)
- Potential Mitigation
  - Operation procedure to operate the San Luis Rey-Talega 69kV system in radial mode
  - Re-evaluation with clear picture on Post-SONGS transmission plan, or
  - Re-conductor TL692A

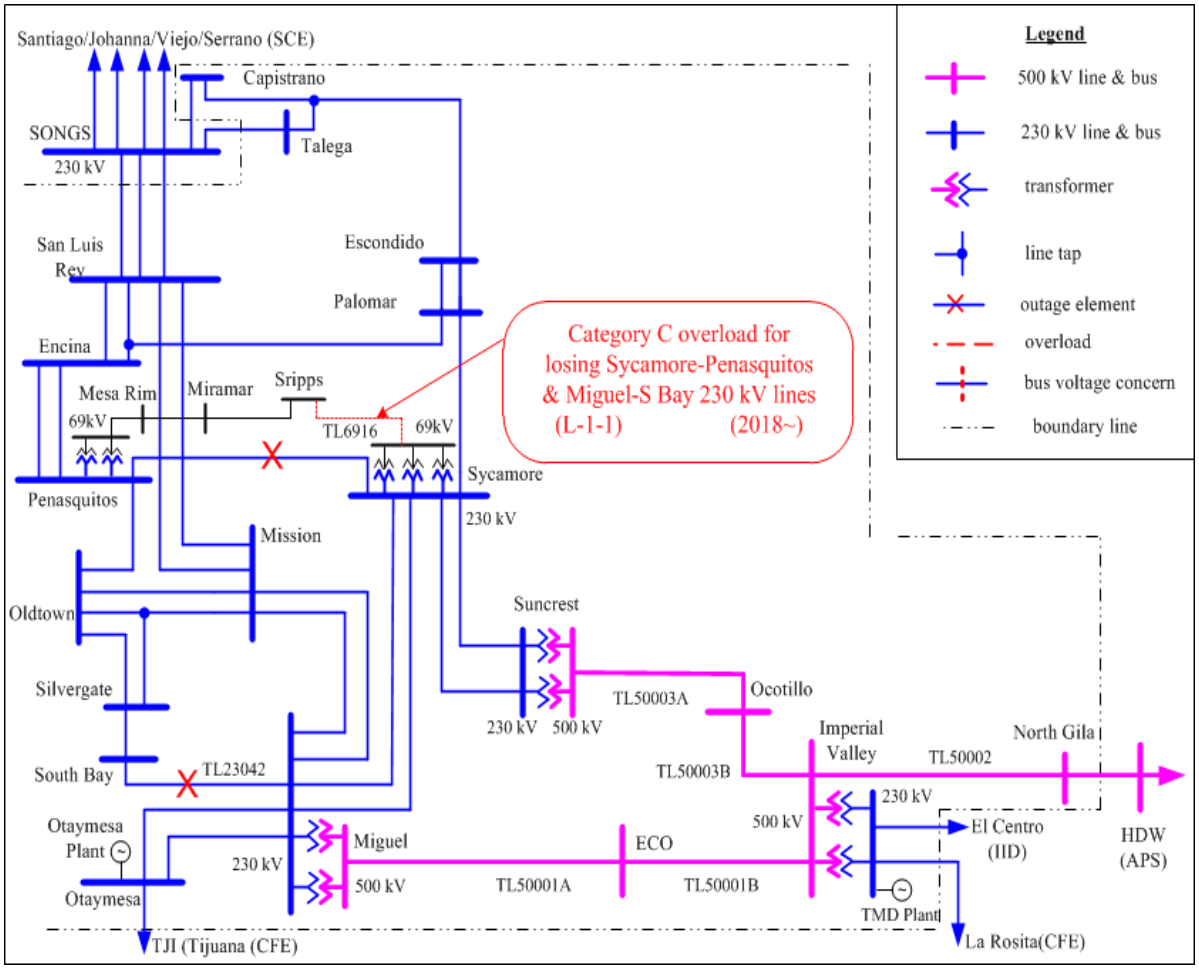
Category C Thermal Violation – (4)



Orange Country 138 kV T/L

- Thermal overload
  - L-1-1 overload on TL13833 section Trabuco-Capistrano for losing TL13834 & TL13831 or TL13838 (2018~)
- Potential Mitigation
  - Re-conductor TL13833 section of 3.7 miles from Trabuco to Capistrano, or
  - SPS to shed loads

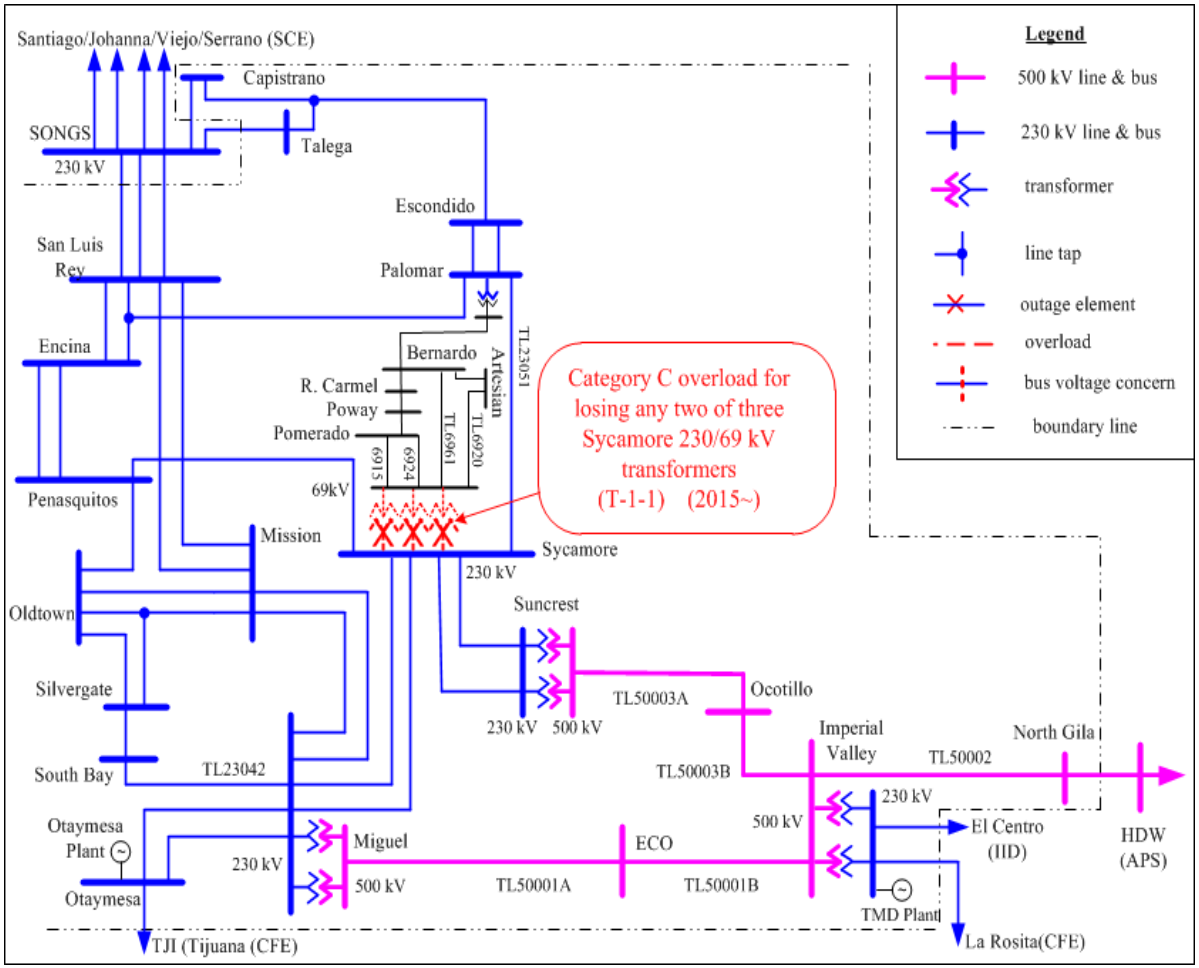
Category C Thermal Violation – (5)



Sycamore-Scripps 69kV T/L

- Thermal Overload
  - TL6916 overload for losing TL23042 & new SX-PQ 230 kV lines (L-1-1) (2018~)
- Potential Mitigation
  - Re-conductor TL6916, or
  - SPS to shed loads

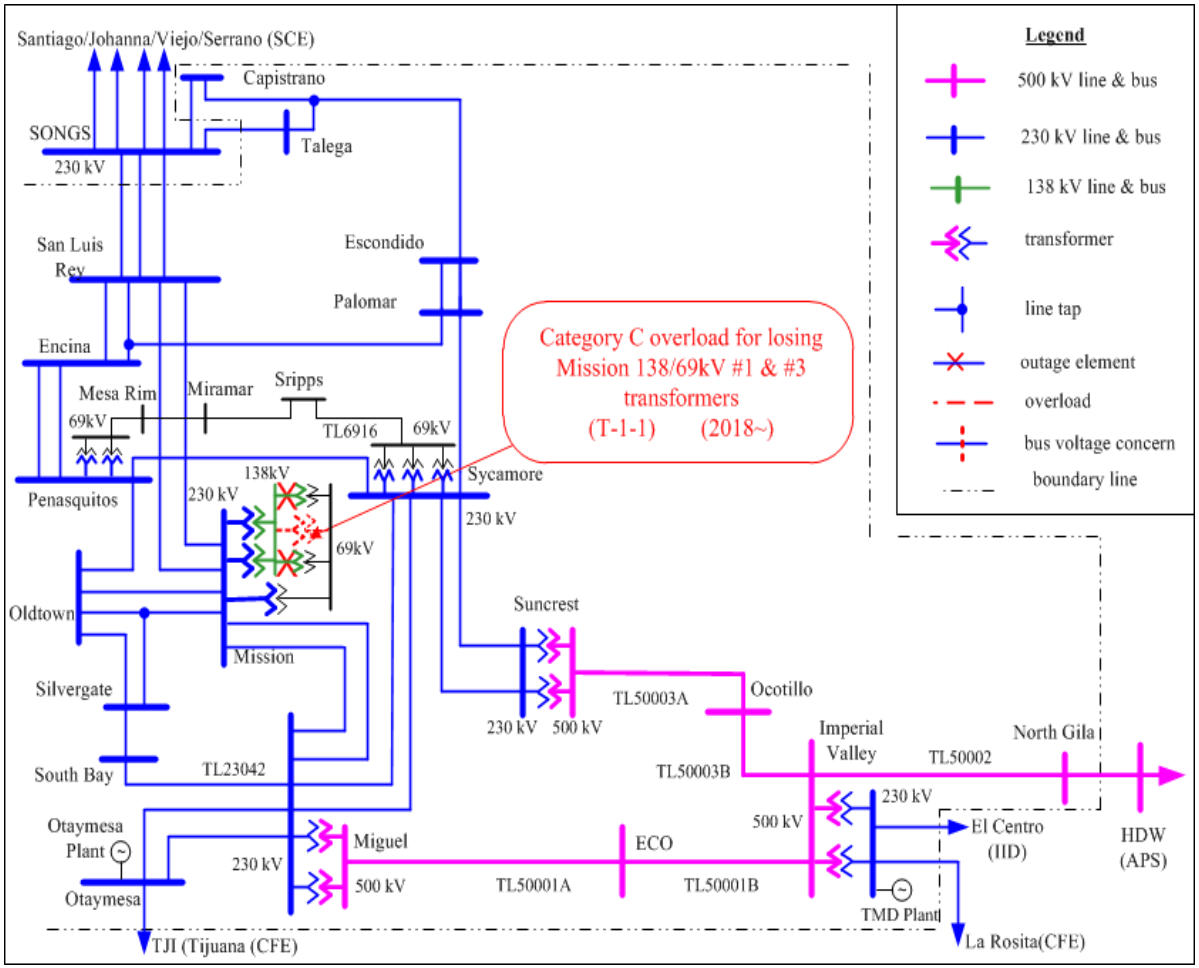
Category C Thermal Violation – (6)



Sycamore Banks 70/71/72

- Thermal Overload
  - One bank overload for losing any other two banks (T-1-1) (2018~)
- Potential Mitigation
  - Build a new Artesian 230/69 kV sub on TL23051
  - Make a spare bank available, or
  - SPS to shed loads

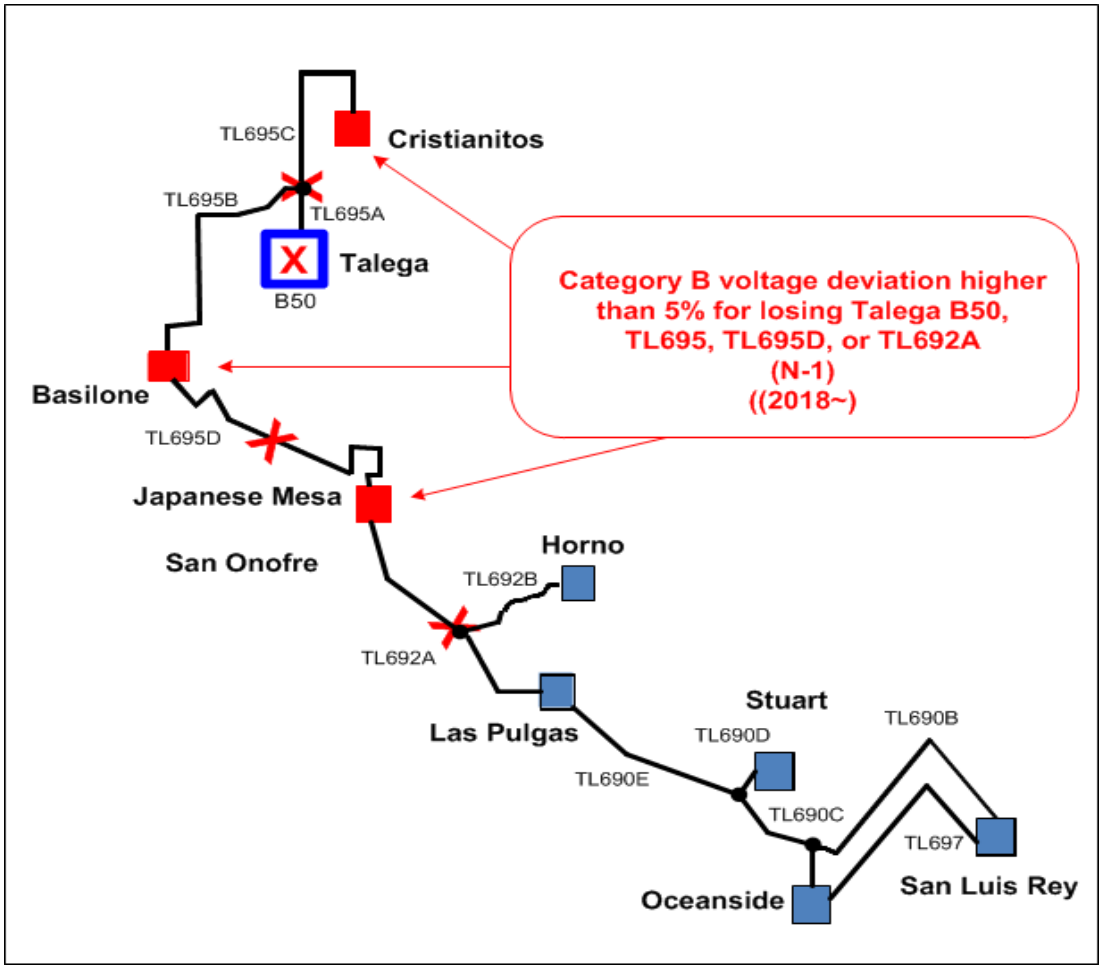
Category C Thermal Violation – (7)



Mission 138/69kV Bank 51

- Thermal Overload
  - Mission Bank 51 overload for losing Bank 50 & 52 (T-1-1) (2018~)
- Potential Mitigation
  - Add a new 230/69 kV bank and get rid of Banks 51 & 50, or
  - SPS to shed load

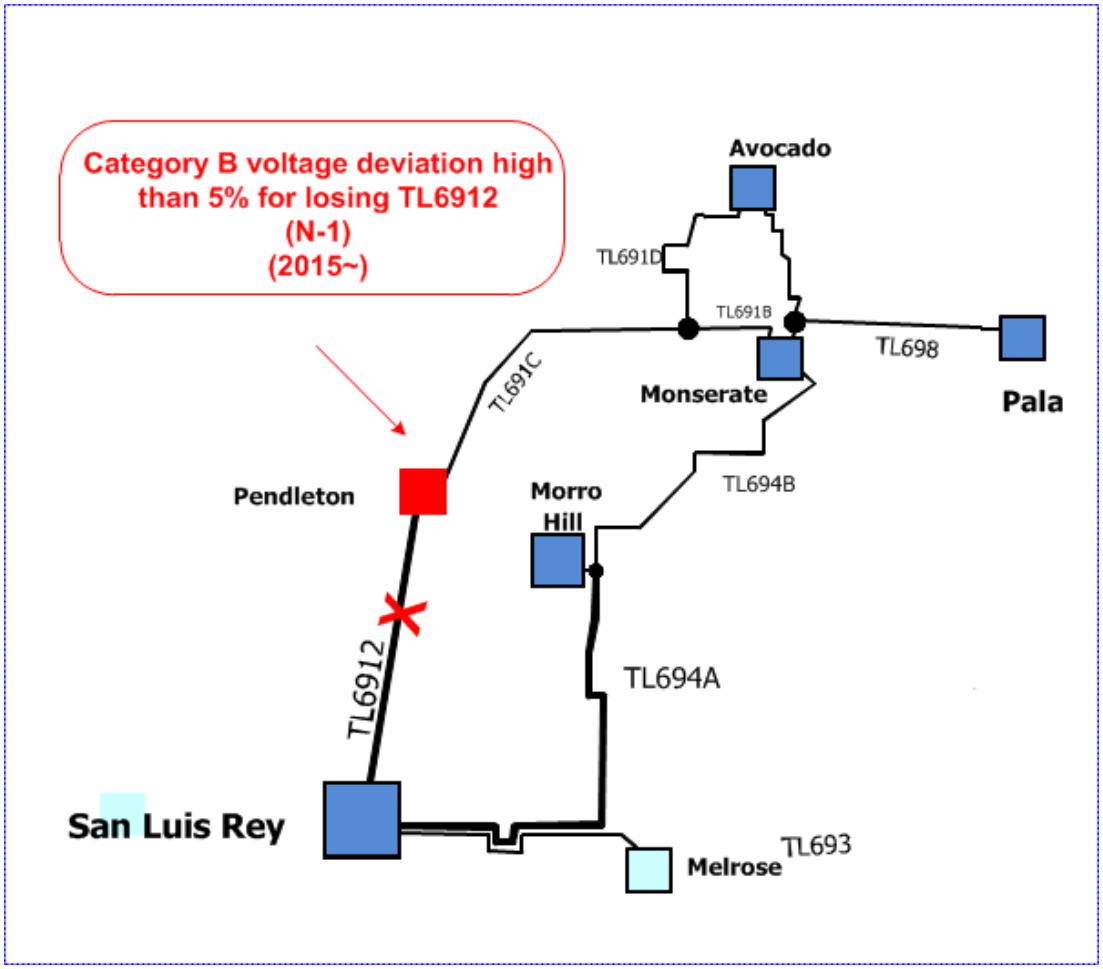
Category B Voltage Violation – (8)



SanLuisRey-Talega 69kV T/Ls

- Voltage Deviation
  - Voltage drop more than 5% for losing Talega B50, TL695 (2018~)
  - Voltage jump more than 5% for losing TL692, or TL695 (2018~)
- Potential Mitigation
  - Re-conductor TL690B & TL690E , and TL692A (also driven by Category B and C thermal violations), or
  - Put distribution caps in automatic mode if any, or
  - Adopt Voltage Deviation criteria as high as 8%

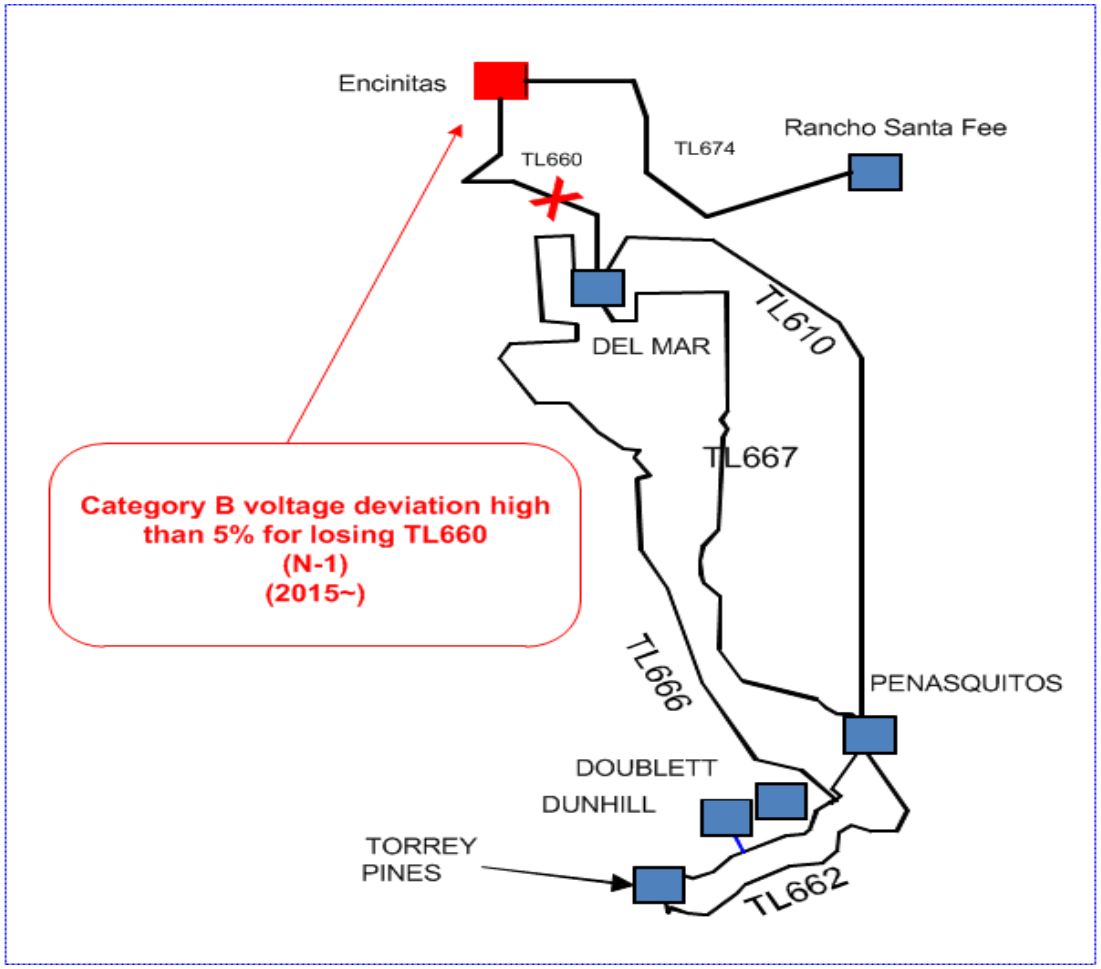
Category B Voltage Violation – (9)



Pendleton 69 kV Bus

- Voltage Deviation
  - Voltage drop more than 5% for losing TL6912 (2015~)
- Potential Mitigation
  - Put distribution caps nearby in automatic mode , or
  - Adopt higher Voltage Deviation criteria

Category B Voltage Violation – (10)

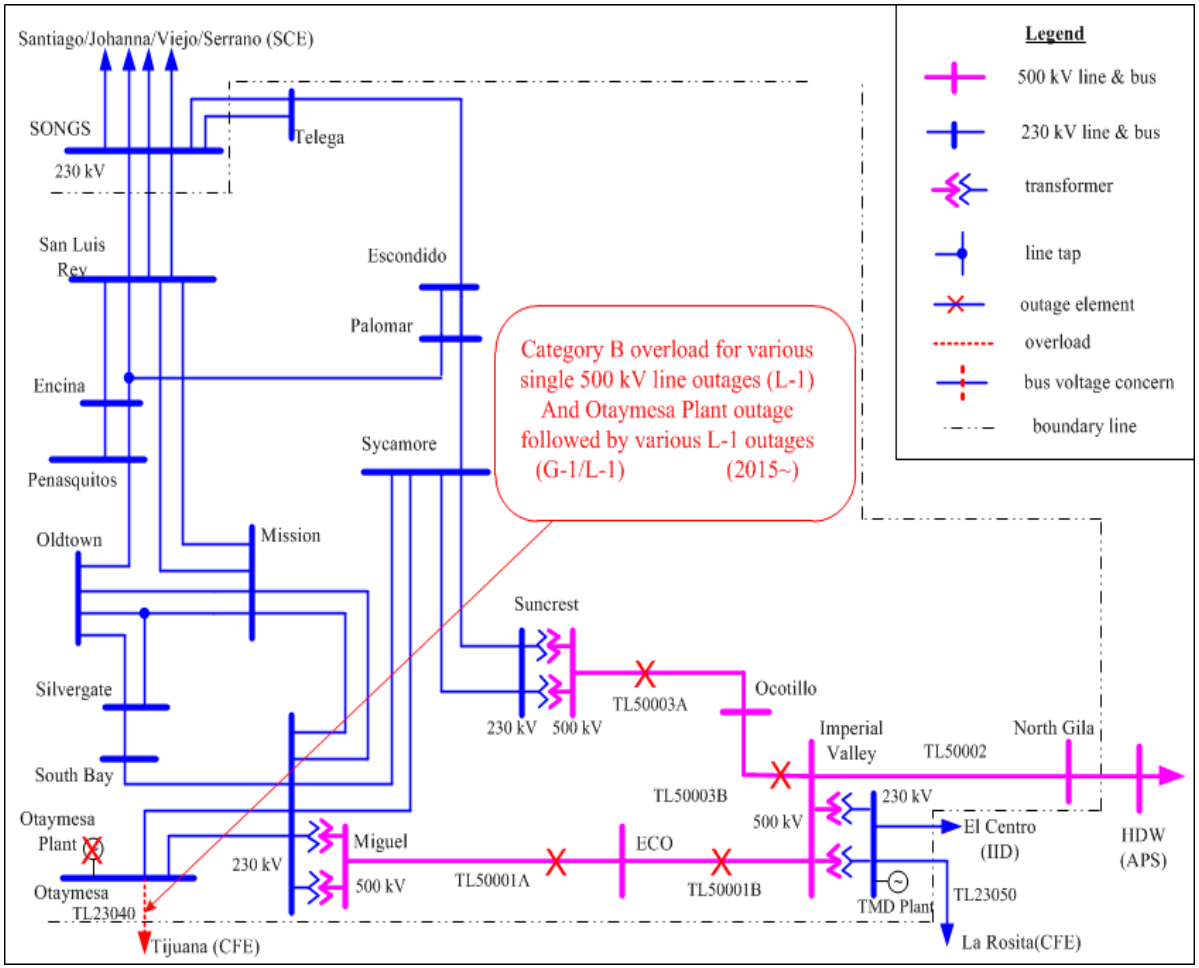


Encinitas 69 kV Bus

- Voltage Deviation
  - Voltage drop more than 5% for losing TL660 (2015~)
- Potential Mitigation
  - Put distribution caps nearby in automatic mode , or
  - Adopt higher Voltage Deviation criteria

SDG&E Main Transmission 500/230 kV System

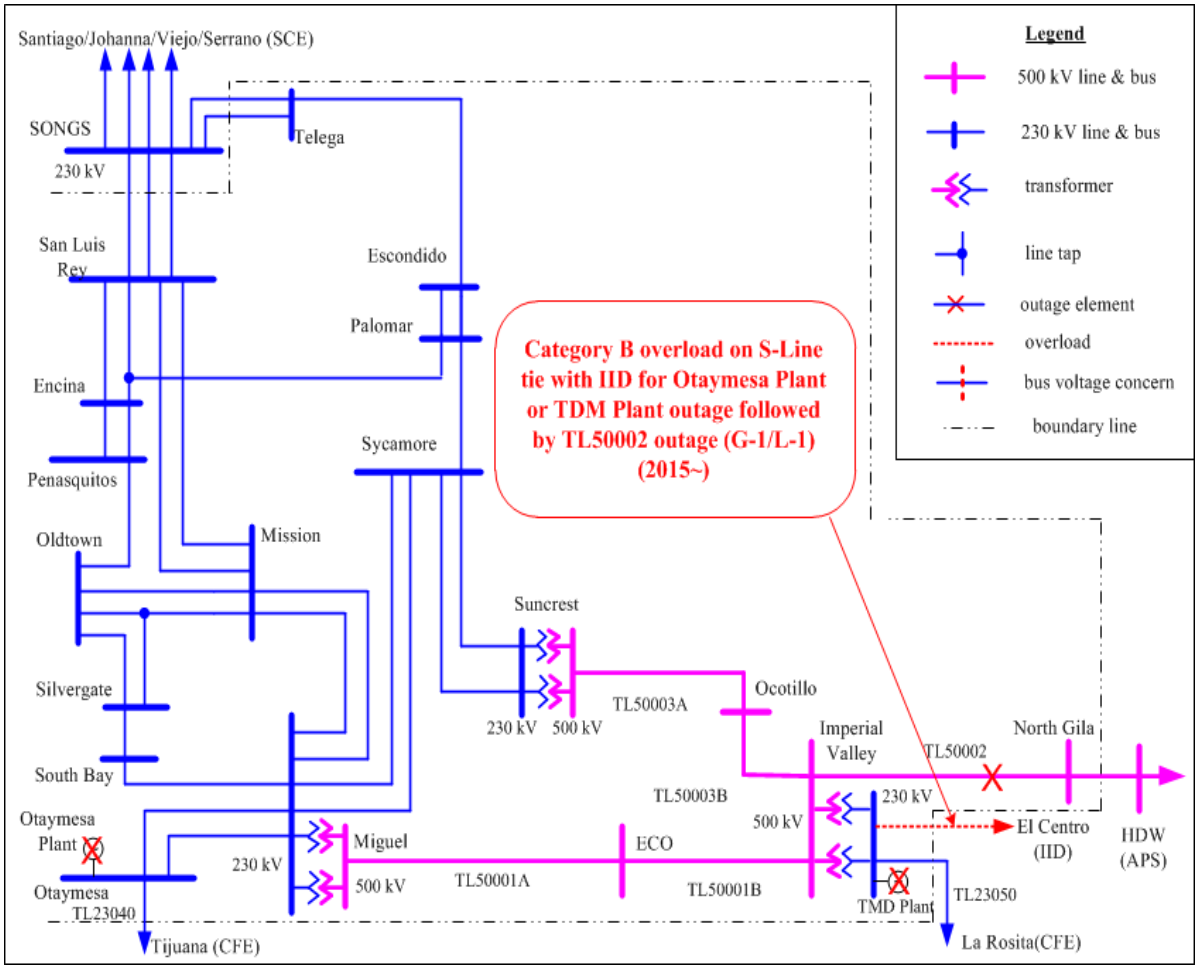
Category B Thermal Violation – (11)



Otaymesa-Tij 230kV Tie

- Thermal Overload
  - TL23040 tie overload for losing various single 500KV line outages(L-1) and for Otaymesa Plant outage followed by various single 500KV line outages(G-1/L-1) (2015~)
- Potential Mitigation
  - Modify SPS to trip generation in IV prior to cross tripping TL23050 tie in the short term
  - Post-SONGS Transmission Plan in the long term

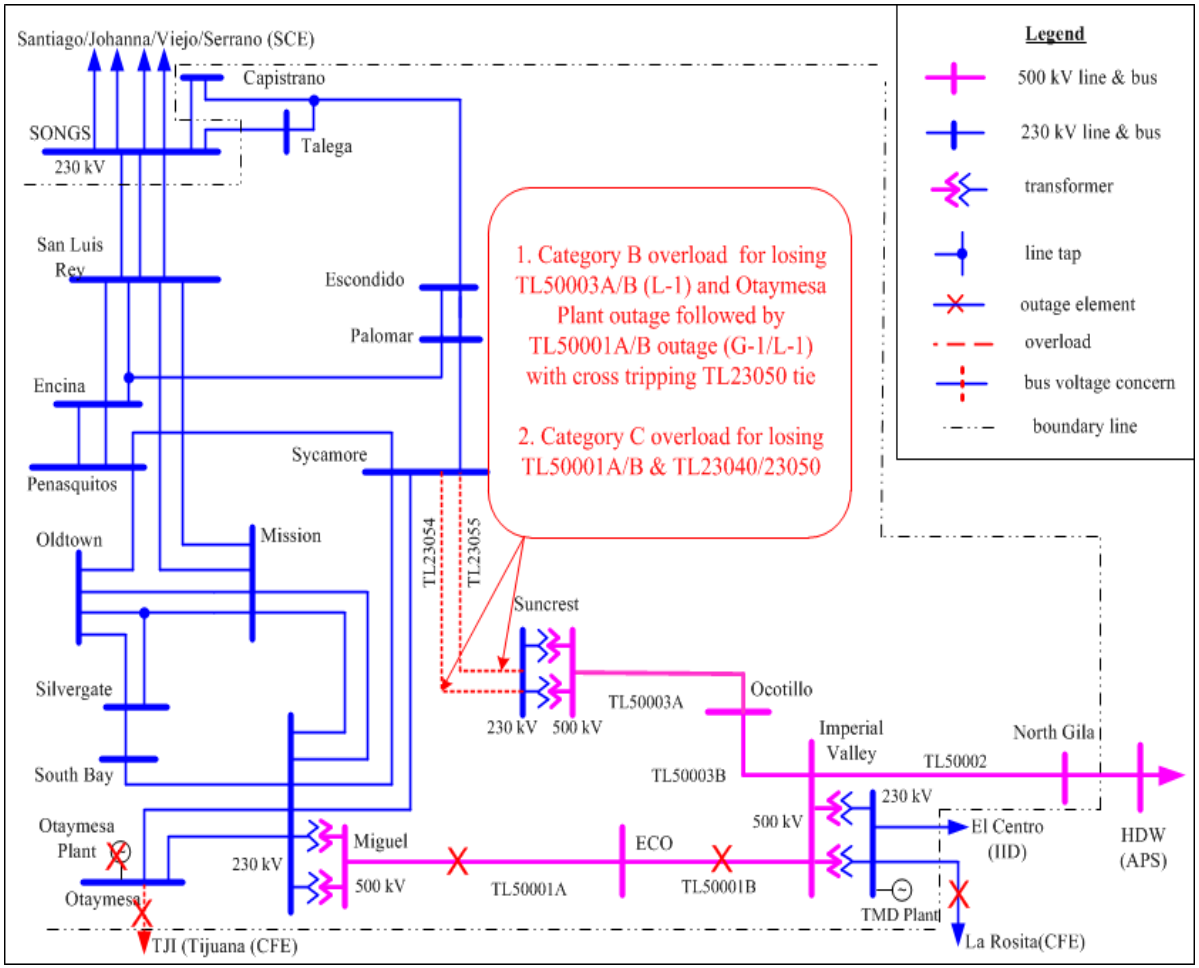
Category B Thermal Violation – (12)



IV-ElCentro 230kV Tie with IID

- Thermal Overload
  - S-Line tie overload for Otay Mesa Plant or TDM Plant outage followed by TL50002 outage(G-1/L-1) (2015~)
- Potential Mitigation
  - Operation Procedure (OP) and generation dispatch in the short term
  - Post-SONGS Transmission Strengthen Plan in the long term

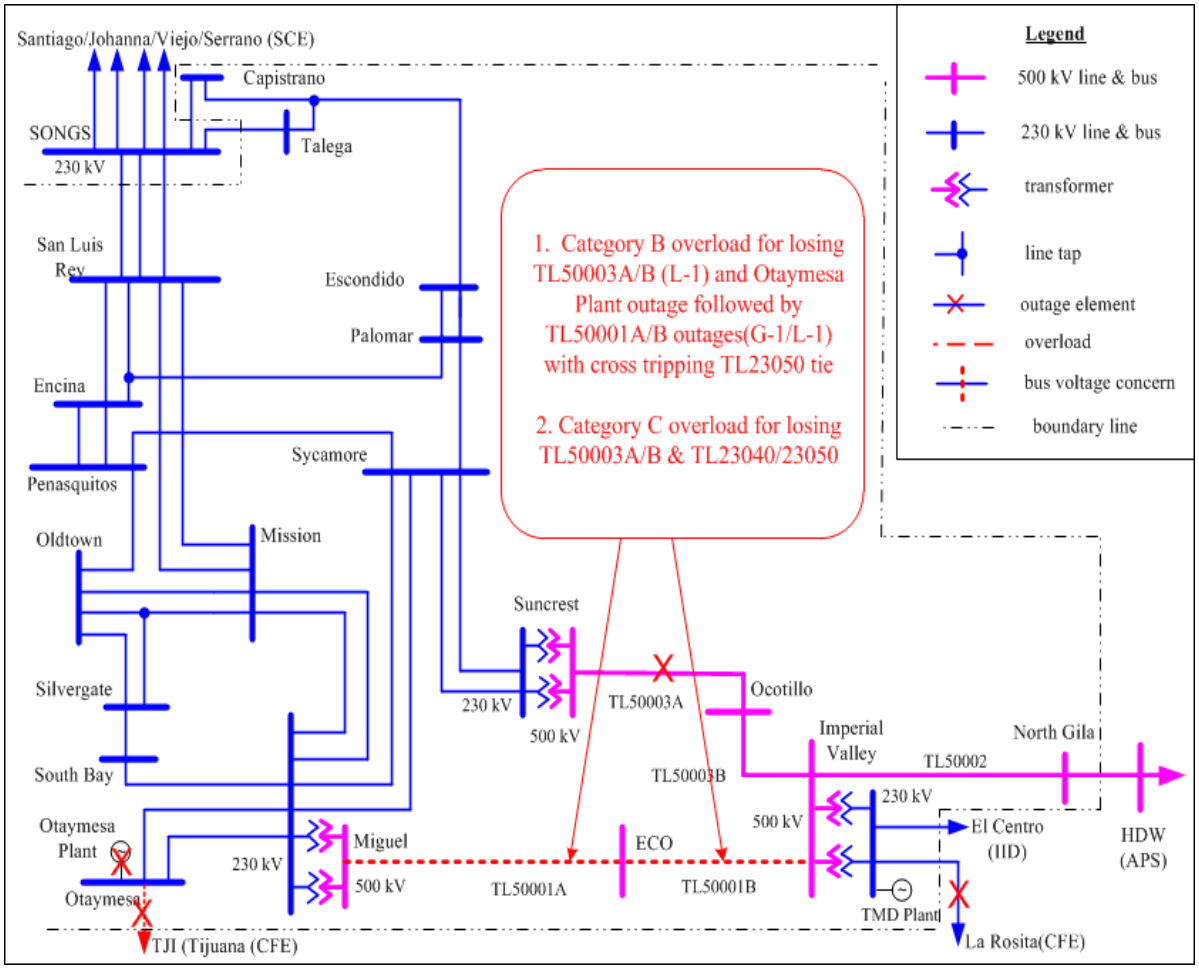
Category B & C Thermal Violation – (13)



Suncrest-SX 230kV T/Ls

- Thermal Overload
  - TL23054&TL23055 overloads for losing TL50001A/B (L-1) & OtayMesa Plant outage followed by TL50001A/B outage(G-1/L-1) with tripping TL23050
  - TL23054&TL23055 overloads for losing TL50001A/B & TL23040/23050 (L-1-1)
- Potential Mitigation
  - Modify SPS to trip IV generation prior to cross tripping TL23050 in the short term
  - Post-SONGS Transmission Plan in the long term

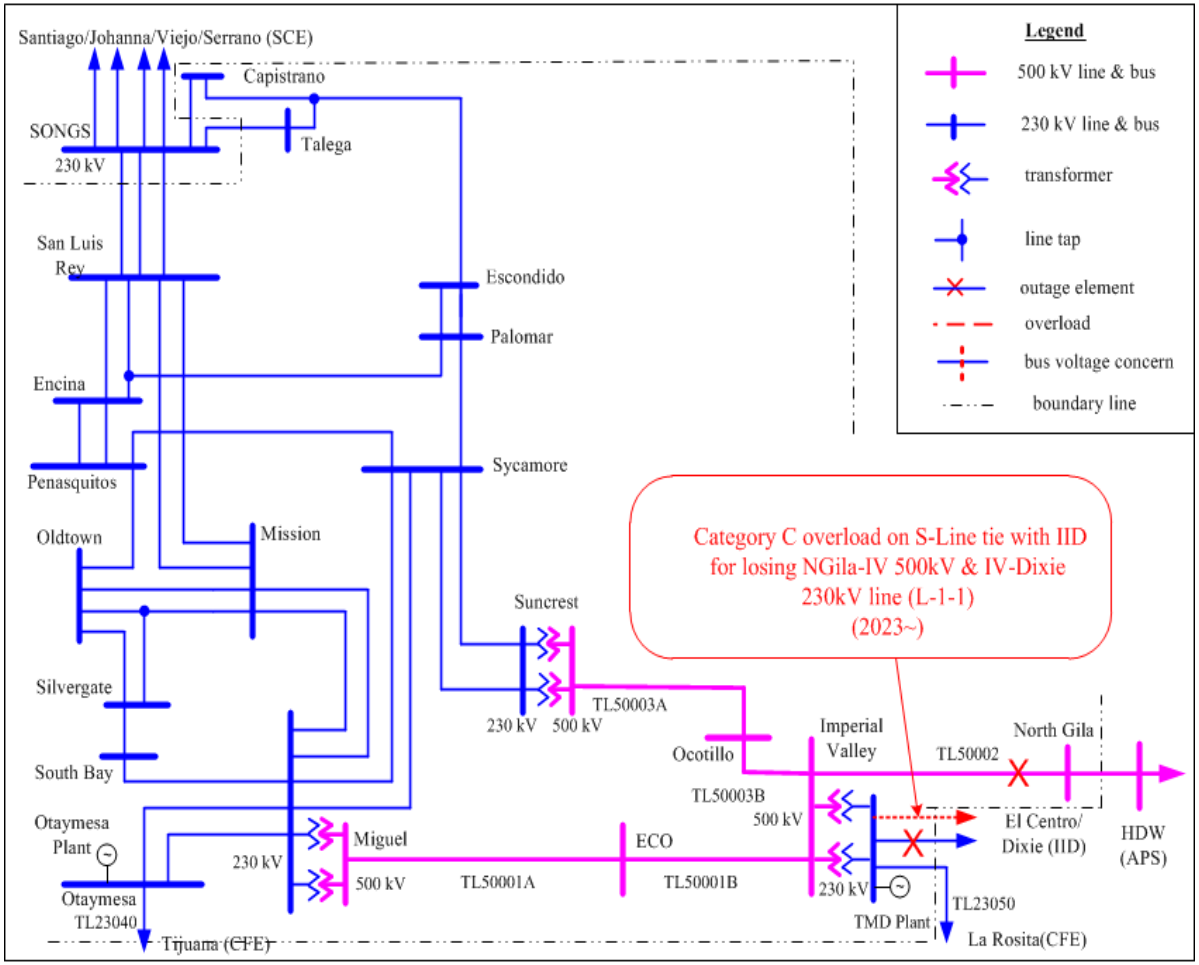
Category B & C Thermal Violation – (14)



IV-ECO-Miguel 500kV T/Ls

- Thermal Overload
  - TL50001A/B overload for losing TL50003A (L-1) & OtayMesa Plant outage followed by TL50001A/B outage(G-1/L-1) with cross tripping TL23050
  - TL50001A/B overload for losing TL50003A and TL23040/23050 (L-1-1)
- Potential Mitigation
  - Modify SPS to trip generation at IV in the short term
  - Post-SONGS Transmission Plan in the long term

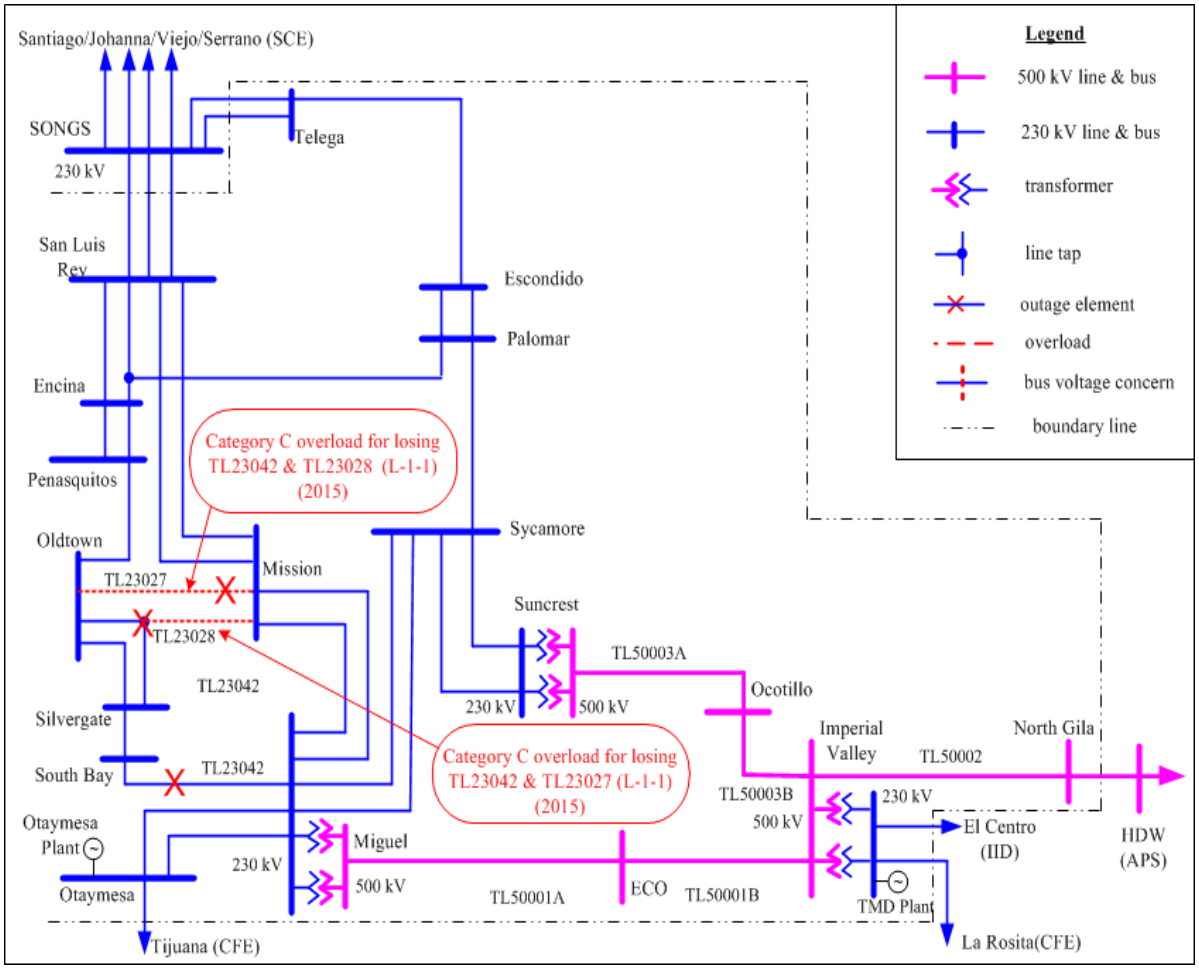
Category C Thermal Violation – (15)



IV-ElCentro 230kV Tie with IID

- Thermal Overload
  - S-Line tie overload for losing TL50002 & and IV-Dixie 230 kV tie with IID (L-1-1) (2023)
- Potential Mitigation
  - OP and generation dispatch in the short term
  - Post-SONGS Transmission Strengthen Plan in the long term

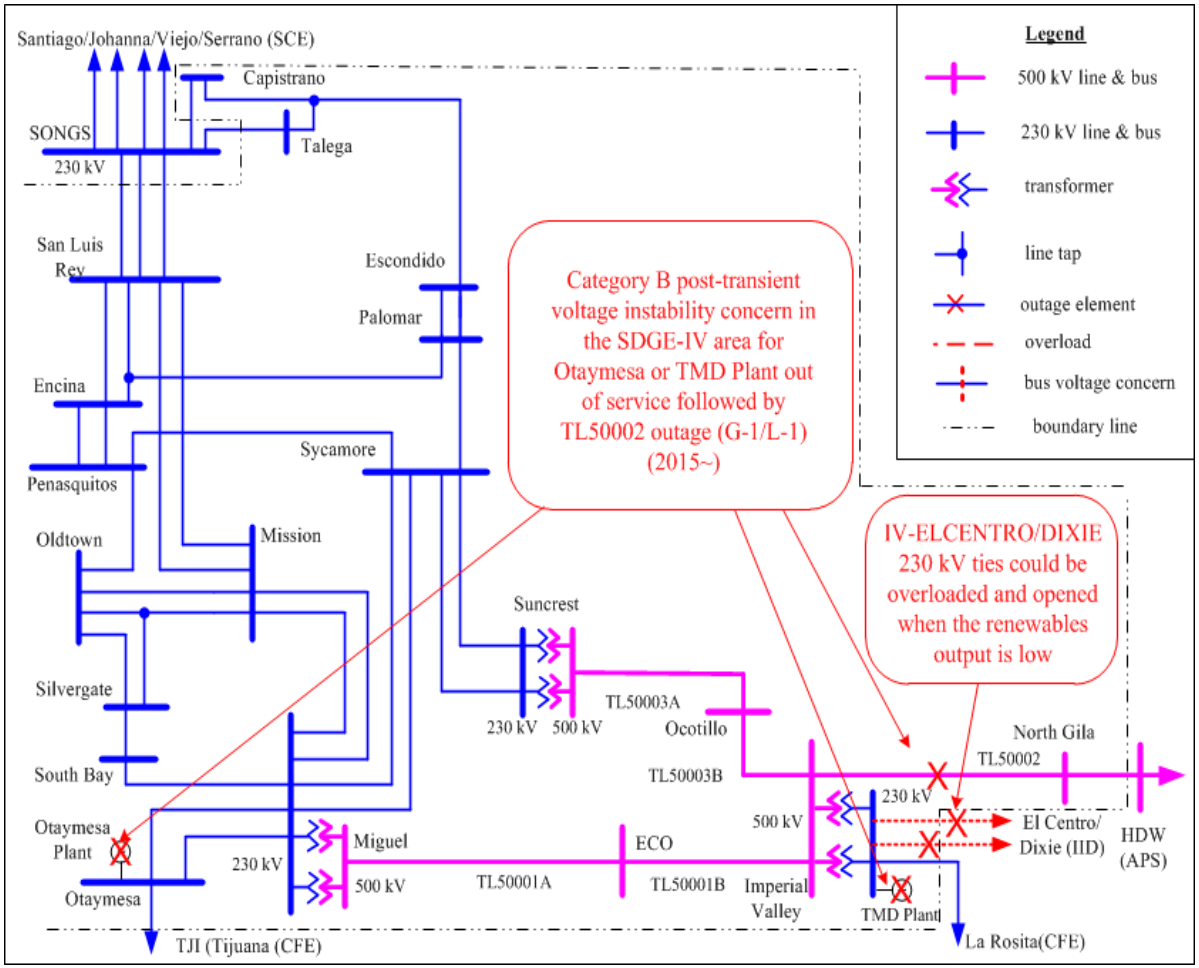
Category C Thermal Violation – (16)



Mission-OldTown 230kV T/Ls

- Thermal Overload
  - TL23027 overload for losing TL23042 & TL23028 lines (2015)
  - TL23028 overload for losing TL23042 & TL23027 lines (2015)
- Potential Mitigation
  - Temporary SPS or OP to shed load until SX-PQ 230 kV line in service, or
  - Develop higher short term emergency line rating

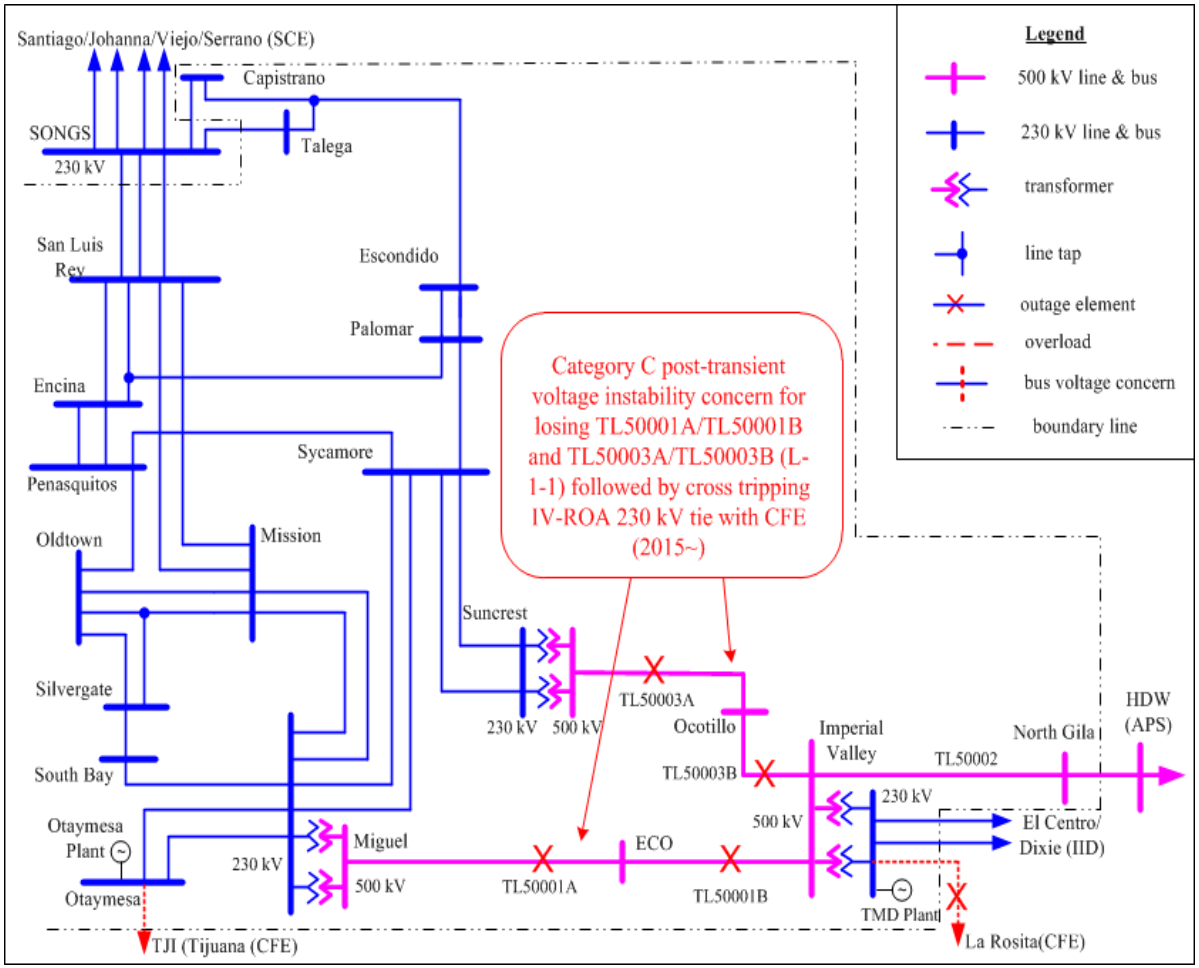
Category B Post-Transient Voltage Instability Concern – (17)



San Diego-Imperial Valley Area

- Post-Transient Voltage Instability Concern
  - For Otay Mesa or TMD Plant outage followed by TL50002 outage (G-1/L-1) (2015~)
- Potential Mitigation
  - OP and generation dispatch in the short term
  - Post-SONGS Transmission Plan in the long term

Category C Post-Transient Voltage Instability Concern – (18)



San Diego Area

- Post-Transient Voltage Instability Concern
  - For losing TL50001A/B and TL50003A/B (L-1-1) followed by cross tripping TL23050 tie with CFE (2015~)
- Potential Mitigation
  - OP, generation dispatch, load shed as needed in the short term
  - Post-SONGS Transmission Plan in the long term

Post-SONGS Transmission Strengthen Plan

Alternatives under Investigation

Alternative A:

Provide support to SDG&E bulk transmission system by constructing 500kV tie-line to SCE system in the north

Alternative B:

Build submarine cable system between SCE and SDG&E

Alternative C:

Build DC system to strengthen the SDG&E main system

Post-SONGS Transmission Strengthen Plan

Alternatives under Investigation (cont'd)

We also need to:

- Consider Energy Efficiency, DG, Demand Response, new conventional generation, re-dispatch, and Operation Procedure
- Improve SDG&E 230 kV system in order to accommodate the Post-SONGS Transmission Strengthen Plan

Thank You!

Determining an Effective Mix of Non Conventional Solutions to Address Local Needs in the TPP

Robert Sparks
Regional Transmission

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Proposed three-step methodology

1. Development of a generic resource catalog reflecting the performance characteristics of response time, duration, and availability
2. Determining an effective mix of resources to meet the performance characteristics needed for a local area
3. Monitoring development of the non-conventional solution

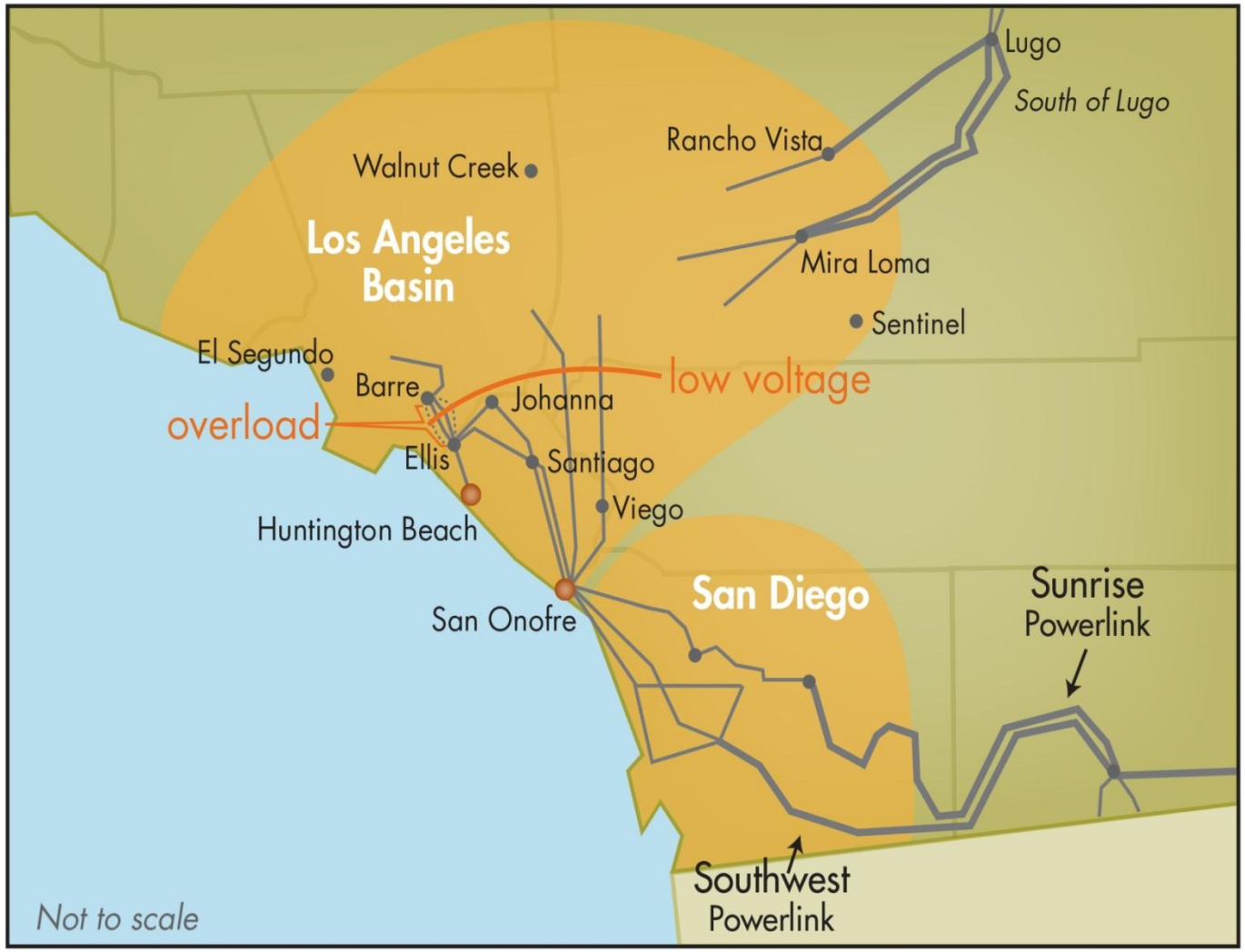
Step two: Determining an effective mix of resources

- Specify performance characteristics and amounts of each required to meet needs of a local area
- Focus is on post-contingency (e.g., fast-acting products for an N-1-1 event)

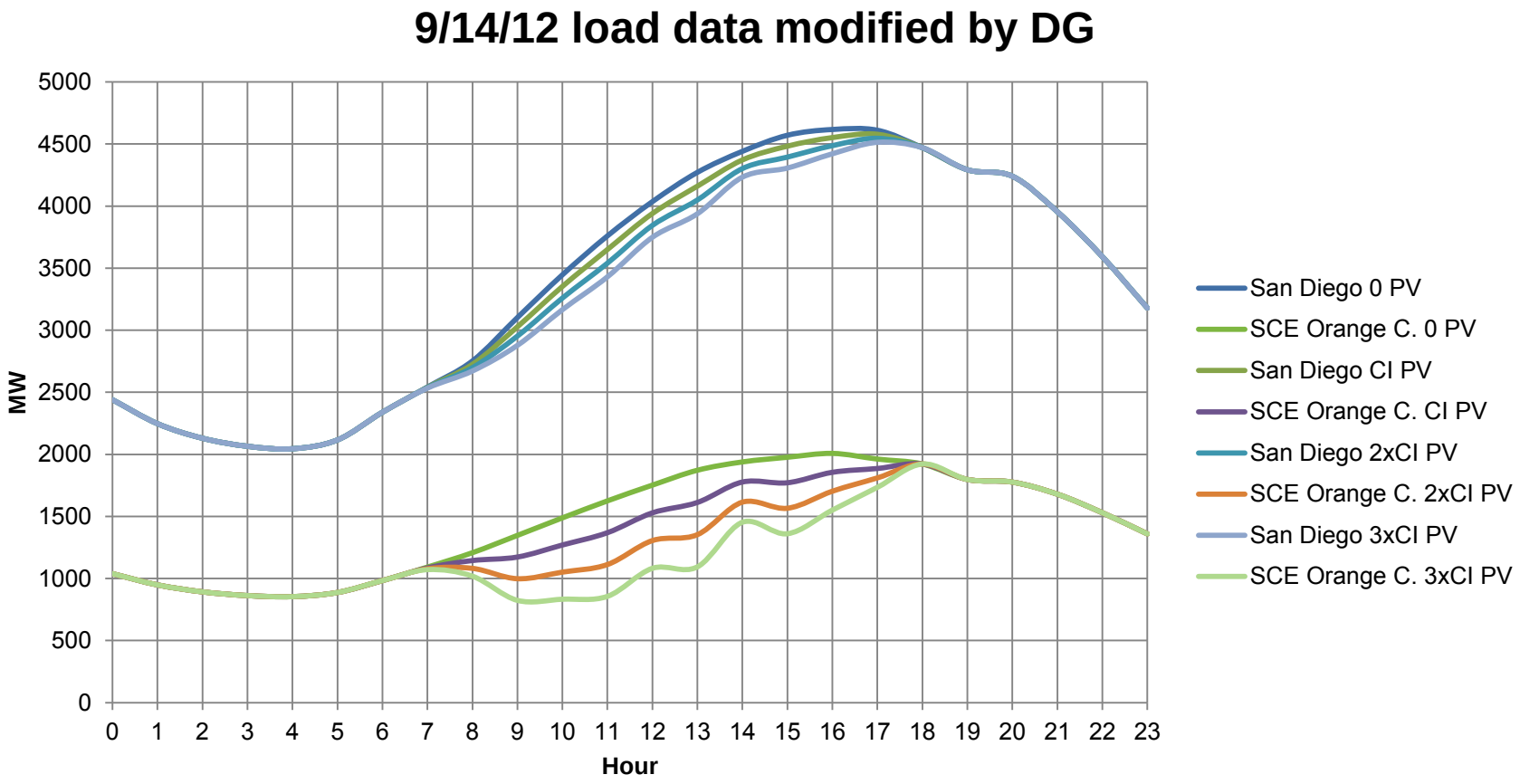
SONGS Study Area

- SCE Portion of Orange County
- Barre, Johanna, Ellis, Santiago, Viejo
- 350 MW of installed Capacity Solar PV DG in the Commercial Interest Portfolio

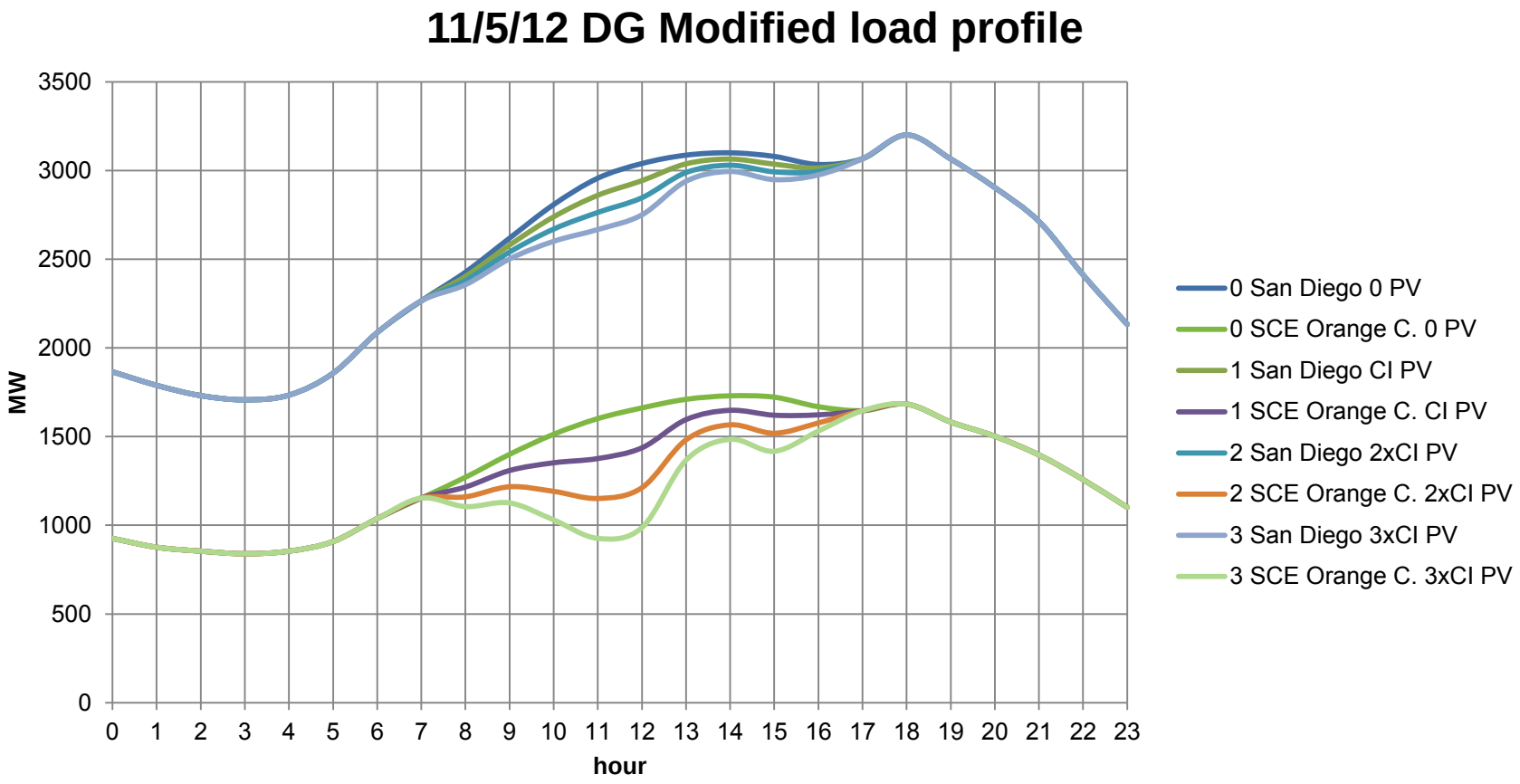
- San Diego
- 150 MW of installed Capacity Solar PV DG in the Commercial Interest Portfolio



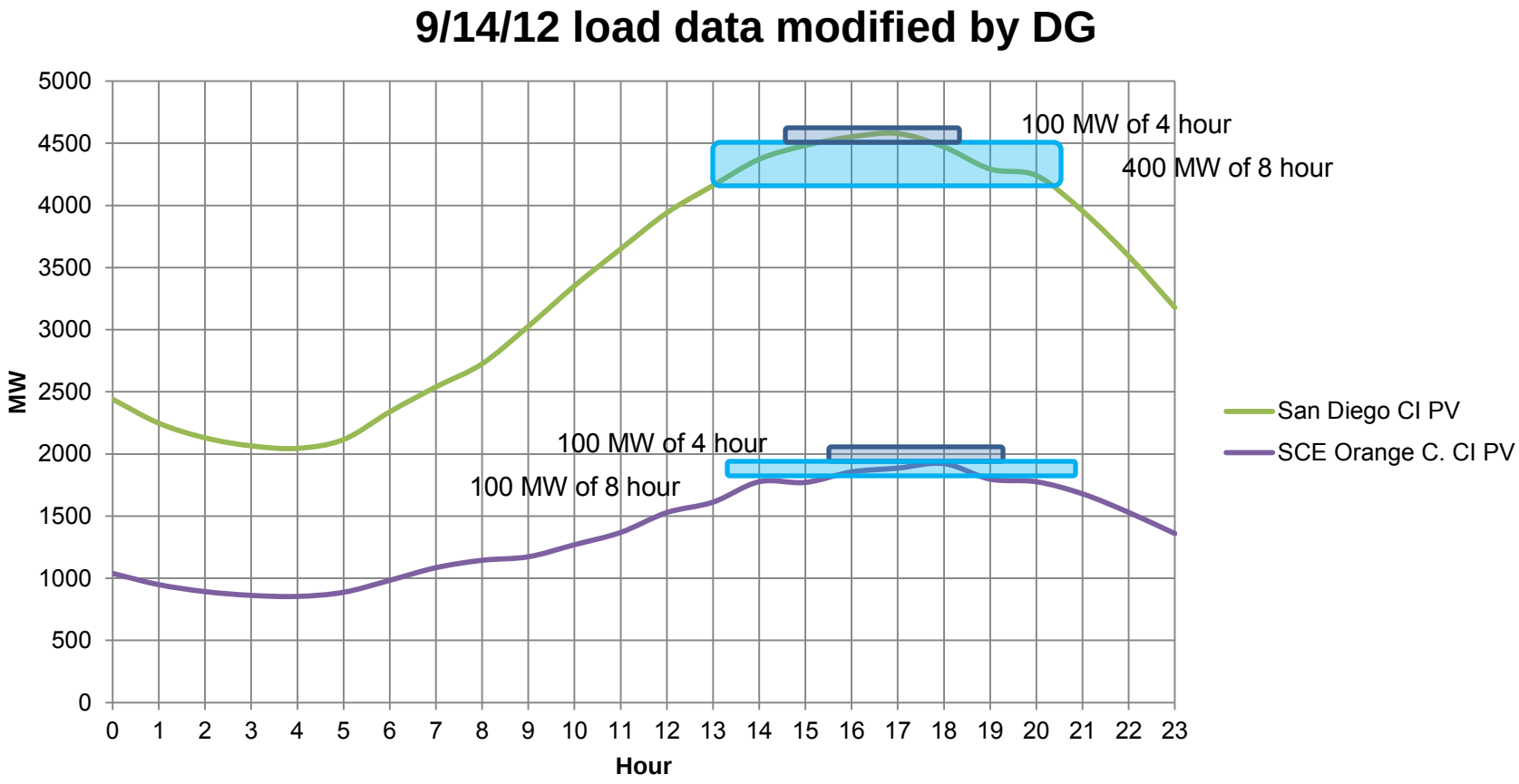
Summer Peak Load Profile Modified by Increasing Amounts of Solar PV DG



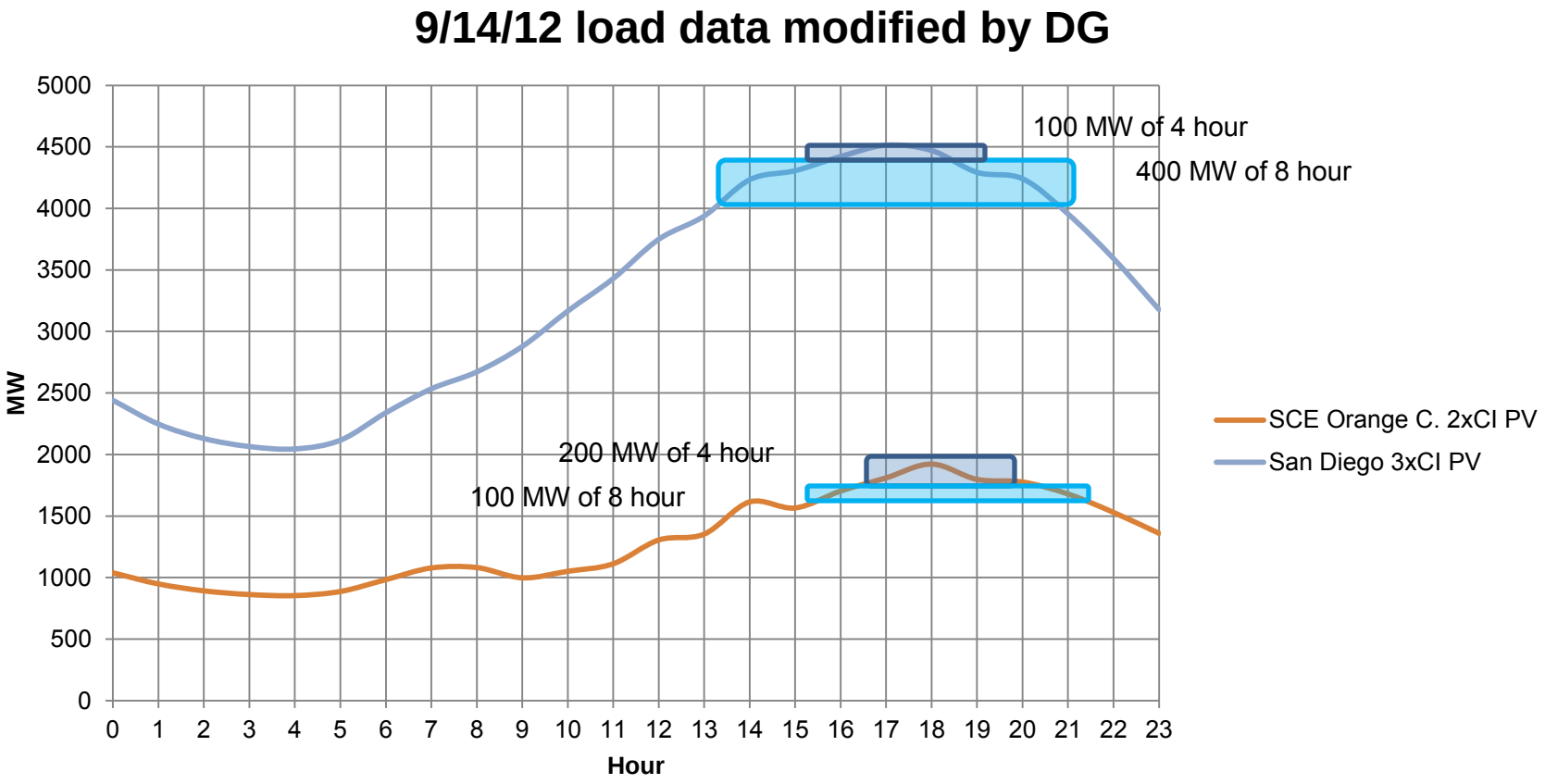
Fall Peak Load Profile Modified by Increasing Amounts of Solar PV DG



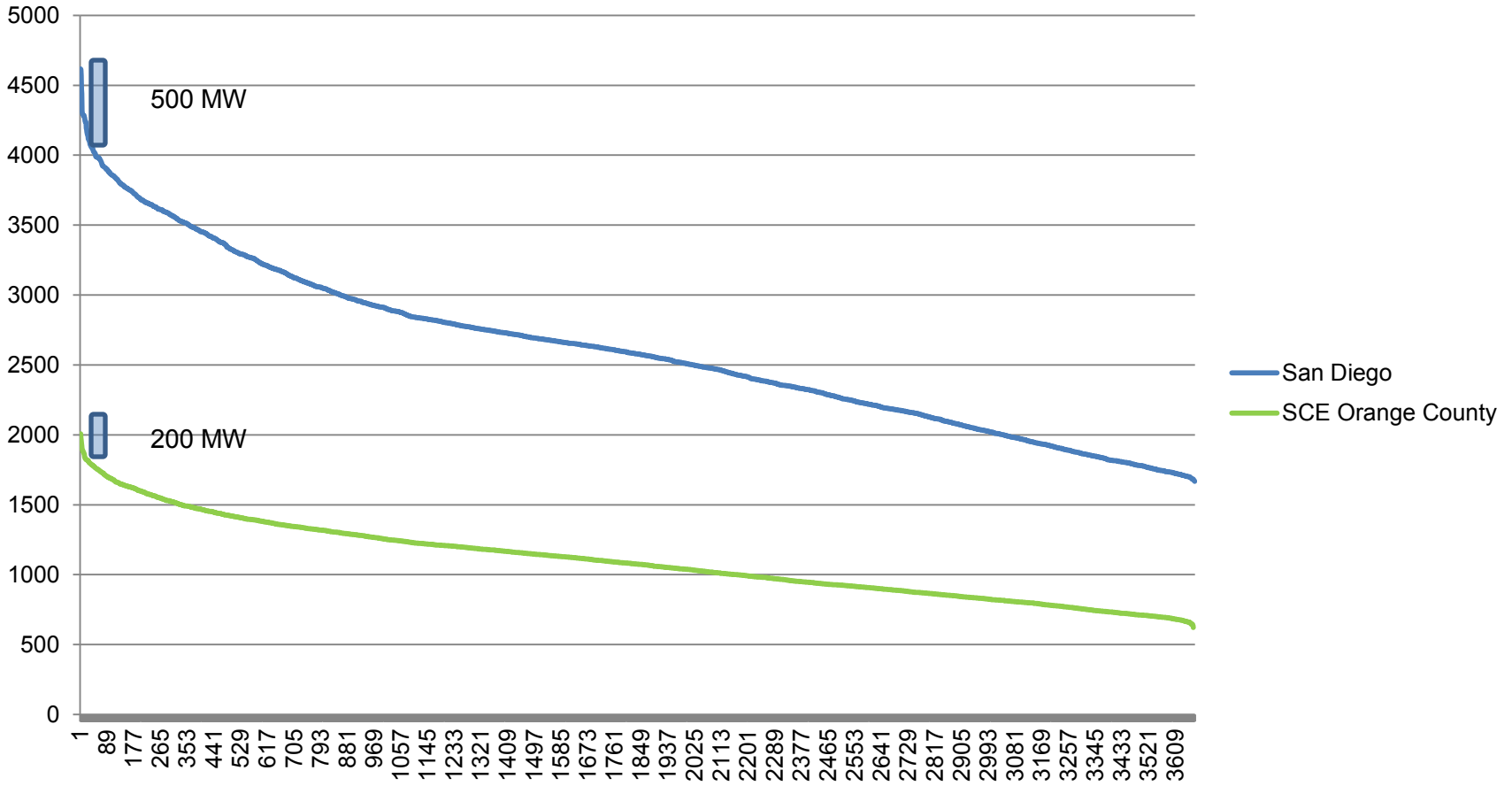
500 MW of DR in San Diego and 200 MW of DR in Orange County would be modeled by reducing corresponding load in the power system model



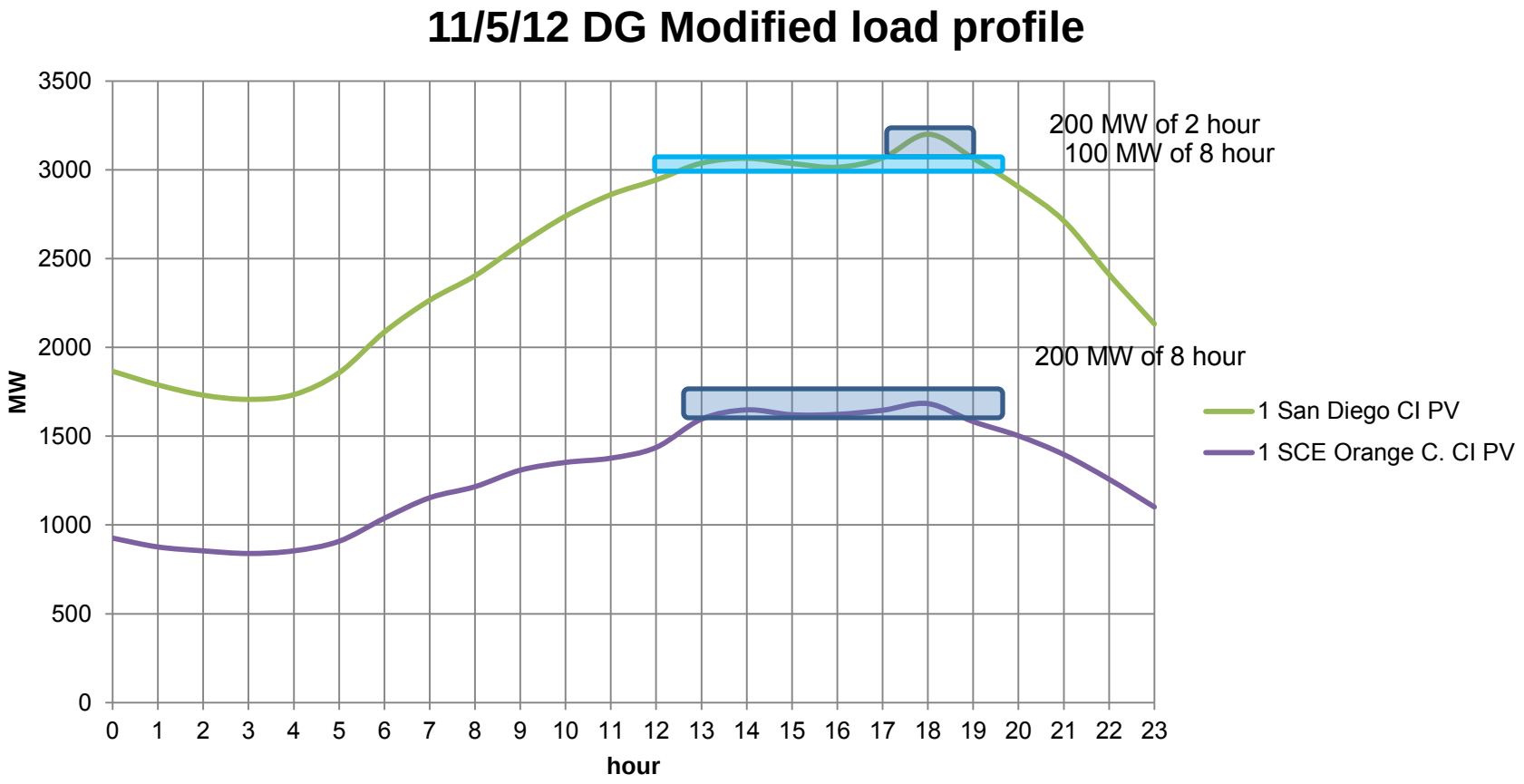
Summer Peak Net Load, Potential Mix #2



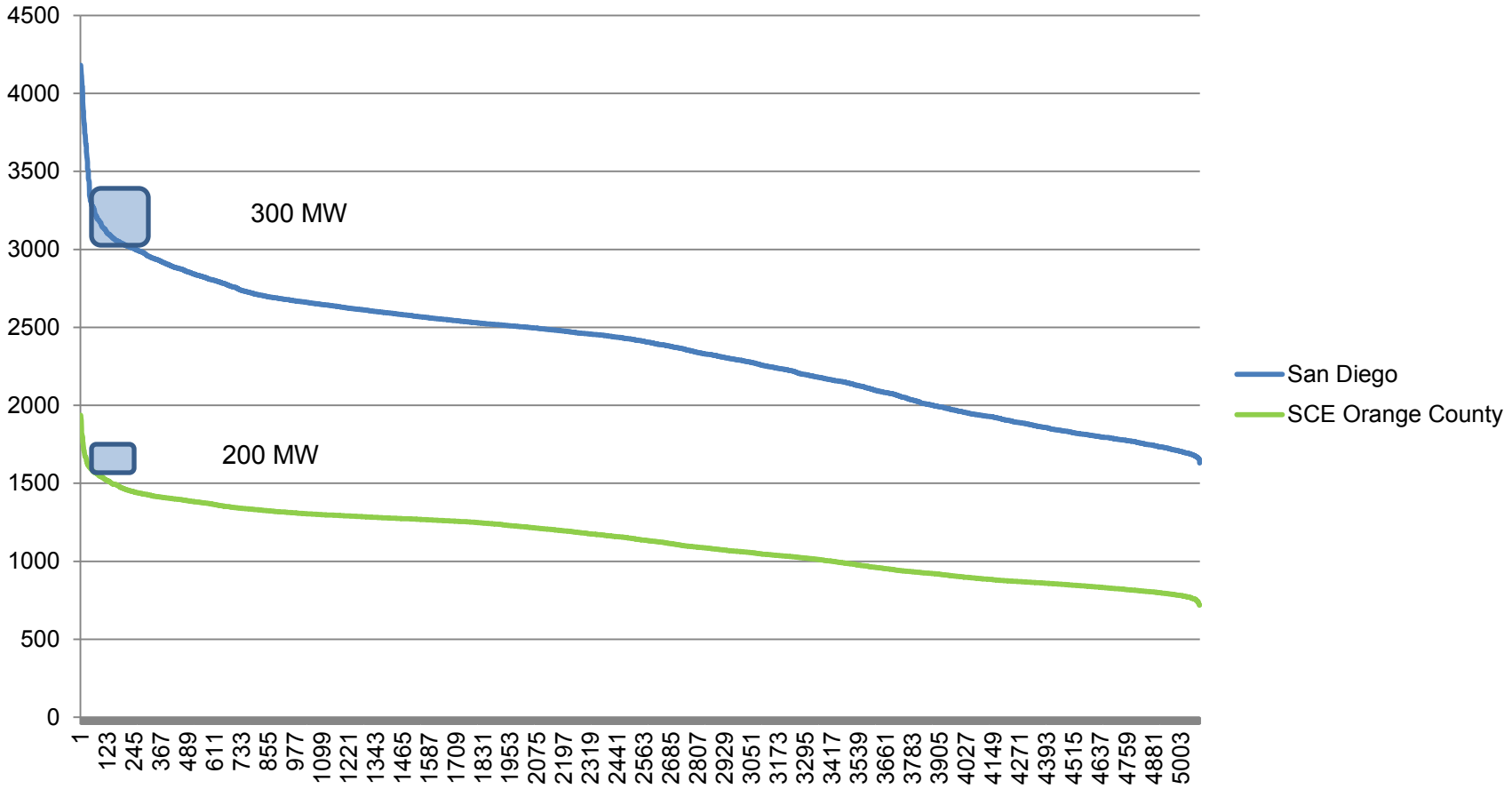
Load Duration Curve, May-September



Fall Peak Net Load



Load Duration Curve, October-April



Next Steps

- Complete the work identifying potential mixes of non-conventional resources
- Model the non-conventional resource mixes in transmission system models and determine the remaining conventional resource and transmission mitigation needs with these potential mixes of non-conventional resources

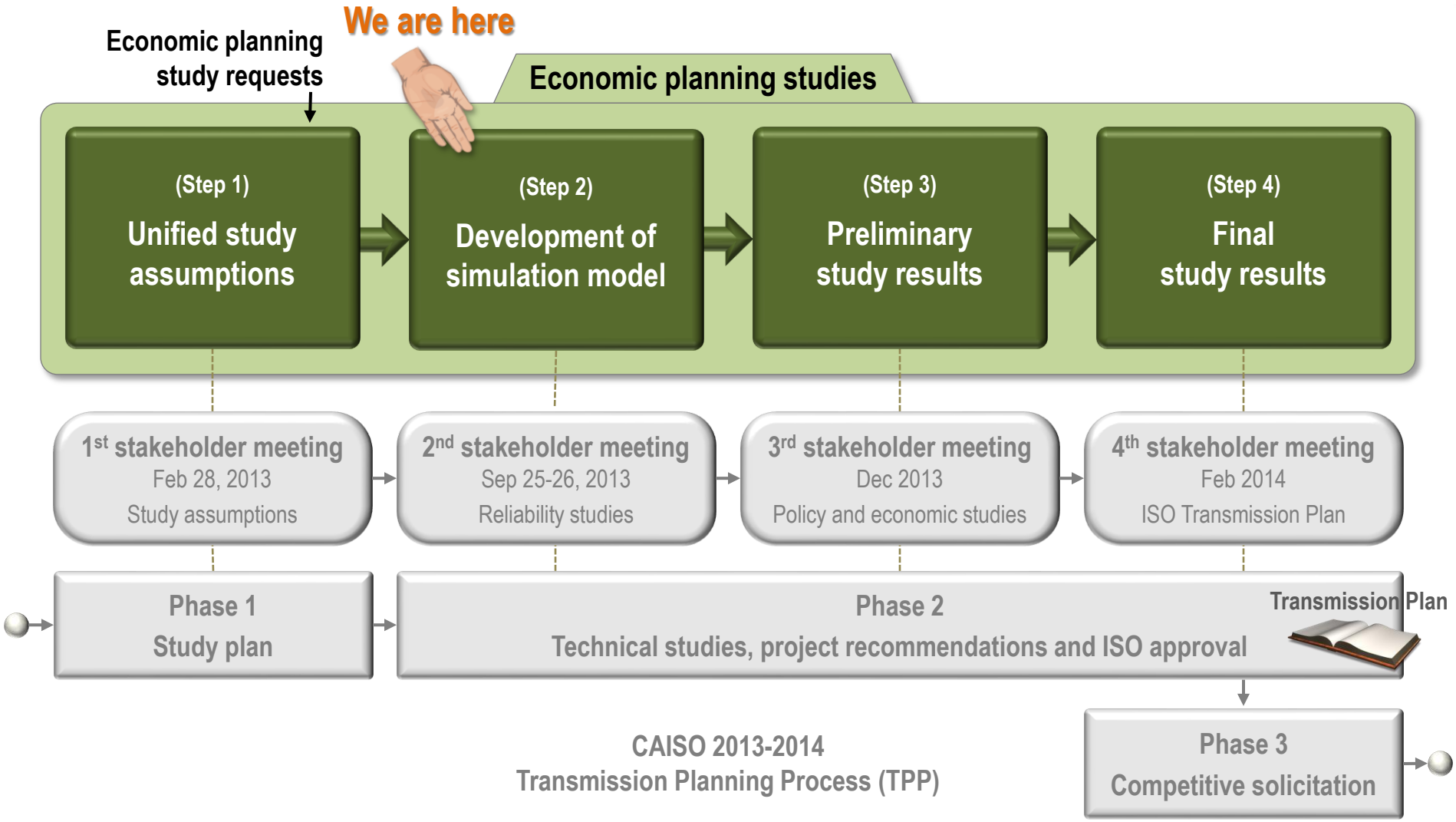
California ISO
Shaping a Renewed Future

Economic planning studies
Development of simulation model

Xiaobo Wang, PhD
Regional Transmission Engineering Lead

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Steps of economic planning studies and where we are



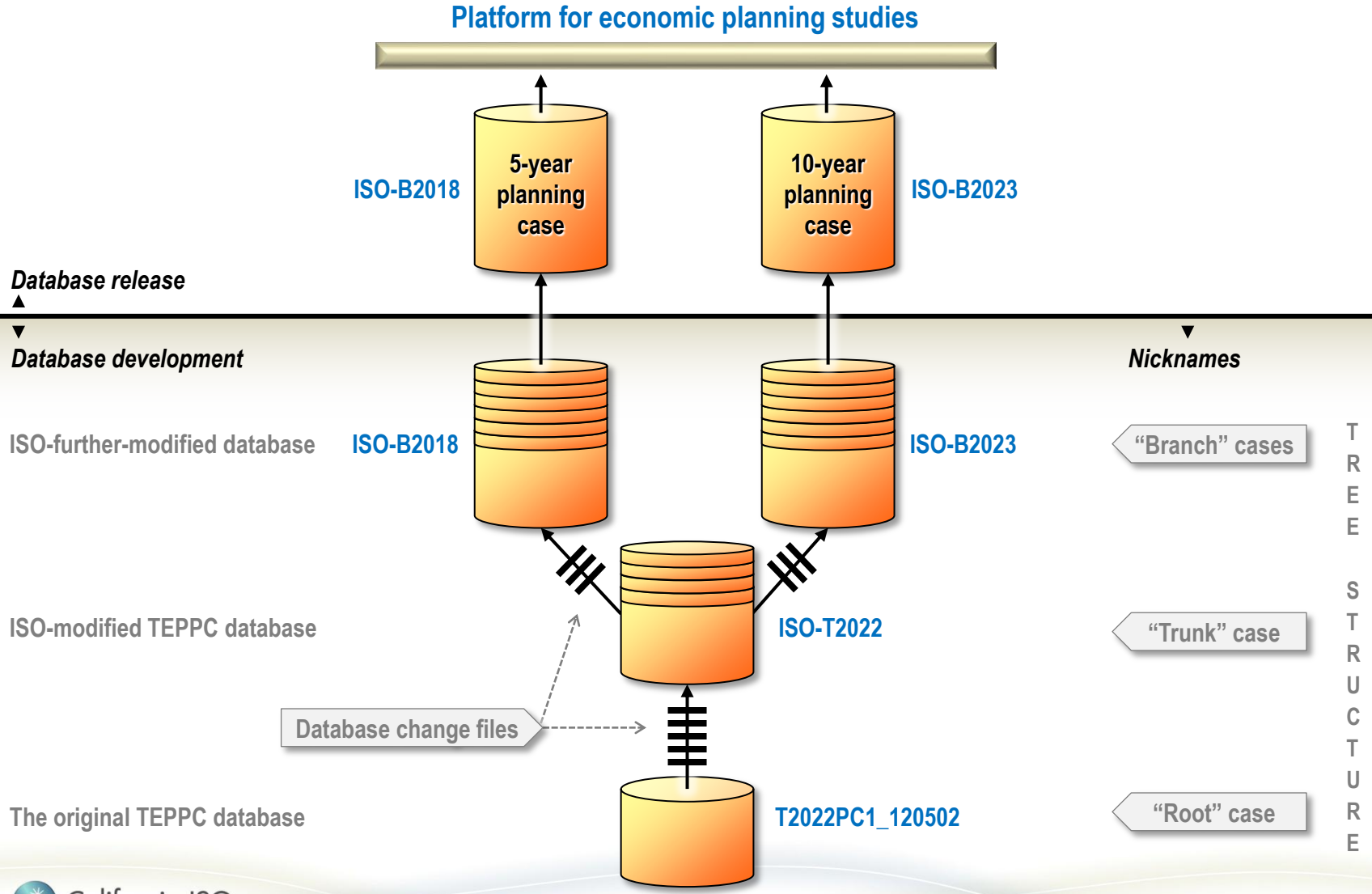
This presentation updates the work scope and describes the current status

For information about the work scope, see the Study Plan published at the Feb-28 stakeholder meeting

See also presentation "***Unified Planning Assumptions & Study Plan - Economic Planning Studies***" published at:
http://www.caiso.com/Documents/Presentations-2013-2014TransmissionPlanningProcessDraftStudyPlan.pdf

Development of simulation model

Production simulation database



Study assumptions with the new simulation model

In contrast to the last year's model

Category	Type	TP2012-2013	TP2013-2014
Load	In-state load	CEC 2011 IEPR	Same but adding incremental EE
	Out-of-state load	LRS 2012 data	Same but changing to 2018 & 2023 load
	Load profiles	TEPPC profiles	Same
	Load distribution	Spring, autumn, summer and winter	Same
Generation	RPS	CPUC/CEC 2012 RPS portfolios	CPUC/CEC 2013 RPS portfolios
	Hydro and pumps	TEPPC hydro data of 2005 pattern	Same
	Coal	Status quo	Some coal retirements in Southwest
	Nuclear	SONGS available	SONGS retired
	Once Through Cooling	ISO 2012 OTC assumptions	Updated assumptions with SONGS out
	Natural gas units	ISO 2012 Unified Study Assumptions	Almost the same
	Natural gas prices	E3 2010 MPR prices	CEC 2013 IEPR Preliminary – NAMGas
	Other fuel prices	TEPPC fuel prices	Same
	GHG prices	CPUC 2011 MPR	CEC 2013 IEPR Preliminary – GHG
Transmission	Reliability upgrades	Addition of approved projects	Addition of to-be-approved projects
	Policy upgrades	Addition of approved projects	Addition of to-be-approved projects
	Economic upgrades	None	None

Implementation details and status

Stage 1 of 2: Further development based on ISO-B2017 and ISO-B2022

Improving the simulation model

#	Incremental changes	Status	Notes
1	Changed AB32 GHG import hurdle interfaces from state to utility boundaries	Completed	Improved the GHG model
2	Replaced benchmarked hurdle rates with tariff wheeling rates	Completed	WECC-wide inter-BAA wheeling rates
3	Modeled commitment of ISO remote resources (aka dynamic resources)	Completed	More accurately reflecting import
4	Implemented CEC-2013-NAMGas model and retired E3-2010-MPR model	Completed	More granular WECC-wide NG model
5	Implemented IPPDC nomogram	Completed	Enforced LADWP generation into the line
6	Restricted hydro reserve contribution to 25% of generation capacity	Completed	Downplayed overly-flexible hydro
7	Froze coal dispatch by making the generation base loaded*	Completed	Took away coal contribution in benefits

* In the current version of the ISO database, the coal-freeze modeling has been rolled back

Updating data and study assumptions

#	Incremental changes	Status	Notes
1	Updated Path 26 line emergency ratings	Completed	Reduced congestion
2	Modeled APS *Four Corners* coal retirement and SCE-to-APS transfer of ownership	Completed	Per news at the end of 2010
3	Removed SDG&E area *Pio Pico* and *Quail Brush* and replace with generic capacity	Completed	Per CPUC Decision on 21-Mar-2013
4	Modeled PNM *San Juan* coal retirement and replacement by 2017	Completed	Per PNM announcement in 2013
5	Retired *Pittsburg #3* tied to OTC retirement although it is not an OTC unit	Completed	Per PG&E request in *NVE Study*
6	Revised GHG prices per CEC 2013 IEPR Preliminary	Completed	Per new data received on 5-May-2013
7	Retired *SONGS*	Completed	Per SCE announcement on 3-Jun-2013
8	Revised OTC replacement scheme based on ISO TP2012-2013 SONGS Study	Completed	Per ISO 2012 study results for SONGS
9	Removed *Mesquite #1* from the ISO area and committed the gen to SRP instead	Completed	Per Sempra-to-SRP sale on 4-Mar-2013
10	Estimated and updated the wheeling rate for NV Energy	Completed	Based on recent data
11	Used ISO-forecasted wheeling rates	Completed	Based on recent data

From DB130201 to DB130718,
the above-mentioned changes have been implemented

Implementation details and status (cont'd)

Stage 2 of 2: Continued development to create ISO-B2018 and ISO-B2023

Improving the simulation model

#	Incremental changes	Status	Notes
1	Modeled the Palo Verde Trading Hub	Completed	Reflecting wheeling-free within the hub
2	Rolled back the modeling of freezing coal dispatch	Completed	Let coal gen movable instead of fixed
3	Re-modeled AESO gap generation to minimize stress on local transmission	Completed	Reduced noises caused by the Alberta data

Updating data and study assumptions

#	Incremental changes	Status	Notes
1	Year 2018 and 2023: CA RPS based on 2013 CEC/CPUC 33% portfolios	In progress	One base and two alternative portfolios
2	Year 2018 and 2023: Flexible reserve requirement pertinent to the CA RPS	In progress	Driven by renewable intermittency and load
3	Year 2018 and 2023: Alignment of hourly profiles from 2022 to 2018 and 2023	In progress	Align week days properly
4	Year 2018 and 2023: Load with CA low scenario of incremental uncommitted EE	In progress	Based on CEC 2011 IEPR
5	Year 2018 and 2023: CA AB32 GHG prices	Completed	Based on CEC 2013 IEPR Preliminary
6	Year 2018 and 2023: WECC wheeling rates	Completed	Based on ISO forecast and WECC data
7	Year 2018 and 2023: WECC transmission setup	Completed	Based on timing of transmission upgrades
8	Coal: Modeled LADWP-to-SRP sale of *Navajo* ownership in 2015	Completed	Per LADWP's plan to exit coal
9	Coal: Retired and replaced *Intermountain* (1847 MW) by 2025	Completed	Per LADWP's plan to exit coal
10	Coal: Retiring *Reid Gardener* (605 MW) and replace with CC and renewables	In progress	Per Nevada SB-123 "NVision"
11	Storage: Modeled CA utilities' pilot projects of battery storage	Completed	PG&E: 2 + 4 MW, SCE: 8 MW
12	Generation and transmission: Plan to replace SONGS power	To do	Assumptions to be updated
13	Transmission: Updated Path 26 line normal ratings	Completed	Reduced congestion
14	Transmission: Updated SCIT limits	Completed	Updates
15	Transmission: Model any significant reliability-driven upgrades to be approved	To do	To be updated in December
16	Transmission: Model any significant policy-driven upgrades to be approved	To do	To be updated in December
17	System: Modeled Merced Irrigation District joining the CAISO	Completed	MeID will leave TID and join the ISO in 2015
18	System: Modeling PacifiCorp-CAISO EIM	In progress	New energy imbalance market
19	System: Retired SCE "Percent Import Limit" aka "40/60 rule"	Completed	This constraint is being phased out

Thanks!

Your questions and comments are welcome

For clarifying questions, please contact Xiaobo Wang at:
(916)608-1264, XBWang@caiso.com

For written comments, please send to:
RegionalTransmission@caiso.com

California ISO
Shaping a Renewed Future

Next Steps

Tom Cuccia
Senior Stakeholder Engagement and Policy Specialist

2013/2014 Transmission Planning Process Stakeholder Meeting
September 25-26, 2013

Next Steps

Date	Milestone
September 26	PTO presentations on mitigation solutions
September 26-October 10	Stakeholder comments on ISO preliminary reliability results and PTO mitigation solutions to be submitted to regionaltransmission@caiso.com
October 15	Request window closes. Submissions to be submitted to requestwindow@caiso.com
October 31	Post final 2013/2014 reliability study results