Agenda – Day 1
Preliminary Reliability Assessment Results

Tom Cuccia
Lead Stakeholder Engagement and Policy Specialist

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
# 2015-2016 Transmission Planning Process Stakeholder Meeting - Today’s Agenda

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Introduction and Overview
Preliminary Reliability Assessment Results

Neil Millar
Executive Director - Infrastructure Development

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Overview

- Process
  - Implementing new standards
  - Non-conventional alternatives
  - Critical Energy Infrastructure Information
- Ongoing studies and related consultation
- Update on Interregional Transmission Planning Process
- Conceptual statewide plan
- Transmission Access Charge
2015-2016 Transmission Planning Cycle

Phase 1
- Development of ISO unified planning assumptions and study plan
  - Incorporates State and Federal policy requirements and directives
  - Demand forecasts, energy efficiency, demand response
  - Renewable and conventional generation additions and retirements
  - Input from stakeholders
  - Ongoing stakeholder meetings

Phase 2
- Technical Studies and Board Approval
  - Reliability analysis
  - Renewable delivery analysis
  - Economic analysis
  - Wrap up of studies continued from previous cycle
  - Publish comprehensive transmission plan
  - ISO Board approval

Phase 3
- Receive proposals to build identified reliability, policy and economic transmission projects.

Continued regional and sub-regional coordination

Dates:
- April 2015: Coordination of Conceptual Statewide Plan
- March 2016: ISO Board Approval of Transmission Plan
- October 2016: Coordination of Conceptual Statewide Plan

**California ISO**
2015-2016 Ten Year Reliability Assessment To Date

- Preliminary study results were posted on August 14, supplemental results were posted on August 31, 2015
  - 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 mitigations
  - Submitted to ISO September 14
2015-2016 Ten Year Reliability Assessment going forward

- Request window
  - Closes October 15
- 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 million will be included in draft plan to be issued for stakeholder comments by January 31, 2015
- Purpose of today’s stakeholder meeting
  - Review the results of the reliability analysis
  - Set stage for stakeholder feedback on potential mitigations
Implementation of new standards:

- TPL-001-4 implementation having a significant effect on the presentation of results, as well as introducing new study requirements
- A separate presentation has been scheduled ahead of the presentation of the draft reliability results
- TPL-001-WECC-CRT-3 revises the transient voltage, transient frequency criteria, as well as providing a criterion for identifying risk of cascading outages. Draft criteria is out for comment and the Effective Date is January 1, 2016.
Alternatives to Transmission or Conventional Generation Methodology

- Planning efforts focus on:
  - Continuing to track forecast reliability in the LA Basin/San Diego area, with very high reliance on preferred resources developing
  - Continuing to explore other potential opportunities
- The issue of generic preferred resource characteristics versus characteristics tailored to local area needs continues to generate discussion
- The ISO is also participating in activities exploring related issues, including:
  - CPUC distributed energy resources proceeding
  - CEC and CPUC processes assessing load modifying resources
  - Resource procurement processes
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 category D 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 migrating planning material over 1 year old to the secure website.
  - One “bulk system” presentation has also been posted on the secure site.
Ongoing studies and related consultation

- ISO 50% special study
- Continuation of frequency response studies
- Gas/electric reliability in southern California
- Sensitivity studies in 2015-2016 Study Plan relating to Imperial Irrigation District
- Review of previously-approved projects in PG&E territory
- Large scale energy storage study
- Buck Blvd. Gen-Tie Loop-In Project – a continuation from the 2014-2015 planning cycle – will be presented separately after ISO 2015-2016 content
The ISO and our neighbors have an interregional coordination framework approved by FERC:

- **Interregional coordination**
  - Annual exchange of information
  - Annual public interregional coordination meeting

- **Joint evaluation of interregional transmission projects**
  - Biennial cycle; projects must be submitted no later than March 31st of any even-numbered year

- **Interregional cost allocation**
  - Each region determines (1) if project meets any regional needs and (2) if project is more cost effective or efficient than regional solution(s)
  - Costs shared in proportion to each region’s share of total benefits
FERC Order 1000 Requirements

• **It Does Require**
  – Process to coordinate/share results/plans among planning regions
  – Procedure to identify & jointly evaluate interregional transmission projects
  – Annual exchange of planning data & related information
  – Mechanism for communicating information about planning processes

• **It Does not Require**
  – Formation of interregional transmission planning entities,
  – The creation of a distinct interregional transmission planning process, or
  – An interregional transmission plan
First cycle of CAISO’s biennial FERC Order 1000 interregional planning project evaluation begins 2016

**Phase 1**
- Development of ISO unified planning assumptions and study plan

**Phase 2**
- Technical Studies and Board Approval

**Phase 3**
- Receive proposals to build identified policy and economic transmission projects

- Project Submissions by Mar 31
- Interregional Coordination Stakeholder Meeting; conceptual solutions
- Conduct Screening Process
- Preliminary Assessment
- Document in Transmission Plan Move to next planning cycle

- Not Viable?
- Inform other Relevant Regions and Stop Assessment

**Stakeholder Meetings**
- Mar 2016: Stakeholder Meeting 1
- Sept 2016: Stakeholder Meeting 2
- Nov 2016: Stakeholder Meeting 3
- Feb 2017: Stakeholder Meeting 4
And continues into the 2016-2017 planning process

Phase 1
Development of ISO unified planning assumptions and study plan

Phase 2
Technical Studies and Board Approval

Phase 3
Receive proposals to build identified policy and economic transmission projects

- Development of ISO unified planning assumptions and study plan
- Technical Studies and Board Approval
- Receive proposals to build identified policy and economic transmission projects

- Stakeholder Meeting 1: Mar 2017
- Stakeholder Meeting 2: Sept 2017
- Stakeholder Meeting 3: Nov 2018
- Stakeholder Meeting 4: Feb 2018

- Data and cost Coordination with other Relevant Regions
- Detailed Assessment
- Document in Transmission Plan

- Annual Information from previous planning cycle
- Interregional Coordination Stakeholder Meeting; conceptual solutions
- Stakeholder Meeting; conceptual solutions

- Not Viable?
- Inform other Relevant Regions and Stop Assessment
- Seek ISO Board approval

- Other Relevant Regions “Committed”
- Project not viable

- Yes?
- No?
Draft Conceptual Statewide Plan has been posted for stakeholder review and comment

- Previous years have primarily relied upon CTPG annual report
  - CTPG activities currently on hold with FERC Order 1000

- This year’s draft plan is based on previous CTPG report updated with publicly available information – as was done last year

- Comment period to October 20th

- We intend to review the value this provides, in light of the FERC Order 1000 regional and interregional planning requirements.
The 2014-2015 TPP model was posted and a stakeholder call held on May 18, 2015

Following the call, the underlying estimated project data was posted

Comments have been received for possible future refinements, and are being considered

The model will be updated in late 2015 for January 2016 posting of draft transmission plan
Transmission Reliability Studies
Study Plan and Criteria

J.E. (Jeff) Billinton
Manager, Regional Transmission – North

2015-2016 Transmission Planning Process
September 21, 2015
2015-2016 Transmission Planning Process

Reliability Studies

- Reliability Studies conducted per 2015-2016 TPP Assumptions and Study Plan
Application of ISO Planning Standards with TPL-001-4

- ISO Planning Standards applying TPL-001-4 have been approved by the ISO Board with an effective date of April 1, 2015

Requirement R3
Contingency Category Comparison

- Contingencies
  - Naming convention has changed
  - Loss of a shunt device (capacitors, reactors, SVCs, etc.)
  - Loss of generator plus loss of another facility (G-1, N-1)
  - Separated and clarified stuck breaker versus relay failure contingencies
## Requirement R3
### Contingency Category Comparison

<table>
<thead>
<tr>
<th>New Category</th>
<th>Old Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>P0</td>
<td>Cat A</td>
<td>System intact</td>
</tr>
<tr>
<td>P1 P2.1 P3.2*</td>
<td>Cat B</td>
<td>Single contingency (Fault of a shunt device- fixed, switched or SVC/STATCOM is new)</td>
</tr>
<tr>
<td>P2</td>
<td>Cat C1, C2</td>
<td>Single event which may result in multiple element outage. Open line w/o fault, bus section fault, internal breaker fault</td>
</tr>
<tr>
<td>P3</td>
<td>Cat C3</td>
<td>Loss of generator unit followed by system adjustments + P1. No load shed is allowed</td>
</tr>
<tr>
<td>P4</td>
<td>Cat C</td>
<td>Fault + stuck breaker events</td>
</tr>
<tr>
<td>P5</td>
<td>n/a</td>
<td>Fault + non redundant relay failure to operate (new)</td>
</tr>
<tr>
<td>P6</td>
<td>Cat C3</td>
<td>Two overlapping singles (not generator)</td>
</tr>
<tr>
<td>P7</td>
<td>Cat C5, C4</td>
<td>Common tower outages; loss of bipolar DC</td>
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* ISO Planning Standard treated as Category B contingency
Contingency P2-1
Open-ended line analysis

• P2-1 – Opening of a line section without a fault
  – Opening of one end of a transmission line without a fault and serving load radially from a single point
    • Typically loads tapped off lines
  – Requires similar performance as P1
  – ISO is reviewing potential mitigation options
Sensitivity Studies  
TPL-001-4 Requirement 2.1.4

- Sensitivity results considered on a case by case basis.
- Not mandatory to address a reliability issue of a single sensitivity case.
- Reliability issue identified in multiple sensitivity cases may warrant mitigation.
- Sensitivity results may also be used to favor a particular mitigation.

<table>
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<th>Sensitivity Study</th>
<th>Near-term Planning Horizon</th>
<th>Long-Term Planning Horizon</th>
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<td></td>
<td>2017</td>
<td>2020</td>
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</table>
| Summer Peak with high CEC forecasted load | - | - | PG&E Local Areas  
SDG&E Area  
SCE Northern  
SCE Bulk  
PGE Bulk |
| Summer Peak with heavy renewable output and minimum gas generation commitment | - | PG&E Bulk  
SDG&E Area  
SCE Bulk  
SCE Northern  
SCE North of Lugo  
SCE East of Lugo  
SCE Eastern  
SDG&E Area | - |
| Summer Off-peak with heavy renewable output and minimum gas generation commitment (renewable generation addition) | - | VEA Area | - |
| Summer Peak with OTC plants replaced | - | SCE Metro Area  
SDG&E Area | - |
| Summer Peak with low hydro output | - | SCE Northern Area | - |
| Retirement of QF Generations | - | - | PG&E Local Areas |
**Sparing Strategy**
TPL-001-4 Requirement 2.1.5

- Assessment of sparing strategy for major Transmission Equipment that have a lead time of one year or more for P0, P1 and P2 contingencies
- ISO working with PTOs on sparing strategies of major Transmission Equipment that may have lead time of longer than one year
  - Such as SVC or reactive devices
- Results will be included in draft Transmission Plan
Short Circuit Assessment
TPL-004-1 Requirement 2.3

• Near-Term Transmission Planning Horizon
  – assess whether circuit breakers have interrupting capability for Faults they are expected to operate for.
• The ISO is coordinating with the PTOs on this assessment who will conduct the studies.
• Circuit breakers that do not have interrupting capability are to be identified by PTOs
• Short circuit data will be provided per the MOD-032 process documents posted on ISO website.
  – [Link](http://www.caiso.com/Pages/documentsbygroup.aspx?GroupId=F94E2438-69DA-4881-BCF7-3B937BE44593)
PG&E Bulk Transmission System
Preliminary Reliability Assessment Results

Available on Market Participant Portal
Confidential – Subject to Transmission Planning NDA

Abhishek Singh
Senior Regional Transmission Engineer
Irina Green
Senior Advisor Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Humboldt, North Coast & North Bay Areas Preliminary Reliability Assessment Results

Rajeev Annaluru
Senior Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Humboldt Area

- 3000 sq. miles. NW corner of PG&E
- Cities: Eureka, Arcata, Garberville
- Generation - Humboldt Bay Power Plant, QFs, total 227 MW
- Voltage 115 kV – from Cottonwood, 60 kV – from Mendocino
- Winter peak 193 MW in 2025, summer peak 169 MW in 2025
Humboldt Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category P2 - 8
  - Thermal overloads due to Category P6 - 13
  - Low voltage due to Category P1 – 2
  - Low voltage due to Category P2 – 2
  - Low voltage due to Category P6 – 1

- Compared to last year results:
  - New violations identified for new contingency categories
  - QF retirement sensitivity in Humboldt identified new violations
Humboldt Area – Results (Category P0 – P2)

- **Thermal Overloads**
  - Humboldt Bay - Rio Dell 60kV Line (Cat P2, 2017)
  - Rio Dell Jct - Bridgeville 60kV Line (Cat P2, 2017)
    - Mitigation Short term: Operating procedure to re-dispatch Humboldt generation.
    - Mitigation Long term: Potentially reconductor the line

- **Low Voltage**
  - Arcata area 60kV (Cat B, 2024)
    - Potential Mitigation: May need a new 60kV cap bank in the 7-10 year timeframe
  - Maple Creek 60kV (Cat B, 2016)
    - Mitigation: Maple creek reactive support project

- **Voltage Deviation**
  - Arcata area 60kV (Cat B, 2024)
    - Potential Mitigation: May need a new 60kV cap bank in the 7-10 year timeframe
  - Maple Creek 60kV (Cat B, 2016)
    - Mitigation: Maple creek reactive support project

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Category C problems will be discussed in the area diagram in next slide
Humboldt Area – Results (cont’d)

- Cat C Overload
- Cat P2 & P6 Voltage violations
- Cat P2&P6 Low and high Voltage violations
- Cat C Overload
- Cat C Overload
- Cat C Overload
- Cat C Overload
- Cat P6 Low Voltage violations
Conclusion

- Retirement of Pacific Lumber (QF unit) has created new thermal constraints, which needs mitigation.
- Humboldt – Arcata pocket has both high and low voltage violations. Additional reactive support may be needed.
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 1538 MW in 2025
The assessment identified:

- Thermal overloads due to Category P1 – 3, P2 - 31 and Category P6 & P7 - 64
- Low voltages due to Category P1 & P2-1 – 3 and Category P2- P7 - 5
- Voltage deviations due to Category P1 & P2 - 3

Compared to last year results:

- Most major issues identified in this years analysis are similar to the issues identified last year.
- New issues identified due to new contingency categories
North Coast / North Bay Area – Results (Category P0-P2)

- **Thermal Overloads**
  - Highway Jct – Highway 115kV (Cat P0 for AAEE Sensitivity)
    - Potential mitigation: Reconductor the line
  - Ignacio – Bolinas #1 & #2 line (Cat P2-1)
    - Potential Mitigation – Reconductor the line between Olema & Bolinas
  - Mendocino – Hartley - Clear Lake 60 kV Line #1(Cat P2, P6, P7)
    - Mitigation – Clear Lake 60kV system reinforcement project
  - Clear Lake – Hopland 60kV line (Cat P1, P6, P7)
    - Mitigation – Clear Lake 60kV system reinforcement project
  - Clear Lake – Eagle Rock 60kV line (Cat P1, P2, P6, P7)
    - Mitigation – Clear Lake 60kV system reinforcement project
  - Bridgeville – Garberville 60kV line
    - Mitigation – Bridgeville – Garberville 115kV line project
  - Tulucay – Napa 60kV line #1 (Cat P2)
    - Mitigation – Reconductor the line
  - Fulton – Fitch Mountain 60kV line (Cat P2)
    - Mitigation – Reconductor the line
North Coast / North Bay Area – Results (Category P0-P2)

- **Low Voltage**
  - Clear Lake, Lower Lake, Konocti, Middle town (Cat P1, P2, P6)
    - Mitigation – Clear Lake 60kV system reinforcement project
  - Greenbrae, Sausalito 60kV (Cat P2)
    - Mitigation – Ignacio – Alto voltage conversion project
  - Bolinas, Stafford, Novato, Olema 60kV (Cat P2)
    - Potential Mitigation – Reconductor Olema – Bolinas 60kV line

- **Voltage Deviation**
  - Clear Lake, Lower Lake, Konocti, Middle town, Calistoga, Dunbar, St. Helna (Cat P1)
    - Mitigation – Clear Lake 60kV system reinforcement project
  - Greenbrae, Sausalito 60kV (Cat P2)
    - Mitigation – Ignacio – Alto voltage conversion project
  - Bolinas, Stafford, Novato, Olema 60kV (Cat P2)
    - Potential Mitigation – Reconductor Olema – Bolinas 60kV line
Mendocino - Eagle Rock Area Thermal Issues

Towards Humboldt
   Garberville
   Bridgeville

Mendocino
   Lucern
   Red Bud J1
   Red Bud
   High land
   Mendocino to Cortina
   Lower Lake
   Cortina

Humboldt
   Annapolis
   Fort Ross

FULTON POCKET
   Gualala 60kV
   Fort Ross

Eagle Rock
   Home Stk
   Cache J

Fitch Mtn

Geysers Jct

Bridgeville

Towards Humboldt

Towada

Laytonville

Cortina

Willits

Menonoite

Calpella

Clear La

Red Bud J1

Upper Lake

Mendocino

Lower Lake

High land

Mendocino

P1

P2

P1

P1

P1

P2

P1

Cat P1 & P2-1 Overload

Cat P2-P7 Overload

G.P. (Geo Energy)
Mendocino - Eagle Rock Area Voltage Issues

Towards Humboldt
Garberville
Bridgeville

Category P2-P7
Voltage issues

Category P1
Voltage issues

Mendocino
Lucern
Red Bud J1
Red Bud
High land

Mendocino to Cortina
Granite
Konocli 60kV
Cortina

Eagle Rock
Cache J
Lower Lake
Home Stk

FULTON POCKET

Category P2
Voltage issues
Ignacio – Alto area issues

Category P2-P7
Voltage issues
Fulton area issues

Towards Middle town

Calistoga

Category P2-P7 Voltage issues

Lakeville 115kV
Conclusions

• Cat P0 overload identified (Highway Jct – Highway 115kV line) in no AAEE Sensitivity case.
• Ignacio – Bolinas #1&2 lines overloaded for P2-1 contingency.
• 115kV corridor between Fulton – Lakeville overloaded for P6 & P7 conditions. May need an SPS for load drop.
North Valley & Central Valley Areas
Preliminary Reliability Assessment Results

Bryan Fong
Sr. Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
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 1,037 MW in 2025 (49 MW of AAEE)
Study Scenarios

- **8 Baseline Scenarios**
  - 2017 Summer Peak
  - 2020 Summer Peak
  - 2025 Summer Peak
  - 2017 Spring Off-peak
  - 2020 Light Load

- **3 Sensitivity Scenarios**
  - 2025 Summer Peak No AAEE
  - 2025 Summer Peak No QF
  - 2020 Summer Peak High Renewable (*Existing & new renewables dispatched to Pmax*)
North Valley Area Assessment Summary

- The 2015-16 assessment identified:
  - Thermal overloads due to Category P0-3, P1 – 2, P2 – 8, P3 – 1, P6 - 18 and P7 – 3
  - Low voltages due to P1 – 4, P2 – 8 and P6 – 10
  - Voltage deviations due to P1 – 15 and P2 – 21
  - Low voltage at 60 and 115 kV buses only
  - One Category P-2 contingency - Table Mountain Stuck Bus-Tie Breaker resulted in divergence

- Compared to last year results:
  - 4 new Category P2-1 overload (new contingency category)
North Valley Area – Results (Category P0 & P1)

- **Thermal Overloads**
  1. Glenn #3 60 kV Line (Cat P0 – Summer 2020)
  2. Glenn #2 230/60kV Bank (Cat P1 – Summer 2025)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.

- **Thermal Overloads (Sensitivity)**
  1. Cottonwood-Anderson 60 kV line (Cat P1 – Summer 2025 No AAEE and 2025 High Renewable)
  2. Palermo-Big Bend 60 kV Line (Cat P1 – Summer 2025 No AAEE and 2025 QF Retirement and Summer 2020 High Renewable)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.
  - Load transfer

Thermal issues resulting from other contingency categories will be discussed in the area diagram.
North Valley Area – Results (Category P0 & P1)

- **Voltage Results**
  - Cascade and Jessup Area 60 kV high voltage (Cat P1 – 2017 Spring Off Peak and 2020 Spring Light Load)

- **Potential Mitigations**
  - Interim action plans for overloads such as load transfer and may need additional reactive support
  - Mitigation under investigation for the high voltage issues

**Voltage Results (Sensitivity)**

- No Cat P0 nor Cat P1 voltage deviation issues

- **Potential Mitigations**
  - N/A

Voltage issues resulting from other contingency categories will be discussed in the area diagram.
North Valley Area – Results (cont’d)

Legend
- 230 kV
- 115 kV
- 60 kV

Mitigation
SPS, Load Switch, Load Drop, Reconductor

Cat P1 voltage deviations & Cat P6 low voltages and deviations
Cat P6 overload
Cat P1 & P6 low voltages and deviations
North Valley Area – Results (cont’d)

Legend

- 230 kV
- 115 kV
- 60 kV

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**Cat P6 low voltages**

**Legend**

- 230 kV
- 115 kV
- 60 kV

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**Cat P6 overloads**

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**Cat P0 overloads**

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**Cat P2 and P6 overload**
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 4,631 MW in 2025 (262 MW of AAEE)
Central Valley Area Assessment Summary

- The assessment identified:
  - Thermal overloads due to Category P0 - 5 P1 – 10, P2 – 32, P3 – 17, P6 - 57 and P7 – 6
  - Low voltages due to P2 – 31 and P6 – 68
  - High voltages due to P1 – 28,
  - Voltage deviations due to P1 – 3 and P2 – 8
  - Area-wide high voltage under normal condition (light-load)

- Compared to last year results:
  - 3 new Category P1 thermal overload due to load increase
  - 5 new Category P2-1 overload (new contingency category)
Sacramento Area – Results (Category P0 & P1)

- **Thermal Overloads**
  1. Vaca Dixon – Winter 60kV Line (Cat P0 – Summer 2017)
  2. Vaca Dixon 115/60 kV Transformer Bank #5 (Cat P1 – Summer 2017)

- **Potential Mitigations**
  - Interim action plans transferring load to adjacent Distribution Planning Areas until Vaca-Davis Voltage Conversion

- **Thermal Overloads (Sensitivity)**
  1. Cortina 230/60 kV Bank (Cat P1 – Summer 2025 No AAEE, QF Retirement & 2020 Renewable)

- **Potential Mitigations**
  - Interim action plans for overloads with load transfer.

Thermal issues resulting from other contingency categories will be discussed in the area diagram.
Sacramento Area – Results (Category P0 & P1)

- **Voltage Results**
  - Plainfield 60 kV (Cat P1 - 2017)
  - Colusa 60 kV (Cat P1 - 2025)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.
  - Mitigation may need additional reactive support

**Voltage Results (Sensitivity)**
- No Cat P0 nor Cat P1 voltage deviation issues

**Potential Mitigations**
- N/A

Voltage issues resulting from other contingency categories will be discussed in the area diagram
Mitigation: SPS, Load Switch, Load Drop, Reconstruct

Cat P1 overload on 115/60 kV bank and Cat C overloads on 230/115 kV banks.
Sierra Area – Results (Category P0 & P1)

- Thermal Overloads
  1. Placer 115/60 kV Bank (Cat P1 – Summer 2025)
  2. East Nicolaus 115/60 kV Bank (Cat P1 – Summer 2017)

- Potential Mitigations
  - Interim action plans for overloads with long-term projects in place.

- Voltage Results (Sensitivity)
  - No Cat P0 nor Cat P1 issues

- Potential Mitigations
  - N/A

Thermal issues resulting from other contingency categories will be discussed in the area diagram.
Sierra Area – Results (Category P0 & P1)

- **Voltage Results**
  - Atlantic Area 60 kV (Cat P1 - 2017)
  - Wheatland 60 kV (Cat P1 - 2017)
  - Higgins 115 kV (Cat P1 - 2017)
  - Grass Valley Area 60 kV (Cat P1 - 2025)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.
  - Potential Mitigation – Distribution load transfer / disable automatics and may add additional reactive support

Voltage issues resulting from other contingency categories will be discussed in the area diagram.
Sierra Area – Results (Category P0 & P1)

- Voltage Results (Sensitivity)
  - No Cat P0 nor Cat P1 voltage deviation issues
- Potential Mitigations
  - N/A

Voltage issues resulting from other contingency categories will be discussed in the area diagram.
Sierra Area – Results (cont’d)

Legend
- 230 kV
- 115 kV
- 60 kV

Mitigation
SPS, Load Switch, Load Drop, Reconductor

Cat P1 high voltage (non peak)

Cat P6 overloads

Cat P6 overload on Rio Oso 230/115 kV bank #1

Cat P1 low voltage
Sierra Area – Results (cont’d)

Legend
- 230 kV
- 115 kV
- 60 kV

- Cat P6 overloads
- Cat P6 low voltages
- Cat P1 low voltages and voltage deviations
- Gold Hill 230/115 kV Bks 1 & 2 Cat P6 overloads
- Cat P6 Potential voltage collapse
Stockton/Stanislaus Area – Results (Category P0 & P1)

- Thermal Overloads
  1. Valley Springs No. 1 60 kV Line (Cat P1 – Summer 2017)
- Potential Mitigations
  - Interim action plans for overloads with long-term projects in place.

- Thermal Overloads (Sensitivity)
  - No Cat P0 nor Cat P1 issues
- Potential Mitigations
  - N/A

Thermal issues resulting from other contingency categories will be discussed in the area diagram.
Stockton/Stanislaus Area – Results (Category P0 & P1)

- **Voltage Results**
  - Westley 60 kV (Cat P1 - 2017)
  - Lockford 230 kV (Cat P1 - 2017)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.
  - Potential Mitigation – Disable automatics during peak loading conditions and may need additional reactive support.

- **Voltage Results (Sensitivity)**
  - No Cat P0 nor Cat P1 voltage deviation issues

- **Potential Mitigations**
  - N/A

Voltage issues resulting from other contingency categories will be discussed in the area diagram.
Stockton/Stanislaus Area – Results (cont’d)

Legend

- 230 kV
- 115 kV
- 60 kV

**Mitigation**
- SPS, Load Switch, Load Drop, Reconductor

---

Cat P1 voltage deviations & Cat P6 overloads & low voltages

Cat P6 overloads

Cat P1 overload
Stockton A-Weber #1 60 kV line

Cat P6 overloads

Cat P6 overloads

Cat P1 overload
Valley Springs #1 60 kV line

Cat P1 overload
Lockeford #1 60 kV line

Cat P6 overloads

Cat P6 overloads

Cat P6 low voltage
## Conclusion

**Reliability issues needing new mitigation**

<table>
<thead>
<tr>
<th>Area</th>
<th>Facility</th>
<th>Contingency Category</th>
<th>Potential Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Valley 60 kV Area</td>
<td>Cottonwood-Benton 60kV Line</td>
<td>P2</td>
<td>System upgrade or preferred resource</td>
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<tr>
<td></td>
<td>Cascade-Stillwater 60kV Line</td>
<td>P6</td>
<td></td>
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<tr>
<td>Sierra 115 kV Area</td>
<td>East Nicolaus 115/60 kV Bank</td>
<td>P6</td>
<td>Approved project scope change if feasible</td>
</tr>
<tr>
<td></td>
<td>Drum-Dutch Flat #1 115kV Line</td>
<td>P6</td>
<td>System upgrade or preferred resource</td>
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<tr>
<td></td>
<td>Horseshoe-Newcastle #2 115kV Line</td>
<td>P6</td>
<td></td>
</tr>
<tr>
<td>Sacramento 115 kV Area</td>
<td>Vica Dixon 230/115kV #3 Bank</td>
<td>P6</td>
<td>System upgrade or preferred resource</td>
</tr>
<tr>
<td>Stockton/ Stanislaus 115 kV Area</td>
<td>Stanislaus-Melone SW Station-Manteca #3 115 kV Line</td>
<td>P7</td>
<td>System upgrade or preferred resource</td>
</tr>
<tr>
<td>North &amp; Central Valley Area</td>
<td>High voltage issues in light load and off-peak conditions</td>
<td>P1</td>
<td>Voltage support or storage</td>
</tr>
</tbody>
</table>
Greater Bay Area
Preliminary Reliability Assessment Results

Binaya Shrestha
Sr. Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
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: Approximately 7,000 MW of generation capacity.
- Comprised of 60, 115 & 230 & 500 kV transmission facilities.
- Summer Peak 8,730 MW in 2025 (666 MW of AAEE) (decrease of 112 MW from last year’s forecast for 2024)
Study Scenarios

- **8 Baseline Scenarios**
  - 2017 Summer Peak
  - 2020 Summer Peak
  - 2025 Summer Peak
  - 2017 Spring Off-peak
  - 2020 Light Load
  - 2017 Winter Peak (SF & Peninsula)
  - 2020 Winter Peak (SF & Peninsula)
  - 2025 Winter Peak (SF & Peninsula)

- **3 Sensitivity Scenarios**
  - 2025 Summer Peak No AAEE *(666 MW)*
  - 2025 Summer Peak No QF *(276 MW)*
  - 2020 Summer Peak High Renewable *(Existing & new renewables dispatched to Pmax)*
Greater Bay Area Assessment Summary

- The 2015-16 assessment identified:
  - Thermal overloads due to Category P1 – 3, P2 – 42, P3 – 1, P6 – 26 and P7 – 18
  - Low voltages due to P2 – 3, P6 – 9 and P7 – 9
  - Voltage deviations due to P1 – 3 and P2 – 8
  - Area-wide high voltage under normal condition (light-load)

- Compared to last year results:
  - 1 new Category P1 thermal overload due to load increase
  - 2 Category P1 overloads eliminated due to previously approved project.
  - 2 Category P1 overloads eliminated due to system reconfiguration.
  - 1 new Category P2-1 overload (new contingency category)
  - Last year there was 1 project approved in this area
    - TBC runback scheme modification & cable rerate.
Greater Bay Area – Results (Category P0 & P1)

- **Thermal Overloads**
  1. Potrero-Mission (AX) 115kV Cable (Cat P1 – Summer 2025 and Winter 2017, 2020 & 2025)
  2. Newark-Dixon Landing 115kV Line (Cat P1 – Summer 2017)
  3. Piercy-Metcalf 115kV Line (Cat P1 – Summer 2017)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.

- **Thermal Overloads (Sensitivity)**
  1. Jefferson-Stanford #1 60kV line (Cat P1 – Summer 2025 No AAEE)
  2. Metcalf-Llagas 115 kV Line (Cat P1 – Summer 2025 High Renewable)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.
  - Generation redispatch

Thermal issues resulting from other contingency categories will be discussed in the area diagram
Greater Bay Area – Results (Category P0 & P1)

- **Voltage Results**
  - Dixon Landing 115 kV voltage deviation (Cat P1 - 2016)
  - Area-wide high voltage (Cat P0 – 2020 light-load)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.
  - Mitigation under investigation for the high voltage issues

- **Voltage Results (Sensitivity)**
  - Owens Brockway 115 kV voltage deviation (Cat P1 – Summer 2025 No AAEE)
  - Gilroy F & Llagas 115 kV voltage deviation (Cat P1 – Summer 2025 High Renewable)

- **Potential Mitigations**
  - Interim action plans for overloads with long-term projects in place.
  - Generation redispatch

Voltage issues resulting from other contingency categories will be discussed in the area diagram.
San Francisco 115 kV system

Approved Projects
- TBC runback scheme modification & cable rerate

Sensitivity
- No significant impact
Oakland 115 kV system (Northern)  

No local generation dispatched

Sensitivity

- Thermal loadings worsen in “No AAEE”
Oakland 115 kV system (Southern)

Approved Projects
- East Shore-Oakland J 115 kV Reconductoring

Sensitivity
- No significant impact
- One new voltage deviation in “No AAEE”
Pittsburg-Moraga 115 kV system

Approved Projects
- North Tower 115 kV Looping
- Pittsburg 230/115 kV Transformer Addition
- Pittsburg-Lakewood SPS

Sensitivity
- Thermal loadings worsen in “No AAEE”
- Couple of new contingency overloads in “No QF” & “High Renewable”
Peninsula 60 kV system

Approved Projects
- Jefferson-Stanford #2 60 kV line

Sensitivity
- Thermal loadings worsen in “No AAEE”
- One new overload in “No AAEE”
Peninsula 60 kV system

Approved Projects
- San Mateo-Bair 60 kV line reconductor project

Sensitivity
- Thermal loadings worsen in “No AAEE”

Cat P6 & P7 O/L

Cat P6 & P7 low voltages and voltage deviations in Peninsula 60 kV system
Peninsula 115 kV system

Approved Projects
- South of San Mateo capacity increase
- Ravenswood-Cooley Landing 115 kV lines reconductor
- Palo Alto Interim SPS

Sensitivity
- Thermal loadings slightly worsen in “No AAEE”
Newark-Monta Vista 115 kV system

Approved Projects
- Newark-Applied Materials 115 kV substation equipment upgrade project
- Monta Vista 230 kV bus upgrade project

Sensitivity
- Thermal loadings worsen in “No AAEE”
San Jose 115 kV system

Approved Projects

- Metcalf-Piercy, Swift-Metcalf and Newark-Dixon Landing 115 kV upgrade
- Evergreen-Mabury 60 to 115 kV Conversion
- Morgan Hill Reinforcement Project

Sensitivity

- Thermal loadings worsen in “No AAEE”
- One new and multiple new contingency overloads in “High Renewable”
- Two new voltage deviations in “High Renewable”
## Reliability issues needing new mitigation

<table>
<thead>
<tr>
<th>Area</th>
<th>Facility</th>
<th>Contingency Category</th>
<th>Potential Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oleum-Christie 115 kV Area</td>
<td>Oleum-Martinez 115kV Line</td>
<td>P2</td>
<td>System upgrade or preferred resource</td>
</tr>
<tr>
<td></td>
<td>Christie-Sobrante (Oleum-Sobrante) 115kV Line</td>
<td>P6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oleum-Christie 115kV Line</td>
<td>P7</td>
<td></td>
</tr>
<tr>
<td>Metcalf 115 kV Area</td>
<td>Newark-Dixon Landing 115kV Line</td>
<td>P2 &amp; P6</td>
<td>Approved project scope change if feasible</td>
</tr>
<tr>
<td></td>
<td>Newark-Milpitas #1 115kV Line</td>
<td>P6</td>
<td>System upgrade or preferred resource</td>
</tr>
<tr>
<td></td>
<td>Newark-Milpitas #2 115kV Line</td>
<td>P6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dixon Landing-McKee 115 kV Line</td>
<td>P6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mabury-Jennings J. 115 kV Line</td>
<td>P6</td>
<td></td>
</tr>
<tr>
<td>Newark-Monta Vista 115 kV Area</td>
<td>Newark-Lawerence 115kV Line</td>
<td>P7</td>
<td>System upgrade or preferred resource</td>
</tr>
<tr>
<td>Peninsula 115 kV</td>
<td>San Mateo-Belmont 115kV Line</td>
<td>P6</td>
<td>Approved project scope change if feasible</td>
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<tr>
<td>Greater Bay Area</td>
<td>High voltage issues in light load conditions</td>
<td>P0</td>
<td>Voltage support or storage</td>
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</tbody>
</table>
East Bay Area Sensitivity Study
Preliminary Reliability Assessment Results

Binaya Shrestha
Sr. Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Objective

To identify the order of magnitude long-term reliability needs and assess reliance on existing SPS in East Bay area without the local generation being available.
Drivers for the long-term need

• Potential retirement of Oakland area generation due to age.

• Eliminate reliance on SPS per new ISO planning standard.
Geographic map – Oakland area transmission system

Claremont
Oakland D
Oakland J
Grant
Moraga
Oakland X
San Leandro
East Shore

(map width: 35.41 miles, map height: 20.20 miles)
One-line Diagram – Oakland area transmission system
2025 Oakland Area Supply
(N-0, Zero local Generation)

- 169 MW (26%)
- 196 MW (30%)
- 222 MW (35%)
- 55 MW (9%)
### Existing SPS in Oakland Area

<table>
<thead>
<tr>
<th>SPS Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moraga – Oakland J 115 kV Line Overload RAS</td>
<td>Prevents overloading of 115 kV lines from Moraga serving San Leandro and Oakland J. Opens circuit breakers at Oakland J to drop load.</td>
</tr>
<tr>
<td>Grant 115 kV Overload SPS</td>
<td>Prevents overloading of the Eastshore - Grant # 1 or # 2 115 kV lines. Trips distribution feeders at Grant.</td>
</tr>
<tr>
<td>Oakland 115 kV C-X cable Overload RAS</td>
<td>Prevents overloading of Oakland C – X #2 115 kV cable. Opens circuit breakers at Oakland C.</td>
</tr>
<tr>
<td>Oakland 115 kV D-L cable Overload RAS</td>
<td>Prevents overloading of Oakland D – L 115 kV cable. Opens circuit breakers at Oakland C.</td>
</tr>
</tbody>
</table>
3 Scenarios

- 2025 Summer Peak all local generation ON
- 2025 Summer Peak all local generation OFF
- 2025 Summer Peak all local generation OFF and No AAEE
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Overloaded Facility</th>
<th>Worst Contingency</th>
<th>Category</th>
<th>2025 Summer Peak with max generation</th>
<th>2025 Summer Peak with zero generation</th>
<th>2025 Summer Peak with zero generation &amp; no AAEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oakland D - Oakland L 115kV Cable</td>
<td>BUS-TIE BREAKER FAULT AT 32790 STATIN X 115.00</td>
<td>P2</td>
<td>62.48</td>
<td>132.39</td>
<td>137.36</td>
</tr>
<tr>
<td>2</td>
<td>Oakland C - Oakland L #1 115kV Cable</td>
<td>BUS-TIE BREAKER 162 FAULT AT 32780 CLARMNT 115.00</td>
<td>P2</td>
<td>97</td>
<td>99.64</td>
<td>105.71</td>
</tr>
<tr>
<td>3</td>
<td>Oakland C - Oakland X #2 115kV Cable</td>
<td>BUS-TIE BREAKER 162 FAULT AT 32780 CLARMNT 115.00</td>
<td>P2</td>
<td>31.66</td>
<td>113.86</td>
<td>120.26</td>
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<tr>
<td>4</td>
<td>Moraga-Claremont #1 115kV Line</td>
<td>BUS-TIE BREAKER FAULT AT 32790 STATIN X 115.00</td>
<td>P2</td>
<td>95.01</td>
<td>127.49</td>
<td>136.27</td>
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<tr>
<td>5</td>
<td>Moraga-Claremont #2 115kV Line</td>
<td>BUS-TIE BREAKER FAULT AT 32790 STATIN X 115.00</td>
<td>P2</td>
<td>95.15</td>
<td>127.67</td>
<td>136.47</td>
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<tr>
<td>6</td>
<td>Sobrante-Moraga 115kV Line</td>
<td>BUS-TIE BREAKER FAULT AT 30540 SOBRENTE 230.00</td>
<td>P2</td>
<td>91.01</td>
<td>96.47</td>
<td>106.11</td>
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<tr>
<td>7</td>
<td>Moraga-Station X 115 kV #1 Line</td>
<td>BUS-TIE BREAKER 162 FAULT AT 32780 CLARMNT 115.00</td>
<td>P2</td>
<td>46.23</td>
<td>111.91</td>
<td>119.31</td>
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<td>8</td>
<td>Moraga-Oakland X #2 115kV Line</td>
<td>BUS-TIE BREAKER 162 FAULT AT 32780 CLARMNT 115.00</td>
<td>P2</td>
<td>41.91</td>
<td>111.91</td>
<td>119.31</td>
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<td>9</td>
<td>Moraga-Station X 115 kV #3 Line</td>
<td>BUS-TIE BREAKER FAULT AT 33020 MORAGA 115.00</td>
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<td>86.8</td>
<td>154.22</td>
<td>165.91</td>
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<tr>
<td>10</td>
<td>Moraga-Station X 115 kV #4 Line</td>
<td>BUS-TIE BREAKER FAULT AT 33020 MORAGA 115.00</td>
<td>P2</td>
<td>86.8</td>
<td>154.22</td>
<td>165.91</td>
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<tr>
<td>11</td>
<td>Oakland D - Oakland L 115kV Cable</td>
<td>Oakland C - Oakland X #2 115kV Cable &amp; Oakland C - Oakland X #3 115kV Cable</td>
<td>P6</td>
<td>&lt;90</td>
<td>132.95</td>
<td>138.12</td>
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<td>12</td>
<td>Oakland C - Oakland L #1 115kV Cable</td>
<td>Claremont K - Oakland D #1 115kV Cable &amp; Claremont K - Oakland D #2 115kV Cable</td>
<td>P6</td>
<td>98.2</td>
<td>98.2</td>
<td>105.99</td>
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<td>13</td>
<td>Oakland C - Oakland X #2 115kV Cable</td>
<td>Oakland C - Oakland X #3 115kV Cable &amp; Oakland D - Oakland L 115kV Cable</td>
<td>P6</td>
<td>94.28</td>
<td>132.35</td>
<td>137.52</td>
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<td>14</td>
<td>Moraga-Claremont #1 115kV Line</td>
<td>Oakland C - Oakland X #2 115kV Cable &amp; Oakland C - Oakland X #3 115kV Cable</td>
<td>P6</td>
<td>&lt;90</td>
<td>106.45</td>
<td>114.45</td>
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<td>15</td>
<td>Moraga-Claremont #2 115kV Line</td>
<td>Oakland C - Oakland X #2 115kV Cable &amp; Oakland C - Oakland X #3 115kV Cable</td>
<td>P6</td>
<td>&lt;90</td>
<td>106.61</td>
<td>114.62</td>
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<td>16</td>
<td>Moraga-Station X 115 kV #1 Line</td>
<td>Claremont K - Oakland D #2 115kV Cable &amp; Claremont K - Oakland D #1 115kV Cable</td>
<td>P6</td>
<td>&lt;90</td>
<td>112.21</td>
<td>119.63</td>
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<tr>
<td>17</td>
<td>Moraga-Oakland X #2 115kV Line</td>
<td>Claremont K - Oakland D #2 115kV Cable &amp; Claremont K - Oakland D #1 115kV Cable</td>
<td>P6</td>
<td>&lt;90</td>
<td>112.21</td>
<td>119.63</td>
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<tr>
<td>18</td>
<td>Moraga-Station X 115 kV #3 Line</td>
<td>Claremont K - Oakland D #2 115kV Cable &amp; Claremont K - Oakland D #1 115kV Cable</td>
<td>P6</td>
<td>&lt;90</td>
<td>112.21</td>
<td>119.63</td>
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<tr>
<td>19</td>
<td>Moraga-Station X 115 kV #4 Line</td>
<td>Claremont K - Oakland D #2 115kV Cable &amp; Claremont K - Oakland D #1 115kV Cable</td>
<td>P6</td>
<td>&lt;90</td>
<td>112.21</td>
<td>119.63</td>
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<tr>
<td>20</td>
<td>Moraga-Station X 115 kV #1 Line</td>
<td>Moraga-Oakland Nos. 3 &amp; 4 115 kV lines</td>
<td>P7</td>
<td>42.26</td>
<td>99.07</td>
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<td>Moraga-Oakland X #2 115kV Line</td>
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<td>42.26</td>
<td>99.07</td>
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<td>22</td>
<td>Moraga-Station X 115 kV #3 Line</td>
<td>Moraga-Oakland X Nos. 1 &amp; 2 115 kV lines</td>
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<td>42.26</td>
<td>99.07</td>
<td>106.26</td>
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<td>23</td>
<td>Moraga-Station X 115 kV #4 Line</td>
<td>Moraga-Oakland X Nos. 1 &amp; 2 115 kV lines</td>
<td>P7</td>
<td>42.26</td>
<td>99.07</td>
<td>106.26</td>
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</table>
# Overloads in southern part of Oakland 115 kV system

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Overloaded Facility</th>
<th>Worst Contingency</th>
<th>Category</th>
<th>2025 Summer Peak with max generation</th>
<th>2025 Summer Peak with zero generation</th>
<th>2025 Summer Peak with zero generation &amp; no AAEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grant-Oakland J 115 kV Line</td>
<td>BUS-TIE BREAKER FAULT AT 30550 MORAGA 230.00</td>
<td>P2</td>
<td>77.85</td>
<td>100.48</td>
<td>109.43</td>
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<td>2</td>
<td>San Leandro - Oakland J #1 115kV Line</td>
<td>Grant-Oakland J 115 kV Line &amp; Moraga-Oakland J 115kV Line</td>
<td>P6</td>
<td>93.13</td>
<td>94.31</td>
<td>101.73</td>
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<td>3</td>
<td>Moraga-San Leandro #1 115kV Line</td>
<td>Moraga-San Leandro #2 115kV Line &amp; Moraga-San Leandro #3 115kV Line</td>
<td>P6</td>
<td>96.66</td>
<td>&lt;90</td>
<td>100.48</td>
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<td>4</td>
<td>Moraga-San Leandro #2 115kV Line</td>
<td>Moraga-San Leandro #1 115kV Line &amp; Moraga-San Leandro #3 115kV Line</td>
<td>P6</td>
<td>97.12</td>
<td>&lt;90</td>
<td>100.95</td>
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## Load Drop Assessment

<table>
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<tr>
<th>Existing SPS</th>
<th>Triggering Contingency Category</th>
<th>2025 Summer Peak with max generation</th>
<th>2025 Summer Peak with zero generation</th>
<th>2025 Summer Peak with zero generation &amp; no AAEE</th>
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</thead>
<tbody>
<tr>
<td>Oakland 115 kV C-X cable Overload RAS</td>
<td>P6</td>
<td>Not triggered</td>
<td>50 MW</td>
<td>58 MW</td>
</tr>
<tr>
<td>Oakland 115 kV D-L cable Overload RAS</td>
<td>P6</td>
<td>Not triggered</td>
<td>50 MW</td>
<td>58 MW</td>
</tr>
<tr>
<td>Moraga – Oakland J 115 kV Line Overload RAS</td>
<td>P6</td>
<td>Not triggered</td>
<td>Not triggered</td>
<td>4 MW</td>
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<tr>
<td>Grant 115 kV Overload SPS</td>
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<td>Not triggered</td>
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</table>

### Maximum load drop for overloads not mitigated by existing SPS

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<tr>
<th>Worst contingency for remaining overloads</th>
<th>Contingency Category</th>
<th>2025 Summer Peak with max generation</th>
<th>2025 Summer Peak with zero generation</th>
<th>2025 Summer Peak with zero generation &amp; no AAEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUS-TIE BREAKER FAULT AT 33020 MORAGA 115.00</td>
<td>P2</td>
<td>Not triggered</td>
<td>165 MW</td>
<td>200 MW</td>
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<tr>
<td>Claremont K - Oakland D #2 115kV Cable &amp; Claremont K - Oakland D #1 115kV Cable</td>
<td>P6</td>
<td>Not triggered</td>
<td>40 MW</td>
<td>60 MW</td>
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<td>Moraga-Oakland X Nos. 1 &amp; 2 115 kV lines</td>
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Estimate of generation run-time need for reliability in 2025

With zero generation in Oakland area, overloads start at about 80% of peak load in the year 2025. This corresponds to about 800 hours of local generation need for reliability.
Oakland Area PV Plots

(Starting load level – 2025)

**Oakland Area 115 kV Voltage (N-0)**

- **Oak_Gen_All_ON (Jenny 115kV)**
- **Oak_Gen_All_OFF (Cartwright 115kV)**
- **Normal Voltage Limit**

**Oakland Area 115 kV Voltage (N-1)**

- **Oak_Gen_All_ON (Jenny 115kV)**
- **Oak_Gen_All_OFF (Cartwright 115kV)**
- **Contingency Voltage Limit**

**Oakland Area 115 kV Voltage (N-2)**

- **Oak_Gen_All_ON (Grant 115kV)**
- **Oak_Gen_All_OFF (Grant 115kV)**
- **Contingency Voltage Limit**
Oakland Area QV Plots

**Qgen vs. Reg. Volt**

- **Bus:** 38022 CARTWRT 115  
- **Contingency:** Oakland D - Oakland L 115kV Cable

**Qgen vs. Reg. Volt**

- **Bus:** 35104 GRANT 115  
- **Contingency:** Grant-Eastshore Nos. 1 & 2 115 kV lines
Potential Mitigations

• **New transmission solution (~$200M)**
  – Moraga – Oakland C 230 kV DCTL.
  – Potrero – Oakland C HVDC submarine cable.

• **Existing facility upgrade & preferred resources.**
  – Preliminary assessment shows that adding at least one breaker at stations causing category P2 issue is feasible with an exception of Oakland C.
  – Demand response could mitigate issues resulting from category P6 contingencies.
  – Storage and possibly combination with small amount load dropping SPS could address issues resulting from category P7 contingencies.
  – Cables rerate, if feasible, could reduce the scope of required facility upgrade and preferred resource.
Summary

- No voltage issues even with no local generation being available.
- No thermal issues with all generation available.
- Existing SPS not triggered with all generation available.
- Ten 115 kV facilities overloads for various categories P2, P6 & P7 contingencies in northern part with no local generation available and no AAEE assumed. Worst overload being 165%.
- Four 115 kV facilities overloads for various categories P2 & P6 contingencies in southern part with no AAEE assumed. Worst overload being 109%.
- Existing SPS in northern part would require to drop ~58 MW load with no local generation available and no AAEE assumed. SPS in southern part would require to drop ~4 MW load.
- Overloads not addressed by existing SPS would require load reduction of ~200 MW with no local generation available and no AAEE assumed, if not addressed with system upgrade.
Conclusion

• With the reliance on aging generation in the area, the ISO is continuing to assess the transmission needs in the Oakland area without the generation being available.
• The ISO will be considering transmission, generation or non-transmission solutions as we assess the needs of the area.
• In the near-term the area relies on SPS with a relatively small amount of load shedding as per the ISO Planning Standards; however the ISO will consider alternatives for the long-term horizon.
Questions?
Reference Slides
## All Contingency Report for mitigation development

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<tr>
<th>S. No.</th>
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<td>P7</td>
<td>41.23</td>
<td>99.07</td>
<td>106.26</td>
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</table>
Fresno Area
Preliminary Reliability Assessment Results

Vera Hart
Regional Transmission Engineer

Abhishek Singh
Senior Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Greater Fresno Area

- Includes the San Joaquin Division
- Generation: Over 5,124 MW of generation in 2025 case
- Comprised of 60,115, 230 & 500 kV transmission facilities.
- Summer Peak 3,715 MW in 2025
The assessment identified:

- Thermal overloads due to Category P0 – 1, Category P1 - 5, Category P2-1 – 6, Category P2-2-P2-4- 56, Category P6- 73, Category P7- 16
- Low voltages due to Category P1 - 8, Category P2-1 – 2 and Category P2-2-P2-4- 63, Category P3- 5, Category P6- 26
- Voltage deviations due to Category P1- 8, Category P2-1 – 5 and Category P2-2-P2-4- 48
- High Voltages due to P0 - 13, P1 - 5, P2-1 - 4 , P2-2-P2-4 - 14 , P7 – 4
- For the loss of Gates-Gregg 230kV line, momentary drop of Henrietta 70kV due to SPS Action

Compared to last year results:

- One new Category P0 overload
- One new High Voltage area for P0
- No new P1 230kV line overloads and one new P1 115kV line overload
- New Category P2-1 showing two new overloaded elements
Fresno Area – Thermal Results (P0, P1, and P2-1)

- **Thermal Overloads (P0)**
  - Chowchilla Cogen Jct-Chowchilla Cogen 115kV line (2020, 2025 Peak)

- **Thermal Overloads (P1)**
  - Panoche-Oro Loma 115kV (Panoche-Hammonds Section) (2017 & 2020 Peak)
  - Exchequer-Le Grand 115kV line (2020 & 2025 Peak)
  - San Miguel-Coalinga 70kV line (2017 Peak & Spring off Peak)
  - Coalinga 1-Coalinga 2 70kV (Coalinga 1-Tornado Tap Section) (2017 Peak)

- **Thermal Overloads (P2-1)**
  - Panoche-Oro Loma 115kV (Panoche-Hammonds Section) (2020 & 2025 Peak)
  - Herndon-Bullard #2 (Prundale Jct-Bullard) 115kV (2017, 2020, 2025 Peak)
  - Herndon-Bullard #1 (Prundale Jct-Bullard) 115kV (2017, 2020, 2025 Peak)
  - Oro Loma #2 115/70kV (2017 Peak)
  - Mercy Springs-Canal-Oro Loma 70kV line (Ortiga-Mercy Springs section) (2017 Peak)
  - Coalinga 1-Coalinga 2 70kV line (Coalinga 1-Tornado Tap Section) (2017 Peak)
Fresno Area – Voltage Results (P0, P1, P2-1, P3)

- **High Voltage (P0, P1, P2-1)**
  - Exchequer 115kV and 70kV area (all years)
  - Kearney 70kV area (all years)

- **Low Voltage (P1, P2-1, P3)**
  - Chowchilla 115kV Area (2020, 2025 Peak)
  - Mendota 115kV Area (2017 Peak)

- **Voltage Deviation (P1)**
  - Chowchilla 115kV (Chowchilla 115kV Area) (2025 Peak)
  - Mendota 115kV (Mendota 115kV Area) (2017 Peak)
Fresno Area – Results- Herndon-McCall Area

**Approved Projects**

- Northern Fresno Reinforcement Project
- McCall-Reedley #2 line project

**Sensitivities:**

- Thermal loadings worsen in “No AAEE” and “No QF”
- Thermal loading lessens in High Renewables case
- Approved Projects
  - Oro Loma 70kV reinforcement project (Mercy Springs 230/70kV bank)
  - Wilson 115 kV Area Reinforcement

- Sensitivities
  - Thermal loadings worsen in “No AAEE” and “No QF”
  - New overloads found
Fresno Area – Exchequer

- Approved Projects
  - None

- Sensitivities
  - Thermal loadings worsen in “No AAEE” and “No QF”
  - New Overload P0

Diagram:

- Approved Projects
- Sensitivities
- New Overload P0
Fresno Area – Kearney 70kV

- Approved Projects
  - Kearney-Caruthers reconductoring

- Sensitivities
  - Voltages are better

Diagram showing various locations and voltage ratings in the Fresno Area.
Fresno Area – Oro Loma- Los Banos 70kV

- **Approved Projects**
  - Oro Loma 70kV reinforcement project (Mercy Springs 230/70kV bank)

- **Sensitivities**
  - Thermal loadings worsen in “No AAEE” and “No QF”
  - One new Overload section in the High renewables case
Fresno Area - Borden-Madera 70kV-Results

- Approved Projects
  - Borden 230 kV Voltage Support

- Sensitivities
  - Thermal loadings worsen in all cases
Fresno Area – Coalinga 70kV Results

- **Approved Projects**
  - Estrella Substation

- **Sensitivities**
  - Thermal loadings worsen in all cases
  - New P0 overload due to sensitivity
### Conclusion

- **Reliability Concerns in need of mitigation solution**

<table>
<thead>
<tr>
<th>Area</th>
<th>Facility</th>
<th>Contingency Category</th>
<th>Cases Overloaded</th>
<th>Potential Mitigation</th>
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<td>P1, P2-2</td>
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<td>Upgrade the T/F/ Explore possible SPS Options.</td>
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### Conclusion – Continues

- **Reliability Concerns in need of mitigation solution**

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<td>Modify Exchequer SPS</td>
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<td>Cal Ave, West Fresno 115 kV</td>
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<td>P6</td>
<td>All Peak</td>
<td>Provide additional reactive support (Herndon/McCall 115 kV pocket)</td>
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Questions?
Kern Area
Preliminary Reliability Assessment Results

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

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
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
- Generation: Approximately 3,500 MW of generation
- Transmission system includes 60, 115 and 230 kV facilities.
- 2025 Summer Peak: 2,367 MW
Study Scenarios

- **5 Baseline Scenarios**
  - 2017 Summer Peak
  - 2020 Summer Peak
  - 2025 Summer Peak
  - 2017 Spring Off-peak
  - 2020 Light Load

- **3 Sensitivity Scenarios**
  - 2025 Summer Peak No AAEE (2,440 MW)
  - 2025 Summer Peak No QF (2,367 MW)
  - 2020 Summer Peak High Renewable (*Existing & new renewables dispatched to Pmax*)
Kern Area Assessment Summary

- The 2015-2016 assessment identified:
  - Thermal overloads due to Category P1 – 0, P2 – 0, P3 – 0, P6 – 6 and P7 - 0
  - Low voltage concerns due to Category P1 – 0, P2 – 0, P3 – 2 and P6 – 13 (mostly in 2025)
  - Voltage deviations concerns due to Categories P3 – 4

- Compared to last year results:
  - 0 new Category P1 thermal overloads
  - 6 new Category P6 thermal overloads
  - Last year there was one project approved in this area
    - North East Kern Voltage Conversion Project
Kern Area – Results (Category P0 & P1)

- Thermal Overloads
  - No thermal overloads due to Categories P0 & P1

- Low Voltage – None

- Voltage Deviation – None

New thermal issues resulting from other contingency categories are discussed in the next slide.
Kern Area – Results (Other Contingency Categories)

- Thermal Overloads
  1) Semitropic-Wasco Prison-Charka 115 kV #1 Line (Category P6 – Summer 2025)
  2) Semitropic D-Semitropic E 115 kV #1 Line (Category P6 – Summer 2025)
  3) Taft A-Texaco Buena Vista Hills 70 kV #1 Line (Category P6 – Summer 2025. 101% loading level)

- Potential Mitigations
  - Monitor facility loading levels due to long lead time
Kern Area – Results (Other Contingency Category)

Selected Approved Projects

- North East Kern 115 kV Voltage Conversion
- Wheeler Ridge Junction Station Project
- Kern PP 115 kV Area Reinforcement Project
- Midway-Kern PP #1, #3 & #4 230 kV Line Capacity Increase Project
- Midway-Temblor 115 kV Line Reconductor

Sensitivity

- Category P2-1 (new requirement) thermal overloads were identified with increased levels under No AAEE conditions
- Potential mitigation: Mitigation under review
Central Coast and Los Padres Areas
Preliminary Reliability Assessment Results

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

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
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
- Transmission system includes 60, 115, 230 and 500 kV facilities
- 2025 Winter Peak: 652 MW
- 2025 Summer Peak: 709 MW
Study Scenarios

- 8 Baseline Scenarios
  - 2017 Summer Peak
  - 2020 Summer Peak
  - 2025 Summer Peak
  - 2017 Spring Off-peak
  - 2020 Light Load
  - 2017 Winter Peak (Central Coast)
  - 2020 Winter Peak (Central Coast)
  - 2025 Winter Peak (Central Coast)

- 3 Sensitivity Scenarios
  - 2025 Summer Peak No AAEE (798 MW)
  - 2025 Summer Peak No QF (739 MW)
  - 2020 Summer Peak High Renewable (*Existing & new renewables dispatched to Pmax*)
The 2015-2016 assessment identified:

- Newly identified thermal overloads due to Category P0 – 0, P1 – 0, P2 – 2, P(2-1) – 6, P3 – 0, P6 – 1 and P7 - 0
- Thermal overloads (winter peak) due to Category P6 – 1 (Coburn 230/60 kV #2 Bank)
- Low voltages due to P2 – 8, P3 – 1, P6 – 18 and P7 – 1 (mostly around 0.89 p.u.)
- Voltage deviations due to P2 – 22, P7 - 6
- Area-wide high voltages under normal (P0) conditions (light load)

Compared to last year results:
- 0 new Category P1 thermal overload concern identified
- 2 Category P2
- 6 Category P2-1
Central Coast Area – Results (Category P0 & P1)

- Thermal Overloads
  - No new thermal overloads due to Category P0 & P1

- Low Voltage - None
  - P2 – 5, P(2-1) – 4, P3 – 1, P6 – 19 and P7 - 1
  - Area-wide high voltages under Category P0 contingency conditions (mostly around 1.6 p.u.)

- Voltage Deviation – None

New issues resulting from other contingency categories are discussed in the next slide
Central Coast Area – Results

Selected Approved Projects

- Watsonville 115 kV Voltage Conversion Project
- Nativdad Substation Interconnection
- Crazy Horse Awitching Station
- Soledad 115/60 kV Transformer Capacity Project
- Hollister 115 kV Reconductoring

Sensitivity

- Category P2-1 (new requirement) and P6 thermal overloads were observed with increased levels under No AAEE conditions
- Potential mitigation: Mitigated under review
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: Approximately 950 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
- 2025 Summer Peak: 587 MW
Study Scenarios

- **5 Baseline Scenarios**
  - 2017 Summer Peak
  - 2020 Summer Peak
  - 2025 Summer Peak
  - 2017 Spring Off-peak
  - 2020 Light Load

- **3 Sensitivity Scenarios**
  - 2025 Summer Peak No AAEE (622 MW)
  - 2025 Summer Peak No QF (587 MW)
  - 2020 Summer Peak High Renewable (*Existing & new renewables dispatched to Pmax*)
Los Padres Area Assessment Summary

- The 2015-2016 assessment identified:
  - No new thermal overloads were identified
  - Low voltage due to Category P6 – 1 at 0.81p.u. in both 2020 & 2025)
  - There are no voltage deviation concerns

- Compared to last year results:
  - No new thermal overloads were identified
  - Last year, transmission projects were approved in this area
    - Estrella 230 kV Substation Project
Los Padres Area – Results (Category P0 & P1)

- **Thermal Overloads**
  - No new thermal overloads due to Category P0 or P1 contingency conditions

- Low Voltage due to Category P6 – 1
- Voltage Deviation – None

New issues resulting from other contingency categories are discussed in the next slide.
Los Padres Area – Results

Selected Approved Projects

- Estrella Substation Project
- Midway-Andrew 230 kV Project
- Diablo Canyon Voltage Support Project
- Morro Bay 230/115 kV Transformer Addition Project
- Mesa-Sisquoc 115 kV Line Reconductoring Project

Sensitivity

- Category P2-1 (new requirement) thermal overloads were observed with increased levels under No AAEE conditions
- Potential mitigation: Mitigated by already approved projects (Estrella 230 kV Substation, Midway-Andrew 230 kV Project, Morro Bay 230/115 kV Bank Addition Project, etc.)
SCE Metro Area
Preliminary Reliability Assessment Results

Nebiyu Yimer
Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
SCE Metro Area

- Includes Los Angeles County, Orange County, and surrounding area and is bounded by Vincent, Lugo, Valley and San Onofre substations
- Comprised of 500 and 230 kV transmission facilities
- 1-in-10 Summer Peak load of 23,446 MW in 2025 (22,085 MW including AAEE)
- 12,150 MW of existing generation of which 6100 MW is scheduled for retirement.
- Procurement of about 2143 MW of conventional generation, preferred resources and energy storage underway (LA Basin & Moorpark)
Metro Area Study Scenarios

- 5 Baseline Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Load</th>
<th>Dispatched Gen – Conv</th>
<th>Dispatched Gen. – Ren.</th>
<th>Preferred Res. &amp; ES</th>
<th>Path 26, PDCI</th>
<th>Path 46 (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 SP</td>
<td>1-in-10 mid with low-mid AAEE</td>
<td>&lt; Max</td>
<td>Solar - 36% Wind - 0%</td>
<td>Not initially dispatched, used as mitigation</td>
<td>~ Max</td>
<td>7767</td>
</tr>
<tr>
<td>2020 SP</td>
<td>65% of net 1-in-2</td>
<td>~ Max</td>
<td>Solar - 93% Wind - 93%</td>
<td>&lt; Max</td>
<td>8122</td>
<td></td>
</tr>
<tr>
<td>2025 SP</td>
<td>50% of net 1-in-2</td>
<td>~ 0</td>
<td>Solar - 0% Wind - 93%</td>
<td>&lt; Max</td>
<td>8800</td>
<td></td>
</tr>
</tbody>
</table>

- 2 Sensitivity Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Baseline</th>
<th>Change</th>
<th>Path 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 - Early OTC Ret.</td>
<td>2020 SP</td>
<td>1350 MW reduction in available gen. in LA Basin</td>
<td>8134</td>
</tr>
<tr>
<td>S2 - High CEC Load</td>
<td>2025 SP</td>
<td>1557 MW increase in SoCal load</td>
<td>10468</td>
</tr>
</tbody>
</table>
Metro Area Assessment Summary

- The baseline assessment identified:
  - Thermal overload due to P1 single contingency – 1
  - Thermal overload due to P6/P7 multiple contingency – 5

- In addition, the sensitivity assessment identified:
  - Thermal overload due to P6 multiple contingency – 2
  - Stability-related issue due to P6 multiple contingency – 1

- Compared to last year results:
  - 2 new loading issues
  - Approved project helped in addressing 3 loading issues.
  - 1 new stability-related issue
Metro Area Potential Solutions

- **Potential Mitigation Solutions**
  - Increase line rating
  - Install hot spare transformer bank
  - Operating solutions including utilizing Preferred Resources & Storage
Lugo–Victorville 500 kV Thermal Overload

- Occurs under N-1/N-1 conditions in all summer peak cases
- Starts to occur under N-1 conditions in 2025 with all generation dispatched
- Higher load growth exacerbates the overload
### Lugo–Victorville 500 kV Thermal Overload – Cont’d

<table>
<thead>
<tr>
<th>Worst Contingency</th>
<th>Category</th>
<th>Loading (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2017 SP</td>
</tr>
<tr>
<td>Eldorado–Lugo 500 kV</td>
<td>P1 (L-1)</td>
<td>*</td>
</tr>
<tr>
<td>Eldorado–Lugo 500 kV &amp; Eldorado–Mohave or Mohave–Lugo 500 kV</td>
<td>P6 (L-1/L-1)</td>
<td>114%</td>
</tr>
</tbody>
</table>

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### Potential Mitigation
- Increase rating of the Lugo–Victorville 500 kV line
Mesa–Laguna Bell #1 230 kV Thermal Overload

• Occurs under N-2 and N-1/N-1 conditions in 2025 SP cases
• Loading in the 2025 SP baseline case < 100% when PR & ES are utilized.
• Additional mitigation may be needed if high load growth materializes
Mesa–Laguna Bell #1 230 kV Overload – Cont’d

<table>
<thead>
<tr>
<th>Worst Contingency</th>
<th>Category</th>
<th>Loading (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesa–Lighthipe &amp; Mesa–Laguna Bell #2</td>
<td>P7 (L-2)</td>
<td>102%</td>
</tr>
<tr>
<td>Mesa–Lighthipe &amp; Mesa–Redondo</td>
<td>P6 (L-1/L-1)</td>
<td>108%</td>
</tr>
<tr>
<td>Mesa 500/230 KV #3 &amp; #4 Banks</td>
<td>P6 (T-1/T-1)</td>
<td>105%</td>
</tr>
</tbody>
</table>

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- **Potential Mitigation**
  - System adjustment including utilizing Preferred Resources & Storage
## Serrano 500/230 kV Banks Thermal Overload

<table>
<thead>
<tr>
<th>Worst Contingency</th>
<th>Category</th>
<th>Loading (%)</th>
<th>2017 SP</th>
<th>2020 SP</th>
<th>2025 SP</th>
<th>2017 OP</th>
<th>2020 LL</th>
<th>2020 SP</th>
<th>2025 SP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Serrano 500/230 kV Banks</td>
<td>P6</td>
<td>101%</td>
<td>108%</td>
<td>117%</td>
<td>125%</td>
<td>*</td>
<td>123%</td>
<td>127%</td>
<td></td>
</tr>
<tr>
<td>(T-1/T-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Serrano 500/230 kV Bank &amp; Eco–Miguel 500 kV</td>
<td>P6</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>100%</td>
</tr>
<tr>
<td>(T-1/L-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### Potential Mitigation

- Operating solution including utilizing Preferred Resources & Storage and post-contingency system reconfiguration
- Install a hot spare
### Mesa–Redondo 230 kV Thermal Overload

<table>
<thead>
<tr>
<th>Worst Contingency</th>
<th>Category</th>
<th>Loading (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesa–Lighthipe &amp; Mesa–Laguna Bell #2</td>
<td>P6 (L-1/L-1)</td>
<td>*</td>
</tr>
</tbody>
</table>

### Serrano–Villa Park #1 230 kV Thermal Overload

<table>
<thead>
<tr>
<th>Worst Contingency</th>
<th>Category</th>
<th>Loading (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serrano–Lewis #1 or #2 &amp; Serrano–Villa Park #2</td>
<td>P6 (L-1/L-1)</td>
<td>*</td>
</tr>
</tbody>
</table>

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- **Potential Mitigation**
  - Operating solution including utilizing Preferred Resources & Storage
Metro Area Transient Stability Results

- Voltage dip exceeding 30% following outage of SRPL and SWPL in sensitivity cases
### Worst Contingency Category

<table>
<thead>
<tr>
<th>Worst Contingency</th>
<th>Category</th>
<th>Transient Stability Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eco–Miguel 500 kV &amp; Ocotillo–Suncrest, 3-phase fault at Suncrest</td>
<td>P6 (L-1/L-1)</td>
<td>2017 SP</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

### Potential Mitigation

- **Issue only occurs in the sensitivity cases. Further evaluation needed.**
SCE Bulk System
Preliminary Reliability Assessment Results

Charles Cheung
Senior Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Includes SCE’s 500 kV system and interconnections with PG&E, SDG&E, LADWP, and APS

About 25,000 MW of total existing generation

Total 2025 SCE Area 1-in-5 Summer Peak net load – 25,720 MW

Existing and authorized preferred resources were modeled per the study plan
SCE Bulk System Assessment Summary

- The assessment identified:
  - Before utilizing DG, ES, DR and other system adjustments:
    - Thermal overload due to Category P1 and P6
  - After utilizing DG, ES, DR and other system adjustments:
    - No issues identified

- Compared to last year results:
  - Same as last year
SCE Bulk System Potential Solutions

- Potential Mitigation Solutions
  - Utilize available DG, DR, ES and other system adjustments,
  - Increase emergency ratings of the line
SCE Bulk System – P1 Results

- Thermal Overload
  - Lugo–Victorville 500 kV line (N-1, 2025 Partial Peak case)

- Potential Mitigation
  - Utilize available DG, ES, DR and other system adjustments
  - Increase emergency ratings of the line or
  - Add series reactors
SCE Bulk System – P6 Results

- Thermal Overload
  - Lugo–Victorville 500 kV line (N-1-1, All SP cases)

- Potential Mitigation
  - Utilize available DG, ES, DR and other system adjustments
  - Increase emergency ratings of the line or
  - Add series reactors
SCE Eastern Area
Preliminary Reliability Assessment Results

Charles Cheung
Senior Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
SCE Eastern Area

- Includes the SCE owned transmission system in the Riverside County around and west of the Devers Substation
- Generation: over 3,100 MW of generation
- Comprised of 500, 230 and 161 kV transmission facilities.
- Summer Peak net load of 1,117 MW in 2025
The assessment identified:

**Without allowable system adjustments:**
- Thermal overload due to Category P6
- Voltage/transient instability due to Category P6
- High voltage due to Category P1, P6

**With allowable system adjustments:**
- High voltage due to Category P1, P6

**Compared to last year results:**
- 1 new high voltage problem
SCE Eastern Area Proposed Solutions

- Potential Mitigation Solutions
  - System adjustment after contingency
  - Colorado River – Delaney 500 kV in service in 2020 to relieve Colorado River – Palo Verde 500 kV Outage
SCE Eastern Area – Results

- Voltage Instability
  - Julian Hinds-Mirage & Eagle Mtn-Iron Mtn (N-1-1)
  - Julian Hinds-Mirage & Iron Mtn-Camino-Mead-Gene (N-1-1)

- Potential Mitigation:
  - Operation Procedure 7720F
SCE Eastern Area – Results

- **High Voltage**
  - Buck Blvd., Eagle Mtn., Julian Hinds substation (N-1-1)

- **Potential Mitigation:**
  - Install shunt reactor in Eagle Mtn 230 kV
Tehachapi and Big Creek Corridor Preliminary Reliability Assessment Results

Piyasak Poonpun
Senior Operations Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Tehachapi and Big Creek Corridor Area

- Comprised of 230 kV transmission facilities.
- Over 6,518 MW of existing generation.
- Existing pumping load of 720 MW.
- Summer Peak load of 2,083 MW in 2025.
Study Scenarios

- **5 Study Base Case Scenarios**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 Summer Peak</td>
<td>1-in-10 mid – Low-mid AAEE</td>
<td>&lt; Max</td>
<td>Solar - 36% Wind - 0%</td>
<td></td>
</tr>
<tr>
<td>2020 Summer Peak</td>
<td>~ 65% 1-in-2</td>
<td>&lt; Max</td>
<td>Solar - 93% Wind - 93%</td>
<td>Not dispatched</td>
</tr>
<tr>
<td>2025 Summer Peak</td>
<td>~ 50% 1-in-2</td>
<td>~ 0</td>
<td>Solar - 0% Wind - 93%</td>
<td></td>
</tr>
<tr>
<td>2017 Spring Off-Peak</td>
<td>~ 50% 1-in-2</td>
<td>&lt; Max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020 Spring Light Load</td>
<td>~ 50% 1-in-2</td>
<td>~ 0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **1 Sensitivity Scenario**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Baseline</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>2020 Summer Peak</td>
<td>Assumed 340 MW hydro generation based on last year average Big Creek hydro output during Summer peak hours.</td>
</tr>
</tbody>
</table>
Tehachapi and Big Creek Corridor Area Assessment Summary

- The assessment identified:
  - No concerns were identified in Study Base Case Scenarios.
  - Thermal overload due to one Category P1, two Category P3, and twelve Category P6 contingencies were identified in Study Sensitivity Scenario.

- Compared to last year results:
  - P6 contingency identified last year was not observed due to lower load forecast.
  - Sensitivity study was not performed last year.
Tehachapi and Big Creek Corridor Area Potential Mitigation Solutions

- Potential Mitigation Solutions
  - Thyristor Controlled Series Capacitors (TCSC).
  - Manage hydro generation to utilize during peak hours.
  - Modify RAS arming for low hydro conditions.
  - Additional new Preferred Resources and Energy Storage.
Tehachapi and Big Creek Corridor Area – Results

- **Thermal overload**
  - Magunden-Vestal 230 kV 1 or 2 overloaded for multiple contingencies.

- **Potential Mitigation**
  - Thyristor Controlled Series Capacitor (TCSC).
  - Manage hydro generation to utilize during peak hours.
  - Modify RAS arming for low hydro conditions.
  - Additional new Preferred Resources and Energy Storage.
Tehachapi and Big Creek Corridor Area – Results

- Thermal overload
  - Rector-Vestal 230 kV 1 or 2 overloaded for multiple contingencies.

- Potential Mitigation
  - Thyristor Controlled Series Capacitor (TCSC).
  - Manage hydro generation to utilize during peak hours.
  - Modify RAS arming for low hydro conditions.
  - Additional new Preferred Resources and Energy Storage.
Tehachapi and Big Creek Corridor Area – Results

- **Thermal overload**
  - Magunden-Springville 230 kV 2 overloaded for Magunden-Springville 1 230kV and Rector-Vestal 230kV 1 or 2

- **Potential Mitigation**
  - Thyristor Controlled Series Capacitor (TCSC).
  - Manage hydro generation to utilize during peak hours.
  - Modify RAS arming for low hydro conditions.
  - Additional new Preferred Resources and Energy Storage.
North of Lugo Area
Preliminary Reliability Assessment Results

Sushant Barave
Sr. Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
North of Lugo (NOL) Area

- Comprised of 55, 115, and 230 kV transmission facilities.
- More than 2,500 MW of existing generation.
- Summer Peak load of 1,132 MW in 2025.
NOL Area Assessment Summary

The assessment identified:
- 1 facility overload due to category P1 outage
- 1 bus with high/low voltage concerns for category P0
- 2 buses with high/low voltage concerns for category P1 outage
- 3 facility overloads due to category P6 outages
- 1 issue for further investigation due to category P6 outage

Compared to last year results:
- Load modeled in NOL area was lower
- Generation retirements
- Coolwater – Lugo 230 kV transmission project not modeled
NOL – P0 and P1 Issues

- **P0** High voltage at Inyo PS 115 kV
- **Potential Mitigation:**
  - Adjust generator voltage schedules, reactive devices and taps

- **P1** Thermal overload on Inyo phase shifter
- **P1** High voltage at Inyo 115 kV
- **Potential Mitigation:**
  - Congestion management
  - Adjust generator voltage schedules, reactive devices and taps
NOL – P6 Issues

- Thermal overloads
  i. Victor 230/115 kV banks
  ii. Control – Inyo 115 kV
  iii. Inyo phase shifter

- Potential Mitigation:
  i. Bring the hot spare bank in-service at Victor
  ii. Maintain Inyokern area generation-load balance as described in SCE’s SOB 209 (Kramer RAS)
  iii. Redispatch generation North of Control after the first N-1
- Case divergence due to Lugo 500/230 kV banks (T-1-1)

- Potential Mitigation: Further investigation and operational evaluation of the existing RAS
Thank you
East of Lugo Area
Preliminary Reliability Assessment Results

Sushant Barave
Sr. Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
East of Lugo (EOL) Area

- Includes Eldorado, Mohave, Merchant, Ivanpah, CIMA, Pisgah Mountain Pass, Dunn Siding and Baker substations

- Generation:
  - 1111 MW

- Comprised of 115, 230 & 500 kV transmission facilities.

- Summer Peak load of 14 MW in 2025
EOL Area Assessment Summary

- The assessment identified:
  - 1 facility overload due to category P1 outage
  - 2 facility overloads due to category P6 outages
  - 1 facility overload due to category P1 outages (only in the sensitivity studies)
  - 1 voltage deviation issues due to category P1 outages
  - 1 voltage deviation issue due to category P6 outages
  - 5 high/low voltage issues due to category P0
  - 2 high/low voltage issues due to category P1 outages
  - 1 high/low voltage issues due to category P6 outage

- Compared to last year results:
  - Same Lugo – Victorville overload
  - Additional thermal issues observed at Ivanpah
  - Additional voltage issues observed
EOL Area Proposed Solutions

- Potential Mitigation Solutions
  - Congestion management
  - Future SPSs
  - Mitigation for Lugo-Victorville 500kV overload: Same as the mitigations discussed in SCE bulk system results
    - Congestion management
    - Increase the line rating
EOL Area – P1 (N-1) thermal issue

- Thermal Overload
  - Ivanpah – Mountain Pass 115 kV line overload (2017 off-peak)

- Potential Mitigation
  - Congestion management
  - Upgrade
  - Series reactor

Diagram:
- Nodes: Coolwater, Pahrump, Ivanpah, Bob Tap, MEAD (WAPA), Pisgah, Pahrump, Coolwater, Merchant, Moenkopi (ASP), McCullough (LADWP), Eldorado (SCE), CIMA, Mtn Pass, Dunn Siding, Baker, Primm, CIMA, Moave 500 kV, To Lugo, To Northwest (NVE), 230 kV.
EOL Area – P6 (N-1-1) thermal issue 1

- **Thermal Overload**
  - Ivanpah 230/115 kV A bank
    - (2017 off-peak, high renewable sensitivities)

- **Potential Mitigation**
  - Congestion management

---

- [Diagram of power system with nodes and connections]

---

California ISO
Shaping a Renewed Future

Slide 6
EOL Area – P6 (N-1-1) thermal issue 2

- **Thermal Overload**
  - Lugo – Victorville 500kV (all scenarios except 2020 light load)

- **Potential Mitigation**
  - Same as the mitigations discussed in SCE bulk system results
    - System adjustments after initial contingency including bypassing series caps per ISO OP 6610, dispatching Preferred Resources and Energy Storage (PR&ES) or
    - Increase the emergency rating of the line (SCE and LADWP Portion)
    - Install series reactors to limit flows on the line.
EOL Area – Voltage Deviation Issues

- Voltage deviation
  - Laughlin 500 kV and Mohave 500 kV (P1: all years)
  - Primm 230 kV (P6: 2017 off-peak)

- Potential Mitigation
  - Exception or dynamic VAR support
EOL Area – High/Low Voltage Issues

- High/Low voltage issues
  - Cima, Eldorado, Ivanpah, Pisgah and Primm 230 kV (P0: 2020 light-load)
  - Laughlin and Mohave 500 kV (P1: all years)
  - Ivanpah 230 kV (P6: 2017 off-peak)

- Potential Mitigation
  - Adjust generator voltage schedules, taps and reactive devices.
EOL Area – P1 (N-1) issue under sensitivity study

- **Thermal Overload**
  - Mead – Bob 230 kV overload (only under high renewable sensitivities)

- **Potential Mitigation**
  - Include Eldorado AA bank (T-1) outage in the Ivanpah RAS
Thank you
Valley Electric Area
Preliminary Reliability Assessment Results

Sushant Barave
Sr. Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
Valley Electric Association (VEA) Area

- VEA system is connected to WAPA’s Mead 230kV substation, WAPA’s Amargosa 138kV substation, NV Energy’s Northwest 230kV substation and shared buses at Jackass 138kV and Mercury 138kV stations.

- Generation Modeled:
  - 0 MW

- Comprised of 138 and 230 KV transmission facilities under ISO control.

- Summer Peak load of 145 MW in 2025.
VEA Assessment Summary

- The assessment identified:
  - 1 facility overload due to category P4 (breaker failure) outage
  - 4 facility overloads due to category P6 outages
  - 1 facility overload due to category P1 (only in the sensitivity study)
  - 2 buses with high/low voltage concerns for category P0
  - 20 buses with high/low voltage concerns for category P6 outages
  - 6 buses with voltage deviation concerns for category P1 outages
  - 19 buses with voltage deviation concerns for category P6 outages

- Compared to last year results:
  - Very similar to last year’s results owing to the fact that planned upgrades modeled in this year’s TPP are the same as last year’s
VEA Potential Solutions

- Potential Mitigation Solutions
  - Existing UVLS in VEA area
  - Operational action plan for category P6 outages (switching after N-1 outage)
  - Planned future SPS for mitigating Bob-Mead 230 kV overload
  - Adjust voltage schedules, taps and reactive devices
  - Exception for certain buses
VEA – P0 (N-0) Issues

- **High voltage**
  - Bob and Pahrump 230 kV (2020 light-load)

- **Potential Mitigation**
  - Adjust generator voltage schedules, taps and reactive devices or seek for an exception

---

**Legend**
- 230 kV line & bus
- 115/138 kV line & bus
- Transformer
- Outage
- Overload
- Bus voltage concern
- Boundary line

---

California ISO: Shaping a Renewed Future

Slide 5
VEA – P1 (N-1) Issues

- **Voltage deviation**
  - Charleston, Thousandaire, Gamebird and Sandy 138 kV (2017 peak)
  - Pahrump 230 kV (2017 and 2025 peak)
  - Desert View 230 kV (2020 light-load)

- **Potential Mitigation**
  - Planned Charleston – Vista 138 kV line will mitigate 138 kV issues.
  - An exception OR dynamic reactive support for other buses
VEA – P4 (breaker failure) Issues

- **Thermal overload**
  - Pahrump 230/115 kV transformer bank (2025 peak)

- **Potential Mitigation**
  - Explore short-term emergency rating or rely on future generation in VEA or automatic load transfer SPS
VEA – Several P6 (N-1-1) Issues

- **Overload**
  - Amargosa 230/138kV bank (2017, 2020 and 2025 peak)

- **Voltage Concerns**
  - Deviations and low voltages across the 138kV system in VEA (all study years)

- **Potential Mitigation**
  - Rely on UVLS or radially serve VEA 138 kV system after the 1st outage
VEA – P1 (N-1) Issue – only under sensitivity scenario

- **Thermal Overload**
  - Mead – Bob 230 kV overload (only under high renewable sensitivity)

- **Potential Mitigation**
  - Include Eldorado AA bank (T-1) outage in the Ivanpah RAS

---

Diagram showing the electrical connections between various locations such as Mead, Bob, Pahrump, Coolwater, Merchant, and others.
Thank you
San Diego Gas & Electric Main System Preliminary Reliability Assessment Results

Frank Chen
Sr. Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
SDG&E System

- Peak Loads and AAEE in MW

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<tr>
<th>1-in-10 Load (MW)</th>
<th>2017</th>
<th>2020</th>
<th>2025</th>
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<tr>
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<td>Energy Efficiency</td>
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<td>Net Peak Load</td>
<td>5335</td>
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- Area resources under CAISO control

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<th>Generation Resources (MW)</th>
<th>2017</th>
<th>2020</th>
<th>2025</th>
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<td>by location</td>
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<td>San Diego Metro</td>
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<tr>
<td>Total in MW</td>
<td>5448</td>
<td>5394</td>
<td>5356</td>
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- Collaborated with IID and CENACE
Reliability Assessment Summary

The assessment identified:

- 9 branches in SWPL/SPL overloaded for P1/P2/P4/P6 outages
- 4 branches 230 kV overloaded in SDGE for P2/P4/P6/P7 outages
- 2 branches 220 kV overloaded in SCE for P6 outages
- Transient voltage dip concern in Southern California for P6 outages
Reliability Assessment Summary - Cont'd

- Compared to last year results:
  - SDG&E import capability increased with the IV PST in service
  - Higher thermal loadings in the SWPL/SPL system
  - Increased flow northbound via the SONGS transfer path under off-peak condition
  - thermal overloads on adjacent SCE system
  - transient instability concern observed for the first time
Potential Mitigation Solutions

- Distributed Generation (DG), Demand Response (DR), and Energy Storage (ES)

- Alternatives to address the P2/P4/P6/P7 branch thermal overloads in SDG&E and SCE include but are not limited to:
  - upgrade the Old Town-Mission 230 kV line
  - add 2nd circuit on double-circuit structure of Miguel-BayBlvd 230 kV line
  - upgrade the 230 kV system between Silvergate and Bay Blvd
  - add 3rd bank at Bay Blvd 230/69 kV substation
  - upgrade the Ellis 220 kV corridor by replacing terminal equipment & increasing line clearance
  - retain/repower resources that could potentially retire
Potential Mitigation Solutions – Cont’d

- Alternatives to address the P1/P2/P4/P6 thermal overloads in SWPL/SPL systems include but are not limited to:
  - add 3rd bank at Miguel
  - increase SWPL/SPL ratings by replacing 525 kV disconnect switches
  - add 3rd 230 kV line out of Suncrest
  - re-configure Banks #80/#81/#82 in IV 525/230 kV substation
  - Operation Procedure and SPS modifications prior to the IV PST in service

- Continuing to coordinate with CENACE on IV PST operation procedure along with elimination of CENACE’s SPS cross tripping the SDGE-CENACE ties
Category P2/P4/P6 Thermal Violation – (1)

Silvergate 230/69 kV Banks

- Thermal Overload
  - for outages of Silvergate-Bay Blvd 230 kV line and the other Bay Blvd 230/69 kV bank, starting from 2020

- Potential Mitigations
  - DG, DR, and ES
  - add 3rd bank at Bay Blvd
  - add 2nd Silvergate-South Bay Blvd 230 kV line
  - retain/repower retirement resources
  - Operation Procedure (OP)

Bay Blvd 230/69 kV bank overloads as high as 109–115% for Silvergate-Bay Blvd 230 kV line outage and the other Bay Blvd bank outage (P2/P4/P6)
Category P2/P4/P7 Thermal Violation – (2)

- **Miguel-Bay Blvd 230 kV T/L**
  - **Thermal Overload**
    - for simultaneous outages of the two Miguel-Mission 230 kV lines (P2/P4/P7), starting from 2020
  - **Potential Mitigations**
    - DG, DR, and Energy Storage
    - build 2nd 230 kV circuit between Miguel-Bay Blvd
    - retain/repower retirement resources
    - Operation Procedure
Mission-OldTown 230KV T/L

- **Thermal Overload**
  - for overlapping outage of Miguel-Bay Blvd and Mission-OldTown-Silvergate 230 kV lines, starting from 2020

- **Potential Mitigations**
  - DG, DR, and ES
  - upgrade the Old Town-Mission 230 kV line,
  - add 2nd Miguel-Bay Blvd 230 kV line, and/or
  - retain/repower retirement resources
  - Operation Procedure
Category P6 Thermal Violation – (4)

San Luis Rey-Encina 230 kV T/Ls

- Thermal Overload
  - for overlapping outage of San Luis Rey-Mission and the other San Luis Rey-Encina 230 kV lines (P6), 2017 Off-Peak

- Potential Mitigations
  - Operation Procedure to curtail northbound flow via the North of SONGS path until the Encina Power Plant retirement

overloaded as high as 102% for the overlapping outage of San Luis Rey Mission and the other San Luis Rey-Encina 230 kV lines (P6), 2017 Off-Peak
P6 Thermal Violation in SCE (5)

SCE’s Ellis-Santiago 220 kV line

- Thermal Overload
  - for various P6 outages, the worst one is the overlapping outage of ECO-Miguel 525 kV line and Ellis-Johanna 230 kV line, starting from 2025

- Potential Mitigation
  - DG, DR, and ES
  - upgrade the Ellis 220 kV south corridor by replacing terminal equipment and increasing the line clearance
  - Operation Procedure adjusting system
P6 Thermal Violation in SCE (6)

SCE’s Ellis-Johanna 220 kV line

- **Thermal Overload**
  - for various P6 outages, the worst one is the overlapping outage of ECO-Miguel 525 kV line and Ellis-Santiago 220 kV line, starting from 2025

- **Potential Mitigation**
  - DG, DR, and Energy Storage
  - upgrade the Ellis south corridor by replacing terminal equipment and increasing the line clearance
  - Operation Procedure adjusting system
Category P1 Thermal Violation (7)

Miguel 525/230 kV Banks

- Thermal Overload
  - for loss of other Miguel 525/230 kV bank (P1) with gen tripping SPS
  - Heavily overloaded for various P3/P6 outages

- Potential Mitigation
  - DG, DR, and ES
  - modify Miguel Bank SPS
  - add SPS to open overloaded bank
  - add 3rd bank at Miguel
  - Operation Procedure adjusting system
Category P1 Thermal Violation (8)

ECO-Miguel 525 kV T/L

- Thermal Overload
  - for loss of Ocotillo-Suncrest 525 kV Line (P1) without gen tripping SPS, and overloads much worst for various P6 outages

- Potential Mitigation
  - DG, DR, and ES
  - *modify* SWPL SPS gen shedding
  - increase SWPL ratings by replacing disconnect switches
  - Operation Procedure adjusting system
Category P1 Thermal Violation (9)

Suncrest 525/230 kV Banks and Suncrest-Sycamore 230 kV lines

- **Thermal Overload**
  - Heavily overloaded for various P6 outages respectively

- **Potential Mitigation**
  - DG, DR, and ES
  - modify SPL SPS and add SPS to open the overloaded bank or the line
  - add 3rd bank at Suncrest
  - increase SPL ratings by replacing switches
  - add 3rd 230 kV line out of Suncrest
  - Operation Procedure
Category P2/P4 Thermal Violation (10)

**IV 525/230 kV BK80 & BK82**
- **Thermal Overload**
  - for CB #8022 internal fault/stuck breaker (P2/P4)
  - for various P6 outages
- **Potential Mitigation**
  - Operation Procedure
  - reconfigure BK81/80/82
  - develop higher ratings for the banks
  - modify SPS dropping generation in IV
  - upgrade aged BK80 in size of 600 MVA to 1120 MVA
Transient Instability Concern (11)

Transient Voltage Dip in SCE

- Transient Voltage Dip
  - Exceeds the 30% of WECC performance criterion at Johanna/Santiago/Ellis/Viejo buses (as high as 39.8%) for ECO-Miguel 525kV line outage followed by system adjustments and a 3-phase fault at Suncrest 525 kV bus with normal clearing

- Potential Mitigation
  - Further Evaluation
San Diego Gas & Electric Area Sub-Transmission Preliminary Reliability Assessment Results

Charles Cheung
Senior Regional Transmission Engineer

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
SDG&E Area Sub-Transmission Assessment Summary

- The assessment identified:
  - Branches overloaded for Category P2, P6 and P7 outages
  - Low voltage for Category P2 outage
  - Voltage instability for contingencies in the Eastern area

- Compared to last year results:
  - A few thermal and voltage violations in the 69 kV sub-transmission system due to multi-terminal line contingencies (P2.1) and low power factor in 2017 SP case
  - Thermal violations and voltage instability in the sub-transmission system due to load growth
SDG&E Area Sub-Transmission Potential Mitigation Solutions

- Network upgrades to address sub-transmission Category P6 issues
- Increase power factor to improve high/low voltage
- Energy Efficiency, DG, Demand Response, and Energy Storage
SDG&E Sub-Transmission 138/69 kV System
Category P2 Thermal and Voltage Violation (1)

- **Thermal Overload**
  - TL695 overload for losing one section of TL690 (2017SP)

- **Low Voltage**
  - Low power factor requiring reactive power import from Talega 69/138 kV Transformer

- **Potential Mitigation**
  - SPS to trip TL 695 for interim
  - Re-conduct Talega Tap-Stuart Tap 69 kV line in 2018
  - Increase power factor to increase voltage
Category P6 Thermal Violation

Stuart Tap-Las Pulgas 69 kV

- **Thermal Overload**
  - TL690D overload for losing two San Luis Rey-S. Onofre lines (N-1-1) (2017OP)

- **Potential Mitigation**
  - Existing Talega SPS until the overloaded section is re-conducted
Stuart Tap-Las Pulgas 69 kV

- Thermal Overload
  - TL690D overload for losing two San Luis Rey-S. Onofre lines (N-1-1) (2017OP)

- Potential Mitigation
  - Existing Talega SPS until the overloaded section is re-conducted
Category P7 Thermal Violation (2)

Oceanside Tap-Stuart Tap 69kV

- Thermal overload
  - TL690C section overload for N-2 outage of TL23052 and TL23007 (2020SP and 2025SP)

- Potential Mitigation
  - Modify the existing SPS
  - Re-conduct TL690C section as part of the wood-to-steel project
Category P2 Thermal Violation (2)

Bay Blvd-Montgomery 69kV

- Thermal overload
  - TL641 overload for N-1 outage of TL642A (2020SP and 2025SP) after Bay Blvd substation and transformers in service

- Potential Mitigation
  - Repower retired generation
  - SPS to trip Bay Blvd Transformer
  - Re-conduct Bay Blvd-Montgomery 69 kV
Category P6 Thermal Violation (2)

Bay Blvd-Montgomery Tap 69kV

- Thermal overload
  - TL642A overload for N-1-1 outage of TL641 and TL644 (2020SP and 2025SP) after Bay Blvd substation and transformers in service

- Potential Mitigation
  - Repower retired generation
  - SPS to trip Bay Blvd Transformer
  - Re-conduct Bay Blvd-Montgomery Tap 69 kV
Category P6 Voltage Instability

Eastern Back Country 69 kV Area
- Voltage instability in the Eastern back country 69 kV area for
  - Losing TL678 and TL6914 (All SP cases)
  - Losing TL635 and TL6917 (All SP cases)
  - Losing TL681 and TL682 (20SP and 25SP)

Potential Mitigation
- DG, DR, and Energy Storage
- New 69 kV transmission source in the area
- SPS to shed up to 70 MW loads for the 2nd contingency
- Operation procedure to open TL626
Next Steps

Tom Cuccia
Lead Stakeholder Engagement and Policy Specialist

2015-2016 Transmission Planning Process Stakeholder Meeting
September 21-22, 2015
## Next Steps

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<th>Date</th>
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<tr>
<td>September 22</td>
<td>PTO presentations on mitigation solutions</td>
</tr>
<tr>
<td>September 22-October 6</td>
<td>Stakeholder comments to be submitted to <a href="mailto:regionaltransmission@caiso.com">regionaltransmission@caiso.com</a></td>
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<tr>
<td>October 15</td>
<td>Request window closes. Submissions to be submitted to <a href="mailto:requestwindow@caiso.com">requestwindow@caiso.com</a></td>
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<td>October 30</td>
<td>Post final 2015-2016 reliability study results</td>
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