

2012/2013 ISO Reliability Assessment - Study Results

Study Area: **PG&E Greater Bay Area Peninsula - Summer Peak**



Thermal Overloads

| ID | Overloaded Facility | Worst Contingency | Category | Category Description | Loading (%) | | | Potential Mitigation Solutions |
|--------------|--|---|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Penn-SP-T-01 | Bair - Cooley Landing #1 60 kV Line | BUS FAULT AT 33375 CLY LNDG 60.00 Bus #1 | C1 | Bus | 95% | 103% | 111% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-02 | Bair - Cooley Landing #2 60 kV Line | BUS FAULT AT 33367 BAIR 60.00 | C1 | Bus | 95% | 102% | 109% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-03 | Ravenswood - Palo Alto #2 115 kV Line | CB FAULT AT RVNSWD 115 CB522 | C2 | Breaker | 120% | 124% | 132% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-04 | Ravenswood - Cooley Landing #1 115 kV Line | CB FAULT AT RVNSWD 115 CB532 | C2 | Breaker | 101% | N/A | N/A | Ravenswood - Cooley Landing Reconductor Project |
| Penn-SP-T-05 | Bair - Cooley Landing #1 60 kV Line | CB FAULT AT CLY LNDG 60 CB2 | C2 | Breaker | 97% | 105% | 113% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-06 | SANMATEO 115/230 kV Bank 6 | CB FAULT AT 30700 SANMATEO 230 CB712 | C2 | Breaker | 100% | 102% | 108% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-07 | BAIR 60/115kV Bank 1 | CB FAULT AT CLY LNDG 60 CB2 | C2 | Breaker | 120% | 129% | 138% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-08 | BAIR 60/115kV Bank 1 | Ravenswood-Cooley Landing #2 115kV Lin_Cooley Landing 115/60kV Transformer #1 | C3 | N-1-1 | 113% | 121% | 129% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-09 | San Mateo - Hillsdale JCT 60 kV Line | Jefferson 230/60kV Transformer #1 _Jefferson 230/60kV Transformer #2 | C3 | N-1-1 | 90% | 95% | 108% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |

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|--------------|--|--|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Penn-SP-T-10 | Bair - Cooley Landing #1 60 kV Line | Bair-Cooley Landing #2 60kV Line _Bair 115/60kV Transformer #1 | C3 | N-1-1 | 89% | 95% | 103% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-11 | Cooley Landing - Palo Alto 115 kV Line | Ravenswood-Palo Alto #1 115kV Line _Ravenswood-Palo Alto #2 115kV Line | C3 | N-1-1 | 124% | 125% | 131% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-12 | Cooley Landing - Stanford 60 kV Line | Jefferson 230/60kV Transformer #1 _Jefferson 230/60kV Transformer #2 | C3 | N-1-1 | 88% | 92% | 102% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-13 | Cooley Landing 115/60 kV Transformer No. 2 | Bair 115/60kV Transformer #1 _Cooley Landing 115/60kV Transformer #1 | C3 | N-1-1 | 116% | 121% | 130% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-14 | Jefferson - Stanford 60 kV Line | Cooley Landing-Stanford 60kV Line (Coo_Jefferson-Las Pulgas 60kV Line (Jefferso | C3 | N-1-1 | 104% | 111% | 120% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-15 | Cooley Landing - Stanford 60 kV Line | Jefferson 230/60kV Transformer #1 _Jefferson 230/60kV Transformer #2 | C3 | N-1-1 | 89% | 94% | 104% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-16 | Martin - Sneath Lane 60 kV Line | Martin-Millbrae 115kV Line _Millbrae- San Mateo #1 115kV Line | C3 | N-1-1 | 164% | 173% | 186% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-17 | Bair - Cooley Landing #2 60 kV Line | Bair-Cooley Landing #1 60kV Line _Bair 115/60kV Transformer #1 | C3 | N-1-1 | 95% | 101% | 109% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-18 | Bair - Cooley Landing #1 60 kV Line | Bair-Cooley Landing #2 60kV Line _Bair 115/60kV Transformer #1 | C3 | N-1-1 | 89% | 94% | 103% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |

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|--------------|---------------------------------------|--|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Penn-SP-T-19 | Bair - Cooley Landing #2 60 kV Line | San Mateo-Bair 60kV Line _Bair 115/60kV Transformer #1 | C3 | N-1-1 | 99% | 106% | 114% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-20 | Ravenswood - Palo Alto #1 115 kV Line | Ravenswood-Palo Alto #2 115kV Line _Ravenswood-Cooley Landing #1 115kV Line | C3 | N-1-1 | 118% | 122% | 130% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-21 | San Mateo - Hillsdale JCT 60 kV Line | Jefferson 230/60kV Transformer #1 _Jefferson 230/60kV Transformer #2 | C3 | N-1-1 | 89% | 93% | 105% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-22 | San Mateo - Belmont 115 kV Line | Ravenswood 230/115kV Transformer #1 _Ravenswood 230/115kV Transformer #2 | C3 | N-1-1 | 121% | 123% | 127% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-23 | SANMATEO 115/230kV Bank5 | San Mateo 230/115kV Transformer #6 _San Mateo 230/115kV Transformer #7 | C3 | N-1-1 | 108% | 110% | 116% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-24 | SANMATEO 115/230kV Bank6 | San Mateo 230/115kV Transformer #5 _San Mateo 230/115kV Transformer #7 | C3 | N-1-1 | 107% | 110% | 116% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-25 | SANMATEO 115/230kV Bank7 | San Mateo 230/115kV Transformer #5 _San Mateo 230/115kV Transformer #6 | C3 | N-1-1 | 110% | 113% | 119% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-26 | SANMATEO 60/115 kV Bank3 | San Mateo-Bair 60kV Line (San Carlos-B_San Mateo 115/60kV Transformer #8 | C3 | N-1-1 | 88% | 92% | 100% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-27 | Millbrae - Sneath Lane 60 kV Line | Martin-Millbrae 115kV Line _Millbrae- San Mateo #1 115kV Line | C3 | N-1-1 | 110% | 116% | 125% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |

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|--------------|--|---|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Penn-SP-T-28 | San Mateo - Hillsdale JCT 60 kV Line | Monta Vista-Jefferson Nos. 1 & 2 230 kV lines | C5 | DCTL | 87% | 92% | 104% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-29 | Cooley Landing - Palo Alto 115 kV Line | Ravenswood-Palo Alto Nos. 1 & 2 115 kV lines | C5 | DCTL | 124% | 125% | 131% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-30 | Cooley Landing - Stanford 60 kV Line | Monta Vista-Jefferson Nos. 1 & 2 230 kV lines | C5 | DCTL | 90% | 95% | 105% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-31 | East Shore - San Mateo 230 kV Line | Newark-Ravenswood 230 kV and Tesla-Ravenswood 230 kV lines | C5 | DCTL | 100% | 105% | 109% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |
| Penn-SP-T-32 | Cooley Landing - Stanford 60 kV Line | Monta Vista-Jefferson Nos. 1 & 2 230 kV lines | C5 | DCTL | 92% | 97% | 107% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-33 | San Mateo - Belmont 115 kV Line | Ravenswood-Bair Nos. 1 & 2 115 kV lines | C5 | DCTL | 98% | 102% | 103% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-34 | Ravenswood - Palo Alto #2 115 kV Line | Ravenswood-Palo Alto No. 1 115 kV and Cooley Landing-Palo Alto 115 kV lines | C5 | DCTL | 104% | 105% | 109% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-35 | Ravenswood - Cooley Landing #1 115 kV Line | Ravenswood-Palo Alto Nos. 1 & 2 115 kV lines | C5 | DCTL | 144% | 111% | 120% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-SP-T-36 | San Mateo - Hillsdale JCT 60 kV Line | Monta Vista-Jefferson Nos. 1 & 2 230 kV lines | C5 | DCTL | 86% | 91% | 102% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |

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Study Area: **PG&E Greater Bay Area Peninsula - Winter Peak**



Thermal Overloads

| ID | Overloaded Facility | Worst Contingency | Category | Category Description | Loading (%) | | | Potential Mitigation Solutions |
|--------------|--|---|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Winter Peak | 2017 Winter Peak | 2022 Winter Peak | |
| Penn-WP-T-01 | Ravenswood - Palo Alto #2 115 kV Line | CB FAULT AT RVNSWD 115 CB522 | C2 | Breaker | 93% | 96% | 102% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-02 | Bair 115/60 kV Transformer No. 1 | CB FAULT AT CLY LNDG 60 CB2 | C2 | Breaker | 104% | 111% | 119% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-03 | San Mateo 230/115 kV Transformer No. 5 | San Mateo 230/115kV Transformer #6 _San Mateo 230/115kV Transformer #7 | C3 | N-1-1 | 101% | 102% | 109% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-04 | San Mateo 230/115 kV Transformer No. 6 | San Mateo 230/115kV Transformer #5 _San Mateo 230/115kV Transformer #7 | C3 | N-1-1 | 100% | 102% | 109% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-05 | San Mateo 230/115 kV Transformer No. 7 | San Mateo 230/115kV Transformer #5 _San Mateo 230/115kV Transformer #6 | C3 | N-1-1 | 103% | 105% | 112% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-06 | Martin 115/60 kV Transformer No. 6 | Martin-Millbrae 115kV Line _Millbrae-San Mateo #1 115kV Line | C3 | N-1-1 | 94% | 99% | 106% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-07 | Bair 115/60 kV Transformer No. 1 | Ravenswood-Cooley Landing #2 115kV Line _Cooley Landing 115/60kV Transformer #1 | C3 | N-1-1 | 103% | 108% | 116% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-08 | Cooley Landing 115/60 kV Transformer No. 2 | Bair 115/60kV Transformer #1 _Cooley Landing 115/60kV Transformer #1 | C3 | N-1-1 | 106% | 111% | 119% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-09 | San Mateo 115/60 kV Transformer No. 3 | San Mateo-Bair 60kV Line (San Carlos-Bai_San Mateo 115/60kV Transformer #8 | C3 | N-1-1 | 95% | 97% | 109% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |

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| ID | Overloaded Facility | Worst Contingency | Category | Category Description | Loading (%) | | | Potential Mitigation Solutions |
|--------------|---------------------------------------|--|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Winter Peak | 2017 Winter Peak | 2022 Winter Peak | |
| Penn-WP-T-10 | Millbrae 115/60 kV Transformer No. 5 | Martin-Sneath Lane 60kV Line _Hillsdale JCT - Half Moon Bay 60kV Line | C3 | N-1-1 | 101% | 105% | 124% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-11 | Martin-Sneath Lane 60 kV Line | Martin-Millbrae 115kV Line _Millbrae- San Mateo #1 115kV Line | C3 | N-1-1 | 132% | 139% | 150% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-12 | Millbrae-Sneath Lane 60 kV Line | Martin-Sneath Lane 60kV Line _Hillsdale JCT - Half Moon Bay 60kV Line | C3 | N-1-1 | 104% | 108% | 131% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-13 | Millbrae - Pacifica 60 kV Line | Martin-Sneath Lane 60kV Line _Hillsdale JCT - Half Moon Bay 60kV Line | C3 | N-1-1 | 133% | 139% | 167% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-14 | San Mateo - Hillsdale JCT 60 kV Line | Jefferson 230/60kV Transformer #1 _Jefferson 230/60kV Transformer #2 | C3 | N-1-1 | 89% | 93% | 106% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-15 | San Mateo - Hillsdale JCT 60 kV Line | Monta Vista-Jefferson Nos. 1 & 2 230 kV lines | C5 | DCTL | 88% | 92% | 105% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Penn-WP-T-16 | Ravenswood-Cooley Landing 115 kV Line | Ravenswood-Palo Alto Nos. 1 & 2 115 kV lines | C5 | DCTL | 114% | 88% | 93% | Ravenswood - Cooley Landing Reconductor Project |

Thermal Overloads

| ID | Overloaded Facility | Worst Contingency | Category | Category Description | Loading (%) | | | Potential Mitigation Solutions |
|----|---------------------|-------------------|----------|----------------------|------------------------|----------------------|-----|--------------------------------|
| | | | | | 2014 Summer Light Load | 2017 Summer Off-Peak | N/A | |
| | | | | | | | | |

No thermal overloads identified.

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Voltage Deviations



| ID | Substation | Worst Contingency | Category | Category Description | Post Cont. Voltage Deviation % | | | Potential Mitigation Solutions |
|---------------|----------------|---|----------|----------------------|--------------------------------|------------------|------------------|--------------------------------|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Penn-SP-DV-01 | MILLBRAE 115kV | Martin-Millbrae 115kV Line San Mateo #1 115kV Line | C3 | N-1-1 | -10% | -11% | -12% | Reactive Support |
| Penn-SP-DV-02 | SANPAULA 115kV | Martin-Millbrae 115kV Line San Mateo #1 115kV Line | C3 | N-1-1 | -10% | -11% | -12% | Reactive Support |



Voltage Deviations

| ID | Substation | Worst Contingency | Category | Category Description | Post Cont. Voltage Deviation % | | | Potential Mitigation Solutions |
|----|------------|-------------------|----------|----------------------|--------------------------------|------------------|------------------|--------------------------------|
| | | | | | 2014 Winter Peak | 2017 Winter Peak | 2022 Winter Peak | |
| | | | | | | | | |

No voltage deviations identified.



Voltage Deviations

| ID | Substation | Worst Contingency | Category | Category Description | Post Cont. Voltage Deviation % | | | Potential Mitigation Solutions |
|----|------------|-------------------|----------|----------------------|--------------------------------|----------------------|-----|--------------------------------|
| | | | | | 2014 Summer Light Load | 2017 Summer Off-Peak | N/A | |
| | | | | | | | | |

No voltage deviations identified.



High/Low Voltage

| ID | Substation | Worst Contingency | Category | Category Description | Voltage (PU) | | | Potential Mitigation Solutions |
|----|------------|-------------------|----------|----------------------|------------------|------------------|------------------|--------------------------------|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| | | | | | | | | |

No high/low voltage issues identified.



High/Low Voltage

| ID | Substation | Worst Contingency | Category | Category Description | Voltage (PU) | | | Potential Mitigation Solutions |
|----|------------|-------------------|----------|----------------------|------------------|------------------|------------------|--------------------------------|
| | | | | | 2014 Winter Peak | 2017 Winter Peak | 2022 Winter Peak | |
| | | | | | | | | |

No high/low voltage issues identified.

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High/Low Voltage

| ID | Substation | Worst Contingency | Category | Category Description | Voltage (PU) | | | Potential Mitigation Solutions |
|--------------|----------------|-------------------|----------|----------------------|------------------------|----------------------|-----|--------------------------------|
| | | | | | 2014 Summer Light Load | 2017 Summer Off-Peak | N/A | |
| Penn-OP-V-01 | RVNSWD E 115kV | Normal | A | N-0 | 1.06 | 1.04 | | Reactive Support |
| Penn-OP-V-02 | CLY LND2 115kV | Normal | A | N-0 | 1.05 | 1.04 | | Reactive Support |
| Penn-OP-V-03 | CLY LND 115kV | Normal | A | N-0 | 1.06 | 1.05 | | Reactive Support |
| Penn-OP-V-04 | RVNSWD D 115kV | Normal | A | N-0 | 1.06 | 1.04 | | Reactive Support |
| Penn-OP-V-05 | CCSF_TAP 115kV | Normal | A | N-0 | 1.06 | 1.04 | | Reactive Support |
| Penn-OP-V-06 | CCSF 115kV | Normal | A | N-0 | 1.06 | 1.04 | | Reactive Support |

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Study Area: **PG&E Greater Bay Area Peninsula - Summer Light Load & Summer Off-Peak**



Transient Stability

| ID | Contingency | Category | Category Description | Transient Stability Performance | | | Potential Mitigation Solutions |
|----|-------------|----------|----------------------|---------------------------------|----------------------|-----|--------------------------------|
| | | | | 2014 Summer Light Load | 2017 Summer Off-Peak | N/A | |
| | | | | | | | |

No single source substation with more than 100 MW Load

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Single Contingency Load Drop

| ID | Worst Contingency | Category | Category Description | Amount of Load Drop (MW) | | | Potential Mitigation Solutions |
|----|-------------------|----------|----------------------|--------------------------|------|------|--------------------------------|
| | | | | 2014 | 2017 | 2022 | |
| | | | | | | | |

No single contingency resulted in total load drop of more than 250 MW.



Transient Stability

| ID | Contingency | Category | Category Description | Transient Stability Performance | | | Potential Mitigation Solutions |
|----|-------------|----------|----------------------|---------------------------------|------------------|------------------|--------------------------------|
| | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| | | | | | | | |

No single source substation with more than 100 MW Load

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Single Source Substation with more than 100 MW Load



| ID | Substation | Load Served (MW) | | | Potential Mitigation Solutions |
|----|------------|------------------|------|------|--------------------------------|
| | | 2014 | 2017 | 2022 | |
| | | | | | |

No single source substation with more than 100 MW Load