

2012/2013 ISO Reliability Assessment - Preliminary Study Results

Study Area: **PG&E Greater Bay Area Mission - 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 | |
| Miss-SP-T-01 | Dumbarton - Newark 115 kV Line | Eastshore-San Mateo 230kV Line | B | N-1 | 102% | N/A | N/A | East Shore - Oakland J 115 kV Reconductor project |
| Miss-SP-T-02 | Moraga - San Leandro #1 115 kV Line | BUS FAULT AT 35101 SN LNDRO 115.00 Sec E | C1 | Bus | 126% | 108% | 114% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-03 | East Shore - San Mateo 230 kV Line | CB FAULT AT 35105 EASTSHRE 115 CB302 | C2 | Breaker | 103% | 103% | 104% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |
| Miss-SP-T-04 | NEWARK F 115/230kV Bank 11 | CB FAULT AT NEWARK 230 CB810 | C2 | Breaker | 107% | 111% | 116% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-05 | Newark - Ames #1 115 kV Line | Eastshore-San Mateo 230kV Line _Newark-Ravenswood 230kV Line | C3 | N-1-1 | 107% | N/A | N/A | South of San Mateo SPS South of San Mateo Capacity Project |
| Miss-SP-T-06 | North Dublin - Cayetano 230 KV Line | Contra Costa-Las Positas 230kV Line _Tesla-Newark #2 230kV Line | C3 | N-1-1 | 95% | 99% | 102% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-07 | Newark - Vallecitos 60 kV Line | Radum-Livermore 60kV Line _San Ramon 230/60kV Transformer #1 | C3 | N-1-1 | 114% | 118% | 125% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-08 | Dumbarton - Newark 115 kV Line | Pittsburg-Eastshore 230kV Line _Eastshore-San Mateo 230kV Line | C3 | N-1-1 | 122% | N/A | N/A | East Shore - Oakland J 115 kV Reconductor project |
| Miss-SP-T-09 | Dumbarton - Newark 115 kV Line | Eastshore-San Mateo 230kV Line _Oakland J - Grant 115kV Line | C3 | N-1-1 | 102% | 101% | N/A | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |

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|--------------|--------------------------------------|---|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Miss-SP-T-10 | East Shore - San Mateo 230 kV Line | Eastshore 230/115kV Transformer #1 _Eastshore 230/115kV Transformer #2 | C3 | N-1-1 | 104% | 103% | 104% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-11 | EASTSHRE - E. SHORE 115/230kV Bank 1 | Eastshore-San Mateo 230kV Line _Eastshore 230/115kV Transformer #2 | C3 | N-1-1 | 112% | 127% | 129% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |
| Miss-SP-T-12 | EASTSHRE - E. SHORE 115/230kV Bank 2 | Eastshore-San Mateo 230kV Line _Eastshore 230/115kV Transformer #1 | C3 | N-1-1 | 113% | 127% | 129% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |
| Miss-SP-T-13 | Grant - Oakland J 115 kV Line | Eastshore-San Mateo 230kV Line _Eastshore-Dumbarton 115kV Line | C3 | N-1-1 | N/A | 123% | 123% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |
| Miss-SP-T-14 | Grant - East Shore #1 115 kV Line | Eastshore-San Mateo 230kV Line _Grant- Eastshore #2 115kV Line | C3 | N-1-1 | N/A | 104% | 107% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |
| Miss-SP-T-15 | Grant - East Shore #2 115 kV Line | Eastshore-San Mateo 230kV Line _Grant- Eastshore #1 115kV Line | C3 | N-1-1 | N/A | 104% | 107% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate or reduce RCEC generation |
| Miss-SP-T-16 | Newark - Livermore 60 kV Line | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | N/A | N/A | 106% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |

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Thermal Overloads

| ID | Overloaded Facility | Worst Contingency | Category | Category Description | Loading (%) | | | Potential Mitigation Solutions |
|--------------|-------------------------------------|---|----------|----------------------|------------------|------------------|------------------|---|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Miss-SP-T-17 | Lone Tree - Cayetano 230 kV Line | Contra Costa-Las Positas 230kV Line _Moraga-Castro Valley 230kV Line | C3 | N-1-1 | 102% | 104% | 108% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-18 | Moraga - San Leandro #1 115 kV Line | Moraga-San Leandro #2 115kV Line _Moraga-San Leandro #3 115kV Line | C3 | N-1-1 | 150% | 123% | 130% | Moraga - Oakland J SPS |
| Miss-SP-T-19 | Moraga - San Leandro #2 115 kV Line | Moraga-San Leandro #1 115kV Line _Moraga-San Leandro #3 115kV Line | C3 | N-1-1 | 150% | 124% | 130% | Moraga - Oakland J SPS |
| Miss-SP-T-20 | Moraga - San Leandro #3 115 kV Line | Moraga-San Leandro #1 115kV Line _Moraga-San Leandro #2 115kV Line | C3 | N-1-1 | 120% | 100% | 106% | Moraga - Oakland J SPS |
| Miss-SP-T-21 | Newark 115/60 kV Bank 2 | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 100% | 105% | 114% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-22 | Newark - Ames #3 115 kV Line | Eastshore-San Mateo 230kV Line _Newark-Ravenswood 230kV Line | C3 | N-1-1 | 106% | N/A | N/A | South of San Mateo Capacity Project |
| Miss-SP-T-23 | Newark - Ames #2 115 kV Line | Eastshore-San Mateo 230kV Line _Newark-Ravenswood 230kV Line | C3 | N-1-1 | 108% | N/A | N/A | South of San Mateo Capacity Project |
| Miss-SP-T-24 | NEWARK F 115/230kV Bank 11 | Newark-Newark Dist 230kV section _Newark 230/115kV Transformer #7 | C3 | N-1-1 | 101% | 107% | 111% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-25 | Newark - Vallecitos 60 kV Line | Radum-Livermore 60kV Line _San Ramon 230/60kV Transformer #1 | C3 | N-1-1 | 114% | 118% | 125% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-26 | Lone Tree - Cayetano 230 kV Line | Contra Costa-Las Positas 230kV Line _Moraga-Castro Valley 230kV Line | C3 | N-1-1 | 102% | 104% | 108% | Re-rate or reconductor line. Drop load either manually or thru SPS as appropriate |
| Miss-SP-T-27 | 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 |

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Study Area: **PG&E Greater Bay Area Mission - 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 | |
| Miss-SP-T-28 | Dumbarton - Newark 115 kV Line | Eastshore-San Mateo 230 kV and Pittsburg-San Mateo 230 kV lines | C5 | DCTL | 111% | 88% | 86% | East Shore - Oakland J 115 kV 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.

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 | |
| Miss-SP-DV-01 | GRANT 115kV | CB FAULT AT 35105 EASTSHRE 115 CB302 | C2 | Breaker | -6% | -9% | -10% | Add reactive support |
| Miss-SP-DV-02 | CALMAT60 60kV | Livermore-Las Positas 60kV Line _San Ramon 230/60kV Transformer #1 | C3 | N-1-1 | -14% | -15% | -16% | Add reactive support |
| Miss-SP-DV-04 | E DUBLIN 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -15% | -16% | -18% | Add reactive support |
| Miss-SP-DV-05 | GRANT 115kV | Grant-Eastshore #1 115kV Line _Grant-Eastshore #2 115kV Line | C3 | N-1-1 | -6% | -9% | -11% | Add reactive support |
| Miss-SP-DV-06 | IUKA 60kV | Livermore-Las Positas 60kV Line _San Ramon 230/60kV Transformer #1 | C3 | N-1-1 | -14% | -15% | -16% | Add reactive support |
| Miss-SP-DV-07 | LIVERMRE 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -15% | -16% | -18% | Add reactive support |
| Miss-SP-DV-08 | LIVRMR_2 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -15% | -16% | -18% | Add reactive support |
| Miss-SP-DV-09 | LPOSTAS 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -16% | -17% | -19% | Add reactive support |
| Miss-SP-DV-10 | NEWARK 60kV | Las Positas 230/60kV Transformer #4 _Newark 115/60kV Transformer #1 | C3 | N-1-1 | -11% | -11% | -12% | Add reactive support |
| Miss-SP-DV-11 | PARKS 60kV | Livermore-Las Positas 60kV Line _San Ramon 230/60kV Transformer #1 | C3 | N-1-1 | -14% | -15% | -16% | Add reactive support |
| Miss-SP-DV-12 | RADUM 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -15% | -16% | -18% | Add reactive support |
| Miss-SP-DV-13 | SAN RAMN 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -16% | -17% | -19% | Add reactive support |
| Miss-SP-DV-14 | SEAWEST 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -16% | -17% | -19% | Add reactive support |
| Miss-SP-DV-15 | VASCO 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -16% | -17% | -19% | Add reactive support |
| Miss-SP-DV-16 | ZONDWD 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -16% | -17% | -19% | Add reactive support |

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 | |
| Miss-SP-DV-17 | USWP-FRK 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -16% | -17% | -19% | Add reactive support |
| Miss-SP-DV-18 | VALLECTS 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -11% | -12% | -14% | Add reactive support |
| Miss-SP-DV-19 | SUNOL 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -10% | -11% | -12% | Add reactive support |
| Miss-SP-DV-20 | VINEYARD 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | -15% | -16% | -18% | Add reactive support |

2012/2013 ISO Reliability Assessment - Preliminary Study Results

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



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 | |
| Miss-OP-DV-01 | SEAWEST 60kV | Wind Farms 60kV Line | B | N-1 | -6% | -5% | | Add reactive support |
| Miss-OP-DV-02 | USWP-WKR 60kV | Vasco-Herdlyn 60kV Line | B | N-1 | -6% | -3% | | Add reactive support |
| Miss-OP-DV-03 | ZONDWD 60kV | Wind Farms 60kV Line | B | N-1 | -6% | -5% | | Add reactive support |
| Miss-OP-DV-04 | PARKS 60kV | San Ramon-Radum 60kV Line | B | N-1 | -8% | -7% | | Add reactive support |
| Miss-OP-DV-05 | USWP-FRK 60kV | Wind Farms 60kV Line | B | N-1 | -6% | -5% | | Add reactive support |
| Miss-OP-DV-06 | ALTAMONT 60kV | Vasco-Herdlyn 60kV Line | B | N-1 | -6% | -3% | | Add reactive support |
| Miss-OP-DV-07 | IUKA 60kV | Radum-Vallecitos 60kV Line | B | N-1 | -9% | -8% | | Add reactive support |
| Miss-OP-DV-08 | SUNOL 60kV | Newark-Vallecitos 60kV Line | B | N-1 | -9% | -7% | | Add reactive support |
| Miss-OP-DV-09 | FLOWIND1 60kV | Wind Farms 60kV Line | B | N-1 | -6% | -5% | | Add reactive support |
| Miss-OP-DV-10 | E DUBLIN 60kV | San Ramon-Radum 60kV Line | B | N-1 | -8% | -7% | | Add reactive support |
| Miss-OP-DV-11 | CALMAT60 60kV | Radum-Livermore 60kV Line | B | N-1 | -9% | -8% | | Add reactive support |
| Miss-OP-DV-12 | VINEYARD 60kV | Radum-Vallecitos 60kV Line | B | N-1 | -9% | -8% | | Add reactive support |

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

High/Low Voltage



| ID | Substation | Worst Contingency | Category | Category Description | Voltage (PU) | | | Potential Mitigation Solutions |
|--------------|---------------|---|----------|----------------------|------------------|------------------|------------------|--------------------------------|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Miss-SP-V-01 | CALMAT 60 kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-02 | DCTO JCT 60kV | Las Positas 230/60kV Transformer #4 _Newark 115/60kV Transformer #1 | C3 | N-1-1 | 0.89 | 0.89 | 0.88 | Add reactive support |
| Miss-SP-V-03 | E DUBLIN 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-04 | FLOWIND1 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-05 | IUKA 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.85 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-06 | LIVERMRE 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-07 | LIVRMR_2 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-08 | LPOSTAS 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-09 | SEAWEST 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-10 | VASCO 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-11 | ZONDWD 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-12 | RADUM 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-13 | PARKS 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-14 | USWP-FRK 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |
| Miss-SP-V-15 | SAN RAMN 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |

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High/Low Voltage

| ID | Substation | Worst Contingency | Category | Category Description | Voltage (PU) | | | Potential Mitigation Solutions |
|--------------|---------------|---|----------|----------------------|------------------|------------------|------------------|--------------------------------|
| | | | | | 2014 Summer Peak | 2017 Summer Peak | 2022 Summer Peak | |
| Miss-SP-V-16 | VALLECTS 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.88 | 0.86 | 0.85 | Add reactive support |
| Miss-SP-V-17 | SUNOL 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.89 | 0.88 | 0.86 | Add reactive support |
| Miss-SP-V-18 | VINEYARD 60kV | San Ramon 230/60kV Transformer #1 _Las Positas 230/60kV Transformer #4 | C3 | N-1-1 | 0.84 | 0.83 | 0.81 | Add reactive support |

2012/2013 ISO Reliability Assessment - Preliminary Study Results

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



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 | |
| Miss-OP-V-01 | NEWARK D 115kV | Normal | A | N-0 | 1.05 | 1.03 | | Add reactive support |
| Miss-OP-V-02 | USWP-WKR 60kV | Normal | A | N-0 | 1.08 | 1.05 | | Add reactive support |
| Miss-OP-V-03 | ALTAMONT 60kV | Normal | A | N-0 | 1.08 | 1.05 | | Add reactive support |

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Study Area: **PG&E Greater Bay Area Mission**



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.

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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



Transient Stability

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

No transient stability issues identified.



Transient Stability

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

No transient stability issues identified.