

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                     | Contingency (All and Worst P6)   | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---|--|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |  |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 30330 RIO OSO 230 30482 LOCKFORD 230 1  | P1-2:A11:4:_LOCKEFORD-BELLOTA 230KV & P1-2:A11:84:_HAMMER-COUNTRY CLUB 60KV MOAS OPENED ON MORADAJT_MSHR 60V | P6       | N-1/N-1              | 134                            | 107              | <100             | <100                 | <100                 | 139                               | 77                               | <100                                  | <100                              | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan    |
| 30330 RIO OSO 230 30335 ATLANTC 230 1   | P2-2:A5:4:_GOLDHILL 230KV SECTION 2D   | P2       | Bus                  | 103                            | 91               | 90               | 29                   | 35                   | 93                                | 70                               | 32                                    | 90                                | Project: Gold Hill 230/115 kV Transformer Addition Project<br>In-Service Date: Dec 2024<br>Short term: Action plan |
|   | P2-3:A5:5:_GOLDHILL - 2D 230KV & MIDDLE FORK-GOLD HILL LINE  | P2       | Non-Bus-Tie Breaker  | 103                            | 91               | 90               | 29                   | 35                   | 93                                | 70                               | 32                                    | 90                                | Project: Gold Hill 230/115 kV Transformer Addition Project<br>In-Service Date: Dec 2024<br>Short term: Action plan |
| 30330 RIO OSO 230 30348 BRIGHTON 230 1  | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker      | 105                            | 110              | 98               | 22                   | 22                   | 109                               | 71                               | 18                                    | 99                                | SPS Recommended in 2017-2018 TPP   |
| 30350 LOCKJ2 230 30500 BELLOTA 230 1    | P1-2:A4:5:_RIO OSO-BRIGHTON 230KV & P1-2:A11:4:_LOCKEFORD-BELLOTA 230KV                                      | P6       | N-1/N-1              | <100                           | <100             | 100              | <100                 | <100                 | <100                              | <100                             | <100                                  | 99                                | Continue to monitor future load forecast   |
| 30460 VACA-DIX 230 30478 LAMBIE 230 1   | P2-3:A4:3:_BDLSWSTA 230KV - MIDDLE BREAKER BAY 2   | P2       | Non-Bus-Tie Breaker  | 110                            | 109              | 112              | 78                   | 4                    | 109                               | 116                              | 92                                    | 86                                | System upgrade, operating procedure, or SPS  |
| 30478 LAMBIE 230 30479 BDLSWSTA 230 1   | P2-3:A4:3:_BDLSWSTA 230KV - MIDDLE BREAKER BAY 2   | P2       | Non-Bus-Tie Breaker  | 91                             | 91               | 92               | 78                   | 3                    | 91                                | 116                              | 93                                    | 67                                | Sensitivity only   |
| 30482 LOCKFORD 230 30500 BELLOTA 230 1  | P1-2:A4:5:_RIO OSO-BRIGHTON 230KV & P1-2:A11:4:_LOCKEFORD-BELLOTA 230KV                                      | P6       | N-1/N-1              | 102                            | 99               | <100             | <100                 | <100                 | 100                               | 88                               | <100                                  | <100                              | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan    |
| 30482 LOCKFORD 230 30500 BELLOTA 230 1  | P2-4:A11:23:_STAGG-D SECTION 1D & STAGG-E SECTION 1E 230KV   | P2       | Bus-Tie Breaker      | 102                            | 98               | 48               | 34                   | 34                   | 100                               | 87                               | 30                                    | 47                                | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan    |
| 30500 BELLOTA 230 30515 WARNERVL 230 1  | P1-2:A11:16:_BELLOTA-COTTLE 230KV  | P1       | N-1                  | 40                             | 13               | 10               | 80                   | 36                   | 17                                | 102                              | 34                                    | 10                                | Sensitivity only   |
|   | P1-2:A12:2:_COTTLE-MELONES 230KV   | P1       | N-1                  | 48                             | 17               | 13               | 81                   | 36                   | 20                                | 107                              | 34                                    | 13                                | Sensitivity only   |
|   | P2-3:A12:20:_COTTLE 230KV - RING R4 & R5   | P2       | Non-Bus-Tie Breaker  | 41                             | 14               | 10               | 81                   | 36                   | 17                                | 103                              | 34                                    | 10                                | Sensitivity only   |
|   | P2-3:A12:21:_COTTLE 230KV - RING R4 & R3   | P2       | Non-Bus-Tie Breaker  | 42                             | 14               | 11               | 80                   | 36                   | 18                                | 103                              | 34                                    | 11                                | Sensitivity only   |
|   | P2-3:A12:22:_COTTLE 230KV - RING R2 & R1   | P2       | Non-Bus-Tie Breaker  | 47                             | 16               | 13               | 81                   | 36                   | 20                                | 107                              | 34                                    | 13                                | Sensitivity only   |
|   | P2-3:A12:23:_COTTLE 230KV - RING R2 & R3   | P2       | Non-Bus-Tie Breaker  | 47                             | 17               | 13               | 81                   | 36                   | 20                                | 106                              | 34                                    | 13                                | Sensitivity only   |
| 31960 MOBILCHE 115 31966 WODLNDJ1 115 1 | P1-2:A4:30:_RIO OSO-WOODLAND #2 115KV & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV                                    | P6       | N-1/N-1              | 83                             | 99               | 101              | <100                 | <100                 | 97                                | <100                             | <100                                  | 102                               | Continue to monitor future load forecast   |
| 31960 MOBILCHE 115 31970 WOODLD 115 1   | P1-2:A4:30:_RIO OSO-WOODLAND #2 115KV & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV                                    | P6       | N-1/N-1              | 82                             | 99               | 101              | <100                 | <100                 | 97                                | <100                             | <100                                  | 102                               | Continue to monitor future load forecast   |

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| Overloaded Facility                        | Contingency (All and Worst P6)   | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--|--|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|  |  |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 31962 WOODLANDTP 115 31970 WOODLD 115 1    | P1-2:A4:44:_RIO OSO-WEST SACRAMENTO 115KV & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV                                | P6       | N-1/N-1              | 110                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | <100                              | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 31962 WOODLANDTP 115 365930 Q653FJCT 115 1 | P1-2:A4:44:_RIO OSO-WEST SACRAMENTO 115KV & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV                                | P6       | N-1/N-1              | 126                            | <100             | <100             | <100                 | <100                 | <100                              | 81                               | <100                                  | <100                              | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 31962 WOODLANDTP 115 31970 WOODLD 115 1    | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker      | 112                            | 81               | 34               | 14                   | 9                    | 83                                | 77                               | 7                                     | 35                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 31962 WOODLANDTP 115 365930 Q653FJCT 115 1 | P2-2:A4:20:_BRIGHTN 115KV SECTION ME   | P2       | Bus                  | 104                            | 71               | 77               | 20                   | 12                   | 73                                | 85                               | 6                                     | 77                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|  | P2-3:A4:18:_BRIGHTN - ME 115KV & WEST SACRAMENTO-BRIGHTON LINE   | P2       | Non-Bus-Tie Breaker  | 104                            | 72               | 78               | 20                   | 12                   | 73                                | 86                               | 6                                     | 78                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|  | P2-3:A4:19:_BRIGHTN - ME 115KV & BRIGHTN-UCD_TP2-BRKR SLG LINE   | P2       | Non-Bus-Tie Breaker  | 103                            | 71               | 77               | 19                   | 11                   | 72                                | 84                               | 6                                     | 77                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|  | P2-4:A4:10:_BRIGHTN 115KV - SECTION ME & MD  | P2       | Bus-Tie Breaker      | 104                            | 71               | 77               | 20                   | 12                   | 73                                | 85                               | 6                                     | 77                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 31964 KNIGHT2 115 31968 WODLNDJ2 115 2     | P1-2:A4:41:_UC DAVIS #1 TAP 115KV MOAS OPENED ON BRKRJCT_UCD_TP2 & P1-2:A4:28:_WOODLD-KNIGHTLD-RIO OSO 115KV | P6       | N-1/N-1              | 89                             | 96               | 107              | <100                 | <100                 | 99                                | <100                             | <100                                  | 106                               | Continue to monitor future load forecast   |
| 31965 KNIGHT1 115 31966 WODLNDJ1 115 1     | P1-2:A4:30:_RIO OSO-WOODLAND #2 115KV & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV                                    | P6       | N-1/N-1              | 83                             | 99               | 101              | <100                 | <100                 | 97                                | <100                             | <100                                  | 102                               | Continue to monitor future load forecast   |
| 31978 DPWT_TP2 115 31984 BRIGHTN 115 1     | P1-2:A4:29:_WOODLAND-DAVIS 115KV & P1-2:A4:33:_BRIGHTN-UCD_TP2-BRKR SLG 115KV MOAS OPENED ON BRKRJCT_UCD_TP2 | P6       | N-1/N-1              | 118                            | 116              | 127              | <100                 | <100                 | 119                               | 82                               | <100                                  | 127                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 31978 DPWT_TP2 115 31984 BRIGHTN 115 1     | P2-2:A5:10:_RIO OSO 115KV SECTION 2D   | P2       | Bus                  | 100                            | 99               | 106              | 8                    | 4                    | 102                               | 67                               | 2                                     | 106                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|  | P2-3:A5:15:_RIO OSO - 2D 115KV & BOGUE-RIO OSO LINE  | P2       | Non-Bus-Tie Breaker  | 100                            | 99               | 106              | 8                    | 4                    | 102                               | 67                               | 2                                     | 106                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|  | P2-3:A5:16:_RIO OSO - 2D 115KV & RIO OSO-WOODLAND #2 LINE  | P2       | Non-Bus-Tie Breaker  | 97                             | 96               | 103              | 7                    | 4                    | 99                                | 65                               | 3                                     | 103                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |

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| Overloaded Facility                     | Contingency (All and Worst P6)   | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---|--|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |  |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|   | P2-3:A5:17:_RIO OSO - 2D 115KV & RIO OSO-DRUM-BRUNSWCK LINE  | P2       | Non-Bus-Tie Breaker  | 101                            | 99               | 106              | 8                    | 5                    | 102                               | 68                               | 2                                     | 106                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker      | 144                            | 151              | 127              | 14                   | 8                    | 155                               | 98                               | 4                                     | 127                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P7-1:A4:16_Rio Oso-Woodland #1 115 kV Line & Rio Oso-Woodland #2 115 kV Line                                 | P7       | DCTL                 | 96                             | 98               | 110              | 5                    | 2                    | 101                               | 63                               | 5                                     | 109                               | Continue to monitor future load forecast   |
| 31980 DPWTR_TP 115 31986 W.SCRMNO 115 1 | P1-2:A4:33:_BRIGHTN-UCD_TP2-BRKR SLG 115KV MOAS OPENED ON BRKRJCT_UCD_TP2 & P1-2:A4:29:_WOODLAND-DAVIS 115KV | P6       | N-1/N-1              | 94                             | 99               | 112              | <100                 | <100                 | 101                               | <100                             | <100                                  | 112                               | Continue to monitor future load forecast   |
| 31980 DPWTR_TP 115 31990 DAVIS 115 1    | P1-2:A4:33:_BRIGHTN-UCD_TP2-BRKR SLG 115KV MOAS OPENED ON BRKRJCT_UCD_TP2 & P1-2:A4:29:_WOODLAND-DAVIS 115KV | P6       | N-1/N-1              | 92                             | 97               | 111              | <100                 | <100                 | 99                                | <100                             | <100                                  | 111                               | Continue to monitor future load forecast   |
| 31984 BRIGHTN 115 30348 BRIGHTON 230 9  | P1-3:A4:3:_BRIGHTON 230/115KV TB 10 & P1-2:A4:29:_WOODLAND-DAVIS 115KV                                       | P6       | N-1/N-1              | 99                             | 97               | 105              | <100                 | <100                 | 101                               | <100                             | <100                                  | 105                               | Continue to monitor future load forecast   |
| 31984 BRIGHTN 115 31993 BRKRJCT 115 1   | P1-2:A4:29:_WOODLAND-DAVIS 115KV & P1-2:A4:32:_WEST SACRAMENTO-DAVIS 115KV                                   | P6       | N-1/N-1              | 123                            | 132              | 150              | <100                 | <100                 | 134                               | 78                               | <100                                  | 150                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 31984 BRIGHTN 115 31993 BRKRJCT 115 1   | P2-3:A4:20:_W.SCRMNO - DE 115KV & WEST SACRAMENTO-BRIGHTON LINE  | P2       | Non-Bus-Tie Breaker  | 101                            | 94               | 106              | 11                   | 2                    | 98                                | 59                               | 7                                     | 106                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker      | 123                            | 130              | 102              | 10                   | 6                    | 133                               | 77                               | 5                                     | 102                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P7-1:A4:16_Rio Oso-Woodland #1 115 kV Line & Rio Oso-Woodland #2 115 kV Line                                 | P7       | DCTL                 | 97                             | 101              | 115              | 4                    | 2                    | 104                               | 59                               | 5                                     | 115                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P7-1:A4:17_Rio Oso-West Sacramento 115 kV Line & West Sacramento-Brighton 115 kV Line                        | P7       | DCTL                 | 101                            | 94               | 104              | 10                   | 3                    | 98                                | 75                               | 5                                     | 104                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P7-1:A5:15_Rio Oso-Woodland No. 1 115 kV Line & Rio Oso-Woodland No. 2 115 kV Line                           | P7       | DCTL                 | 97                             | 101              | 115              | 4                    | 2                    | 104                               | 59                               | 5                                     | 115                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 31993 BRKRJCT 115 32001 UCD_TP2 115 1   | P1-2:A4:29:_WOODLAND-DAVIS 115KV & P1-2:A4:32:_WEST SACRAMENTO-DAVIS 115KV                                   | P6       | N-1/N-1              | 122                            | 130              | 149              | <100                 | <100                 | 133                               | 77                               | <100                                  | 149                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P2-3:A4:20:_W.SCRMNO - DE 115KV & WEST SACRAMENTO-BRIGHTON LINE  | P2       | Non-Bus-Tie Breaker  | 99                             | 92               | 105              | 10                   | 2                    | 97                                | 57                               | 8                                     | 105                               | Continue to monitor future load forecast   |

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|---|--|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |  |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 31993 BRKRJCT 115 32001 UCD_TP2 115 1     | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker      | 121                            | 128              | 101              | 8                    | 4                    | 132                               | 76                               | 6                                     | 101                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P7-1:A4:16:_Rio Oso-Woodland #1 115 kV Line & Rio Oso-Woodland #2 115 kV Line  | P7       | DCTL                 | 95                             | 100              | 114              | 3                    | 1                    | 102                               | 57                               | 7                                     | 113                               | Continue to monitor future load forecast   |
|   | P7-1:A4:17:_Rio Oso-West Sacramento 115 kV Line & West Sacramento-Brighton 115 kV Line   | P7       | DCTL                 | 99                             | 92               | 103              | 9                    | 1                    | 96                                | 74                               | 6                                     | 103                               | Continue to monitor future load forecast   |
|   | P7-1:A5:15:_Rio Oso-Woodland No. 1 115 kV Line & Rio Oso-Woodland No. 2 115 kV Line  | P7       | DCTL                 | 95                             | 100              | 114              | 3                    | 1                    | 102                               | 57                               | 7                                     | 113                               | Continue to monitor future load forecast   |
| 31998 VACA-DIX 115 31997 SCHMLBCH 115 1   | P1-2:A4:38:_VACA-VACAVILLE-JAMESON-NORTH TOWER 115KV MOAS OPENED ON HALE J1_HALE & P1-2:A4:42:_VACA-SUISUN 115KV MOAS OPENED ON VACA-DIX_WEC (2) | P6       | N-1/N-1              | 93                             | 94               | 108              | <100                 | <100                 | 98                                | 89                               | <100                                  | 109                               | Continue to monitor future load forecast   |
| 32001 UCD_TP2 115 31990 DAVIS 115 1       | P1-2:A4:29:_WOODLAND-DAVIS 115KV & P1-2:A4:32:_WEST SACRAMENTO-DAVIS 115KV   | P6       | N-1/N-1              | 99                             | 105              | 121              | <100                 | <100                 | 107                               | <100                             | <100                                  | 120                               | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 32001 UCD_TP2 115 31990 DAVIS 115 1       | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker      | 98                             | 104              | 81               | 6                    | 3                    | 106                               | 61                               | 5                                     | 82                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 32018 GOLDHILL 115 32231 HORSHE2 115 2    | P1-2:A5:16:_PLACER-GOLD HILL #1 115KV & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS   | P6       | N-1/N-1              | 94                             | 90               | 101              | <100                 | <100                 | 93                                | <100                             | <100                                  | 101                               | Continue to monitor future load forecast   |
| 32056 CORTINA 60.0 30451 CRTNA M 230 1    | P1-3:A4:5:_CORTINA 230/115KV TB 4  | P1       | N-1                  | 116                            | 127              | 131              | 48                   | 58                   | 129                               | 70                               | 77                                    | 130                               | Existing operating procedure   |
|   | P1-1:A4:13:_WADHAM 13.80KV GEN UNIT 1 & P1-3:A4:5:_CORTINA 230/115KV TB 4  | P3       | G-1/N-1              | 134                            | 144              | 150              | <100                 | <100                 | 146                               | 87                               | <100                                  | 148                               | Existing operating procedure   |
| 32063 ARBJCT 60.0 32078 WLKSLJCT 60.0 2   | Base Case  | P0       | Base Case            | 75                             | 75               | 74               | 101                  | 48                   | 77                                | 62                               | 47                                    | 75                                | Load power factor under review   |
| 32088 VACA-DXN 60.0 31998 VACA-DIX 115 5  | P1-3:A4:21:_VACA-DIX 115/60KV TB 9   | P1       | N-1                  | 108                            | 47               | 51               | 42                   | 12                   | 48                                | 77                               | 10                                    | 53                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 32100 DIXONPGE 60.0 32101 DIXON-J2 60.0 2 | P1-2:A4:52:_VACA-DXN-DIXON-J1-TRAVIS 60KV MOAS OPENED ON TRAVIS_TRAVISJT   | P1       | N-1                  | 133                            | 62               | 72               | 36                   | 14                   | 63                                | 101                              | 12                                    | 72                                | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P1-1:A4:3:_SOLANO3WIND 1.00KV GEN UNIT 3 & P1-2:A4:52:_VACA-DXN-DIXON-J1-TRAVIS 60KV MOAS OPENED ON TRAVIS_TRAVISJT                              | P3       | G-1/N-1              | 133                            | <100             | <100             | <100                 | <100                 | <100                              | 101                              | <100                                  | <100                              | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
|   | P1-2:A4:31:_WEST SACRAMENTO-BRIGHTON 115KV & P1-2:A5:15:_PALERMO-NICOLAUS 115KV MOAS OPENED ON PALERMO_E.MRY J2                                  | P6       | N-1/N-1              | 89                             | 96               | 115              | <100                 | <100                 | 100                               | <100                             | <100                                  | 115                               | Continue to monitor future load forecast   |

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| Overloaded Facility                                  | Contingency (All and Worst P6)  | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--|---|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|  |   |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 32200 PEASE      115   31506 HONC JT1      115   1   | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D  | P2       | Bus-Tie Breaker        | 104                            | <100             | <100             | 28                   | <100                 | <100                              | 57                               | <100                                  | <100                              | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
|  | P7-1:A5:13_Palermo-Nicolaus 115 kV Line & Bogue-Rio Oso 115 kV Line   | P7       | DCTL                   | 92                             | 90               | 107              | 27                   | 18                   | 91                                | 44                               | 27                                    | 107                               | Continue to monitor future load forecast   |
|  | P7-1:A5:5_Colgate-Rio Oso 230 kV Line & Table Mountain-Rio Oso 230 kV Line                                      | P7       | DCTL                   | 90                             | 93               | 108              | 33                   | 27                   | 94                                | 47                               | 34                                    | 107                               | Continue to monitor future load forecast   |
|  | P7-1:A5:6_Table Mountain-Rio Oso 230 kV Line & Palermo-Colgate 230 kV Line                                      | P7       | DCTL                   | 76                             | 79               | 101              | 46                   | 43                   | 81                                | 41                               | 50                                    | 99                                | Continue to monitor future load forecast   |
|  | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D  | P2       | Bus-Tie Breaker        | 120                            | <100             | <100             | 15                   | <100                 | <100                              | 82                               | <100                                  | <100                              | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
|  | P7-1:A5:5_Colgate-Rio Oso 230 kV Line & Table Mountain-Rio Oso 230 kV Line                                      | P7       | DCTL                   | 101                            | 49               | 47               | 29                   | 7                    | 48                                | 69                               | 8                                     | 47                                | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
| 32212 E.NICOLS      115   32214 RIO OSO      115   1 | P1-2:A4:31:_WEST SACRAMENTO-BRIGHTON 115KV & P1-2:A5:15:_PALERMO-NICOLAUS 115KV MOAS OPENED ON PALERMO_E.MRY J2 | P6       | N-1/N-1                | 104                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | <100                              | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
|  | P1-2:A5:15:_PALERMO-NICOLAUS 115KV MOAS OPENED ON PALERMO_E.MRY J2  | P1       | N-1                    | 101                            | 30               | 39               | 17                   | 15                   | 31                                | 61                               | 16                                    | 39                                | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
|  | P2-1:A5:5:_PALERMO-NICOLAUS 115KV [3210] (PALERMO-E.MRY J2)   | P2       | Line Section w/o Fault | 101                            | 30               | 39               | 17                   | 15                   | 31                                | 61                               | 16                                    | 39                                | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
|  | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D  | P2       | Bus-Tie Breaker        | 106                            | <100             | <100             | 26                   | <100                 | <100                              | 70                               | <100                                  | <100                              | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
|  | P1-1:A4:14:_WOODLAND 13.80KV GEN UNIT 1 & P1-2:A5:15:_PALERMO-NICOLAUS 115KV MOAS OPENED ON PALERMO_E.MRY J2    | P3       | G-1/N-1                | 102                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | <100                              | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan                       |
| 32214 RIO OSO      115   30330 RIO OSO      230   1  | P1-3:A5:3:_RIO OSO 230/115KV TB 2 & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV   | P6       | N-1/N-1                | 110                            | <100             | <100             | <100                 | <100                 | <100                              | 77                               | <100                                  | <100                              | Project: Rio Oso 230/115 kV Transformer Upgrade Project<br>In-Service Date: Jun. 2022<br>Short term: Action plan |
|  | P5-5:A5:1:_ATLANTIC 230 KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)   | P5-5     | P5-5                   | 101                            | 44               | 58               | 37                   | 7                    | 46                                | 62                               | 10                                    | 59                                | Project: Rio Oso 230/115 kV Transformer Upgrade Project<br>In-Service Date: Jun. 2022<br>Short term: Action plan |



Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                    | Contingency (All and Worst P6)   | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--|--|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|  |  |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|  | P7-1:A5:2_Rio Oso-Atlantic 230 kV Line & Rio Oso-Gold Hill 230 kV Line                                       | P7       | DCTL                   | 107                            | 47               | 52               | 32                   | 15                   | 49                                | 69                               | 18                                    | 53                                | Project: Rio Oso 230/115 kV Transformer Upgrade Project<br>In-Service Date: Jun. 2022<br>Short term: Action plan |
| 32214 RIO OSO 115 30330 RIO OSO 230 2  | P1-3:A5:2:_RIO OSO 230/115KV TB 1 & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV  | P6       | N-1/N-1                | 110                            | <100             | <100             | <100                 | <100                 | <100                              | 75                               | <100                                  | <100                              | Project: Rio Oso 230/115 kV Transformer Upgrade Project<br>In-Service Date: Jun. 2022<br>Short term: Action plan |
|  | P5-5:A5:1:_ATLANTIC 230 KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)                                      | P5-5     | P5-5                   | 105                            | 44               | 58               | 27                   | 7                    | 46                                | 60                               | 10                                    | 59                                | Project: Rio Oso 230/115 kV Transformer Upgrade Project<br>In-Service Date: Jun. 2022<br>Short term: Action plan |
|  | P7-1:A5:2_Rio Oso-Atlantic 230 kV Line & Rio Oso-Gold Hill 230 kV Line                                       | P7       | DCTL                   | 112                            | 47               | 52               | 23                   | 15                   | 49                                | 69                               | 18                                    | 53                                | Project: Rio Oso 230/115 kV Transformer Upgrade Project<br>In-Service Date: Jun. 2022<br>Short term: Action plan |
| 32214 RIO OSO 115 31964 KNIGHT2 115 2  | P1-2:A4:41:_UC DAVIS #1 TAP 115KV MOAS OPENED ON BRKRJCT_UCD_TP2 & P1-2:A4:28:_WOODLD-KNIGHTLD-RIO OSO 115KV | P6       | N-1/N-1                | 89                             | 96               | 107              | <100                 | <100                 | 99                                | <100                             | <100                                  | 106                               | Continue to monitor future load forecast   |
| 32214 RIO OSO 115 31965 KNIGHT1 115 1  | P1-2:A4:30:_RIO OSO-WOODLAND #2 115KV & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV                                    | P6       | N-1/N-1                | 87                             | 103              | 106              | <100                 | <100                 | 102                               | <100                             | <100                                  | 106                               | Continue to monitor future load forecast   |
| 32214 RIO OSO 115 31986 W.SCRMNO 115 1 | P1-2:A4:5:_RIO OSO-BRIGHTON 230KV & P1-2:A11:3:_BRIGHTON-BELLOTA 230KV                                       | P6       | N-1/N-1                | 113                            | <100             | <100             | <100                 | <100                 | <100                              | 94                               | <100                                  | <100                              | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan           |
| 32214 RIO OSO 115 32225 BRNSWKTP 115 1 | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1 & P1-2:A5:31:_RIO OSO-DRUM-BRUNSWCK 115KV        | P6       | N-1/N-1                | <100                           | <100             | <100             | 171                  | <100                 | <100                              | <100                             | <100                                  | <100                              | Existing operating procedure   |
|  | P2-1:A5:28:_DRUM-HIGGINS 115KV [4393] (CHCGO PK-HIGGINS)   | P2       | Line Section w/o Fault | 63                             | 68               | 64               | 124                  | 21                   | 65                                | 79                               | 31                                    | 63                                | Existing operating procedure   |
|  | P2-1:A5:34:_HIGGINS-BELL 115KV [1412] (HIGGINS-BELL PGE)   | P2       | Line Section w/o Fault | 49                             | 54               | 50               | 121                  | 21                   | 51                                | 71                               | 28                                    | 49                                | Existing operating procedure   |
|  | P2-2:A5:15:_PLACER 115KV SECTION 1D  | P2       | Bus                    | 32                             | 37               | 32               | 118                  | 20                   | 35                                | 60                               | 27                                    | 31                                | Existing operating procedure   |
|  | P2-3:A5:24:_PLACER - 1D 115KV & PLACER-GOLD HILL #1 LINE   | P2       | Non-Bus-Tie Breaker    | 32                             | 38               | 32               | 118                  | 20                   | 35                                | 60                               | 27                                    | 31                                | Existing operating procedure   |
|  | P2-3:A5:26:_PLACER - 1D 115KV & BELL-PLACER LINE   | P2       | Non-Bus-Tie Breaker    | 32                             | 37               | 32               | 118                  | 20                   | 35                                | 60                               | 27                                    | 31                                | Existing operating procedure   |
|  | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3  | P2       | Non-Bus-Tie Breaker    | 45                             | 52               | 46               | 206                  | 26                   | 49                                | 74                               | 49                                    | 45                                | Existing operating procedure   |
|  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F  | P2       | Bus-Tie Breaker        | 39                             | 37               | 67               | 137                  | 28                   | 42                                | 37                               | 16                                    | 68                                | Existing operating procedure   |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                    | Contingency (All and Worst P6)   | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions |
|--|--|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|  |  |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|  | P1-1:A5:9:_NEWCASTLE 13.20KV GEN UNIT 1 & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS | P3       | G-1/N-1                | <100                           | <100             | <100             | 122                  | <100                 | <100                              | <100                             | <100                                  | <100                              | Existing operating procedure                           |
|  | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line                     | P7       | DCTL                   | 16                             | 21               | 20               | 132                  | 23                   | 22                                | 43                               | 20                                    | 21                                | Existing operating procedure                           |
| 32214 RIO OSO 115 32244 BRNSWCKP 115 2 | P1-2:A5:30:_RIO OSO-BRNSWALT-DRUM 115KV & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS | P6       | N-1/N-1                | 56                             | 59               | 57               | 196                  | <100                 | 58                                | 70                               | <100                                  | 57                                | Existing operating procedure                           |
|  | P2-1:A5:28:_DRUM-HIGGINS 115KV [4393] (CHCGO PK-HIGGINS)   | P2       | Line Section w/o Fault | 50                             | 54               | 55               | 117                  | 18                   | 52                                | 69                               | 32                                    | 54                                | Existing operating procedure                           |
|  | P2-1:A5:34:_HIGGINS-BELL 115KV [1412] (HIGGINS-BELL PGE)   | P2       | Line Section w/o Fault | 36                             | 41               | 41               | 114                  | 18                   | 38                                | 61                               | 29                                    | 40                                | Existing operating procedure                           |
|  | P2-2:A5:15:_PLACER 115KV SECTION 1D  | P2       | Bus                    | 19                             | 25               | 24               | 111                  | 17                   | 22                                | 49                               | 28                                    | 23                                | Existing operating procedure                           |
|  | P2-3:A5:24:_PLACER - 1D 115KV & PLACER-GOLD HILL #1 LINE   | P2       | Non-Bus-Tie Breaker    | 19                             | 25               | 24               | 111                  | 18                   | 22                                | 49                               | 28                                    | 23                                | Existing operating procedure                           |
|  | P2-3:A5:25:_PLACER - 1D 115KV & PLACER-GOLD HILL #2 LINE   | P2       | Non-Bus-Tie Breaker    | 18                             | 25               | 24               | 111                  | 17                   | 22                                | 49                               | 28                                    | 23                                | Existing operating procedure                           |
|  | P2-3:A5:26:_PLACER - 1D 115KV & BELL-PLACER LINE   | P2       | Non-Bus-Tie Breaker    | 19                             | 25               | 24               | 111                  | 17                   | 22                                | 49                               | 28                                    | 23                                | Existing operating procedure                           |
|  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F  | P2       | Bus-Tie Breaker        | 48                             | 45               | 77               | 130                  | 25                   | 51                                | 28                               | 18                                    | 77                                | Existing operating procedure                           |
|  | P1-1:A5:35:_ELDRADO1 21.60KV GEN UNIT 1 & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS | P3       | G-1/N-1                | <100                           | <100             | <100             | 115                  | <100                 | <100                              | <100                             | <100                                  | <100                              | Existing operating procedure                           |
|  | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line                     | P7       | DCTL                   | 23                             | 22               | 30               | 125                  | 20                   | 26                                | 33                               | 21                                    | 30                                | Existing operating procedure                           |
| 32214 RIO OSO 115 32404 SPI JCT 115 1  | P1-2:A5:10:_ATLANTIC-GOLD HILL 230KV & P1-2:A5:6:_RIO OSO-ATLANTIC 230KV                                 | P6       | N-1/N-1                | 116                            | 122              | 146              | <100                 | <100                 | 126                               | <100                             | <100                                  | 146                               | SPS Recommended in 2017-2018 TPP                       |
|  | P5-5:A5:1:_ATLANTIC 230 KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)                                  | P5-5     | P5-5                   | 116                            | 122              | 147              | 16                   | 21                   | 126                               | 62                               | 32                                    | 147                               | SPS Recommended in 2017-2018 TPP                       |
| 32218 DRUM 115 32220 DTCH FL1 115 1    | P1-2:A5:16:_PLACER-GOLD HILL #1 115KV & P1-2:A5:17:_PLACER-GOLD HILL #2 115KV                            | P6       | N-1/N-1                | 100                            | 94               | 108              | <100                 | <100                 | 99                                | <100                             | <100                                  | 108                               | Continue to monitor future load forecast               |
|  | P2-3:A5:83:_DRUM 115KV - RING R5 & R4  | P2       | Non-Bus-Tie Breaker    | 67                             | 71               | 74               | 106                  | 33                   | 70                                | 64                               | 42                                    | 72                                | Gereneration redispatch                                |
|  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F  | P2       | Bus-Tie Breaker        | 162                            | 151              | 244              | 52                   | 24                   | 160                               | 56                               | 39                                    | 242                               | SPS Recommended in 2018-2019 TPP                       |
|  | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker        | 51                             | 57               | 52               | 116                  | 32                   | 55                                | 56                               | 45                                    | 50                                | Gereneration redispatch                                |
|  | P7-1:A5:11_Drum-Rio Oso No. 1 115 kV Line & Drum-Rio Oso No. 2 115 kV Line                               | P7       | DCTL                   | 67                             | 71               | 74               | 106                  | 33                   | 70                                | 64                               | 42                                    | 72                                | Gereneration redispatch                                |
|  | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line                     | P7       | DCTL                   | 101                            | 93               | 119              | 45                   | 11                   | 99                                | 27                               | 28                                    | 119                               | Continue to monitor future load forecast               |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                 | Contingency (All and Worst P6)   | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions |
|-------------------------------------|--|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|                                     |  |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 32218 DRUM 115 32222 DTCH FL2 115 1 | P1-2:A5:31:_RIO OSO-DRUM-BRUNSWCK 115KV & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS | P6       | N-1/N-1                | 144                            | 100              | 100              | 119                  | <100                 | 163                               | 146                              | <100                                  | 100                               | Existing SPS under review                              |
|                                     | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3  | P2       | Non-Bus-Tie Breaker    | 77                             | 76               | 81               | 177                  | 26                   | 74                                | 82                               | 47                                    | 79                                | Existing operating procedure                           |
|                                     | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F  | P2       | Bus-Tie Breaker        | 45                             | 40               | 79               | 105                  | 27                   | 46                                | 11                               | 19                                    | 79                                | Existing operating procedure                           |
| 32218 DRUM 115 32242 DRUM 1M 115 1  | P2-1:A5:26:_DRUM-RIO OSO #2 115KV [1430] (DRUM-BRNSWCKP)   | P2       | Line Section w/o Fault | 60                             | 58               | 61               | 184                  | 12                   | 58                                | 64                               | 15                                    | 60                                | Existing operating procedure                           |
|                                     | P2-2:A5:15:_PLACER 115KV SECTION 1D  | P2       | Bus                    | 61                             | 59               | 60               | 184                  | 15                   | 58                                | 64                               | 15                                    | 60                                | Existing operating procedure                           |
|                                     | P2-3:A5:24:_PLACER - 1D 115KV & PLACER-GOLD HILL #1 LINE   | P2       | Non-Bus-Tie Breaker    | 61                             | 59               | 60               | 184                  | 15                   | 58                                | 64                               | 15                                    | 60                                | Existing operating procedure                           |
|                                     | P2-3:A5:25:_PLACER - 1D 115KV & PLACER-GOLD HILL #2 LINE   | P2       | Non-Bus-Tie Breaker    | 61                             | 59               | 60               | 184                  | 15                   | 58                                | 64                               | 15                                    | 60                                | Existing operating procedure                           |
|                                     | P2-3:A5:26:_PLACER - 1D 115KV & BELL-PLACER LINE   | P2       | Non-Bus-Tie Breaker    | 61                             | 59               | 60               | 184                  | 15                   | 58                                | 64                               | 15                                    | 60                                | Existing operating procedure                           |
|                                     | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F  | P2       | Bus-Tie Breaker        | 67                             | 64               | 66               | 184                  | 14                   | 64                                | 67                               | 16                                    | 66                                | Existing operating procedure                           |
|                                     | P1-1:A5:19:_HALSEY F 6.60KV GEN UNIT 1 & P1-2:A5:35:_BELL-PLACER 115KV MOAS OPENED ON PLACER_BELL PGE    | P3       | G-1/N-1                | <100                           | <100             | <100             | 184                  | <100                 | <100                              | <100                             | <100                                  | <100                              | Existing operating procedure                           |
|                                     | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line                     | P7       | DCTL                   | 64                             | 62               | 64               | 184                  | 14                   | 62                                | 65                               | 16                                    | 64                                | Existing operating procedure                           |
| 32218 DRUM 115 32244 BRNSWCKP 115 2 | P1-2:A5:30:_RIO OSO-BRNSWALT-DRUM 115KV & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS | P6       | N-1/N-1                | 100                            | 100              | 100              | 202                  | <100                 | 100                               | 100                              | <100                                  | 100                               | Existing operating procedure                           |
|                                     | P2-1:A5:28:_DRUM-HIGGINS 115KV [4393] (CHCGO PK-HIGGINS)   | P2       | Line Section w/o Fault | 93                             | 95               | 97               | 123                  | 22                   | 94                                | 97                               | 29                                    | 96                                | Existing operating procedure                           |
|                                     | P2-1:A5:34:_HIGGINS-BELL 115KV [1412] (HIGGINS-BELL PGE)   | P2       | Line Section w/o Fault | 79                             | 81               | 82               | 120                  | 22                   | 79                                | 89                               | 27                                    | 81                                | Existing operating procedure                           |
|                                     | P2-2:A5:15:_PLACER 115KV SECTION 1D  | P2       | Bus                    | 61                             | 62               | 64               | 117                  | 21                   | 60                                | 77                               | 26                                    | 62                                | Existing operating procedure                           |
|                                     | P2-3:A5:24:_PLACER - 1D 115KV & PLACER-GOLD HILL #1 LINE   | P2       | Non-Bus-Tie Breaker    | 61                             | 63               | 64               | 117                  | 21                   | 61                                | 77                               | 26                                    | 63                                | Existing operating procedure                           |
|                                     | P2-3:A5:25:_PLACER - 1D 115KV & PLACER-GOLD HILL #2 LINE   | P2       | Non-Bus-Tie Breaker    | 61                             | 62               | 63               | 117                  | 21                   | 60                                | 77                               | 26                                    | 62                                | Existing operating procedure                           |
|                                     | P2-3:A5:26:_PLACER - 1D 115KV & BELL-PLACER LINE   | P2       | Non-Bus-Tie Breaker    | 61                             | 62               | 64               | 117                  | 21                   | 60                                | 77                               | 26                                    | 62                                | Existing operating procedure                           |
|                                     | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F  | P2       | Bus-Tie Breaker        | 7                              | 4                | 43               | 136                  | 30                   | 2                                 | 50                               | 16                                    | 42                                | Existing operating procedure                           |



Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                     | Contingency (All and Worst P6)  | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions |
|---|---|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |   |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|   | P1-1:A5:19:_HALSEY F 6.60KV GEN UNIT 1 & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS | P3       | G-1/N-1                | 93                             | <100             | <100             | 122                  | <100                 | <100                              | 98                               | <100                                  | <100                              | Existing operating procedure                           |
|   | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line                    | P7       | DCTL                   | 25                             | 28               | 23               | 131                  | 24                   | 25                                | 60                               | 19                                    | 22                                | Existing operating procedure                           |
| 32220 DTCH FL1 115 32224 CHCGO PK 115 1 | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F   | P2       | Bus-Tie Breaker        | 121                            | 113              | 178              | 22                   | 18                   | 120                               | 49                               | 25                                    | 177                               | SPS Recommended in 2018-2019 TPP                       |
| 32224 CHCGO PK 115 32232 HIGGINS 115 1  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F   | P2       | Bus-Tie Breaker        | 126                            | 119              | 178              | 18                   | 15                   | 125                               | 64                               | 21                                    | 177                               | SPS Recommended in 2018-2019 TPP                       |
|   | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line                    | P7       | DCTL                   | 90                             | 86               | 103              | 14                   | 9                    | 89                                | 49                               | 15                                    | 103                               | Continue to monitor future load forecast               |
| 32225 BRNSWKTP 115 32222 DTCH FL2 115 1 | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1 & P1-2:A5:31:_RIO OSO-DRUM-BRUNSWCK 115KV   | P6       | N-1/N-1                | 101                            | 100              | 100              | 176                  | <100                 | 100                               | 100                              | <100                                  | 100                               | Existing operating procedure                           |
|   | P2-1:A5:28:_DRUM-HIGGINS 115KV [4393] (CHCGO PK-HIGGINS)  | P2       | Line Section w/o Fault | 83                             | 84               | 89               | 124                  | 17                   | 82                                | 90                               | 31                                    | 88                                | Existing operating procedure                           |
|   | P2-1:A5:34:_HIGGINS-BELL 115KV [1412] (HIGGINS-BELL PGE)  | P2       | Line Section w/o Fault | 69                             | 70               | 74               | 121                  | 18                   | 68                                | 81                               | 30                                    | 73                                | Existing operating procedure                           |
|   | P2-2:A5:15:_PLACER 115KV SECTION 1D   | P2       | Bus                    | 51                             | 51               | 55               | 118                  | 18                   | 49                                | 70                               | 29                                    | 54                                | Existing operating procedure                           |
|   | P2-3:A5:24:_PLACER - 1D 115KV & PLACER-GOLD HILL #1 LINE  | P2       | Non-Bus-Tie Breaker    | 52                             | 52               | 55               | 118                  | 18                   | 49                                | 70                               | 29                                    | 54                                | Existing operating procedure                           |
|   | P2-3:A5:26:_PLACER - 1D 115KV & BELL-PLACER LINE  | P2       | Non-Bus-Tie Breaker    | 51                             | 51               | 55               | 118                  | 18                   | 49                                | 70                               | 29                                    | 54                                | Existing operating procedure                           |
|   | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3   | P2       | Non-Bus-Tie Breaker    | 108                            | 108              | 112              | 211                  | 26                   | 106                               | 113                              | 48                                    | 111                               | Existing SPS under review                              |
|   | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F   | P2       | Bus-Tie Breaker        | 22                             | 13               | 48               | 137                  | 27                   | 17                                | 42                               | 20                                    | 47                                | Existing operating procedure                           |
|   | P1-1:A5:19:_HALSEY F 6.60KV GEN UNIT 1 & P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS | P3       | G-1/N-1                | 83                             | <100             | <100             | 122                  | <100                 | <100                              | 90                               | <100                                  | <100                              | Existing operating procedure                           |
|   | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line                    | P7       | DCTL                   | 22                             | 20               | 16               | 132                  | 21                   | 17                                | 53                               | 22                                    | 14                                | Existing operating procedure                           |
| 32228 PLACER 115 32238 BELL PGE 115 1   | P2-3:A5:83:_DRUM 115KV - RING R5 & R4   | P2       | Non-Bus-Tie Breaker    | 48                             | 54               | 53               | 102                  | 28                   | 51                                | 66                               | 26                                    | 52                                | Existing operating procedure                           |
|   | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F   | P2       | Bus-Tie Breaker        | 119                            | 110              | 166              | 24                   | 16                   | 116                               | 56                               | 22                                    | 165                               | SPS Recommended in 2018-2019 TPP                       |
|   | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D  | P2       | Bus-Tie Breaker        | 37                             | 43               | 38               | 110                  | 28                   | 40                                | 61                               | 27                                    | 37                                | Existing operating procedure                           |
|   | P7-1:A5:11_Drum-Rio Oso No. 1 115 kV Line & Drum-Rio Oso No. 2 115 kV Line                              | P7       | DCTL                   | 48                             | 54               | 53               | 102                  | 28                   | 51                                | 66                               | 26                                    | 52                                | Existing operating procedure                           |
| 32232 HIGGINS 115 32238 BELL PGE 115 1  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F   | P2       | Bus-Tie Breaker        | 125                            | 117              | 175              | 19                   | 14                   | 123                               | 62                               | 20                                    | 174                               | SPS Recommended in 2018-2019 TPP                       |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                      | Contingency (All and Worst P6)   | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions  |
|--|--|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|---|
|  |  |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |   |
| 32250 ELDORAD 115 32481 APLHTAP2 115 2   | P2-1:A5:10:_MISSOURI FLAT-GOLD HILL #1 115KV [2660] (GOLDHILL-CPM TAP)                       | P2       | Line Section w/o Fault | 22                             | 94               | 101              | 17                   | 14                   | 99                                | 15                               | 16                                    | 101                               | Continue to monitor future load forecast  |
|  | P2-1:A5:9:_MISSOURI FLAT-GOLD HILL #2 115KV [2670] (GOLDHILL-SHPRING2)                       | P2       | Line Section w/o Fault | 171                            | 83               | 95               | 8                    | 9                    | 86                                | 92                               | 16                                    | 93                                | Project: Switching Shingle Spring substation load<br>In-Service Date: 2022<br>Short term: Action plan |
| 32250 ELDORAD 115 32482 APLHTAP1 115 1   | P2-1:A5:9:_MISSOURI FLAT-GOLD HILL #2 115KV [2670] (GOLDHILL-SHPRING2)                       | P2       | Line Section w/o Fault | 134                            | 60               | 68               | 24                   | 6                    | 63                                | 66                               | 12                                    | 66                                | Project: Switching Shingle Spring substation load<br>In-Service Date: 2022<br>Short term: Action plan |
| 32290 OLIVH J1 115 32288 E.MRY J1 115 1  | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D   | P2       | Bus-Tie Breaker        | 119                            | <100             | <100             | 15                   | <100                 | <100                              | 82                               | <100                                  | <100                              | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan            |
|  | P7-1:A5:5_Colgate-Rio Oso 230 kV Line & Table Mountain-Rio Oso 230 kV Line                   | P7       | DCTL                   | 101                            | 49               | 47               | 28                   | 7                    | 48                                | 69                               | 8                                     | 47                                | Project: South of Palermo Project<br>In-Service Date: Nov. 2022<br>Short term: Action plan            |
| 32303 PMHYCJCT 60.0 32304 YCECJCT 60.0 1 | Base Case  | P0       | Base Case              | 102                            | 103              | 101              | 0                    | 0                    | 102                               | 75                               | 0                                     | 101                               | Line rating under review  |
| 32356 LINCLN 115 32398 ULTRA JT 115 1    | P1-2:A5:10:_ATLANTIC-GOLD HILL 230KV & P1-2:A5:6:_RIO OSO-ATLANTIC 230KV                     | P6       | N-1/N-1                | 94                             | 100              | 123              | <100                 | <100                 | 103                               | <100                             | <100                                  | 123                               | SPS Recommended in 2017-2018 TPP  |
|  | P5-5:A5:1:_ATLANTIC 230 KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)                      | P5-5     | P5-5                   | 95                             | 100              | 124              | 11                   | 12                   | 103                               | 54                               | 20                                    | 124                               | SPS Recommended in 2017-2018 TPP  |
| 32356 LINCLN 115 32404 SPI JCT 115 1     | P1-2:A5:10:_ATLANTIC-GOLD HILL 230KV & P1-2:A5:6:_RIO OSO-ATLANTIC 230KV                     | P6       | N-1/N-1                | 121                            | 127              | 152              | <100                 | <100                 | 131                               | 66                               | <100                                  | 152                               | SPS Recommended in 2017-2018 TPP  |
|  | P5-5:A5:1:_ATLANTIC 230 KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)                      | P5-5     | P5-5                   | 121                            | 127              | 153              | 11                   | 17                   | 131                               | 66                               | 28                                    | 153                               | SPS Recommended in 2017-2018 TPP  |
|  | P7-1:A5:2_Rio Oso-Atlantic 230 kV Line & Rio Oso-Gold Hill 230 kV Line                       | P7       | DCTL                   | 91                             | 101              | 100              | 38                   | 40                   | 104                               | 60                               | 36                                    | 101                               | SPS Recommended in 2017-2018 TPP  |
| 32398 ULTRA JT 115 32408 PLSNT GR 115 1  | P1-2:A5:10:_ATLANTIC-GOLD HILL 230KV & P1-2:A5:6:_RIO OSO-ATLANTIC 230KV                     | P6       | N-1/N-1                | 106                            | 111              | 136              | <100                 | <100                 | 115                               | <100                             | <100                                  | 136                               | SPS Recommended in 2017-2018 TPP  |
|  | P5-5:A5:1:_ATLANTIC 230 KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)                      | P5-5     | P5-5                   | 106                            | 111              | 137              | 5                    | 10                   | 115                               | 62                               | 14                                    | 137                               | SPS Recommended in 2017-2018 TPP  |
| 32481 APLHTAP2 115 32257 PLCRVLT2 115 2  | P2-1:A5:10:_MISSOURI FLAT-GOLD HILL #1 115KV [2660] (GOLDHILL-CPM TAP)                       | P2       | Line Section w/o Fault | 23                             | 95               | 101              | 17                   | 14                   | 99                                | 16                               | 17                                    | 101                               | Continue to monitor future load forecast  |
|  | P2-1:A5:9:_MISSOURI FLAT-GOLD HILL #2 115KV [2670] (GOLDHILL-SHPRING2)                       | P2       | Line Section w/o Fault | 171                            | 83               | 95               | 8                    | 9                    | 86                                | 92                               | 16                                    | 93                                | Project: Switching Shingle Spring substation load<br>In-Service Date: 2022<br>Short term: Action plan |
| 32482 APLHTAP1 115 32255 PLCRVLT1 115 1  | P2-1:A5:9:_MISSOURI FLAT-GOLD HILL #2 115KV [2670] (GOLDHILL-SHPRING2)                       | P2       | Line Section w/o Fault | 159                            | 84               | 93               | 20                   | 9                    | 88                                | 85                               | 14                                    | 91                                | Project: Switching Shingle Spring substation load<br>In-Service Date: 2022<br>Short term: Action plan |
|  | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 150                            | <100             | <100             | <100                 | <100                 | <100                              | 85                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan        |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                     | Contingency (All and Worst P6)  | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---|---|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |   |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 33500 MELNS JA 115 33509 AVENATP1 115 1 | P2-1:A11:19:_RPN JNCN-RIPON 115KV NO FAULT  | P2       | Line Section w/o Fault | 45                             | 26               | 26               | 102                  | 103                  | 29                                | 74                               | 98                                    | 26                                | Gereneration redispatch  |
|   | P2-2:A11:25:_RIPON 115KV SECTION 1E   | P2       | Bus                    | 43                             | 24               | 23               | 102                  | 103                  | 28                                | 73                               | 98                                    | 24                                | Gereneration redispatch  |
|   | P2-2:A11:26:_RIPON 115KV SECTION 1D   | P2       | Bus                    | 33                             | 13               | 12               | 103                  | 104                  | 16                                | 69                               | 100                                   | 12                                | Gereneration redispatch  |
|   | P2-3:A11:18:_RIPON - 1D 115KV & MANTECA-RIPON LINE  | P2       | Non-Bus-Tie Breaker    | 33                             | 13               | 12               | 103                  | 104                  | 16                                | 69                               | 100                                   | 12                                | Gereneration redispatch  |
|   | P2-4:A11:13:_BELLOTA 115KV - SECTION 1D & 2D  | P2       | Bus-Tie Breaker        | 16                             | 12               | 5                | 101                  | 101                  | 10                                | 44                               | 101                                   | 5                                 | Gereneration redispatch  |
|   | P2-4:A11:9:_RIPON 115KV - SECTION 1E & 1D   | P2       | Bus-Tie Breaker        | 41                             | 22               | 20               | 102                  | 103                  | 25                                | 72                               | 98                                    | 21                                | Gereneration redispatch  |
|   | P7-1:A11:3:_STANISLAUS-MANTECA #2 115KV & STANISLAUS-MELONES SW STA-RIVERBANK JCT SW STA 115KV  | P7       | DCTL                   | 58                             | 32               | 31               | 124                  | 124                  | 37                                | 89                               | 116                                   | 31                                | Existing SPS under review  |
|   | P7-1:A12:4:_STANISLAUS-MANTECA #2 115KV & STANISLAUS-MELONES SW STA-RIVERBANK JCT SW STA 115KV  | P7       | DCTL                   | 58                             | 32               | 31               | 124                  | 124                  | 37                                | 89                               | 116                                   | 31                                | Existing SPS under review  |
| 33509 AVENATP1 115 33514 MANTECA 115 1  | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV  | P6       | N-1/N-1                | 120                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P7-1:A11:3:_STANISLAUS-MANTECA #2 115KV & STANISLAUS-MELONES SW STA-RIVERBANK JCT SW STA 115KV  | P7       | DCTL                   | 35                             | 9                | 8                | 117                  | 116                  | 13                                | 72                               | 110                                   | 9                                 | Existing SPS under review  |
|   | P7-1:A11:8:_STANISLAUS-MANTECA #2 115KV & STANISLAUS-MELONES SW STA-RIVERBANK JCT SW STA 115KV (2)                                      | P7       | DCTL                   | 35                             | <100             | <100             | 117                  | <100                 | <100                              | 72                               | <100                                  | <100                              | Existing SPS under review  |
|   | P7-1:A12:4:_STANISLAUS-MANTECA #2 115KV & STANISLAUS-MELONES SW STA-RIVERBANK JCT SW STA 115KV  | P7       | DCTL                   | 35                             | 9                | 8                | 117                  | 116                  | 13                                | 72                               | 110                                   | 9                                 | Existing SPS under review  |
|   | P7-1:A12:6:_STANISLAUS-MANTECA #2 115KV & RIVERBANK JCT SW STA-MANTECA 115KV  | P7       | DCTL                   | 27                             | <100             | <100             | 117                  | <100                 | <100                              | 68                               | <100                                  | <100                              | Existing SPS under review  |
| 33513 LID JCT 115 33526 KSSN-JC1 115 1  | P1-2:A11:35:_STANISLAUS-MELONES SW STA-MANTECA #1 115KV MOAS OPENED ON STANISLS_FRGTNTP1 & P1-2:A11:36:_STANISLS-MELONES-RIVRBKIT 115KV | P6       | N-1/N-1                | 116                            | 87               | 99               | <100                 | <100                 | 86                                | <100                             | <100                                  | 99                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P2-2:A11:27:_KASSON 115KV SECTION 1D  | P2       | Bus                    | 103                            | 73               | 87               | 19                   | 15                   | 74                                | 41                               | 19                                    | 87                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P2-3:A11:20:_KASSON - 1D 115KV & VIERRA-TRACY-KASSON LINE   | P2       | Non-Bus-Tie Breaker    | 103                            | 73               | 87               | 32                   | 22                   | 74                                | 41                               | 27                                    | 87                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                    | Contingency (All and Worst P6)   | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--|--|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|  |  |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|  | P2-3:A11:21:_ KASSON - 1D 115KV & LAMMERS-KASSON LINE  | P2       | Non-Bus-Tie Breaker    | 104                            | 74               | 88               | 18                   | 14                   | 75                                | 42                               | 18                                    | 88                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33514 MANTECA 115 33513 LID JCT 115 1  | P1-3:A11:32:_ KASSON 115/60KV TB 1 & P1-2:A11:44:_ VIERRA-TRACY-KASSON 115KV                   | P6       | N-1/N-1                | 113                            | 85               | 97               | <100                 | <100                 | 84                                | <100                             | <100                                  | 97                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P2-2:A11:27:_ KASSON 115KV SECTION 1D  | P2       | Bus                    | 101                            | 71               | 85               | 20                   | 16                   | 72                                | 39                               | 20                                    | 85                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P2-3:A11:20:_ KASSON - 1D 115KV & VIERRA-TRACY-KASSON LINE                                     | P2       | Non-Bus-Tie Breaker    | 101                            | 71               | 85               | 34                   | 23                   | 72                                | 39                               | 28                                    | 85                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P2-3:A11:21:_ KASSON - 1D 115KV & LAMMERS-KASSON LINE  | P2       | Non-Bus-Tie Breaker    | 102                            | 72               | 86               | 19                   | 15                   | 73                                | 40                               | 19                                    | 86                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P1-2:A11:39:_ SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_ SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 236                            | <100             | 75               | <100                 | <100                 | <100                              | 95                               | <100                                  | 74                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33514 MANTECA 115 33970 INGRM C. 115 1 | P2-3:A11:19:_ KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE                           | P2       | Non-Bus-Tie Breaker    | 132                            | 49               | 65               | 15                   | 13                   | 50                                | 68                               | 15                                    | 65                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33517 RPNJ2 115 33514 MANTECA 115 1    | P1-3:A11:10:_ BELLOTA 230/115KV TB 1 & P1-3:A11:11:_ BELLOTA 230/115KV TB 2                    | P6       | N-1/N-1                | 149                            | 165              | 161              | <100                 | <100                 | 163                               | <100                             | 92                                    | 161                               | Existing operating procedure   |
|  | P1-2:A11:36:_ STANISLS-MELONES-RIVRBKJT 115KV  | P1       | N-1                    | 92                             | 96               | 106              | 3                    | 7                    | 99                                | 51                               | 15                                    | 106                               | Continue to monitor future load forecast   |
|  | P1-2:A12:13:_ MELONES-RIVRBKJT-STANISLS 115KV  | P1       | N-1                    | 92                             | 96               | 106              | 3                    | 7                    | 99                                | 51                               | 15                                    | 106                               | Continue to monitor future load forecast   |
|  | P1-2:A11:38:_ STANISLAUS-MELONES SW STA-MANTECA #1 115KV MOAS OPENED ON STANISLS_FRGTNTP1 (2)  | P1       | N-1                    | 36                             | 57               | 62               | 103                  | 108                  | 56                                | 44                               | 109                                   | 61                                | Gerneration redispatch   |
|  | P1-2:A12:11:_ STANISLAUS-MELONES SW STA-MANTECA #1 115KV MOAS OPENED ON STANISLS_FRGTNTP1      | P1       | N-1                    | 36                             | 57               | 62               | 103                  | 108                  | 56                                | 44                               | 109                                   | 61                                | Gerneration redispatch   |
|  | P1-2:A12:3:_ STANISLAUS-MANTECA #2 115KV   | P1       | N-1                    | 34                             | 53               | 58               | 98                   | 103                  | 52                                | 42                               | 104                                   | 57                                | Gerneration redispatch   |
|  | P2-1:A11:10:_ STANISLAUS-MELONES SW STA-MANTECA #1 115KV (MELNS JA-AVENATP1)                   | P2       | Line Section w/o Fault | 34                             | 53               | 58               | 103                  | 109                  | 53                                | 46                               | 109                                   | 57                                | Gerneration redispatch   |
|  | P2-1:A11:15:_ STANISLAUS-MELONES SW STA-MANTECA #1 115KV (AVENATP1-MANTECA)                    | P2       | Line Section w/o Fault | 38                             | 60               | 65               | 102                  | 107                  | 59                                | 40                               | 108                                   | 65                                | Gerneration redispatch   |
|  | P2-3:A11:101:_ MANTECA 115KV - RING R2 & R3  | P2       | Non-Bus-Tie Breaker    | 45                             | 67               | 73               | 101                  | 107                  | 66                                | 35                               | 108                                   | 73                                | Gerneration redispatch   |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                              | Contingency (All and Worst P6)  | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--|---|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|  |   |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|  | P2-3:A11:102:_MANTECA 115KV - RING R2 & R1  | P2       | Non-Bus-Tie Breaker  | 45                             | 66               | 73               | 101                  | 107                  | 66                                | 35                               | 108                                   | 72                                | Gerneration redispatch   |
|  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E   | P2       | Bus-Tie Breaker      | 149                            | 165              | 161              | 88                   | 96                   | 163                               | 53                               | 105                                   | 161                               | SPS Recommended in 2017-2018 TPP   |
|  | P2-4:A11:13:_BELLOTA 115KV - SECTION 1D & 2D  | P2       | Bus-Tie Breaker      | 61                             | 70               | 83               | 106                  | 110                  | 73                                | 22                               | 116                                   | 83                                | Existing operating procedure   |
|  | P2-4:A11:7:_TESLA E 230KV - SECTION 2E & 1E   | P2       | Bus-Tie Breaker      | 45                             | 68               | 78               | 104                  | 110                  | 66                                | 34                               | 112                                   | 78                                | Existing operating procedure   |
|  | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A11:36:_STANISLS-MELONES-RIVRBKJT 115KV                            | P3       | G-1/N-1              | <100                           | <100             | 106              | <100                 | <100                 | <100                              | <100                             | <100                                  | 107                               | Continue to monitor future load forecast   |
| 33517 RPNJ2    115   33520 RIPON    115   1      | P1-3:A11:10:_BELLOTA 230/115KV TB 1 & P1-3:A11:11:_BELLOTA 230/115KV TB 2   | P6       | N-1/N-1              | 95                             | 105              | 103              | <100                 | <100                 | 104                               | <100                             | <100                                  | 103                               | Existing operating procedure   |
| 33518 VIERRA    115   33514 MANTECA    115   1   | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV                      | P6       | N-1/N-1              | 172                            | <100             | <100             | <100                 | <100                 | <100                              | 87                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33526 KSSN-JC1    115   33528 KASSON    115   1  | P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV        | P6       | N-1/N-1              | 167                            | 116              | <100             | <100                 | <100                 | 119                               | 108                              | <100                                  | <100                              | Existing SPS under review  |
|  | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV   | P1       | N-1                  | 115                            | 83               | 99               | 18                   | 22                   | 84                                | 66                               | 15                                    | 99                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P2-3:A11:109:_LAMMERS 115KV - RING R4 & R3  | P2       | Non-Bus-Tie Breaker  | 100                            | 71               | 86               | 17                   | 21                   | 72                                | 56                               | 15                                    | 86                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P2-3:A11:33:_SCHULTE 115KV - MIDDLE BREAKER BAY 2   | P2       | Non-Bus-Tie Breaker  | 115                            | 89               | 96               | 27                   | 35                   | 90                                | 63                               | 26                                    | 96                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P5-5:A11:1:_SCHULTE 115KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)  | P5-5     | P5-5                 | 106                            | 59               | 78               | 10                   | 9                    | 61                                | 63                               | 6                                     | 78                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33528 KASSON    115   33531 OWENSTP1    115   1  | P1-2:A4:31:_WEST SACRAMENTO-BRIGHTON 115KV & P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC       | P6       | N-1/N-1              | 110                            | 86               | <100             | <100                 | <100                 | 87                                | <100                             | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P7-1:A11:31:_SCHULTE SW STA-KASSON-MANTECA 115KV & TESLA-SALADO-MANTECA 115KV                                     | P7       | DCTL                 | 102                            | 68               | 83               | 16                   | 10                   | 69                                | 50                               | 13                                    | 82                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33529 LAMMERS    115   33531 OWENSTP1    115   1 | P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC & P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV | P6       | N-1/N-1              | 115                            | 90               | <100             | <100                 | <100                 | 92                                | <100                             | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |



Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                     | Contingency (All and Worst P6)  | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---|---|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |   |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|   | P7-1:A11:31:_SCHULTE SW STA-KASSON-MANTECA 115KV & TESLA-SALADO-MANTECA 115KV                                     | P7       | DCTL                 | 106                            | 73               | 87               | 9                    | 6                    | 73                                | 55                               | 5                                     | 87                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33530 KSSN-JC2 115 33550 HJ HEINZ 115 1 | P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC & P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV | P6       | N-1/N-1              | <100                           | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | 107                               | Sensitivity only   |
|   | P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC  | P1       | N-1                  | 94                             | 97               | 106              | 27                   | 20                   | 100                               | 77                               | 15                                    | 106                               | Continue to monitor future load forecast   |
|   | P7-1:A11:29:_TESLA-SCHULTE SW STA #2 115KV & TESLA-SCHULTE SW STA #1 115KV  | P7       | DCTL                 | 16                             | 43               | 27               | 126                  | 121                  | 42                                | 0                                | 108                                   | 27                                | Existing SPS under review  |
|   | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC          | P3       | G-1/N-1              | <100                           | <100             | 106              | <100                 | <100                 | <100                              | <100                             | <100                                  | 106                               | Continue to monitor future load forecast   |
| 33533 OWENSTP2 115 33526 KSSN-JC1 115 1 | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV   | P1       | N-1                  | 108                            | 85               | 100              | 6                    | 9                    | 86                                | 54                               | 10                                    | 100                               | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P2-3:A11:33:_SCHULTE 115KV - MIDDLE BREAKER BAY 2   | P2       | Non-Bus-Tie Breaker  | 108                            | 92               | 96               | 9                    | 17                   | 93                                | 50                               | 9                                     | 96                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33537 SFWY_TP1 115 33549 SCHULTE 115 1  | P1-2:A11:47:_TESLA-SCHULTE SW STA #2 115KV & P1-2:A11:55:_GWFTRACY-SCHULTE #1 115KV                               | P6       | N-1/N-1              | 105                            | 75               | 92               | <100                 | <100                 | 77                                | <100                             | <100                                  | 92                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33540 TESLA 115 33541 AEC_TP1 115 1     | P1-2:A11:50:_LAWRENCE LIVERMORE LAB #1 TAP 115KV & P1-3:A11:16:_TESLA D 230/115KV TB 1                            | P6       | N-1/N-1              | 136                            | 98               | 119              | <100                 | <100                 | 100                               | <100                             | <100                                  | 119                               | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P5-5:A11:1:_SCHULTE 115KV BAAH BUS #1 (FAILURE OF NON-REDUNDENT RELAY)  | P5-5     | P5-5                 | 119                            | 74               | 92               | 14                   | 18                   | 75                                | 66                               | 21                                    | 93                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33540 TESLA 115 33543 AEC_TP2 115 1     | P1-2:A11:46:_TESLA-SCHULTE SW STA #1 115KV & P1-2:A11:55:_GWFTRACY-SCHULTE #1 115KV                               | P6       | N-1/N-1              | 136                            | 98               | 119              | <100                 | <100                 | 100                               | <100                             | <100                                  | 119                               | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33540 TESLA 115 33574 LLNL TAP 115 1    | P1-3:A11:2:_TESLA 500/230KV TB 4 & P1-2:A11:55:_GWFTRACY-SCHULTE #1 115KV   | P6       | N-1/N-1              | <100                           | <100             | <100             | 81                   | 83                   | <100                              | <100                             | 100                                   | <100                              | Sensitivity only   |
|   | P1-3:A11:16:_TESLA D 230/115KV TB 1   | P1       | N-1                  | 6                              | 8                | 11               | 79                   | 84                   | 6                                 | 13                               | 100                                   | 11                                | Sensitivity only   |
|   | P2-4:A11:8:_TESLA D 230KV - SECTION 1D & 2D   | P2       | Bus-Tie Breaker      | 21                             | 35               | 72               | 164                  | 171                  | 40                                | 54                               | 201                                   | 73                                | SPS Recommended in 2017-2018 TPP   |
| 33540 TESLA 115 33959 TCHRT_T2 115 1    | P1-2:A11:43:_MANTECA-VIERRA 115KV & P1-3:A11:16:_TESLA D 230/115KV TB 1   | P6       | N-1/N-1              | 227                            | 73               | <100             | <100                 | <100                 | 74                                | 74                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                       | Contingency (All and Worst P6)   | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---|--|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |  |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 33540 TESLA 115 33959 TCHRT_T2 115 1      | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE                                      | P2       | Non-Bus-Tie Breaker  | 135                            | 62               | 76               | 36                   | 35                   | 64                                | 50                               | 38                                    | 76                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33541 AEC_TP1 115 33537 SFWY_TP1 115 1    | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV             | P6       | N-1/N-1              | 107                            | 77               | 93               | <100                 | <100                 | 78                                | <100                             | <100                                  | 93                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33548 TRACY 115 33550 HJ HEINZ 115 1      | P1-2:A11:46:_TESLA-SCHULTE SW STA #1 115KV & P1-2:A11:55:_GWFRACY-SCHULTE #1 115KV                       | P6       | N-1/N-1              | <100                           | <100             | 105              | <100                 | <100                 | <100                              | <100                             | <100                                  | 105                               | Continue to monitor future load forecast   |
|   | P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC   | P1       | N-1                  | 92                             | 96               | 105              | 27                   | 19                   | 98                                | 75                               | 15                                    | 105                               | Continue to monitor future load forecast   |
|   | P7-1:A11:29:_TESLA-SCHULTE SW STA #2 115KV & TESLA-SCHULTE SW STA #1 115KV                               | P7       | DCTL                 | 16                             | 42               | 26               | 124                  | 119                  | 41                                | 0                                | 106                                   | 27                                | Existing SPS under review  |
|   | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A11:48:_TESLA-TRACY 115KV MOAS OPENED ON LEPRINO_TRACY JC | P3       | G-1/N-1              | <100                           | <100             | 104              | <100                 | <100                 | <100                              | <100                             | <100                                  | 105                               | Continue to monitor future load forecast   |
| 33549 SCHULTE 115 33533 OWENSTP2 115 2    | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV  | P1       | N-1                  | 108                            | 85               | 100              | 6                    | 9                    | 86                                | 54                               | 10                                    | 100                               | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P2-3:A11:33:_SCHULTE 115KV - MIDDLE BREAKER BAY 2  | P2       | Non-Bus-Tie Breaker  | 108                            | 92               | 96               | 9                    | 17                   | 93                                | 50                               | 9                                     | 96                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33558 LCKFRDJB 115 33562 BELLOTA 115 1    | P2-3:A11:38:_BELLOTA - 1D 115KV & GOLD HILL-BELLOTA-LOCKEFORD LINE                                       | P2       | Non-Bus-Tie Breaker  | 111                            | 124              | 113              | 33                   | 26                   | 115                               | 91                               | 20                                    | 113                               | Existing operating procedure   |
| 33558 LCKFRDJB 115 33564 LOCKFORD 115 1   | P2-3:A11:38:_BELLOTA - 1D 115KV & GOLD HILL-BELLOTA-LOCKEFORD LINE                                       | P2       | Non-Bus-Tie Breaker  | 115                            | 133              | 117              | 38                   | 32                   | 120                               | 93                               | 26                                    | 116                               | Existing operating procedure   |
| 33562 BELLOTA 115 33950 RVRBK TP 115 1    | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV             | P6       | N-1/N-1              | 145                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E  | P2       | Bus-Tie Breaker      | 117                            | 129              | 104              | 21                   | 15                   | 118                               | 65                               | 10                                    | 104                               | Existing operating procedure   |
| 33568 TH.E.DV. 115 33570 SPC JCT. 115 1   | P1-2:A11:45:_LAMMERS-KASSON 115KV & P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV                     | P6       | N-1/N-1              | <100                           | 133              | 184              | <100                 | <100                 | 136                               | <100                             | <100                                  | 184                               | Existing SPS under review  |
|   | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV  | P1       | N-1                  | 32                             | 77               | 111              | 33                   | 50                   | 79                                | 32                               | 53                                    | 111                               | Continue to monitor future load forecast   |
| 33570 SPC JCT. 115 33595 VIERATP2 115 1   | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV & P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV             | P6       | N-1/N-1              | <100                           | 102              | 115              | <100                 | <100                 | 105                               | <100                             | <100                                  | 115                               | Existing SPS under review  |
| 33610 VIIV SPS 60 0 33619 AMFOR SW 60 0 1 | P1-2:A11:69:_VALLEY SPRINGS-CLAY 60KV  | P1       | N-1                  | 138                            | 141              | 150              | 39                   | 35                   | 144                               | 105                              | 28                                    | 150                               | Existing operating procedure   |
|   | P1-3:A11:41:_PRDESWS 60/7.2KV TB 1   | P1       | N-1                  | 71                             | 73               | 76               | 9                    | 6                    | 75                                | 51                               | 1                                     | 102                               | Sensitivity only   |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                          | Contingency (All and Worst P6)   | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions  |
|--|--|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|---|
|  |  |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |   |
|  | P1-1:A4:14:_ WOODLAND 13.80KV GEN UNIT 1 & P1-2:A11:69:_ VALLEY SPRINGS-CLAY 60KV              | P3       | G-1/N-1              | 138                            | 141              | 150              | 39                   | 35                   | 144                               | 105                              | 28                                    | 150                               | Existing operating procedure  |
| 33619 AMFOR_SW 60.0 33616 MARTELL 60.0 1     | P1-2:A11:69:_ VALLEY SPRINGS-CLAY 60KV   | P1       | N-1                  | 120                            | 124              | 130              | 28                   | 25                   | 126                               | 89                               | 20                                    | 130                               | Existing operating procedure  |
|  | P1-1:A4:14:_ WOODLAND 13.80KV GEN UNIT 1 & P1-2:A11:69:_ VALLEY SPRINGS-CLAY 60KV              | P3       | G-1/N-1              | 120                            | 124              | 130              | 28                   | 25                   | 126                               | 89                               | 20                                    | 130                               | Existing operating procedure  |
| 33690 ROGH-RDY 60.0 33695 ROGH-RDYJCT 60.0 1 | Base Case  | P0       | Base Case            | 104                            | 104              | 102              | 60                   | 56                   | 107                               | 99                               | 53                                    | 102                               | Line rating under review  |
| 33716 HMMR JCT 60.0 33717 MORADAJT 60.0 1    | P1-2:A11:4:_ LOCKEFORD-BELLOTA 230KV   | P1       | N-1                  | 97                             | 104              | 74               | 17                   | 15                   | 107                               | 70                               | 10                                    | 74                                | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
|  | P1-2:A11:89:_ LOCKEFORD #1 60KV  | P1       | N-1                  | 108                            | 111              | 117              | 21                   | 12                   | 114                               | 83                               | 10                                    | 117                               | SPS under review  |
|  | P1-1:A4:12:_ DG_VADIX 13.80KV GEN UNIT 1 & P1-2:A11:89:_ LOCKEFORD #1 60KV                     | P3       | G-1/N-1              | 108                            | 111              | 117              | 21                   | 12                   | 114                               | 83                               | 10                                    | 117                               | SPS under review  |
| 33717 MORADAJT 60.0 33740 MSHR 60V 60.0 1    | P1-2:A11:89:_ LOCKEFORD #1 60KV  | P1       | N-1                  | 99                             | 101              | 107              | 24                   | 16                   | 104                               | 77                               | 14                                    | 107                               | SPS under review  |
|  | P1-1:A4:3:_ SOLANO3WIND 1.00KV GEN UNIT 3 & P1-2:A11:89:_ LOCKEFORD #1 60KV                    | P3       | G-1/N-1              | 99                             | 101              | 107              | 24                   | 16                   | 104                               | 77                               | 14                                    | 107                               | SPS under review  |
| 33742 MANTECA 60.0 33514 MANTECA 115 3       | P1-3:A11:32:_ KASSON 115/60KV TB 1   | P1       | N-1                  | 204                            | 218              | 244              | 65                   | 75                   | 223                               | 157                              | 68                                    | 244                               | Existing SPS under review   |
|  | P1-1:A4:8:_ SHILOH 0.60KV GEN UNIT 1 & P1-3:A11:32:_ KASSON 115/60KV TB 1                      | P3       | G-1/N-1              | 204                            | 219              | 244              | <100                 | <100                 | 223                               | 157                              | <100                                  | 243                               | Existing SPS under review   |
| 33748 MSSDLESW 60.0 33750 CALVO 60.0 1       | P1-3:A11:32:_ KASSON 115/60KV TB 1   | P1       | N-1                  | 112                            | 124              | 151              | 24                   | 42                   | 127                               | 77                               | 39                                    | 151                               | Existing SPS under review   |
|  | P1-1:A4:20:_ WOLFSKIL 13.80KV GEN UNIT 1 & P1-3:A11:32:_ KASSON 115/60KV TB 1                  | P3       | G-1/N-1              | 112                            | 124              | 151              | <100                 | <100                 | 127                               | <100                             | <100                                  | 151                               | Existing SPS under review   |
| 33750 CALVO 60.0 33756 KASSON 60.0 1         | P1-3:A11:32:_ KASSON 115/60KV TB 1   | P1       | N-1                  | 108                            | 119              | 146              | 19                   | 37                   | 123                               | 73                               | 35                                    | 146                               | Existing SPS under review   |
|  | P1-1:A4:20:_ WOLFSKIL 13.80KV GEN UNIT 1 & P1-3:A11:32:_ KASSON 115/60KV TB 1                  | P3       | G-1/N-1              | 108                            | 120              | 146              | <100                 | <100                 | 123                               | <100                             | <100                                  | 146                               | Existing SPS under review   |
| 33766 MNTCA JT 60.0 33768 BNTA CRB 60.0 1    | Base Case  | P0       | Base Case            | 98                             | 98               | 103              | 33                   | 31                   | 100                               | 87                               | 29                                    | 103                               | Continue to monitor future load forecast  |
| 33912 SPRNG GJ 115 33914 MI-WUK 115 1        | P1-3:A11:10:_ BELLOTA 230/115KV TB 1 & P1-3:A11:11:_ BELLOTA 230/115KV TB 2                    | P6       | N-1/N-1              | 104                            | 106              | 109              | <100                 | <100                 | 104                               | <100                             | <100                                  | 109                               | Existing operating procedure  |
|  | P2-4:A11:1:_ BELLOTA 230KV - SECTION 1E & 2E   | P2       | Bus-Tie Breaker      | 104                            | 106              | 109              | 78                   | 72                   | 104                               | 87                               | 60                                    | 109                               | Existing operating procedure  |
| 33916 CURTISS 115 33917 SPISONORAJCT 115 1   | P1-3:A11:10:_ BELLOTA 230/115KV TB 1 & P1-3:A11:11:_ BELLOTA 230/115KV TB 2                    | P6       | N-1/N-1              | 103                            | 104              | 104              | <100                 | <100                 | 102                               | <100                             | <100                                  | 104                               | Existing operating procedure  |
|  | P2-4:A11:1:_ BELLOTA 230KV - SECTION 1E & 2E   | P2       | Bus-Tie Breaker      | 103                            | 105              | 104              | 80                   | 74                   | 102                               | 84                               | 62                                    | 104                               | Existing operating procedure  |
| 33932 MELONES 115 33500 MELNS JA 115 1       | P1-2:A11:39:_ SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_ SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1              | 186                            | <100             | <100             | <100                 | <100                 | <100                              | 75                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan                  |
|  | P2-4:A11:1:_ BELLOTA 230KV - SECTION 1E & 2E   | P2       | Bus-Tie Breaker      | 120                            | 137              | 116              | 62                   | 62                   | 130                               | 50                               | 63                                    | 115                               | Existing operating procedure  |
| 33932 MELONES 115 33934 TULLOCH 115 1        | P1-3:A11:10:_ BELLOTA 230/115KV TB 1 & P1-3:A11:11:_ BELLOTA 230/115KV TB 2                    | P6       | N-1/N-1              | 193                            | 216              | 181              | <100                 | <100                 | 202                               | 87                               | <100                                  | 181                               | Existing operating procedure  |

Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                     | Contingency (All and Worst P6)   | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---|--|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |  |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 33932 MELONES 115 33934 FOLLOCH 115 1   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E  | P2       | Bus-Tie Breaker        | 193                            | 215              | 181              | 8                    | 14                   | 202                               | 87                               | 19                                    | 181                               | Existing operating procedure   |
| 33932 MELONES 115 33936 MELNS JB 115 1  | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 196                            | <100             | <100             | <100                 | <100                 | <100                              | 76                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E  | P2       | Bus-Tie Breaker        | 124                            | 141              | 120              | 62                   | 63                   | 134                               | 50                               | 65                                    | 119                               | SPS Recommended in 2017-2018 TPP   |
|   | P1-2:A11:42:_MANTECA-RIPON 115KV   | P1       | N-1                    | 97                             | 103              | 116              | 3                    | 7                    | 106                               | 53                               | 15                                    | 116                               | Continue to monitor future load forecast   |
|   | P2-1:A11:20:_RPNJ2-RIPON 115KV [0] NO FAULT  | P2       | Line Section w/o Fault | 97                             | 103              | 116              | 3                    | 7                    | 106                               | 53                               | 15                                    | 116                               | Continue to monitor future load forecast   |
|   | P2-3:A11:103:_MANTECA 115KV - RING R4 & R5   | P2       | Non-Bus-Tie Breaker    | 97                             | 103              | 116              | 3                    | 7                    | 107                               | 53                               | 15                                    | 116                               | Continue to monitor future load forecast   |
|   | P2-3:A11:105:_MANTECA 115KV - RING R6 & R5   | P2       | Non-Bus-Tie Breaker    | 97                             | 103              | 116              | 3                    | 7                    | 107                               | 53                               | 15                                    | 116                               | Continue to monitor future load forecast   |
|   | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE                          | P2       | Non-Bus-Tie Breaker    | 114                            | 55               | 67               | 72                   | 74                   | 58                                | 84                               | 67                                    |                                   | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P2-4:A11:13:_BELLOTA 115KV - SECTION 1D & 2D   | P2       | Bus-Tie Breaker        | 32                             | 27               | 23               | 105                  | 104                  | 26                                | 53                               | 101                                   | 23                                | SPS Recommended in 2017-2018 TPP   |
|   | P2-4:A11:7:_TESLA E 230KV - SECTION 2E & 1E  | P2       | Bus-Tie Breaker        | 48                             | 29               | 27               | 103                  | 104                  | 33                                | 72                               | 98                                    | 28                                | SPS Recommended in 2017-2018 TPP   |
|   | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A11:42:_MANTECA-RIPON 115KV                   | P3       | G-1/N-1                | 97                             | 103              | 116              | <100                 | <100                 | 106                               | <100                             | <100                                  | 116                               | Continue to monitor future load forecast   |
| 33936 MELNS JB 115 33947 RIVRBKJT 115 1 | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV & P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV | P6       | N-1/N-1                | 187                            | <100             | 91               | <100                 | <100                 | <100                              | 98                               | <100                                  | 91                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33946 RVRBK J1 115 33944 RVRBANK 115 1  | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 118                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  |                                   | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33947 RIVRBKJT 115 33951 VLYHMTP1 115 1 | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV & P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV | P6       | N-1/N-1                | 179                            | <100             | 87               | <100                 | <100                 | <100                              | 94                               | <100                                  | 87                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|   | P1-2:A11:42:_MANTECA-RIPON 115KV   | P1       | N-1                    | 93                             | 99               | 111              | 3                    | 7                    | 102                               | 50                               | 14                                    | 111                               | Continue to monitor future load forecast   |
|   | P2-1:A11:20:_RPNJ2-RIPON 115KV [0] NO FAULT  | P2       | Line Section w/o Fault | 93                             | 99               | 111              | 3                    | 7                    | 102                               | 50                               | 14                                    | 111                               | Continue to monitor future load forecast   |
|   | P2-3:A11:103:_MANTECA 115KV - RING R4 & R5   | P2       | Non-Bus-Tie Breaker    | 93                             | 99               | 111              | 3                    | 7                    | 102                               | 51                               | 14                                    | 111                               | Continue to monitor future load forecast   |
|   | P2-3:A11:105:_MANTECA 115KV - RING R6 & R5   | P2       | Non-Bus-Tie Breaker    | 93                             | 99               | 111              | 3                    | 7                    | 102                               | 50                               | 14                                    | 111                               | Continue to monitor future load forecast   |
|   | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE                          | P2       | Non-Bus-Tie Breaker    | 109                            | 52               | 65               | 68                   | 70                   | 56                                | 80                               | 63                                    | 65                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |



Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                      | Contingency (All and Worst P6)   | Category | Category Description   | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--|--|----------|------------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|  |  |          |                        | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
|  | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A11:42:_MANTECA-RIPON 115KV                   | P3       | G-1/N-1                | 93                             | 99               | 111              | <100                 | <100                 | 102                               | <100                             | <100                                  | 111                               | Continue to monitor future load forecast   |
| 33950 RVRBK TP 115 33934 TULLOCH 115 1   | P1-3:A11:10:_BELLOTA 230/115KV TB 1 & P1-3:A11:11:_BELLOTA 230/115KV TB 2                    | P6       | N-1/N-1                | 229                            | 251              | 218              | <100                 | <100                 | 238                               | 116                              | <100                                  | 218                               | Existing operating procedure   |
|  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E  | P2       | Bus-Tie Breaker        | 229                            | 251              | 218              | 29                   | 25                   | 238                               | 116                              | 20                                    | 218                               | SPS Recommended in 2017-2018 TPP   |
| 33950 RVRBK TP 115 33944 RVRBANK 115 1   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E  | P2       | Bus-Tie Breaker        | 115                            | 124              | 115              | 9                    | 15                   | 122                               | 53                               | 15                                    | 116                               | SPS Recommended in 2017-2018 TPP   |
|  | P1-3:A11:10:_BELLOTA 230/115KV TB 1 & P1-3:A11:11:_BELLOTA 230/115KV TB 2                    | P6       | N-1/N-1                | 115                            | 124              | 116              | <100                 | <100                 | 122                               | <100                             | <100                                  | 115                               | Existing operating procedure   |
| 33951 VLYHMT P1 115 33516 RPN JNCN 115 1 | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV & P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV | P6       | N-1/N-1                | 139                            | <100             | <100             | <100                 | <100                 | <100                              | 84                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P1-2:A11:38:_STANISLAUS-MELONES SW STA-MANTECA #1 115KV MOAS OPENED ON STANISLS_FRGTNTP1 (2) | P1       | N-1                    | 36                             | 18               | 17               | 100                  | 102                  | 21                                | 69                               | 97                                    | 17                                | Generation redispatch  |
|  | P1-2:A12:11:_STANISLAUS-MELONES SW STA-MANTECA #1 115KV MOAS OPENED ON STANISLS_FRGTNTP1     | P1       | N-1                    | 36                             | 18               | 17               | 100                  | 102                  | 21                                | 69                               | 97                                    | 17                                | Generation redispatch  |
|  | P2-1:A11:10:_STANISLAUS-MELONES SW STA-MANTECA #1 115KV (MELNS JA-AVENATP1)                  | P2       | Line Section w/o Fault | 39                             | 21               | 20               | 101                  | 102                  | 24                                | 71                               | 97                                    | 21                                | Generation redispatch  |
|  | P2-4:A11:13:_BELLOTA 115KV - SECTION 1D & 2D   | P2       | Bus-Tie Breaker        | 9                              | 7                | 5                | 104                  | 104                  | 7                                 | 42                               | 104                                   | 5                                 | Generation redispatch  |
|  | P2-4:A11:7:_TESLA E 230KV - SECTION 2E & 1E  | P2       | Bus-Tie Breaker        | 23                             | 7                | 5                | 101                  | 104                  | 9                                 | 60                               | 101                                   | 6                                 | Generation redispatch  |
| 33959 TCHRT_T2 115 33970 INGRM C. 115 1  | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 227                            | 72               | 86               | <100                 | <100                 | 74                                | 75                               | <100                                  | 85                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
|  | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE                          | P2       | Non-Bus-Tie Breaker    | 135                            | 62               | 76               | 37                   | 35                   | 64                                | 50                               | 38                                    | 76                                | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33960 MDSTO CN 115 33962 SALDO TP 115 1  | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 158                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33962 SALDO TP 115 33964 SALADO 115 1    | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 152                            | <100             | <100             | <100                 | <100                 | <100                              | <100                             | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| 33965 SALADO J 115 33964 SALADO 115 1    | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV | P6       | N-1/N-1                | 122                            | <100             | <100             | <100                 | <100                 | <100                              | 76                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |



Study Area: PG&E Central Valley  
Thermal Overloads



| Overloaded Facility                           | Contingency (All and Worst P6)  | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---|---|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|--|
|   |   |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 33970 INGRM C. 115 33965 SALADO J 115 1       | P1-2:A11:39:_SCHULTE SW STA-KASSON-MANTECA 115KV & P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV              | P6       | N-1/N-1              | 130                            | <100             | <100             | <100                 | <100                 | <100                              | 81                               | <100                                  | <100                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan         |
| 34003 SALADO 60.0 34006 PATTERSN 60.0 1       | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV   | P1       | N-1                  | 122                            | 129              | 138              | 42                   | 46                   | 132                               | 23                               | 55                                    | 138                               | Line rating and load forecast under review   |
|   | P1-2:A12:17:_NEWMAN-CROWCREEK SS 60KV   | P1       | N-1                  | 120                            | 126              | 138              | 7                    | 5                    | 131                               | 68                               | 13                                    | 138                               | Line rating and load forecast under review   |
|   | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A12:18:_ 60KV  | P3       | G-1/N-1              | 121                            | 128              | 140              | <100                 | <100                 | 132                               | <100                             | <100                                  | 140                               | Line rating and load forecast under review   |
| 34007 PATTERSN 60.0 34010 CRWS LDJ 60.0 1     | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV   | P1       | N-1                  | 95                             | 100              | 107              | 33                   | 36                   | 103                               | 18                               | 43                                    | 107                               | Continue to monitor future load forecast   |
|   | P1-2:A12:17:_NEWMAN-CROWCREEK SS 60KV   | P1       | N-1                  | 93                             | 98               | 107              | 6                    | 4                    | 101                               | 53                               | 10                                    | 107                               | Continue to monitor future load forecast   |
|   | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A12:18:_ 60KV  | P3       | G-1/N-1              | 94                             | 100              | 109              | <100                 | <100                 | 103                               | <100                             | <100                                  | 109                               | Continue to monitor future load forecast   |
| 34009 STNSLRP 60.0 34009 CROWCREEK SS 60.0 1  | P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ                                       | P1       | N-1                  | 100                            | 105              | 115              | 36                   | 40                   | 109                               | 20                               | 48                                    | 115                               | Disable automatics   |
|   | P1-1:A4:8:_SHILOH 0.60KV GEN UNIT 1 & P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ | P3       | G-1/N-1              | 100                            | 105              | 115              | <100                 | <100                 | 109                               | <100                             | <100                                  | 116                               | Disable automatics   |
| 34010 CROWCREEK SS 60.0 34016 MEDLIN J 60.0 1 | P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ                                       | P1       | N-1                  | 100                            | 106              | 116              | 6                    | 4                    | 109                               | 57                               | 11                                    | 116                               | Disable automatics   |
|   | P1-1:A4:8:_SHILOH 0.60KV GEN UNIT 1 & P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ | P3       | G-1/N-1              | 100                            | 106              | 116              | <100                 | <100                 | 109                               | <100                             | <100                                  | 116                               | Disable automatics   |
| 34011 CRWS LDJ 60.0 34012 GUSTN JT 60.0 1     | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV   | P1       | N-1                  | 88                             | 93               | 101              | 33                   | 37                   | 95                                | 13                               | 43                                    | 101                               | Continue to monitor future load forecast   |
|   | P1-2:A12:17:_NEWMAN-CROWCREEK SS 60KV   | P1       | N-1                  | 86                             | 91               | 101              | 4                    | 5                    | 94                                | 48                               | 11                                    | 101                               | Continue to monitor future load forecast   |
|   | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A12:18:_ 60KV  | P3       | G-1/N-1              | <100                           | 92               | 102              | <100                 | <100                 | 95                                | <100                             | <100                                  | 102                               | Continue to monitor future load forecast   |
| 34012 GUSTN JT 60.0 34014 NEWMAN 60.0 1       | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV   | P1       | N-1                  | 88                             | 93               | 101              | 33                   | 37                   | 95                                | 13                               | 43                                    | 101                               | Continue to monitor future load forecast   |
|   | P1-1:A4:20:_WOLFSKIL 13.80KV GEN UNIT 1 & P1-2:A12:18:_ 60KV  | P3       | G-1/N-1              | <100                           | 92               | 102              | <100                 | <100                 | 95                                | <100                             | <100                                  | 102                               | Continue to monitor future load forecast   |
| 34014 NEWMAN 60.0 34018 NWMN JCT 60.0 1       | P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ                                       | P1       | N-1                  | 93                             | 98               | 109              | 4                    | 6                    | 101                               | 52                               | 12                                    | 109                               | Continue to monitor future load forecast   |
|   | P1-1:A4:8:_SHILOH 0.60KV GEN UNIT 1 & P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ | P3       | G-1/N-1              | 93                             | 98               | 109              | <100                 | <100                 | 101                               | <100                             | <100                                  | 109                               | Continue to monitor future load forecast   |
| 365930 Q653FJCT 115 31990 DAVIS 115 1         | P1-2:A4:44:_RIO OSO-WEST SACRAMENTO 115KV & P1-2:A4:5:_RIO OSO-BRIGHTON 230KV                             | P6       | N-1/N-1              | 102                            | <100             | <100             | <100                 | <100                 | <100                              | 74                               | <100                                  | <100                              | Project: Vaca Dixon Area Reinforcement Project<br>In-Service Date: Feb 2022<br>Short term: Action plan |
| 37649 LLNLAB 115 33574 LLNL TAP 115 1         | P1-3:A11:16:_TESLA D 230/115KV TB 1   | P1       | N-1                  | 6                              | 8                | 11               | 79                   | 84                   | 6                                 | 13                               | 100                                   | 11                                | Sensitivity only   |
|   | P2-2:A11:18:_TESLA D 230KV SECTION 2D   | P2       | Bus                  | 14                             | 14               | 4                | 80                   | 84                   | 12                                | 7                                | 100                                   | 5                                 | Sensitivity only   |
|   | P2-3:A11:8:_TESLA D - 2D 230KV & DELTA SWITCHING YARD-TESLA LINE  | P2       | Non-Bus-Tie Breaker  | 14                             | 14               | 4                | 80                   | 84                   | 12                                | 7                                | 100                                   | 5                                 | Sensitivity only   |
|   | P2-4:A11:24:_TESLA E SECTION 1E & TESLA D SECTION 1D 230KV  | P2       | Bus-Tie Breaker      | 11                             | 11               | 8                | 80                   | 84                   | 9                                 | 10                               | 101                                   | 8                                 | Sensitivity only   |

Study Area: PG&E Central Valley

Thermal Overloads



| Overloaded Facility                  | Contingency (All and Worst P6)                                 | Category | Category Description | Loading % (Baseline Scenarios) |                  |                  |                      |                      | Loading % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions  |
|--------------------------------------|--|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|---|
|                                      |  |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |   |
|                                      | P2-4:A11:8:_TESLA D 230KV - SECTION 1D & 2D                    | P2       | Bus-Tie Breaker      | 21                             | 35               | 72               | 164                  | 171                  | 40                                | 54                               | 201                                   | 73                                | SPS Recommended in 2017-2018 TPP  |
| 38206 COTTLE 230 37563 MELONES 230 1 | P2-4:A11:4:_BELLOTA 230KV - SECTION 1D & 2D                    | P2       | Bus-Tie Breaker      | 66                             | 47               | 45               | 85                   | 90                   | 51                                | 101                              | 87                                    | 45                                | Sensitivity only  |
|                                      | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                    | P2       | Bus-Tie Breaker      | Diverge                        | Diverge          | Diverge          | <100                 | <100                 | Diverge                           | Diverge                          | <100                                  | Diverge                           | SPS Recommended in 2018-2019 TPP  |
|                                      | P2-4:A11:10:_TESLA 115KV - SECTION 2D & 1D                     | P2       | Bus-Tie Breaker      | Diverge                        | Diverge          | Diverge          | <100                 | <100                 | Diverge                           | Diverge                          | <100                                  | Diverge                           | SPS Recommended in 2017-2018 TPP  |
|                                      | P7-1:A11:25:_RIO OSO-LOCKEFORD 230KV & LOCKEFORD-BELLOTA 230KV | P7       | DCTL                 | Diverge                        | Diverge          | <100             | <100                 | <100                 | Diverge                           | Diverge                          | <100                                  | <100                              | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| 0227-WD 230  | Base Case                      | P0       | Base Case            | 1.00   | 1.00             | 0.98             | 1.05                 | 1.05                 | 1.00  | 1.00                             | 1.05                                  | 0.98                              | Load power factor correction and voltage support if needed |
| AEC_300 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.05                 | 1.05                 | 1.03  | 1.04                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| ALLEGHNY 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.02             | 1.08                 | 1.07                 | 1.04  | 1.04                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| ALTA-CGE 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.04             | 1.07                 | 1.06                 | 1.04  | 1.03                             | 1.06                                  | 1.04                              | Load power factor correction and voltage support if needed |
| AM FORST 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.05                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| AMERIGAS 115 | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.03             | 1.09                 | 1.08                 | 1.07  | 1.07                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| AMFOR_SW 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.05                 | 1.05                 | 1.04  | 1.03                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| APPLE HL 115 | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.05                             | 1.13                                  | 1.00                              | Load power factor correction and voltage support if needed |
| ARBALT 60    | Base Case                      | P0       | Base Case            | 0.97   | 0.97             | 0.99             | 1.08                 | 1.00                 | 0.97  | 1.00                             | 1.00                                  | 0.98                              | Load power factor correction and voltage support if needed |
| ATLANTC 230  | Base Case                      | P0       | Base Case            | 0.98   | 1.00             | 0.97             | 1.05                 | 1.04                 | 1.00  | 1.00                             | 1.05                                  | 0.97                              | Load power factor correction and voltage support if needed |
| ATLANTI 60   | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 0.98             | 1.09                 | 1.11                 | 1.05  | 1.06                             | 1.12                                  | 0.98                              | Load power factor correction and voltage support if needed |
| ATLANTIC 115 | Base Case                      | P0       | Base Case            | 1.01   | 1.03             | 0.99             | 1.08                 | 1.07                 | 1.02  | 1.02                             | 1.07                                  | 0.99                              | Load power factor correction and voltage support if needed |
| AVENA 115    | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 0.99             | 1.05                 | 1.05                 | 1.02  | 1.03                             | 1.05                                  | 0.99                              | Load power factor correction and voltage support if needed |
| B.BTHNY- 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.07                 | 1.06                 | 1.04  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| BANGOR 60    | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.02             | 1.09                 | 1.08                 | 1.04  | 1.04                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| BANTA 60     | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.01             | 1.06                 | 1.06                 | 1.06  | 1.05                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| BARRY 60     | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 0.99             | 1.05                 | 1.04                 | 1.03  | 1.03                             | 1.04                                  | 0.99                              | Load power factor correction and voltage support if needed |
| BEALE_1 60   | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.03             | 1.05                 | 1.04                 | 1.03  | 1.02                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| BEALE_2 60   | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.02             | 1.05                 | 1.04                 | 1.02  | 1.01                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation    | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|---------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|               |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| BELL PGE 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 0.99             | 1.11                 | 1.10                 | 1.03  | 1.03                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed |
| BELLOTA 115   | Base Case                      | P0       | Base Case            | 1.05   | 1.04             | 1.04             | 1.05                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.04                              | Load power factor correction and voltage support if needed |
| BELLOTA 230   | Base Case                      | P0       | Base Case            | 1.00   | 1.00             | 0.99             | 1.06                 | 1.05                 | 1.00  | 1.00                             | 1.06                                  | 0.99                              | Load power factor correction and voltage support if needed |
| BOGUE 115     | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.02             | 1.09                 | 1.06                 | 1.03  | 1.02                             | 1.07                                  | 1.01                              | Load power factor correction and voltage support if needed |
| BRIGHTN 115   | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.04             | 1.05                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.04                              | Load power factor correction and voltage support if needed |
| BRIGHTON 230  | Base Case                      | P0       | Base Case            | 0.98   | 1.00             | 0.96             | 1.06                 | 1.05                 | 1.00  | 1.00                             | 1.05                                  | 0.96                              | Load power factor correction and voltage support if needed |
| BRKR SLG 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.06                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| BRNSWALT 115  | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 1.03             | 1.08                 | 1.05                 | 1.02  | 1.02                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| BRUNSWCK 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.02             | 1.09                 | 1.05                 | 1.02  | 1.02                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| BRWNS VY 60   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.06                 | 1.04  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| BUENAVISTA 60 | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.04             | 1.06                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| CAL CMNT 60   | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.03             | 1.05                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| CALVO 60      | Base Case                      | P0       | Base Case            | 1.05   | 1.05             | 1.01             | 1.06                 | 1.06                 | 1.05  | 1.05                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CAMANCH 230   | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 1.00             | 1.08                 | 1.07                 | 1.01  | 1.00                             | 1.08                                  | 0.99                              | Load power factor correction and voltage support if needed |
| CAMANCHE 115  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.05                 | 1.04                 | 1.04  | 1.04                             | 1.05                                  | 1.04                              | Load power factor correction and voltage support if needed |
| CAMANCPP 230  | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 1.00             | 1.08                 | 1.07                 | 1.01  | 1.00                             | 1.08                                  | 0.99                              | Load power factor correction and voltage support if needed |
| CAMPUS 115    | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.06                 | 1.05                 | 1.02  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| CATARACT 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.06                 | 1.06                 | 1.03  | 1.04                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| CDCRSTN 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.04                 | 1.04                 | 1.03  | 1.02                             | 1.04                                  | 1.02                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| CH.STN 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.02             | 1.01             | 1.05                 | 1.05                 | 1.02  | 1.03                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CHCGO PK 115 | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.02             | 1.10                 | 1.07                 | 1.04  | 1.04                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| CHLLNGEA 60  | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.04             | 1.08                 | 1.07                 | 1.06  | 1.05                             | 1.07                                  | 1.04                              | Load power factor correction and voltage support if needed |
| CISCO GR 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.06                 | 1.03                 | 1.04  | 1.04                             | 1.02                                  | 1.03                              | Load power factor correction and voltage support if needed |
| CL AMMNA 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.05                 | 1.04                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| CLAY 60      | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.03             | 1.06                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CLMBA HL 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.03             | 1.08                 | 1.07                 | 1.05  | 1.05                             | 1.07                                  | 1.03                              | Load power factor correction and voltage support if needed |
| CLRKSVLE 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.04                             | 1.13                                  | 1.00                              | Load power factor correction and voltage support if needed |
| CLSA CRS 60  | Base Case                      | P0       | Base Case            | 0.98   | 0.98             | 0.97             | 1.04                 | 1.07                 | 0.98  | 1.07                             | 1.08                                  | 0.96                              | Load power factor correction and voltage support if needed |
| CMP FRWT 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.05                 | 1.04                 | 1.04  | 1.03                             | 1.04                                  | 1.03                              | Load power factor correction and voltage support if needed |
| CNTRY CB 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.03             | 1.05                 | 1.06                 | 1.05  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| COLGATE 60   | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.04             | 1.08                 | 1.07                 | 1.05  | 1.05                             | 1.07                                  | 1.04                              | Load power factor correction and voltage support if needed |
| COLGATEA 60  | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.04             | 1.08                 | 1.07                 | 1.06  | 1.05                             | 1.07                                  | 1.04                              | Load power factor correction and voltage support if needed |
| COLUSA 60    | Base Case                      | P0       | Base Case            | 0.98   | 0.98             | 0.97             | 1.04                 | 1.08                 | 0.98  | 1.07                             | 1.08                                  | 0.95                              | Load power factor correction and voltage support if needed |
| CORDELIA 115 | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.01             | 1.09                 | 1.09                 | 1.07  | 1.06                             | 1.09                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CORRAL 60    | Base Case                      | P0       | Base Case            | 1.00   | 1.01             | 0.99             | 1.05                 | 1.04                 | 1.00  | 1.01                             | 1.05                                  | 0.99                              | Load power factor correction and voltage support if needed |
| CORT_D 115   | Base Case                      | P0       | Base Case            | 1.05   | 1.05             | 1.03             | 1.09                 | 1.08                 | 1.05  | 1.08                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| CORTINA 115  | Base Case                      | P0       | Base Case            | 1.05   | 1.05             | 1.03             | 1.09                 | 1.08                 | 1.05  | 1.08                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| CPM 115      | Base Case                      | P0       | Base Case            | 1.04   | 1.06             | 1.02             | 1.12                 | 1.11                 | 1.06  | 1.05                             | 1.12                                  | 1.01                              | Load power factor correction and voltage support if needed |



Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| CRWS LDG 60  | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 0.99             | 1.05                 | 1.05                 | 1.00  | 1.03                             | 1.06                                  | 0.99                              | Load power factor correction and voltage support if needed |
| CURTISS 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.00             | 1.04                 | 1.05                 | 1.02  | 1.02                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DAVIS 115    | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.06                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DEEPWATR 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.02             | 1.06                 | 1.05                 | 1.04  | 1.05                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| DEL MAR 60   | Base Case                      | P0       | Base Case            | 1.02   | 1.04             | 0.96             | 1.06                 | 1.11                 | 1.04  | 1.06                             | 1.12                                  | 0.96                              | Load power factor correction and voltage support if needed |
| DELEVAN 60   | Base Case                      | P0       | Base Case            | 0.98   | 0.99             | 0.98             | 1.04                 | 1.06                 | 0.98  | 1.06                             | 1.07                                  | 0.97                              | Load power factor correction and voltage support if needed |
| DIMOND_1 115 | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.05                             | 1.13                                  | 1.01                              | Load power factor correction and voltage support if needed |
| DIMOND_2 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.00             | 1.12                 | 1.12                 | 1.05  | 1.04                             | 1.13                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DIST2047 60  | Base Case                      | P0       | Base Case            | 0.90   | 0.90             | 0.92             | 1.16                 | 0.94                 | 0.90  | 0.94                             | 0.94                                  | 0.91                              | Load forecast under review                                 |
| DIXONCAN 60  | Base Case                      | P0       | Base Case            | 1.07   | 1.08             | 1.00             | 1.07                 | 1.07                 | 1.08  | 1.07                             | 1.08                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DIXONPGE 60  | Base Case                      | P0       | Base Case            | 1.07   | 1.08             | 1.01             | 1.07                 | 1.08                 | 1.08  | 1.08                             | 1.08                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DMND SPR 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.00             | 1.12                 | 1.12                 | 1.05  | 1.04                             | 1.13                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DOBBINS 60   | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.04             | 1.08                 | 1.07                 | 1.06  | 1.05                             | 1.07                                  | 1.04                              | Load power factor correction and voltage support if needed |
| DRUM 115     | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.04             | 1.09                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.04                              | Load power factor correction and voltage support if needed |
| DTCH FL1 115 | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.09                 | 1.06                 | 1.04  | 1.04                             | 1.07                                  | 1.03                              | Load power factor correction and voltage support if needed |
| DTCH FL2 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.04             | 1.09                 | 1.05                 | 1.04  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.02             | 1.09                 | 1.07                 | 1.05  | 1.03                             | 1.07                                  | 1.02                              | Load power factor correction and voltage support if needed |
| E.NICOLS 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.03             | 1.09                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| EIGHT MI 230 | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 0.99             | 1.06                 | 1.05                 | 1.02  | 1.01                             | 1.06                                  | 0.99                              | Load power factor correction and voltage support if needed |
| ELDORAD 115  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.05                             | 1.13                                  | 1.01                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| ELECTRA 230  | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.06                 | 1.05                 | 1.02  | 1.01                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| ELLS GTY 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.04                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| ENVRO_HY 60  | Base Case                      | P0       | Base Case            | 1.00   | 1.00             | 0.99             | 1.05                 | 1.00                 | 1.00  | 1.01                             | 1.01                                  | 0.99                              | Load power factor correction and voltage support if needed |
| FLINT 115    | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.00             | 1.11                 | 1.10                 | 1.04  | 1.03                             | 1.11                                  | 1.00                              | Load power factor correction and voltage support if needed |
| FLINT1 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.00             | 1.11                 | 1.10                 | 1.04  | 1.03                             | 1.12                                  | 1.00                              | Load power factor correction and voltage support if needed |
| FLINT2 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.00             | 1.11                 | 1.10                 | 1.04  | 1.03                             | 1.11                                  | 1.00                              | Load power factor correction and voltage support if needed |
| FLOWIND2 230 | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.02                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| FLTN JCT 115 | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.03             | 1.09                 | 1.08                 | 1.07  | 1.07                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |
| FORST HL 60  | Base Case                      | P0       | Base Case            | 1.00   | 1.00             | 0.98             | 1.05                 | 1.00                 | 1.00  | 1.00                             | 1.01                                  | 0.98                              | Load power factor correction and voltage support if needed |
| FROGTOWN 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.01             | 1.06                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| GLEAF 1 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.09                 | 1.06                 | 1.04  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| GOLDHILL 115 | Base Case                      | P0       | Base Case            | 1.04   | 1.06             | 1.02             | 1.12                 | 1.11                 | 1.06  | 1.05                             | 1.12                                  | 1.02                              | Load power factor correction and voltage support if needed |
| GOLDHILL 230 | Base Case                      | P0       | Base Case            | 0.99   | 1.00             | 0.97             | 1.06                 | 1.05                 | 1.00  | 1.00                             | 1.06                                  | 0.97                              | Load power factor correction and voltage support if needed |
| GRAND IS 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.04                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| GRANITE 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.05                 | 1.04                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| GRSS VLY 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.02             | 1.08                 | 1.07                 | 1.04  | 1.03                             | 1.07                                  | 1.02                              | Load power factor correction and voltage support if needed |
| GWFTACY 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.03                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| HALE 115     | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.01             | 1.09                 | 1.09                 | 1.07  | 1.06                             | 1.09                                  | 1.00                              | Load power factor correction and voltage support if needed |
| HALE2 115    | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.01             | 1.09                 | 1.09                 | 1.07  | 1.06                             | 1.09                                  | 1.00                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| HAMMER 60    | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.06                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| HERDLYN 60   | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.07                 | 1.06                 | 1.04  | 1.03                             | 1.07                                  | 1.03                              | Load power factor correction and voltage support if needed |
| HIGGINS 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.00             | 1.11                 | 1.09                 | 1.03  | 1.03                             | 1.10                                  | 1.00                              | Load power factor correction and voltage support if needed |
| HJ HEINZ 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.00             | 1.04                 | 1.04                 | 1.02  | 1.02                             | 1.04                                  | 1.00                              | Load power factor correction and voltage support if needed |
| HORSESHE 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.01             | 1.11                 | 1.11                 | 1.04  | 1.03                             | 1.12                                  | 1.00                              | Load power factor correction and voltage support if needed |
| HORSHE1 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.01             | 1.11                 | 1.11                 | 1.04  | 1.03                             | 1.12                                  | 1.00                              | Load power factor correction and voltage support if needed |
| HORSHE2 115  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.01             | 1.11                 | 1.11                 | 1.05  | 1.04                             | 1.12                                  | 1.01                              | Load power factor correction and voltage support if needed |
| HUSTD 60     | Base Case                      | P0       | Base Case            | 1.00   | 1.00             | 1.02             | 1.06                 | 1.02                 | 1.00  | 1.02                             | 1.02                                  | 1.01                              | Load power factor correction and voltage support if needed |
| INE PRSN 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.03                             | 1.06                                  | 1.00                              | Load power factor correction and voltage support if needed |
| INE_TP 60    | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.04                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| JAMESN-A 115 | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.01             | 1.08                 | 1.08                 | 1.07  | 1.05                             | 1.08                                  | 1.01                              | Load power factor correction and voltage support if needed |
| JAMESON 115  | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.00             | 1.09                 | 1.09                 | 1.07  | 1.06                             | 1.09                                  | 1.00                              | Load power factor correction and voltage support if needed |
| KASSON 60    | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.01             | 1.06                 | 1.06                 | 1.06  | 1.05                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| KASSON 115   | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.05                 | 1.04                 | 1.03  | 1.03                             | 1.04                                  | 1.00                              | Load power factor correction and voltage support if needed |
| KELSO 230    | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.05                 | 1.04                 | 1.02  | 1.02                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| KNIGHT1 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| KNIGHT2 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| KNIGHTLD 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| LAMMERS 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.06                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| LEPRINO 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.00             | 1.04                 | 1.04                 | 1.02  | 1.02                             | 1.04                                  | 1.00                              | Load power factor correction and voltage support if needed |
| LIMESTNE 60  | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 1.03             | 1.05                 | 1.05                 | 1.02  | 1.02                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| LINCLN 115   | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| LLNL TAP 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| LOUISE 60    | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.00             | 1.05                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| LYOTH-SP 60  | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.01             | 1.06                 | 1.06                 | 1.06  | 1.05                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MADISON 115  | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.01             | 1.09                 | 1.09                 | 1.07  | 1.06                             | 1.09                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MAINE-PR 60  | Base Case                      | P0       | Base Case            | 1.07   | 1.08             | 1.02             | 1.07                 | 1.08                 | 1.08  | 1.07                             | 1.08                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MANTECA 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 0.99             | 1.04                 | 1.04                 | 1.02  | 1.02                             | 1.04                                  | 0.99                              | Load power factor correction and voltage support if needed |
| MARIPOSA 230 | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.05                 | 1.04                 | 1.02  | 1.02                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MARTELL 60   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.05                 | 1.05                 | 1.04  | 1.03                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| MAXWELL 60   | Base Case                      | P0       | Base Case            | 0.98   | 0.99             | 0.98             | 1.04                 | 1.06                 | 0.98  | 1.06                             | 1.07                                  | 0.97                              | Load power factor correction and voltage support if needed |
| MCSP 60      | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.03                             | 1.06                                  | 1.00                              | Load power factor correction and voltage support if needed |
| MDSTO CN 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.01             | 1.05                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MDWYWND 115  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| MELONES 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.01             | 1.05                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MERIDIAN 60  | Base Case                      | P0       | Base Case            | 0.99   | 0.99             | 0.98             | 1.04                 | 1.06                 | 0.99  | 1.03                             | 1.06                                  | 0.97                              | Load power factor correction and voltage support if needed |
| METTLER 60   | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.02             | 1.05                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| MIDLFORK 230 | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 1.00             | 1.06                 | 1.05                 | 1.02  | 1.02                             | 1.06                                  | 1.00                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| MILLER 115   | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.06                 | 1.05                 | 1.02  | 1.04                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MIZOU_T1 115 | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.05                             | 1.13                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MIZOU_T2 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.00             | 1.12                 | 1.12                 | 1.05  | 1.04                             | 1.13                                  | 1.00                              | Load power factor correction and voltage support if needed |
| MOBILCHE 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| MSHR 60V 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.01             | 1.06                 | 1.06                 | 1.03  | 1.02                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| MSSDLESW 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.01             | 1.05                 | 1.05                 | 1.05  | 1.04                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| N BRANCH 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.04             | 1.05                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.04                              | Load power factor correction and voltage support if needed |
| N.HOGAN 60   | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| NARRWS 1 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.02             | 1.07                 | 1.06                 | 1.04  | 1.03                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| NARRWS 2 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.07                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| NEWCSTL1 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.00             | 1.11                 | 1.10                 | 1.04  | 1.03                             | 1.12                                  | 1.00                              | Load power factor correction and voltage support if needed |
| NEWCSTL2 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.00             | 1.11                 | 1.10                 | 1.04  | 1.04                             | 1.12                                  | 1.00                              | Load power factor correction and voltage support if needed |
| NEWCSTLE 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.00             | 1.11                 | 1.10                 | 1.04  | 1.03                             | 1.12                                  | 1.00                              | Load power factor correction and voltage support if needed |
| OI GLASS 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.06                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| OLETA 60     | Base Case                      | P0       | Base Case            | 0.97   | 0.97             | 1.00             | 1.06                 | 1.06                 | 0.97  | 0.98                             | 1.07                                  | 1.00                              | Load power factor correction and voltage support if needed |
| OLIVHRST 115 | Base Case                      | P0       | Base Case            | 1.01   | 1.03             | 1.00             | 1.06                 | 1.05                 | 1.03  | 1.02                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| OXBOW 60     | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 0.99             | 1.05                 | 1.00                 | 1.00  | 1.01                             | 1.01                                  | 0.99                              | Load power factor correction and voltage support if needed |
| P.GRVEJ. 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.02             | 1.07                 | 1.06                 | 1.04  | 1.03                             | 1.07                                  | 1.03                              | Load power factor correction and voltage support if needed |
| PARDEE A 60  | Base Case                      | P0       | Base Case            | 1.05   | 1.05             | 1.05             | 1.06                 | 1.05                 | 1.05  | 1.05                             | 1.06                                  | 1.05                              | Load power factor correction and voltage support if needed |



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High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| PATTERSN 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.02             | 1.01             | 1.05                 | 1.05                 | 1.02  | 1.04                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| PEASE 115    | Base Case                      | P0       | Base Case            | 1.00   | 1.02             | 0.99             | 1.05                 | 1.04                 | 1.02  | 1.02                             | 1.05                                  | 0.99                              | Load power factor correction and voltage support if needed |
| PEORIA 115   | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.05                 | 1.05                 | 1.02  | 1.03                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| PIKE CTY 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.02             | 1.08                 | 1.07                 | 1.05  | 1.05                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| PLACER 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 0.99             | 1.11                 | 1.10                 | 1.03  | 1.03                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed |
| PLSNT GR 115 | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 0.99             | 1.08                 | 1.06                 | 1.02  | 1.02                             | 1.07                                  | 0.99                              | Load power factor correction and voltage support if needed |
| PLUMAS 60    | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 0.97             | 1.05                 | 1.05                 | 1.02  | 1.03                             | 1.05                                  | 0.97                              | Load power factor correction and voltage support if needed |
| PNE GRVE 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.02             | 1.07                 | 1.06                 | 1.03  | 1.03                             | 1.07                                  | 1.02                              | Load power factor correction and voltage support if needed |
| POST 115     | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.02             | 1.06                 | 1.05                 | 1.04  | 1.05                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| PPASSWND 230 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.02                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| PRDESW 60    | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.04             | 1.06                 | 1.06                 | 1.04  | 1.05                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| PUTH CRK 115 | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.03             | 1.09                 | 1.09                 | 1.07  | 1.07                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |
| PUTHCRK1 115 | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.03             | 1.09                 | 1.08                 | 1.07  | 1.07                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |
| Q1103 115    | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.06                 | 1.06                 | 1.02  | 1.04                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| Q653F 115    | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.07                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| R.TRACK 115  | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.01             | 1.06                 | 1.05                 | 1.02  | 1.03                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| RALPH 230    | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.05                 | 1.04                 | 1.02  | 1.02                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| RALSTON 230  | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 1.00             | 1.06                 | 1.05                 | 1.02  | 1.01                             | 1.06                                  | 1.00                              | Load power factor correction and voltage support if needed |
| RICE 60      | Base Case                      | P0       | Base Case            | 0.98   | 0.98             | 0.98             | 1.05                 | 1.06                 | 0.98  | 1.02                             | 1.07                                  | 0.98                              | Load power factor correction and voltage support if needed |

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High/Low Voltages



| Substation    | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|---------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|               |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| RIO OSO 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.04             | 1.09                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.04                              | Load power factor correction and voltage support if needed |
| ROCKLIN 60    | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 0.98             | 1.09                 | 1.11                 | 1.05  | 1.06                             | 1.12                                  | 0.98                              | Load power factor correction and voltage support if needed |
| RVRBANK 115   | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.02             | 1.05                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| SAFEWAY 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.03                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| SALADO 60     | Base Case                      | P0       | Base Case            | 1.04   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.05                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| SALADO 115    | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.05                 | 1.05                 | 1.02  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SALDO TP 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.05                 | 1.05                 | 1.03  | 1.04                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SCHMLBCH 115  | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.01             | 1.08                 | 1.08                 | 1.07  | 1.05                             | 1.08                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SCHULTE 115   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.03                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| SHPRING 115   | Base Case                      | P0       | Base Case            | 1.04   | 1.06             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.04                             | 1.13                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SHPRING1 115  | Base Case                      | P0       | Base Case            | 1.05   | 1.06             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.05                             | 1.13                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SHPRING2 115  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.01             | 1.12                 | 1.11                 | 1.05  | 1.04                             | 1.13                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SIERRAPI 60   | Base Case                      | P0       | Base Case            | 1.02   | 1.04             | 0.96             | 1.06                 | 1.11                 | 1.04  | 1.06                             | 1.12                                  | 0.96                              | Load power factor correction and voltage support if needed |
| SMRTSVLE 60   | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| SOUTH BY 60   | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.03             | 1.06                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| SP CMPNY 115  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.01             | 1.05                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SPICAMIN 115  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.05                             | 1.13                                  | 1.00                              | Load power factor correction and voltage support if needed |
| SPI-LINC 115  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SPISONORA 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.00             | 1.04                 | 1.05                 | 1.02  | 1.02                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| STAGG 60     | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.04             | 1.05                 | 1.06                 | 1.05  | 1.04                             | 1.06                                  | 1.04                              | Load power factor correction and voltage support if needed |
| STAGG-D 230  | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 0.99             | 1.05                 | 1.05                 | 1.01  | 1.01                             | 1.05                                  | 0.99                              | Load power factor correction and voltage support if needed |
| STAGG-E 230  | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 0.99             | 1.05                 | 1.05                 | 1.01  | 1.01                             | 1.05                                  | 0.99                              | Load power factor correction and voltage support if needed |
| STAGG-F 230  | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 0.99             | 1.06                 | 1.05                 | 1.01  | 1.01                             | 1.05                                  | 0.99                              | Load power factor correction and voltage support if needed |
| STAGG-H 230  | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 0.99             | 1.06                 | 1.05                 | 1.01  | 1.01                             | 1.06                                  | 0.99                              | Load power factor correction and voltage support if needed |
| STANISLS 115 | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.02             | 1.06                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| STKTON A 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.02             | 1.01             | 1.04                 | 1.04                 | 1.02  | 1.02                             | 1.04                                  | 1.02                              | Load power factor correction and voltage support if needed |
| STKTON B 115 | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.02             | 1.04                 | 1.04                 | 1.03  | 1.03                             | 1.05                                  | 1.03                              | Load power factor correction and voltage support if needed |
| STN COGN 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.02             | 1.02             | 1.04                 | 1.04                 | 1.03  | 1.02                             | 1.04                                  | 1.02                              | Load power factor correction and voltage support if needed |
| STNSLSRP 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.03             | 1.02             | 1.06                 | 1.06                 | 1.03  | 1.05                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| SUISUN 115   | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.01             | 1.08                 | 1.08                 | 1.07  | 1.05                             | 1.08                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SUMMIT 60    | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.04             | 1.07                 | 1.03                 | 1.04  | 1.05                             | 1.03                                  | 1.04                              | Load power factor correction and voltage support if needed |
| TAMARACK 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.04             | 1.06                 | 1.03                 | 1.04  | 1.04                             | 1.02                                  | 1.04                              | Load power factor correction and voltage support if needed |
| TAYLOR 60    | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 0.98             | 1.09                 | 1.11                 | 1.05  | 1.06                             | 1.12                                  | 0.98                              | Load power factor correction and voltage support if needed |
| TCHRT_T1 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.01             | 1.05                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| TESLA 115    | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| TESLA &1 230 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.02                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| TESLA C 230  | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.02                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| TESLA D 230  | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.01             | 1.05                 | 1.04                 | 1.02  | 1.02                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |

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High/Low Voltages



| Substation      | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|-----------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|                 |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| TESLA E 230     | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.00             | 1.05                 | 1.04                 | 1.02  | 1.01                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| TH.E.DV. 115    | Base Case                      | P0       | Base Case            | 1.03   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.04                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| TIGR CRK 230    | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 1.01             | 1.06                 | 1.05                 | 1.02  | 1.01                             | 1.06                                  | 1.00                              | Load power factor correction and voltage support if needed |
| TOSCO-PP 60     | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| TRACY 115       | Base Case                      | P0       | Base Case            | 1.02   | 1.02             | 1.00             | 1.04                 | 1.04                 | 1.02  | 1.02                             | 1.04                                  | 1.00                              | Load power factor correction and voltage support if needed |
| TRAVISJT 60     | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 0.99             | 1.04                 | 1.05                 | 1.05  | 1.04                             | 1.05                                  | 0.98                              | Load power factor correction and voltage support if needed |
| TULLOCH 115     | Base Case                      | P0       | Base Case            | 1.04   | 1.03             | 1.02             | 1.05                 | 1.05                 | 1.03  | 1.04                             | 1.06                                  | 1.02                              | Load power factor correction and voltage support if needed |
| UCDAVSJ1 115    | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.06                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| ULTR-RCK 120.75 | Base Case                      | P0       | Base Case            | 1.01   | 1.03             | 1.00             | 1.08                 | 1.06                 | 1.02  | 1.02                             | 1.07                                  | 1.00                              | Load power factor correction and voltage support if needed |
| UOP 60          | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.03             | 1.05                 | 1.06                 | 1.05  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| VACA-CB 115     | Base Case                      | P0       | Base Case            | 1.08   | 1.08             | 1.06             | 1.10                 | 1.10                 | 1.08  | 1.08                             | 1.10                                  | 1.06                              | Load power factor correction and voltage support if needed |
| VACA-D&1 115    | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.02             | 1.08                 | 1.08                 | 1.07  | 1.05                             | 1.08                                  | 1.01                              | Load power factor correction and voltage support if needed |
| VACA-DIX 115    | Base Case                      | P0       | Base Case            | 1.07   | 1.07             | 1.03             | 1.09                 | 1.08                 | 1.07  | 1.07                             | 1.08                                  | 1.02                              | Load power factor correction and voltage support if needed |
| VACA-DXN 60     | Base Case                      | P0       | Base Case            | 1.07   | 1.08             | 1.03             | 1.08                 | 1.09                 | 1.08  | 1.07                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |
| VACAVLL1 115    | Base Case                      | P0       | Base Case            | 1.07   | 1.07             | 1.02             | 1.09                 | 1.09                 | 1.07  | 1.06                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |
| VACAVLL2 115    | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.02             | 1.09                 | 1.09                 | 1.07  | 1.06                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |
| VALLY HM 115    | Base Case                      | P0       | Base Case            | 1.01   | 1.02             | 0.99             | 1.04                 | 1.04                 | 1.01  | 1.02                             | 1.05                                  | 0.99                              | Load power factor correction and voltage support if needed |
| VCVLE1J 115     | Base Case                      | P0       | Base Case            | 1.07   | 1.07             | 1.03             | 1.09                 | 1.09                 | 1.07  | 1.07                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |
| VCVLE2J 115     | Base Case                      | P0       | Base Case            | 1.07   | 1.07             | 1.03             | 1.09                 | 1.09                 | 1.07  | 1.07                             | 1.09                                  | 1.02                              | Load power factor correction and voltage support if needed |

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High/Low Voltages



| Substation   | Contingency (All and Worst P6) | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--------------------------------|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |                                |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| VIERRA 115   | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.05                 | 1.04                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| VLLY SPS 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.05             | 1.04             | 1.05                 | 1.05                 | 1.04  | 1.04                             | 1.05                                  | 1.04                              | Load power factor correction and voltage support if needed |
| VLLY SPS 230 | Base Case                      | P0       | Base Case            | 1.00   | 1.01             | 0.99             | 1.06                 | 1.05                 | 1.01  | 1.00                             | 1.06                                  | 0.99                              | Load power factor correction and voltage support if needed |
| VSLDSW87 60  | Base Case                      | P0       | Base Case            | 1.05   | 1.05             | 1.05             | 1.06                 | 1.05                 | 1.05  | 1.05                             | 1.06                                  | 1.05                              | Load power factor correction and voltage support if needed |
| W.SCRMNO 115 | Base Case                      | P0       | Base Case            | 1.03   | 1.05             | 1.02             | 1.06                 | 1.05                 | 1.04  | 1.05                             | 1.05                                  | 1.02                              | Load power factor correction and voltage support if needed |
| WDLND_BM 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.07                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| WEBER 230    | Base Case                      | P0       | Base Case            | 1.00   | 1.00             | 0.98             | 1.05                 | 1.05                 | 1.00  | 1.00                             | 1.05                                  | 0.98                              | Load power factor correction and voltage support if needed |
| WEC 115      | Base Case                      | P0       | Base Case            | 1.06   | 1.07             | 1.02             | 1.08                 | 1.08                 | 1.07  | 1.05                             | 1.08                                  | 1.01                              | Load power factor correction and voltage support if needed |
| WESCOT1 60   | Base Case                      | P0       | Base Case            | 0.99   | 1.00             | 0.99             | 1.05                 | 1.05                 | 0.99  | 1.03                             | 1.05                                  | 0.98                              | Load power factor correction and voltage support if needed |
| WESCOT2 60   | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 1.02             | 1.05                 | 1.04                 | 1.01  | 1.04                             | 1.04                                  | 1.01                              | Load power factor correction and voltage support if needed |
| WEST PNT 60  | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.07                 | 1.07                 | 1.04  | 1.04                             | 1.07                                  | 1.03                              | Load power factor correction and voltage support if needed |
| WEST SDE 60  | Base Case                      | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.07                 | 1.06                 | 1.03  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| WILKINS 60   | Base Case                      | P0       | Base Case            | 0.92   | 0.92             | 0.94             | 1.11                 | 0.96                 | 0.92  | 0.96                             | 0.96                                  | 0.92                              | Load forecast under review                                 |
| WILLIAMS 60  | Base Case                      | P0       | Base Case            | 1.01   | 1.01             | 1.01             | 1.05                 | 1.05                 | 1.01  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| WILSONAV 60  | Base Case                      | P0       | Base Case            | 0.98   | 0.98             | 0.97             | 1.04                 | 1.08                 | 0.98  | 1.07                             | 1.08                                  | 0.95                              | Load power factor correction and voltage support if needed |
| WINTERS 60   | Base Case                      | P0       | Base Case            | 1.02   | 1.05             | 0.98             | 1.06                 | 1.09                 | 1.05  | 1.04                             | 1.10                                  | 0.95                              | Load power factor correction and voltage support if needed |
| WODLNDJ1 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| WODLNDJ2 115 | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| WOODLD 115   | Base Case                      | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.07                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.00                              | Load power factor correction and voltage support if needed |
| WSTLNE SW 60 | Base Case                      | P0       | Base Case            | 1.04   | 1.04             | 1.03             | 1.05                 | 1.06                 | 1.04  | 1.04                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |



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High/Low Voltages



| Substation      | Contingency (All and Worst P6)                                      | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|-----------------|---|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|                 |   |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| YUBAGOLD 60     | Base Case   | P0       | Base Case            | 1.03   | 1.04             | 1.03             | 1.06                 | 1.05                 | 1.04  | 1.03                             | 1.06                                  | 1.03                              | Load power factor correction and voltage support if needed |
| ZAMORA 115      | Base Case   | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.06                                  | 1.00                              | Load power factor correction and voltage support if needed |
| ZAMORA1 115     | Base Case   | P0       | Base Case            | 1.02   | 1.03             | 1.01             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.05                                  | 1.01                              | Load power factor correction and voltage support if needed |
| ZAMORA2 115     | Base Case   | P0       | Base Case            | 1.02   | 1.03             | 1.00             | 1.08                 | 1.05                 | 1.03  | 1.03                             | 1.06                                  | 1.00                              | Load power factor correction and voltage support if needed |
| APPLE HL 115    | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.05             | 1.00             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.00                              | Load power factor correction and voltage support if needed |
| ATLANTI 60      | P1-2:A5:80:_DEL MAR-ATLANTIC #2 60KV MOAS OPENED ON ATLANTI_DEL MAR | P1       | N-1                  | 1.05   | 1.07             | 1.02             | 1.11                 | 1.10                 | 1.07  | 1.05                             | 1.11                                  | 1.02                              | Load power factor correction and voltage support if needed |
| ATLANTI 60      | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.05             | 0.98             | NA                   | 1.14                 | 1.05  | NA                               | 1.15                                  | 0.98                              | Load power factor correction and voltage support if needed |
| ATLANTIC 115    | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.03             | 0.99             | NA                   | 1.09                 | 1.02  | NA                               | 1.10                                  | 0.99                              | Load power factor correction and voltage support if needed |
| BANTA 60        | P1-3:A11:32:_KASSON 115/60KV TB 1                                   | P1       | N-1                  | 0.98   | 0.98             | 0.89             | 1.01                 | 0.98                 | 0.98  | 1.00                             | 0.99                                  | 0.89                              | Continue to monitor future load forecast                   |
| BELL PGE 115    | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1         | P1       | N-1                  | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.03  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| BELL PGE 115    | P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS      | P1       | N-1                  | 1.02   | 1.03             | 0.97             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.97                              | Load power factor correction and voltage support if needed |
| BELL PGE 115    | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.03             | 0.99             | NA                   | 1.12                 | 1.03  | NA                               | 1.13                                  | 0.99                              | Load power factor correction and voltage support if needed |
| CARBONA 60      | P1-3:A11:32:_KASSON 115/60KV TB 1                                   | P1       | N-1                  | 0.96   | 0.96             | 0.87             | 1.01                 | 0.97                 | 0.95  | 0.98                             | 0.98                                  | 0.87                              | Continue to monitor future load forecast                   |
| CHCGO PK 115    | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1         | P1       | N-1                  | 1.03   | 1.04             | 1.01             | 1.12                 | 1.11                 | 1.04  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CLRKSVLE 115    | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.05             | 1.01             | NA                   | 1.14                 | 1.05  | NA                               | 1.15                                  | 1.00                              | Load power factor correction and voltage support if needed |
| CPM 115         | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.06             | 1.02             | NA                   | 1.14                 | 1.06  | NA                               | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CROWCREEK SS 60 | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV                               | P1       | N-1                  | 0.92   | 0.92             | 0.88             | 1.09                 | 1.11                 | 0.92  | 1.05                             | 1.11                                  | 0.88                              | Continue to monitor future load forecast                   |
| DEL MAR 60      | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.04             | 0.96             | NA                   | 1.14                 | 1.04  | NA                               | 1.15                                  | 0.96                              | Load power factor correction and voltage support if needed |
| DIMOND_1 115    | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.06             | 1.01             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.01                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation    | Contingency (All and Worst P6)                                      | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|---------------|---|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|               |   |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| DIMOND_2 115  | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.05             | 1.00             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DIST2047 60   | P1-3:A4:25:_CORTINA 115/60KV TB 5                                   | P1       | N-1                  | 0.94   | 0.94             | 0.90             | 1.16                 | 0.95                 | 0.94  | 0.95                             | 0.95                                  | 0.88                              | Continue to monitor future load forecast                   |
| DMND SPR 115  | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.05             | 1.00             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.00                              | Load power factor correction and voltage support if needed |
| DTCH FL1 115  | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1         | P1       | N-1                  | 1.03   | 1.03             | 1.01             | 1.12                 | 1.11                 | 1.03  | 1.03                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115  | P1-2:A5:26:_RIO OSO-NICOLAUS 115KV                                  | P1       | N-1                  | 1.03   | 1.05             | 0.98             | 1.09                 | 1.10                 | 1.05  | 1.02                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115  | P1-2:A5:38:_PALERMO-NICOLAUS 115KV MOAS OPENED ON E.MRY J2_E.NICOLS | P1       | N-1                  | 1.05   | 1.07             | 1.02             | 1.09                 | 1.09                 | 1.07  | 1.02                             | 1.10                                  | 1.02                              | Load power factor correction and voltage support if needed |
| E.NICOLS 115  | P1-2:A5:26:_RIO OSO-NICOLAUS 115KV                                  | P1       | N-1                  | 1.02   | 1.04             | 0.96             | 1.09                 | 1.11                 | 1.04  | 1.02                             | 1.12                                  | 0.96                              | Load power factor correction and voltage support if needed |
| ELDORAD 115   | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.05             | 1.01             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.01                              | Load power factor correction and voltage support if needed |
| FLINT 115     | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1         | P1       | N-1                  | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| FLINT 115     | P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS      | P1       | N-1                  | 1.02   | 1.04             | 0.98             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.98                              | Load power factor correction and voltage support if needed |
| FLINT 115     | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.04             | 1.00             | NA                   | 1.12                 | 1.04  | NA                               | 1.14                                  | 1.00                              | Load power factor correction and voltage support if needed |
| FRONTIERPV 60 | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV                               | P1       | N-1                  | 0.92   | 0.92             | 0.88             | 1.09                 | 1.11                 | 0.92  | 1.06                             | 1.11                                  | 0.88                              | Continue to monitor future load forecast                   |
| GOLDHILL 115  | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                  | NA   | 1.06             | 1.02             | NA                   | 1.14                 | 1.06  | NA                               | 1.15                                  | 1.02                              | Load power factor correction and voltage support if needed |
| GUSTINE 60    | P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ | P1       | N-1                  | 0.93   | 0.92             | 0.87             | 1.05                 | 1.07                 | 0.91  | 1.00                             | 1.07                                  | 0.87                              | Continue to monitor future load forecast                   |
| GUSTINE 60    | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV                               | P1       | N-1                  | 0.89   | 0.89             | 0.85             | 1.06                 | 1.08                 | 0.89  | 1.01                             | 1.09                                  | 0.85                              | Load forecast under review                                 |
| GUSTINE 60    | P1-2:A12:17:_NEWMAN-CROWCREEK SS 60KV                               | P1       | N-1                  | 0.93   | 0.92             | 0.86             | 1.04                 | 1.06                 | 0.91  | 0.99                             | 1.07                                  | 0.86                              | Continue to monitor future load forecast                   |
| HIGGINS 115   | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1         | P1       | N-1                  | 1.02   | 1.03             | 0.99             | 1.13                 | 1.12                 | 1.03  | 1.03                             | 1.15                                  | 0.99                              | Load power factor correction and voltage support if needed |
| HIGGINS 115   | P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS      | P1       | N-1                  | 1.01   | 1.03             | 0.97             | 1.14                 | 1.13                 | 1.02  | 1.03                             | 1.14                                  | 0.97                              | Load power factor correction and voltage support if needed |

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High/Low Voltages



| Substation   | Contingency (All and Worst P6)                                       | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions  |
|--------------|--|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|---|
|              |  |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |   |
| HORSESHE 115 | P1-4:A5:7:_RIO OSO SVD=V   | P1       | N-1                  | NA   | 1.05             | 1.01             | NA                   | 1.13                 | 1.04  | NA                               | 1.15                                  | 1.00                              | Load power factor correction and voltage support if needed  |
| KASSON 60    | P1-3:A11:32:_KASSON 115/60KV TB 1                                    | P1       | N-1                  | 0.98   | 0.98             | 0.90             | 1.01                 | 0.98                 | 0.98  | 1.00                             | 0.99                                  | 0.90                              | Continue to monitor future load forecast  |
| LOCKFORD 230 | P1-2:A11:4:_LOCKEFORD-BELLOTA 230KV                                  | P1       | N-1                  | 0.88   | 0.90             | 0.97             | 0.98                 | 0.97                 | 0.90  | 0.90                             | 0.98                                  | 0.97                              | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
| LYOTH-SP 60  | P1-3:A11:32:_KASSON 115/60KV TB 1                                    | P1       | N-1                  | 0.98   | 0.98             | 0.89             | 1.01                 | 0.98                 | 0.98  | 1.00                             | 0.99                                  | 0.89                              | Continue to monitor future load forecast  |
| MARTELL 60   | P1-2:A11:68:_VALLEY SPRINGS-MARTELL #1 60KV                          | P1       | N-1                  | 1.02   | 1.03             | 0.98             | 1.07                 | 1.07                 | 1.02  | 1.02                             | 1.08                                  | 0.93                              | Load power factor correction and voltage support if needed  |
| NEWCSTLE 115 | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1          | P1       | N-1                  | 1.03   | 1.04             | 1.00             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 1.00                              | Load power factor correction and voltage support if needed  |
| NEWCSTLE 115 | P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS       | P1       | N-1                  | 1.02   | 1.04             | 0.99             | 1.13                 | 1.13                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed  |
| NEWCSTLE 115 | P1-4:A5:7:_RIO OSO SVD=V   | P1       | N-1                  | NA   | 1.04             | 1.00             | NA                   | 1.13                 | 1.04  | NA                               | 1.14                                  | 1.00                              | Load power factor correction and voltage support if needed  |
| NEWMAN 60    | P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON CRWS LDG_CRWS LDJ  | P1       | N-1                  | 0.94   | 0.94             | 0.88             | 1.06                 | 1.07                 | 0.93  | 1.01                             | 1.08                                  | 0.88                              | Continue to monitor future load forecast  |
| NEWMAN 60    | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV                                | P1       | N-1                  | 0.93   | 0.92             | 0.89             | 1.06                 | 1.08                 | 0.92  | 1.03                             | 1.09                                  | 0.89                              | Continue to monitor future load forecast  |
| NEWMAN 60    | P1-2:A12:17:_NEWMAN-CROWCREEK SS 60KV                                | P1       | N-1                  | 0.94   | 0.93             | 0.88             | 1.04                 | 1.06                 | 0.93  | 1.01                             | 1.07                                  | 0.88                              | Continue to monitor future load forecast  |
| NEWMAN 60    | P1-2:A12:18:_ 60KV   | P1       | N-1                  | 0.94   | 0.93             | 0.88             | 1.05                 | 1.06                 | 0.92  | 1.00                             | 1.07                                  | 0.88                              | Continue to monitor future load forecast  |
| OLIVHRST 115 | P1-2:A5:39:_PEASE-RIO OSO 115KV MOAS OPENED ON OLIVH J1_E.MRY J1 (2) | P1       | N-1                  | 1.02   | 1.03             | 1.01             | 1.09                 | 1.06                 | 1.03  | 1.02                             | 1.07                                  | 1.01                              | Load power factor correction and voltage support if needed  |
| PLACER 115   | P1-2:A5:33:_DRUM-HIGGINS 115KV MOAS OPENED ON DRUM_DTCH FL1          | P1       | N-1                  | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed  |
| PLACER 115   | P1-2:A5:34:_DRUM-HIGGINS 115KV MOAS OPENED ON CHCGO PK_HIGGINS       | P1       | N-1                  | 1.02   | 1.03             | 0.98             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.98                              | Load power factor correction and voltage support if needed  |
| PLACER 115   | P1-4:A5:7:_RIO OSO SVD=V   | P1       | N-1                  | NA   | 1.04             | 0.99             | NA                   | 1.12                 | 1.03  | NA                               | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed  |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)                                      | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|---|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |   |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| PLCRVLB2 115 | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                    | NA   | 1.05             | 1.00             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.00                              | Load power factor correction and voltage support if needed |
| PLCRVLB3 115 | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                    | NA   | 1.05             | 1.00             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.00                              | Load power factor correction and voltage support if needed |
| RIPON 115    | P1-2:A11:42:_MANTECA-RIPON 115KV                                    | P1       | N-1                    | 0.95   | 0.94             | 0.89             | 1.05                 | 1.05                 | 0.93  | 0.98                             | 1.06                                  | 0.89                              | Continue to monitor future load forecast                   |
| ROCKLIN 60   | P1-2:A5:80:_DEL MAR-ATLANTIC #2 60KV MOAS OPENED ON ATLANTI_DEL MAR | P1       | N-1                    | 1.05   | 1.07             | 1.02             | 1.11                 | 1.10                 | 1.07  | 1.06                             | 1.11                                  | 1.01                              | Load power factor correction and voltage support if needed |
| ROCKLIN 60   | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                    | NA   | 1.05             | 0.98             | NA                   | 1.14                 | 1.05  | NA                               | 1.15                                  | 0.98                              | Load power factor correction and voltage support if needed |
| SHPRING 115  | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                    | NA   | 1.06             | 1.01             | NA                   | 1.14                 | 1.05  | NA                               | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed |
| SIERRAPI 60  | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                    | NA   | 1.04             | 0.96             | NA                   | 1.14                 | 1.04  | NA                               | 1.15                                  | 0.96                              | Load power factor correction and voltage support if needed |
| SPICAMIN 115 | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                    | NA   | 1.05             | 1.01             | NA                   | 1.14                 | 1.05  | NA                               | 1.16                                  | 1.00                              | Load power factor correction and voltage support if needed |
| TAYLOR 60    | P1-2:A5:80:_DEL MAR-ATLANTIC #2 60KV MOAS OPENED ON ATLANTI_DEL MAR | P1       | N-1                    | 1.05   | 1.07             | 1.02             | 1.11                 | 1.10                 | 1.07  | 1.06                             | 1.11                                  | 1.02                              | Load power factor correction and voltage support if needed |
| TAYLOR 60    | P1-4:A5:7:_RIO OSO SVD=V  | P1       | N-1                    | NA   | 1.05             | 0.98             | NA                   | 1.14                 | 1.05  | NA                               | 1.15                                  | 0.98                              | Load power factor correction and voltage support if needed |
| WESTLEY 60   | P1-2:A11:54:_SCHULTE SW STA-LAMMERS 115KV                           | P1       | N-1                    | 0.89   | 0.92             | 0.88             | 1.01                 | 1.02                 | 0.92  | 0.93                             | 1.02                                  | 0.88                              | Continue to monitor future load forecast                   |
| WESTLEY 60   | P1-2:A11:55:_GWFTRACY-SCHULTE #1 115KV                              | P1       | N-1                    | 0.91   | 0.93             | 0.87             | 1.01                 | 1.02                 | 0.92  | 0.93                             | 1.02                                  | 0.87                              | Continue to monitor future load forecast                   |
| WESTLEY 60   | P1-3:A11:31:_MANTECA 115/60KV TB 3                                  | P1       | N-1                    | 0.91   | 0.92             | 0.86             | 1.01                 | 1.02                 | 0.91  | 0.93                             | 1.03                                  | 0.86                              | Continue to monitor future load forecast                   |
| WESTLEY 60   | P1-3:A11:32:_KASSON 115/60KV TB 1                                   | P1       | N-1                    | 0.91   | 0.92             | 0.86             | 1.00                 | 0.99                 | 0.91  | 0.93                             | 1.00                                  | 0.86                              | Continue to monitor future load forecast                   |
| WILKINS 60   | P1-3:A4:25:_CORTINA 115/60KV TB 5                                   | P1       | N-1                    | 0.95   | 0.96             | 0.91             | 1.11                 | 0.97                 | 0.95  | 0.97                             | 0.97                                  | 0.90                              | Sensitivity only   |
| AMERIGAS 115 | P2-2:A4:7:_VACA-DIX 230KV SECTION NA                                | P2-2     | Bus                    | 1.07   | 1.07             | 1.01             | 1.10                 | 1.10                 | 1.07  | 1.07                             | 1.10                                  | 1.00                              | Sensitivity only   |
| APPLE HL 115 | P2-1:A5:10:_MISSOURI FLAT-GOLD HILL #1 115KV (GOLDHILL-CPM TAP)     | P2-1     | Line Section w/o Fault | 1.04   | 1.02             | 0.92             | 1.12                 | 1.14                 | 1.02  | 1.05                             | 1.15                                  | 0.92                              | Load power factor correction and voltage support if needed |
| APPLE HL 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.48                             | 1.22                                  | 0.37                              | SPS Recommended in 2018-2019 TPP                           |
| BELL PGE 115 | P2-1:A5:24:_DRUM-HIGGINS 115KV (DRUM-DTCH FL1)                      | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.03  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |



Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)                             | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |  |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| BELL PGE 115 | P2-1:A5:27:_DRUM-HIGGINS 115KV (DTCH FL1-CHCGO PK)         | P2-1     | Line Section w/o Fault | 1.02   | 1.03             | 0.98             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.98                              | Load power factor correction and voltage support if needed |
| BELL PGE 115 | P2-1:A5:28:_DRUM-HIGGINS 115KV (CHCGO PK-HIGGINS)          | P2-1     | Line Section w/o Fault | 1.02   | 1.03             | 0.97             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.97                              | Load power factor correction and voltage support if needed |
| BELL PGE 115 | P2-1:A5:34:_HIGGINS-BELL 115KV (HIGGINS-BELL PGE)          | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 0.98             | 1.13                 | 1.12                 | 1.04  | 1.04                             | 1.13                                  | 0.98                              | Load power factor correction and voltage support if needed |
| BELL PGE 115 | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3                  | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 0.99             | 1.12                 | 1.12                 | 1.03  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| BELL PGE 115 | P2-3:A5:86:_BRNSWALT 115KV - RING R3 & R6                  | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.03  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| BELL PGE 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.45             | 1.19                 | 1.15                 | Diverge   | 0.52                             | 1.18                                  | 0.45                              | SPS Recommended in 2018-2019 TPP                           |
| BELL PGE 115 | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F                | P2-4     | Bus-Tie Breaker        | 0.88   | 0.90             | 0.57             | 1.13                 | 1.08                 | 0.88  | 0.95                             | 1.10                                  | 0.58                              | SPS Recommended in 2018-2019 TPP                           |
| BELLOTA 115  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                | P2-4     | Bus-Tie Breaker        | 0.60   | 0.55             | NA               | 1.04                 | 1.09                 | 0.59  | 0.89                             | 1.10                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |
| CAMANCH 230  | P2-1:A11:2:_RANCHO SECO-BELLOTA #2 230KV (CAMANCH-BELLOTA) | P2-1     | Line Section w/o Fault | 1.01   | 1.01             | 1.01             | 1.14                 | 1.13                 | 1.01  | 1.01                             | 1.14                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CAMANCH 230  | P2-2:A11:10:_BELLOTA 230KV SECTION 2D                      | P2-2     | Bus                    | 1.01   | 1.01             | 1.01             | 1.14                 | 1.14                 | 1.01  | 1.01                             | 1.14                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CAMANCH 230  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                | P2-4     | Bus-Tie Breaker        | 1.01   | 1.01             | NA               | 1.10                 | 1.09                 | 1.01  | 1.01                             | 1.09                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |
| CAMANCH 230  | P2-4:A11:3:_BELLOTA 230KV - SECTION 2E & 2D                | P2-4     | Bus-Tie Breaker        | 1.01   | 1.02             | 1.00             | 1.14                 | 1.14                 | 1.01  | 1.01                             | 1.14                                  | 1.00                              | SPS Recommended in 2018-2019 TPP                           |
| CAMANCH 230  | P2-4:A11:4:_BELLOTA 230KV - SECTION 1D & 2D                | P2-4     | Bus-Tie Breaker        | 1.02   | 1.02             | 1.01             | 1.30                 | 1.28                 | 1.02  | 1.02                             | 1.30                                  | 1.01                              | SPS Recommended in 2018-2019 TPP                           |
| CAMANCHE 115 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                | P2-4     | Bus-Tie Breaker        | 0.60   | 0.55             | NA               | 1.04                 | 1.09                 | 0.58  | 0.89                             | 1.10                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |
| CAMANCPP 230 | P2-1:A11:2:_RANCHO SECO-BELLOTA #2 230KV (CAMANCH-BELLOTA) | P2-1     | Line Section w/o Fault | 1.01   | 1.01             | 1.01             | 1.14                 | 1.13                 | 1.01  | 1.01                             | 1.14                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CAMANCPP 230 | P2-2:A11:10:_BELLOTA 230KV SECTION 2D                      | P2-2     | Bus                    | 1.01   | 1.01             | 1.01             | 1.14                 | 1.14                 | 1.01  | 1.01                             | 1.14                                  | 1.01                              | Load power factor correction and voltage support if needed |
| CAMANCPP 230 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                | P2-4     | Bus-Tie Breaker        | 1.01   | 1.01             | NA               | 1.10                 | 1.09                 | 1.01  | 1.01                             | 1.09                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |



Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)                                      | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--------------|---|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |   |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| CAMANCPP 230 | P2-4:A11:3:_BELLOTA 230KV - SECTION 2E & 2D                         | P2-4     | Bus-Tie Breaker        | 1.01   | 1.02             | 1.00             | 1.14                 | 1.14                 | 1.01  | 1.01                             | 1.14                                  | 1.00                              | SPS Recommended in 2018-2019 TPP   |
| CAMANCPP 230 | P2-4:A11:4:_BELLOTA 230KV - SECTION 1D & 2D                         | P2-4     | Bus-Tie Breaker        | 1.02   | 1.02             | 1.01             | 1.30                 | 1.28                 | 1.02  | 1.02                             | 1.30                                  | 1.01                              | SPS Recommended in 2018-2019 TPP   |
| CATARACT 115 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.87   | 0.86             | NA               | 1.06                 | 1.06                 | 0.87  | 1.01                             | 1.07                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| CDCRSTN 115  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.57   | 0.52             | NA               | 1.03                 | 1.08                 | 0.56  | 0.86                             | 1.09                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| CH.STN 115   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.82   | 0.80             | NA               | 1.05                 | 1.06                 | 0.82  | 0.98                             | 1.07                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| CH.STN 115   | P2-4:A11:10:_TESLA 115KV - SECTION 2D & 1D                          | P2-4     | Bus-Tie Breaker        | 0.87   | 1.01             | -1.75            | 0.97                 | 0.88                 | 0.80  | -1.15                            | 0.87                                  | -1.75                             | SPS Recommended in 2018-2019 TPP   |
| CH.STN 115   | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E                        | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.78             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.79                              | SPS Recommended in 2018-2019 TPP   |
| CHCGO PK 115 | P2-1:A5:24:_DRUM-HIGGINS 115KV (DRUM-DTCH FL1)                      | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 1.01             | 1.12                 | 1.11                 | 1.04  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed                                     |
| CHCGO PK 115 | P2-1:A5:27:_DRUM-HIGGINS 115KV (DTCH FL1-CHCGO PK)                  | P2-1     | Line Section w/o Fault | 1.02   | 1.03             | 0.97             | 1.15                 | 1.13                 | 1.03  | 1.03                             | 1.15                                  | 0.97                              | Load power factor correction and voltage support if needed                                     |
| CHCGO PK 115 | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3                           | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 1.01             | 1.12                 | 1.11                 | 1.04  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed                                     |
| CHCGO PK 115 | P2-3:A5:86:_BRNSWALT 115KV - RING R3 & R6                           | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 1.01             | 1.12                 | 1.11                 | 1.04  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed                                     |
| CHCGO PK 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.72             | 1.14                 | 1.10                 | Diverge   | 0.74                             | 1.11                                  | 0.72                              | SPS Recommended in 2018-2019 TPP   |
| CHCGO PK 115 | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F                         | P2-4     | Bus-Tie Breaker        | 0.96   | 0.98             | 0.78             | 1.11                 | 1.06                 | 0.97  | 1.01                             | 1.07                                  | 0.79                              | SPS Recommended in 2018-2019 TPP   |
| CL AMMNA 115 | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE | P2-3     | Non-Bus-Tie Breaker    | 0.90   | 1.01             | 0.94             | 1.03                 | 1.04                 | 1.01  | 0.99                             | 1.04                                  | 0.94                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| CLRKSVLE 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.36             | 1.22                 | 1.18                 | Diverge   | 0.45                             | 1.22                                  | 0.37                              | SPS Recommended in 2018-2019 TPP   |
| CORDELIA 115 | P2-2:A4:7:_VACA-DIX 230KV SECTION NA                                | P2-2     | Bus                    | 1.06   | 1.07             | 0.99             | 1.10                 | 1.10                 | 1.07  | 1.06                             | 1.10                                  | 0.99                              | Sensitivity only   |
| CORTINA 230  | P2-3:A4:49:_CORTINA 230KV - RING R2 & R3                            | P2-3     | Non-Bus-Tie Breaker    | 0.94   | 0.93             | 0.89             | 1.02                 | 0.99                 | 0.93  | 0.98                             | 1.00                                  | 0.89                              | Continue to monitor future load forecast   |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)                                  | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|---|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |   |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| CPM 115      | P2-1:A5:10:_MISSOURI FLAT-GOLD HILL #1 115KV (GOLDHILL-CPM TAP) | P2-1     | Line Section w/o Fault | 1.04   | 1.01             | 0.90             | 1.12                 | 1.14                 | 1.01  | 1.05                             | 1.16                                  | 0.90                              | Load power factor correction and voltage support if needed |
| CPM 115      | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                     | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.46                             | 1.21                                  | 0.38                              | SPS Recommended in 2018-2019 TPP                           |
| CURTISS 115  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                     | P2-4     | Bus-Tie Breaker        | 0.85   | 0.83             | NA               | 1.04                 | 1.06                 | 0.85  | 0.98                             | 1.06                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |
| CURTISS 115  | P2-4:A11:10:_TESLA 115KV - SECTION 2D & 1D                      | P2-4     | Bus-Tie Breaker        | 0.90   | 1.00             | -1.72            | 0.98                 | 0.91                 | 0.83  | -1.13                            | 0.90                                  | -1.72                             | SPS Recommended in 2018-2019 TPP                           |
| CURTISS 115  | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E                    | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.81             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.81                              | SPS Recommended in 2018-2019 TPP                           |
| DIMOND_1 115 | P2-1:A5:10:_MISSOURI FLAT-GOLD HILL #1 115KV (GOLDHILL-CPM TAP) | P2-1     | Line Section w/o Fault | 1.04   | 1.01             | 0.91             | 1.12                 | 1.14                 | 1.01  | 1.05                             | 1.16                                  | 0.91                              | Load power factor correction and voltage support if needed |
| DIMOND_1 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                     | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.36             | 1.22                 | 1.18                 | Diverge   | 0.47                             | 1.22                                  | 0.37                              | SPS Recommended in 2018-2019 TPP                           |
| DIMOND_2 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                     | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.46                             | 1.22                                  | 0.37                              | SPS Recommended in 2018-2019 TPP                           |
| DMND SPR 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                     | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.46                             | 1.22                                  | 0.37                              | SPS Recommended in 2018-2019 TPP                           |
| DRUM 115     | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                     | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.87             | 1.11                 | 1.07                 | Diverge   | 0.87                             | 1.08                                  | 0.87                              | SPS Recommended in 2018-2019 TPP                           |
| DRUM 1M 115  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F                     | P2-4     | Bus-Tie Breaker        | 0.96   | 0.97             | 0.87             | 0.99                 | 0.98                 | 0.96  | 0.98                             | 0.98                                  | 0.87                              | SPS Recommended in 2018-2019 TPP                           |
| DRUM 2M 115  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F                     | P2-4     | Bus-Tie Breaker        | 0.96   | 0.97             | 0.87             | 1.00                 | 0.98                 | 0.96  | 0.98                             | 0.98                                  | 0.87                              | SPS Recommended in 2018-2019 TPP                           |
| DTCH FL1 115 | P2-1:A5:24:_DRUM-HIGGINS 115KV (DRUM-DTCH FL1)                  | P2-1     | Line Section w/o Fault | 1.03   | 1.03             | 1.01             | 1.12                 | 1.11                 | 1.03  | 1.03                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed |
| DTCH FL1 115 | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3                       | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.03             | 1.01             | 1.12                 | 1.11                 | 1.03  | 1.03                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed |
| DTCH FL1 115 | P2-3:A5:86:_BRNSWALT 115KV - RING R3 & R6                       | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.03             | 1.01             | 1.12                 | 1.11                 | 1.03  | 1.03                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed |
| DTCH FL1 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                     | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.79             | 1.13                 | 1.08                 | Diverge   | 0.80                             | 1.10                                  | 0.79                              | SPS Recommended in 2018-2019 TPP                           |
| DTCH FL1 115 | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F                     | P2-4     | Bus-Tie Breaker        | 0.98   | 0.99             | 0.84             | 1.10                 | 1.05                 | 0.98  | 1.02                             | 1.06                                  | 0.84                              | SPS Recommended in 2018-2019 TPP                           |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)                              | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|---|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |   |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| E.MRYSVE 115 | P2-1:A5:13:_PALERMO-NICOLAUS 115KV (E.MRYSVE-E.MRY J2)      | P2-1     | Line Section w/o Fault | NA   | 1.12             | 0.88             | NA                   | 1.14                 | 1.12  | NA                               | 1.14                                  | 0.88                              | Continue to monitor future load forecast                   |
| E.MRYSVE 115 | P2-2:A5:10:_RIO OSO 115KV SECTION 2D                        | P2-2     | Bus                    | 1.03   | 1.05             | 0.98             | 1.09                 | 1.10                 | 1.05  | 1.02                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115 | P2-3:A5:15:_RIO OSO - 2D 115KV & BOGUE-RIO OSO LINE         | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.05             | 0.98             | 1.09                 | 1.10                 | 1.05  | 1.02                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115 | P2-3:A5:16:_RIO OSO - 2D 115KV & RIO OSO-WOODLAND #2 LINE   | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.05             | 0.98             | 1.09                 | 1.10                 | 1.05  | 1.02                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115 | P2-3:A5:17:_RIO OSO - 2D 115KV & RIO OSO-DRUM-BRUNSWCK LINE | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.05             | 0.98             | 1.09                 | 1.10                 | 1.05  | 1.02                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115 | P2-3:A5:80:_E.NICOLS 115KV - RING R1 & R2                   | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.05             | 0.98             | 1.09                 | 1.10                 | 1.05  | 1.02                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed |
| E.MRYSVE 115 | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D                  | P2-4     | Bus-Tie Breaker        | 1.03   | 1.05             | 0.95             | 1.09                 | 1.11                 | 1.04  | 1.01                             | 1.11                                  | 0.95                              | SPS Recommended in 2018-2019 TPP                           |
| E.NICOLS 115 | P2-2:A5:10:_RIO OSO 115KV SECTION 2D                        | P2-2     | Bus                    | 1.02   | 1.04             | 0.95             | 1.10                 | 1.11                 | 1.04  | 1.01                             | 1.12                                  | 0.95                              | Load power factor correction and voltage support if needed |
| E.NICOLS 115 | P2-3:A5:15:_RIO OSO - 2D 115KV & BOGUE-RIO OSO LINE         | P2-3     | Non-Bus-Tie Breaker    | 1.02   | 1.04             | 0.95             | 1.09                 | 1.11                 | 1.04  | 1.01                             | 1.12                                  | 0.95                              | Load power factor correction and voltage support if needed |
| E.NICOLS 115 | P2-3:A5:16:_RIO OSO - 2D 115KV & RIO OSO-WOODLAND #2 LINE   | P2-3     | Non-Bus-Tie Breaker    | 1.02   | 1.04             | 0.96             | 1.09                 | 1.11                 | 1.04  | 1.01                             | 1.12                                  | 0.95                              | Load power factor correction and voltage support if needed |
| E.NICOLS 115 | P2-3:A5:17:_RIO OSO - 2D 115KV & RIO OSO-DRUM-BRUNSWCK LINE | P2-3     | Non-Bus-Tie Breaker    | 1.02   | 1.04             | 0.95             | 1.10                 | 1.11                 | 1.04  | 1.01                             | 1.12                                  | 0.95                              | Load power factor correction and voltage support if needed |
| E.NICOLS 115 | P2-3:A5:80:_E.NICOLS 115KV - RING R1 & R2                   | P2-3     | Non-Bus-Tie Breaker    | 1.02   | 1.04             | 0.96             | 1.09                 | 1.11                 | 1.04  | 1.02                             | 1.12                                  | 0.96                              | Load power factor correction and voltage support if needed |
| E.NICOLS 115 | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D                  | P2-4     | Bus-Tie Breaker        | 1.02   | 1.04             | 0.92             | 1.09                 | 1.11                 | 1.03  | 1.01                             | 1.12                                  | 0.92                              | SPS Recommended in 2018-2019 TPP                           |
| ELDORAD 115  | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                 | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.48                             | 1.22                                  | 0.38                              | SPS Recommended in 2018-2019 TPP                           |
| FLINT 115    | P2-1:A5:24:_DRUM-HIGGINS 115KV (DRUM-DTCH FL1)              | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-1:A5:27:_DRUM-HIGGINS 115KV (DTCH FL1-CHCGO PK)          | P2-1     | Line Section w/o Fault | 1.02   | 1.04             | 0.98             | 1.14                 | 1.13                 | 1.04  | 1.03                             | 1.14                                  | 0.98                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-1:A5:28:_DRUM-HIGGINS 115KV (CHCGO PK-HIGGINS)           | P2-1     | Line Section w/o Fault | 1.02   | 1.04             | 0.98             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.98                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)                           | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |  |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| FLINT 115    | P2-1:A5:34:_HIGGINS-BELL 115KV (HIGGINS-BELL PGE)        | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.04  | 1.04                             | 1.13                                  | 0.99                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-2:A5:15:_PLACER 115KV SECTION 1D                      | P2-2     | Bus                    | 1.05   | 1.06             | 1.03             | 1.12                 | 1.12                 | 1.06  | 1.05                             | 1.13                                  | 1.03                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-3:A5:24:_PLACER - 1D 115KV & PLACER-GOLD HILL #1 LINE | P2-3     | Non-Bus-Tie Breaker    | 1.04   | 1.06             | 1.01             | 1.12                 | 1.12                 | 1.05  | 1.03                             | 1.13                                  | 1.01                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-3:A5:26:_PLACER - 1D 115KV & BELL-PLACER LINE         | P2-3     | Non-Bus-Tie Breaker    | 1.05   | 1.06             | 1.03             | 1.12                 | 1.12                 | 1.06  | 1.05                             | 1.13                                  | 1.03                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3                | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 0.99             | 1.12                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-3:A5:86:_BRNSWALT 115KV - RING R3 & R6                | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| FLINT 115    | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D              | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.42             | 1.20                 | 1.16                 | Diverge   | 0.50                             | 1.19                                  | 0.43                              | SPS Recommended in 2018-2019 TPP                           |
| FLINT 115    | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F              | P2-4     | Bus-Tie Breaker        | 0.88   | 0.90             | 0.56             | 1.13                 | 1.08                 | 0.88  | 0.95                             | 1.10                                  | 0.57                              | SPS Recommended in 2018-2019 TPP                           |
| FROGTOWN 115 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E              | P2-4     | Bus-Tie Breaker        | 0.85   | 0.84             | NA               | 1.06                 | 1.07                 | 0.85  | 0.99                             | 1.07                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |
| GLEAF 1 115  | P2-4:A5:5:_RIO OSO 115KV - SECTION 2D & 1D               | P2-4     | Bus-Tie Breaker        | 1.01   | 1.02             | 1.00             | 1.09                 | 1.08                 | 1.02  | 1.01                             | 1.10                                  | 1.00                              | SPS Recommended in 2018-2019 TPP                           |
| GOLDHILL 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D              | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.46                             | 1.21                                  | 0.38                              | SPS Recommended in 2018-2019 TPP                           |
| HALE 115     | P2-2:A4:7:_VACA-DIX 230KV SECTION NA                     | P2-2     | Bus                    | 1.06   | 1.07             | 0.99             | 1.10                 | 1.10                 | 1.07  | 1.06                             | 1.10                                  | 0.98                              | Sensitivity only   |
| HALE2 115    | P2-2:A4:7:_VACA-DIX 230KV SECTION NA                     | P2-2     | Bus                    | 1.06   | 1.07             | 0.99             | 1.10                 | 1.10                 | 1.07  | 1.06                             | 1.10                                  | 0.98                              | Sensitivity only   |
| HIGGINS 115  | P2-1:A5:24:_DRUM-HIGGINS 115KV (DRUM-DTCH FL1)           | P2-1     | Line Section w/o Fault | 1.02   | 1.03             | 0.99             | 1.13                 | 1.12                 | 1.03  | 1.03                             | 1.15                                  | 0.99                              | Load power factor correction and voltage support if needed |
| HIGGINS 115  | P2-1:A5:27:_DRUM-HIGGINS 115KV (DTCH FL1-CHCGO PK)       | P2-1     | Line Section w/o Fault | 1.02   | 1.03             | 0.97             | 1.15                 | 1.13                 | 1.03  | 1.03                             | 1.15                                  | 0.97                              | Load power factor correction and voltage support if needed |
| HIGGINS 115  | P2-1:A5:28:_DRUM-HIGGINS 115KV (CHCGO PK-HIGGINS)        | P2-1     | Line Section w/o Fault | 1.01   | 1.03             | 0.97             | 1.14                 | 1.13                 | 1.02  | 1.03                             | 1.14                                  | 0.97                              | Load power factor correction and voltage support if needed |
| HIGGINS 115  | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3                | P2-3     | Non-Bus-Tie Breaker    | 1.02   | 1.03             | 0.99             | 1.12                 | 1.12                 | 1.03  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |



Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)                                      | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions  |
|--------------|---|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|---|
|              |   |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |   |
| HIGGINS 115  | P2-3:A5:86:_BRNSWALT 115KV - RING R3 & R6                           | P2-3     | Non-Bus-Tie Breaker    | 1.02   | 1.03             | 0.99             | 1.13                 | 1.12                 | 1.03  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed  |
| HIGGINS 115  | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.52             | 1.18                 | 1.13                 | Diverge   | 0.58                             | 1.16                                  | 0.53                              | SPS Recommended in 2018-2019 TPP  |
| HIGGINS 115  | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F                         | P2-4     | Bus-Tie Breaker        | 0.90   | 0.92             | 0.63             | 1.12                 | 1.07                 | 0.90  | 0.97                             | 1.09                                  | 0.64                              | SPS Recommended in 2018-2019 TPP  |
| HJ HEINZ 115 | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE | P2-3     | Non-Bus-Tie Breaker    | 0.90   | 1.01             | 0.94             | 1.03                 | 1.04                 | 1.01  | 0.99                             | 1.04                                  | 0.94                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan                  |
| HORSESHE 115 | P2-1:A5:27:_DRUM-HIGGINS 115KV (DTCH FL1-CHCGO PK)                  | P2-1     | Line Section w/o Fault | 1.03   | 1.05             | 1.00             | 1.13                 | 1.13                 | 1.04  | 1.03                             | 1.14                                  | 1.00                              | Load power factor correction and voltage support if needed  |
| HORSESHE 115 | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.39             | 1.21                 | 1.17                 | Diverge   | 0.46                             | 1.20                                  | 0.39                              | SPS Recommended in 2018-2019 TPP  |
| HORSESHE 115 | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F                         | P2-4     | Bus-Tie Breaker        | 0.87   | 0.89             | 0.54             | 1.13                 | 1.08                 | 0.87  | 0.92                             | 1.10                                  | 0.55                              | SPS Recommended in 2018-2019 TPP  |
| JAMESON 115  | P2-2:A4:7:_VACA-DIX 230KV SECTION NA                                | P2-2     | Bus                    | 1.06   | 1.07             | 0.98             | 1.10                 | 1.10                 | 1.07  | 1.06                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed  |
| LOCKFORD 115 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.59   | 0.54             | NA               | 1.04                 | 1.09                 | 0.57  | 0.88                             | 1.10                                  | NA                                | SPS Recommended in 2018-2019 TPP  |
| LOCKFORD 230 | P2-2:A11:8:_BELLOTA 230KV SECTION 2E                                | P2-2     | Bus                    | 0.88   | 0.90             | 0.97             | 0.98                 | 0.97                 | 0.90  | 0.90                             | 0.98                                  | 0.97                              | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
| LOCKFORD 230 | P2-3:A11:88:_LOCKFORD 230KV - RING R3 & R4                          | P2-3     | Non-Bus-Tie Breaker    | 0.88   | 0.90             | NA               | 0.98                 | 0.97                 | 0.90  | 0.91                             | 0.98                                  | NA                                | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
| LOCKFORD 230 | P2-3:A11:89:_LOCKFORD 230KV - RING R3 & R2                          | P2-3     | Non-Bus-Tie Breaker    | 0.88   | 0.90             | NA               | 0.98                 | 0.97                 | 0.90  | 0.91                             | 0.98                                  | NA                                | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
| LOCKFORD 230 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.87   | 0.89             | NA               | 0.98                 | 0.97                 | 0.89  | 0.90                             | 0.98                                  | NA                                | SPS Recommended in 2018-2019 TPP  |
| LOCKFORD 230 | P2-4:A11:3:_BELLOTA 230KV - SECTION 2E & 2D                         | P2-4     | Bus-Tie Breaker        | 0.88   | 0.90             | 0.96             | 0.99                 | 0.97                 | 0.89  | 0.90                             | 0.98                                  | 0.96                              | SPS Recommended in 2018-2019 TPP  |



Study Area: PG&E Central Valley

High/Low Voltages



| Substation      | Contingency (All and Worst P6)                                      | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|-----------------|---|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|                 |   |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| MADISON 115     | P2-2:A4:7:_VACA-DIX 230KV SECTION NA                                | P2-2     | Bus                    | 1.06   | 1.07             | 1.00             | 1.10                 | 1.10                 | 1.07  | 1.06                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed                                     |
| MANTECA 115     | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE | P2-3     | Non-Bus-Tie Breaker    | 0.89   | 1.01             | 0.93             | 1.03                 | 1.03                 | 1.00  | 0.98                             | 1.03                                  | 0.93                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| MDSNVDSW159 115 | P2-2:A4:7:_VACA-DIX 230KV SECTION NA                                | P2-2     | Bus                    | 1.07   | 1.07             | 1.01             | 1.10                 | 1.10                 | 1.07  | 1.07                             | 1.10                                  | 1.00                              | Sensitivity only   |
| MELONES 115     | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.80   | 0.78             | NA               | 1.05                 | 1.07                 | 0.80  | 0.97                             | 1.07                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| MELONES 115     | P2-4:A11:10:_TESLA 115KV - SECTION 2D & 1D                          | P2-4     | Bus-Tie Breaker        | 0.85   | 1.00             | -1.81            | 0.96                 | 0.86                 | 0.79  | -1.17                            | 0.85                                  | -1.81                             | SPS Recommended in 2018-2019 TPP   |
| MELONES 115     | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E                        | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.77             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.77                              | SPS Recommended in 2018-2019 TPP   |
| MI-WUK 115      | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.89   | 0.88             | NA               | 1.04                 | 1.05                 | 0.89  | 0.99                             | 1.06                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| MI-WUK 115      | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E                        | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.85             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.85                              | SPS Recommended in 2018-2019 TPP   |
| NEWCSTLE 115    | P2-1:A5:24:_DRUM-HIGGINS 115KV (DRUM-DTCH FL1)                      | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 1.00             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 1.00                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-1:A5:27:_DRUM-HIGGINS 115KV (DTCH FL1-CHCGO PK)                  | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 0.99             | 1.14                 | 1.13                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-1:A5:28:_DRUM-HIGGINS 115KV (CHCGO PK-HIGGINS)                   | P2-1     | Line Section w/o Fault | 1.02   | 1.04             | 0.99             | 1.13                 | 1.13                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-2:A5:15:_PLACER 115KV SECTION 1D                                 | P2-2     | Bus                    | 1.05   | 1.06             | 1.03             | 1.12                 | 1.12                 | 1.06  | 1.04                             | 1.13                                  | 1.03                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-3:A5:25:_PLACER - 1D 115KV & PLACER-GOLD HILL #2 LINE            | P2-3     | Non-Bus-Tie Breaker    | 1.05   | 1.06             | 1.03             | 1.12                 | 1.12                 | 1.06  | 1.04                             | 1.13                                  | 1.03                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-3:A5:26:_PLACER - 1D 115KV & BELL-PLACER LINE                    | P2-3     | Non-Bus-Tie Breaker    | 1.05   | 1.06             | 1.03             | 1.12                 | 1.12                 | 1.06  | 1.04                             | 1.13                                  | 1.03                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3                           | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 1.00             | 1.12                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 1.00                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-3:A5:86:_BRNSWALT 115KV - RING R3 & R6                           | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 1.00             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 1.00                              | Load power factor correction and voltage support if needed                                     |
| NEWCSTLE 115    | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.41             | 1.20                 | 1.16                 | Diverge   | 0.49                             | 1.19                                  | 0.41                              | SPS Recommended in 2018-2019 TPP   |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation    | Contingency (All and Worst P6)                     | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|---------------|--|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|               |  |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| NEWCASTLE 115 | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F        | P2-4     | Bus-Tie Breaker        | 0.87   | 0.89             | 0.55             | 1.13                 | 1.08                 | 0.87  | 0.94                             | 1.10                                  | 0.56                              | SPS Recommended in 2018-2019 TPP                           |
| PEORIA 115    | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E        | P2-4     | Bus-Tie Breaker        | 0.81   | 0.80             | NA               | 1.05                 | 1.06                 | 0.81  | 0.97                             | 1.07                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |
| PEORIA 115    | P2-4:A11:10:_TESLA 115KV - SECTION 2D & 1D         | P2-4     | Bus-Tie Breaker        | 0.86   | 1.00             | Diverge          | 0.97                 | 0.87                 | 0.80  | Diverge                          | 0.86                                  | Diverge                           | SPS Recommended in 2018-2019 TPP                           |
| PEORIA 115    | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E       | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.78             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.78                              | SPS Recommended in 2018-2019 TPP                           |
| PLACER 115    | P2-1:A5:24:_DRUM-HIGGINS 115KV (DRUM-DTCH FL1)     | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| PLACER 115    | P2-1:A5:27:_DRUM-HIGGINS 115KV (DTCH FL1-CHCGO PK) | P2-1     | Line Section w/o Fault | 1.02   | 1.04             | 0.98             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.98                              | Load power factor correction and voltage support if needed |
| PLACER 115    | P2-1:A5:28:_DRUM-HIGGINS 115KV (CHCGO PK-HIGGINS)  | P2-1     | Line Section w/o Fault | 1.02   | 1.03             | 0.98             | 1.14                 | 1.13                 | 1.03  | 1.03                             | 1.14                                  | 0.98                              | Load power factor correction and voltage support if needed |
| PLACER 115    | P2-1:A5:34:_HIGGINS-BELL 115KV (HIGGINS-BELL PGE)  | P2-1     | Line Section w/o Fault | 1.03   | 1.04             | 0.98             | 1.13                 | 1.12                 | 1.04  | 1.04                             | 1.13                                  | 0.98                              | Load power factor correction and voltage support if needed |
| PLACER 115    | P2-3:A5:85:_BRNSWALT 115KV - RING R4 & R3          | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 0.99             | 1.12                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| PLACER 115    | P2-3:A5:86:_BRNSWALT 115KV - RING R3 & R6          | P2-3     | Non-Bus-Tie Breaker    | 1.03   | 1.04             | 0.99             | 1.13                 | 1.12                 | 1.04  | 1.03                             | 1.14                                  | 0.99                              | Load power factor correction and voltage support if needed |
| PLACER 115    | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D        | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.43             | 1.20                 | 1.15                 | Diverge   | 0.51                             | 1.18                                  | 0.43                              | SPS Recommended in 2018-2019 TPP                           |
| PLACER 115    | P2-4:A5:3:_GOLDHILL 115KV - SECTION 1F & 2F        | P2-4     | Bus-Tie Breaker        | 0.88   | 0.90             | 0.56             | 1.13                 | 1.08                 | 0.88  | 0.95                             | 1.10                                  | 0.57                              | SPS Recommended in 2018-2019 TPP                           |
| PLCRVLB2 115  | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D        | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.47                             | 1.22                                  | 0.38                              | SPS Recommended in 2018-2019 TPP                           |
| PLCRVLB3 115  | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D        | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.47                             | 1.22                                  | 0.38                              | SPS Recommended in 2018-2019 TPP                           |
| PUTH CRK 115  | P2-2:A4:7:_VACA-DIX 230KV SECTION NA               | P2-2     | Bus                    | 1.07   | 1.07             | 1.01             | 1.10                 | 1.10                 | 1.07  | 1.07                             | 1.10                                  | 1.00                              | Sensitivity only   |
| R.TRACK 115   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E        | P2-4     | Bus-Tie Breaker        | 0.80   | 0.78             | NA               | 1.05                 | 1.07                 | 0.80  | 0.97                             | 1.07                                  | NA                                | SPS Recommended in 2018-2019 TPP                           |
| R.TRACK 115   | P2-4:A11:10:_TESLA 115KV - SECTION 2D & 1D         | P2-4     | Bus-Tie Breaker        | 0.84   | 1.00             | -1.81            | 0.96                 | 0.86                 | 0.78  | -1.17                            | 0.84                                  | -1.82                             | SPS Recommended in 2018-2019 TPP                           |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation    | Contingency (All and Worst P6)                                      | Category | Category Description   | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|---------------|---|----------|------------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|               |   |          |                        | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| R.TRACK 115   | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E                        | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.76             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.77                              | SPS Recommended in 2018-2019 TPP   |
| RIPON 115     | P2-3:A11:19:_KASSON - 1D 115KV & SCHULTE SW STA-KASSON-MANTECA LINE | P2-3     | Non-Bus-Tie Breaker    | 0.90   | 1.00             | 0.93             | 1.03                 | 1.03                 | 1.00  | 0.98                             | 1.03                                  | 0.93                              | Project: Vierra 115 kV Looping Project<br>In-Service Date: Jan 2023<br>Short term: Action plan |
| RVRBANK 115   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.62   | 0.58             | NA               | 1.04                 | 1.10                 | 0.61  | 0.90                             | 1.10                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| RVRBANK 115   | P2-4:A11:13:_BELLOTA 115KV - SECTION 1D & 2D                        | P2-4     | Bus-Tie Breaker        | 1.02   | 1.02             | 0.95             | 1.05                 | 1.11                 | 1.01  | 1.03                             | 1.11                                  | 0.95                              | SPS Recommended in 2018-2019 TPP   |
| RVRBANK 115   | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E                        | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.56             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.56                              | SPS Recommended in 2018-2019 TPP   |
| SHPRING 115   | P2-1:A5:10:_MISSOURI FLAT-GOLD HILL #1 115KV (GOLDHILL-CPM TAP)     | P2-1     | Line Section w/o Fault | 1.03   | 1.01             | 0.90             | 1.12                 | 1.14                 | 1.01  | 1.04                             | 1.16                                  | 0.90                              | Load power factor correction and voltage support if needed                                     |
| SHPRING 115   | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.36             | 1.22                 | 1.18                 | Diverge   | 0.46                             | 1.22                                  | 0.37                              | SPS Recommended in 2018-2019 TPP   |
| SPICAMIN 115  | P2-1:A5:10:_MISSOURI FLAT-GOLD HILL #1 115KV (GOLDHILL-CPM TAP)     | P2-1     | Line Section w/o Fault | 1.04   | 1.02             | 0.92             | 1.12                 | 1.14                 | 1.02  | 1.05                             | 1.15                                  | 0.92                              | Sensitivity only   |
| SPICAMIN 115  | P2-4:A5:2:_GOLDHILL 230KV - SECTION 2D & 1D                         | P2-4     | Bus-Tie Breaker        | Diverge  | Diverge          | 0.37             | 1.22                 | 1.18                 | Diverge   | 0.48                             | 1.22                                  | 0.37                              | SPS Recommended in 2018-2019 TPP   |
| SPISONORA 115 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.85   | 0.84             | NA               | 1.04                 | 1.06                 | 0.85  | 0.98                             | 1.06                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| SPISONORA 115 | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E                        | P2-4     | Bus-Tie Breaker        | NA   | NA               | 0.81             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.81                              | SPS Recommended in 2018-2019 TPP   |
| STANISLS 115  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.87   | 0.86             | NA               | 1.06                 | 1.07                 | 0.88  | 1.01                             | 1.07                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| STKTON A 115  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.57   | 0.52             | NA               | 1.03                 | 1.08                 | 0.55  | 0.86                             | 1.09                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| STKTON B 115  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.59   | 0.54             | NA               | 1.03                 | 1.09                 | 0.57  | 0.87                             | 1.10                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| STN COGN 115  | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.57   | 0.52             | NA               | 1.03                 | 1.08                 | 0.56  | 0.86                             | 1.09                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| TULLOCH 115   | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E                         | P2-4     | Bus-Tie Breaker        | 0.73   | 0.70             | NA               | 1.05                 | 1.07                 | 0.73  | 0.95                             | 1.08                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| TULLOCH 115   | P2-4:A11:10:_TESLA 115KV - SECTION 2D & 1D                          | P2-4     | Bus-Tie Breaker        | 0.90   | 1.02             | -1.42            | 0.93                 | 0.82                 | 0.85  | -0.71                            | 0.81                                  | -1.43                             | SPS Recommended in 2018-2019 TPP   |

Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)   | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions   |
|--------------|--|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |  |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| TULLOCH 115  | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E   | P2-4     | Bus-Tie Breaker      | NA   | NA               | 0.69             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.70                              | SPS Recommended in 2018-2019 TPP   |
| VACA-CB 115  | P2-2:A4:7:_VACA-DIX 230KV SECTION NA   | P2-2     | Bus                  | 1.08   | 1.08             | 1.05             | 1.11                 | 1.11                 | 1.08  | 1.08                             | 1.11                                  | 1.04                              | Load power factor correction and voltage support if needed   |
| VACA-DIX 115 | P2-2:A4:7:_VACA-DIX 230KV SECTION NA   | P2-2     | Bus                  | 1.07   | 1.07             | 1.01             | 1.10                 | 1.10                 | 1.07  | 1.07                             | 1.10                                  | 1.01                              | Sensitivity only   |
| VACAVLL1 115 | P2-2:A4:7:_VACA-DIX 230KV SECTION NA   | P2-2     | Bus                  | 1.07   | 1.07             | 1.01             | 1.10                 | 1.10                 | 1.07  | 1.06                             | 1.10                                  | 1.00                              | Sensitivity only   |
| VACAVLL2 115 | P2-2:A4:7:_VACA-DIX 230KV SECTION NA   | P2-2     | Bus                  | 1.07   | 1.07             | 1.01             | 1.10                 | 1.10                 | 1.07  | 1.06                             | 1.10                                  | 1.00                              | Load power factor correction and voltage support if needed   |
| VALLY HM 115 | P2-4:A11:1:_BELLOTA 230KV - SECTION 1E & 2E  | P2-4     | Bus-Tie Breaker      | 0.90   | 0.90             | NA               | 1.04                 | 1.04                 | 0.91  | 1.00                             | 1.05                                  | NA                                | SPS Recommended in 2018-2019 TPP   |
| VALLY HM 115 | P2-4:A11:27:_BELLOTA 230KV - SECTION 2E & 1E   | P2-4     | Bus-Tie Breaker      | NA   | NA               | 0.86             | NA                   | NA                   | NA  | NA                               | NA                                    | 0.86                              | SPS Recommended in 2018-2019 TPP   |
| APPLE HL 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.05   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.05                             | 1.16                                  | 1.01                              | Load power factor correction and voltage support if needed   |
| BELL PGE 115 | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line | P7       | DCTL                 | 0.95   | 0.96             | 0.87             | 1.12                 | 1.06                 | 0.96  | 1.02                             | 1.07                                  | 0.87                              | Load power factor correction and voltage support if needed<br>- Continue to monitor future load forecast |
| CAMANCH 230  | P7-1:A11:20:_BELLOTA-COTTLE 230KV & BELLOTA-WARNERVILLE 230KV                        | P7       | DCTL                 | 1.01   | 1.01             | 0.99             | 1.11                 | 1.10                 | 1.01  | 1.01                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed   |
| CAMANCH 230  | P7-1:A12:3:_BELLOTA-COTTLE 230KV & BELLOTA-WARNERVILLE 230KV                         | P7       | DCTL                 | 1.01   | 1.01             | 0.99             | 1.11                 | 1.10                 | 1.01  | 1.01                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed   |
| CAMANCH 230  | P7-1:A12:8:_COTTLE-MELONES 230KV & BELLOTA-WARNERVILLE 230KV                         | P7       | DCTL                 | 1.01   | 1.01             | 0.99             | 1.11                 | 1.10                 | 1.01  | 1.01                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed   |
| CAMANCPP 230 | P7-1:A11:20:_BELLOTA-COTTLE 230KV & BELLOTA-WARNERVILLE 230KV                        | P7       | DCTL                 | 1.01   | 1.01             | 0.99             | 1.11                 | 1.10                 | 1.01  | 1.01                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed   |
| CAMANCPP 230 | P7-1:A12:3:_BELLOTA-COTTLE 230KV & BELLOTA-WARNERVILLE 230KV                         | P7       | DCTL                 | 1.01   | 1.01             | 0.99             | 1.11                 | 1.10                 | 1.01  | 1.01                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed   |
| CAMANCPP 230 | P7-1:A12:8:_COTTLE-MELONES 230KV & BELLOTA-WARNERVILLE 230KV                         | P7       | DCTL                 | 1.01   | 1.01             | 0.99             | 1.11                 | 1.10                 | 1.01  | 1.01                             | 1.11                                  | 0.99                              | Load power factor correction and voltage support if needed   |
| CLRKSVLE 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.04   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.04  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed   |
| CPM 115      | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.05   | 1.05             | 1.02             | 1.14                 | 1.14                 | 1.05  | 1.05                             | 1.15                                  | 1.02                              | Load power factor correction and voltage support if needed   |
| DIMOND_1 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.06   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.05                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed   |



Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)   | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions  |
|--------------|--|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|---|
|              |  |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |   |
| DIMOND_2 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.04   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed  |
| DMND SPR 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.04   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed  |
| E.MRYSVE 115 | P7-1:A5:12_Rio Oso-Nicolaus 115 kV Line & Bogue-Rio Oso 115 kV Line                  | P7       | DCTL                 | 1.03   | 1.05             | 0.98             | 1.09                 | 1.10                 | 1.05  | 1.02                             | 1.11                                  | 0.98                              | Load power factor correction and voltage support if needed  |
| E.NICOLS 115 | P7-1:A5:12_Rio Oso-Nicolaus 115 kV Line & Bogue-Rio Oso 115 kV Line                  | P7       | DCTL                 | 1.02   | 1.04             | 0.96             | 1.09                 | 1.11                 | 1.04  | 1.02                             | 1.12                                  | 0.96                              | Load power factor correction and voltage support if needed  |
| ELDORAD 115  | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.05   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.05                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed  |
| GOLDHILL 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.05   | 1.05             | 1.02             | 1.13                 | 1.13                 | 1.05  | 1.04                             | 1.15                                  | 1.02                              | Load power factor correction and voltage support if needed  |
| HIGGINS 115  | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line | P7       | DCTL                 | 0.97   | 0.97             | 0.90             | 1.12                 | 1.06                 | 0.97  | 1.02                             | 1.07                                  | 0.90                              | Load power factor correction and voltage support if needed<br>- Continue to monitor future load forecast        |
| HORSESHE 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.04   | 1.04             | 1.01             | 1.13                 | 1.13                 | 1.04  | 1.03                             | 1.14                                  | 1.01                              | Load power factor correction and voltage support if needed  |
| LOCKFORD 230 | P7-1:A11:12:_BRIGHTON-BELLOTA 230KV & LOCKEFORD-BELLOTA 230KV                        | P7       | DCTL                 | 0.87   | 0.89             | NA               | 0.98                 | 0.97                 | 0.89  | 0.90                             | 0.98                                  | NA                                | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
| LOCKFORD 230 | P7-1:A11:25:_RIO OSO-LOCKEFORD 230KV & LOCKEFORD-BELLOTA 230KV                       | P7       | DCTL                 | 0.43   | 0.40             | 0.97             | 0.46                 | 0.44                 | 0.38  | 0.32                             | 0.46                                  | 0.97                              | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
| PEASE 115    | P7-1:A5:20_Palermo-Pease 115 kV Line amd Pease-Rio Oso 115 kV Line                   | P7       | DCTL                 | 0.94   | 0.97             | 0.95             | 0.77                 | 1.04                 | 0.97  | 0.94                             | 1.03                                  | 0.95                              | Project: East Marysville 115/60 kV Project<br>In-Service Date: Dec 2022<br>Short term: Action plan              |
| PLACER 115   | P7-1:A5:19_Placer-Gold Hill No. 1 115 kV Line and Placer-Gold Hill No. 2 115 kV Line | P7       | DCTL                 | 0.95   | 0.96             | 0.87             | 1.13                 | 1.06                 | 0.95  | 1.02                             | 1.07                                  | 0.87                              | Load power factor correction and voltage support if needed<br>- Continue to monitor future load forecast        |
| PLCRVLB2 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.04   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed  |
| PLCRVLB3 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.04   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed  |
| SHPRING 115  | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line             | P7       | DCTL                 | 1.05   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.04                             | 1.15                                  | 1.01                              | Load power factor correction and voltage support if needed  |



Study Area: PG&E Central Valley

High/Low Voltages



| Substation   | Contingency (All and Worst P6)   | Category | Category Description | Post Cont. Voltage Deviation PU (Baseline Scenarios) |                  |                  |                      |                      | Post Cont. Voltage Deviation PU (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions     |
|--------------|--|----------|----------------------|--|------------------|------------------|----------------------|----------------------|---|----------------------------------|---------------------------------------|-----------------------------------|--|
|              |  |          |                      | 2021 Summer Peak                                     | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast                               | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |  |
| SPICAMIN 115 | P7-1:A5:7_Atlantic-Gold Hill 230 kV Line & Rio Oso-Gold Hill 230 kV Line | P7       | DCTL                 | 1.05   | 1.05             | 1.01             | 1.14                 | 1.14                 | 1.05  | 1.05                             | 1.16                                  | 1.01                              | Load power factor correction and voltage support if needed |

Study Area: PG&E Central Valley

Voltage Deviation



| Substation      | Contingency (All and Worst P6)                      | Category | Category Description | Voltage % (Baseline Scenarios) |                  |                  |                      |                      | Voltage % (Sensitivity Scenarios) |                                  |                                       |                                   | ISO Approved Projects & Potential Mitigation Solutions  |
|-----------------|---|----------|----------------------|--------------------------------|------------------|------------------|----------------------|----------------------|-----------------------------------|----------------------------------|---------------------------------------|-----------------------------------|---|
|                 |   |          |                      | 2021 Summer Peak               | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast         | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |   |
| BANTA 60        | P1-3:A11:32:_KASSON 115/60KV TB 1                   | P1       | N-1                  | 7                              | 8                | 12               | 5                    | 8                    | 8                                 | 5                                | 7                                     | 12                                | Continue to monitor future load forecast  |
| BNTA JCT 60     | P1-3:A11:32:_KASSON 115/60KV TB 1                   | P1       | N-1                  | 7                              | 8                | 12               | 5                    | 8                    | 8                                 | 5                                | 7                                     | 12                                | Continue to monitor future load forecast  |
| CALVO 60        | P1-3:A11:32:_KASSON 115/60KV TB 1                   | P1       | N-1                  | 7                              | 7                | 10               | 5                    | 7                    | 7                                 | 5                                | 7                                     | 10                                | Continue to monitor future load forecast  |
| CARBONA 60      | P1-3:A11:32:_KASSON 115/60KV TB 1                   | P1       | N-1                  | 8                              | 8                | 12               | 5                    | 8                    | 8                                 | 5                                | 7                                     | 12                                | Continue to monitor future load forecast  |
| CRBNA JC 60     | P1-3:A11:32:_KASSON 115/60KV TB 1                   | P1       | N-1                  | 7.4                            | 7.7              | 11.6             | 5.0                  | 7.7                  | 8.0                               | 5.3                              | 7.4                                   | 11.6                              | Continue to monitor future load forecast  |
| CROWCREEK SS 60 | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV               | P1       | N-1                  | 11.2                           | 11.4             | 13.4             | -2.9                 | -4.5                 | 11.3                              | -0.3                             | -4.9                                  | 13.5                              | Load forecast under review  |
| FRONTIERPV 60   | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV               | P1       | N-1                  | 11.2                           | 11.4             | 13.4             | -2.8                 | -4.5                 | 11.3                              | -0.3                             | -4.9                                  | 13.5                              | Load forecast under review  |
| GUSTINE 60      | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV               | P1       | N-1                  | 8.4                            | 8.5              | 9.5              | -1.4                 | -2.4                 | 8.3                               | -0.1                             | -2.7                                  | 9.5                               | Load forecast under review  |
| KASSON 60       | P1-3:A11:32:_KASSON 115/60KV TB 1                   | P1       | N-1                  | 7.4                            | 7.7              | 11.6             | 5.0                  | 7.7                  | 8.0                               | 5.3                              | 7.4                                   | 11.6                              | Continue to monitor future load forecast  |
| LOCKFORD 230    | P1-2:A11:4:_LOCKEFORD-BELLOTA 230KV                 | P1       | N-1                  | 9.9                            | 9.1              | 0.7              | 6.5                  | 7.2                  | 9.1                               | 8.2                              | 6.5                                   | 0.7                               | Project: Lockeford-Lodi Area 230 kV Development Project<br>In-Service Date: Jul 2025<br>Short term: Action plan |
| LYOTH-SP 60     | P1-3:A11:32:_KASSON 115/60KV TB 1                   | P1       | N-1                  | 7.4                            | 7.7              | 11.6             | 5.0                  | 7.7                  | 8.0                               | 5.3                              | 7.4                                   | 11.6                              | Continue to monitor future load forecast  |
| MARTELL 60      | P1-2:A11:68:_VALLEY SPRINGS-MARTELL #1 60KV         | P1       | N-1                  | 1.2                            | 1.3              | 4.9              | -1.7                 | -2.2                 | 1.3                               | 1.1                              | -2.6                                  | 9.4                               | Sensitivity only'   |
| NEWMAN 60       | P1-2:A12:15:_SALADO-NEWMAN #2 60KV MOAS OPENED ON C | P1       | N-1                  | 5.6                            | 6.0              | 8.4              | -0.1                 | -0.9                 | 6.2                               | 1.9                              | -1.3                                  | 8.4                               | Continue to monitor future load forecast  |
| NEWMAN 60       | P1-2:A12:16:_SALADO-CROWCREEK SS 60KV               | P1       | N-1                  | 7.5                            | 7.4              | 8.0              | -1.0                 | -1.9                 | 7.2                               | 0.0                              | -2.1                                  | 8.1                               | Continue to monitor future load forecast  |
| NEWMAN 60       | P1-2:A12:17:_NEWMAN-CROWCREEK SS 60KV               | P1       | N-1                  | 6.0                            | 6.5              | 8.8              | 1.1                  | 0.1                  | 6.8                               | 2.7                              | -0.1                                  | 8.8                               | Continue to monitor future load forecast  |
| NEWMAN 60       | P1-2:A12:18:_ 60KV                                  | P1       | N-1                  | 6.5                            | 7.0              | 9.0              | 0.8                  | -0.2                 | 7.4                               | 2.8                              | -0.4                                  | 9.0                               | Continue to monitor future load forecast  |
| RIPON 115       | P1-2:A11:42:_MANTECA-RIPON 115KV                    | P1       | N-1                  | 6.1                            | 7.8              | 9.7              | -1.0                 | -1.5                 | 8.1                               | 3.4                              | -2.0                                  | 9.7                               | Continue to monitor future load forecast  |

Study Area: PG&E Central Valley

Transient Stability



| Contingency   | Category | Category Description | Transient Stability Performance |                  |                      |                           |                                  | Potential Mitigation Solutions |
|---|----------|----------------------|---------------------------------|------------------|----------------------|---------------------------|----------------------------------|--------------------------------|
|   |          |                      | Baseline Scenarios              |                  |                      | Sensitivity Scenarios     |                                  |                                |
|   |          |                      | 2024 Summer Peak                | 2029 Summer Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast | 2024 SpOP Hi Renew & Min Gas Gen |                                |
| Colgate Generator 1 Trip  | P1-1     | N-1                  | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla - Newark 230 kV Line Fault  | P1-2     | N-1                  | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla 500/230 kV Transformer Fault  | P1-3     | N-1                  | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Atlantic SVD Fault  | P1-4     | N-1                  | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla 230 kV Bus Fault  | P2-2     | Bus                  | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla 230 kV non-tie-breaker fault  | P2-3     | Non-Bus-Tie Breaker  | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla 230 kV tie-breaker fault  | P2-4     | Bus-Tie Breaker      | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Golgate out and GWFTracy Generator fault  | P3-1     | G-1/G-1              | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Golgate out and Tesla-Newark 230 kV line fault  | P3-2     | G-1/N-1              | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Colgate out and Tesla 500/230 kV Transformer Fault  | P3-3     | G-1/N-1              | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Colgate out and Atlantic SVD Fault  | P3-4     | G-1/N-1              | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| USWP-RUS Generator fault plus stuck breaker   | P4-1     | Stuck Breaker        | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Bellota line fault plus stuck breaker   | P4-2     | Stuck Breaker        | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Vaca Dixon transformer fault plus stuck breaker   | P4-3     | Stuck Breaker        | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Atlantic SVD Fault plus stuck breaker   | P4-4     | Stuck Breaker        | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla 230 kV bus section fault plus stuck breaker   | P4-5     | Stuck Breaker        | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla 230 kV bus tie-breaker fault  | P4-6     | Stuck Breaker        | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Solano generator fault plus relay failure   | P5-1     | Non-Redundant Relary | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Bellota line fault plus relay failure   | P5-2     | Non-Redundant Relary | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Vaca Dixon transformer fault plus relay failure   | P5-3     | Non-Redundant Relary | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Atlantic SVD Fault plus relay failure   | P5-4     | Non-Redundant Relary | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla transformer out and Tesla-ADCC 230 kV line fault                                    | P6-1     | N-1/N-1              | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Tesla transformer out and another Tesla transformer fault                                 | P6-2     | N-1/N-1              | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Atlantic SVD out and Vaca Dixon SVD fault   | P6-3     | N-1/N-1              | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Pease-Palermo and Pease-Rio Oso 115 kV lines (DCTL)- Temporary fault                      | P7-1     | DCTL                 | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Pease-Palermo and Pease-Rio Oso 115 kV lines (DCTL)- Permanent fault                      | P7-1     | DCTL                 | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Stanislaus-Manteca and Stanislaus-Melones_Riverbank 115 kV lines (DCTL) - Temporary fault | P7-1     | DCTL                 | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |
| Stanislaus-Manteca and Stanislaus-Melones_Riverbank 115 kV lines (DCTL) - Permanent fault | P7-1     | DCTL                 | No Issues                       | No Issues        | No Issues            | No Issues                 | No Issues                        | No mitigation required         |

Study Area: PG&E Central Valley

Single Contingency Load Drop



| Worst Contingency | Category | Category Description | Amount of Load Drop (MW) |                  |                  |                      |                      |                           |                                  |                                       |                                   | Potential Mitigation Solutions |
|-------------------|----------|----------------------|--------------------------|------------------|------------------|----------------------|----------------------|---------------------------|----------------------------------|---------------------------------------|-----------------------------------|--------------------------------|
|                   |          |                      | 2021 Summer Peak         | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |                                |
|                   |          |                      |                          |                  |                  |                      |                      |                           |                                  |                                       |                                   |                                |

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

Study Area: PG&E Central Valley



Single Source Substation with more than 100 MW Load

| Substation | Load Served (MW) |                  |                  |                      |                      |                           |                                  |                                       |                                   | Potential Mitigation Solutions |
|------------|------------------|------------------|------------------|----------------------|----------------------|---------------------------|----------------------------------|---------------------------------------|-----------------------------------|--------------------------------|
|            | 2021 Summer Peak | 2024 Summer Peak | 2029 Summer Peak | 2021 Spring Off-Peak | 2024 Spring Off-Peak | 2024 SP High CEC Forecast | 2024 SpOP Hi Renew & Min Gas Gen | 2021 SP Heavy Renewable & Min Gas Gen | 2029 Retirement of QF Generations |                                |
|            |                  |                  |                  |                      |                      |                           |                                  |                                       |                                   |                                |

No single source substation with more than 100 MW Load