

APPENDIX E: Project Need and Description

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| Name | Lakeville 115 kV Bus Upgrade |
| Brief Description | <ul style="list-style-type: none">Installation of a sectionalizing breaker to be installed on 115 kV bus section "D" at Lakeville. |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none">Category P2 contingency of a bus-tie breaker failure results in an overload on the STHLNJ1 - PUEBLO 115kV Line. |
| Project Need Date | 2020 |
| Expected In-service Date | 2022 |
| Interim Solution | Operational action plan |
| Project Cost | \$10-15 million |
| Alternatives Considered but Rejected | None |

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| Name | Tyler 60 kV Shunt Capacitor |
| Brief Description | <ul style="list-style-type: none">• Installation of a 2x10 MVAR capacitor bank at Tyler 60 kV bus |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none">• P1 contingencies result in low voltage and voltage deviations. |
| Project Need Date | 2020 |
| Expected In-service Date | 2022 |
| Interim Solution | Operational action plan |
| Project Cost | \$5.8-7 Million |
| Alternatives Considered but Rejected | None |

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| Name | Cottonwood 115 kV Bus Sectionalizing Breaker |
| Brief Description | <ul style="list-style-type: none"> Installation of 115 kV bus sectionalizing breaker at Cottonwood substation |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none"> P2 contingency trips two of the 115 kV lines supplying Humboldt area. With two 115 kV lines tripped, the 60 kV connection between Cascade and Humboldt area experiences significant overload. |
| Project Need Date | 2019 |
| Expected In-service Date | 2022 |
| Interim Solution | Operational action plans |
| Project Cost | \$8.5-10.5 million |
| Alternatives Considered but Rejected | None |

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| Name | Gold Hill 230/115 kV Transformer Addition |
| Brief Description | <ul style="list-style-type: none"> Installation of a third 230/115 kV transformer at Gold Hill substation |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none"> P2 and P6 contingencies result in the loss of the existing 230/115 kV transformers at Gold Hill substation resulting in overload of the Drum-Higgins 115 kV line. There are no periods of time during the year that load is low enough in the area to take one of the 230/115 kV transformers at Gold Hill substation where the contingency of the other transformer does not result in overloads. |
| Project Need Date | 2019 |
| Expected In-service Date | 2024 |
| Interim Solution | Operational action plan |
| Project Cost | \$22 million |
| Alternatives Considered but Rejected | <ul style="list-style-type: none"> Upgrade Drum-Higgins 115 kV Line Additional source to Placerville/Shingle Spring area |

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| Name | Jefferson 230 kV Bus Upgrade |
| Brief Description | <ul style="list-style-type: none"> 230 kV bus upgrade at Jefferson substation to keep Jefferson-Martin 230 kV cable in-service following the P7 contingency of the Monta Vista-Jefferson 230 kV lines |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none"> Some 60 kV lines and 115/60 kV transformers in Peninsula area were found to be overloaded in all peak and sensitivity cases for P7 contingencies |
| Project Need Date | 2019 |
| Expected In-service Date | 2022 |
| Interim Solution | Operation action plan |
| Project Cost | \$6-11 million |
| Alternatives Considered but Rejected | None |

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| Name | Christie-Sobrante 115 kV Line Reconductor |
| Brief Description | Reconductor limiting sections of the Christie-Sobrante 115 kV line. |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none"> • Categories P2 and P7 contingency overloads are identified in the Oleum-Martinez 115 kV system. <ul style="list-style-type: none"> ○ P2 overloads are due to loss of supply from Sobrante. ○ The P7 overloads are due to loss of Sobrante-G 115 kV DCTL. |
| Project Need Date | 2019 |
| Expected In-service Date | 2022 |
| Interim Solution | Operational action plan |
| Project Cost | \$10.5 million |
| Alternatives Considered but Rejected | None |

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| Name | Moraga-Sobrante 115 kV Line Reconductor |
| Brief Description | <ul style="list-style-type: none">• Reconductor the Moraga-Sobrante 115 kV line |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none">• Categories P2 contingencies result in overloads on the Moraga-Sobrante 115 kV line. |
| Project Need Date | 2020 |
| Expected In-service Date | 2023 |
| Interim Solution | Operational action plan |
| Project Cost | \$12-18 million |
| Alternatives Considered but Rejected | None |

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| Name | Ravenswood 230/115 kV Transformer #1 Limiting Facility Upgrade |
| Brief Description | Upgrade limiting substation equipment on the Ravenswood 230/115 kV transformer #1 |
| Type | Reliability |
| Objectives | The reliability assessment identified Category P2 and P6 contingencies resulting in overloads on the Ravenswood 230/115 kV Transformer #1. The project addresses the reliability constraints. |
| Project Need Date | 2019 |
| Expected In-service Date | 2019 |
| Interim Solution | Operational action plan |
| Project Cost | \$100K to \$200K |
| Alternatives Considered but Rejected | No other alternatives were considered due to the cost of the project to bring the line up to its full capability . |

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| Name | Tesla 230 kV Bus Series Reactor |
| Brief Description | <p>The project proposes to:</p> <ul style="list-style-type: none"> • Replace existing reactors with 18 ohm equivalent bus reactors between bus sections C-D and D-E • Re-arrange various 230 kV line connections on the Tesla 230kV Bus • Make protection system upgrades as required |
| Type | Reliability |
| Objectives | Due to the number of bulk system connections and its relative proximity to generation facilities, Tesla has had issues with high fault current levels. |
| Project Need Date | <ul style="list-style-type: none"> • Due to the number of bulk system connections and its relative proximity to generation facilities, Tesla has had issues with high fault current levels. • PG&E's System Protection Department has identified a need to reduce the fault current on the Tesla 230 kV Bus due to overstressed Circuit Breakers. • This concern is significant since the level will exceeded the maximum PG&E system design limit of 63 kA. |
| Expected In-service Date | 2023 |
| Interim Solution | Operational action plan |
| Project Cost | \$24-29 million |
| Alternatives Considered but Rejected | <ul style="list-style-type: none"> • Breaker upgrades at Tesla 230 kV |

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| Name | South of Mesa Upgrade |
| Brief Description | <ul style="list-style-type: none"> • Increase the Winter emergency rating of Sisquoc - Santa Ynez 115 kV line to 120 MVA, • Install 20 Mvar capacitor bank at Cabrillo, and • Install SPS to shed load if P6 occurs under peak load |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none"> • To address P2 and P6 contingency overloads • There are no periods of time where loads are low enough to take line out of service where the next P1 contingency does not result in overloads |
| Project Need Date | 2019 |
| Expected In-service Date | 2023 |
| Interim Solution | Operational action plan and existing SPS |
| Project Cost | \$45 million |
| Alternatives Considered but Rejected | <ul style="list-style-type: none"> • Increase the Summer emergency rating of Sisquoc - Santa Ynez 115 kV line to around 160 MVA and install SVC at Cabrillo • Build a new greenfield 115 kV line from Divide to Mesa or other substations. |

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| Name | Round Mountain 500 kV Dynamic Voltage Support |
| Brief Description | <ul style="list-style-type: none"> The installation of a +/- 500 MVAR dynamic voltage support at Round Mountain 500 kV substation |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none"> The results show that the voltage in the area ranges between 488 kV and 558 kV in the existing system which is outside the acceptable range, especially on the high voltage. |
| Project Need Date | 2020 |
| Expected In-service Date | 2024 |
| Interim Solution | Operational action plan |
| Project Cost | \$160-190 million |
| Alternatives Considered but Rejected | <p>Request Window submissions</p> <ul style="list-style-type: none"> Round Mountain Dynamic Reactive 500 kV Transmission System 500 kV Wells Place Substation on Round Mountain-Table Mountain #1 line |

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| Name | Gates 500 kV Dynamic Voltage Support |
| Brief Description | The installation of a +/- 800 MVAR dynamic voltage support at Gates 500 kV substation |
| Type | Reliability |
| Objectives | <ul style="list-style-type: none"> To reduce voltage both on the Diablo 500 kV bus and on all 500 kV buses in the area to the required limits Flows in the southern portion of the PG&E bulk system will vary throughout the day with the continued addition of solar generation. Dynamic stability studies showed large loss of load due to stalling and tripping of induction motors with three-phase faults in the area and also possibility of momentary cessation of inverters that might cause system instability. |
| Project Need Date | 2025 |
| Expected In-service Date | 2024 |
| Interim Solution | None |
| Project Cost | \$210-250 million |
| Alternatives Considered but Rejected | <p>Request Window Submissions</p> <ul style="list-style-type: none"> Gates Substation Voltage Support (three options) Gates or Diablo Reactive 500 kV Transmission System (three options) 500/230 kV Chorro Junction Substation on Diabale-Gates 500 kV line |

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| Name | Giffen Line Reconductoring |
| Brief Description | <ul style="list-style-type: none">Reconductor the tap from Giffen Junction to Giffen substation |
| Type | Economic |
| Objectives | <ul style="list-style-type: none">Significant congestion on the tap from Giffen Junction to Giffen substation when the load at the station is low and the PV generation connected at the station is high. |
| Project Need Date | 2019 |
| Expected In-service Date | 2021 |
| Interim Solution | Congestion management |
| Project Cost | \$ 5 million |
| Alternatives Considered but Rejected | None |