APPENDIX E: Project Need and Description

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Name	**Tyler 60 kV Shunt Capacitor**
Brief Description	• Installation of a 2x10 MVAR capacitor bank at Tyler 60 kV bus
Type	Reliability
Objectives	• 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

Name	**Cottonwood 115 kV Bus Sectionalizing Breaker**
Brief Description	• Installation of 115 kV bus sectionalizing breaker at Cottonwood substation
Type	Reliability
Objectives	• 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

Name	**Gold Hill 230/115 kV Transformer Addition**
Brief Description	• Installation of a third 230/115 kV transformer at Gold Hill substation
Type	Reliability
Objectives	• P2 and P6 contingenices 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	• Upgrade Drum-Higgins 115 kV Line • Additional source to Placerville/Shingle Spring area

Name	**Jefferson 230 kV Bus Upgrade**
Brief Description	• 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	• 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	Opertation action plan
Project Cost	$6-11 million
Alternatives Considered but Rejected	None

Name	**Christie-Sobrante 115 kV Line Reconductor**
Brief Description	Reconductor limiting sections of the Christie-Sobrante 115 kV line.
Type	Reliability
Objectives	• Categories P2 and P7 contingency overloads are identified in the Oleum-Martinez 115 kV system. o P2 overloads are due to loss of supply from Sobrante. o 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

Name	**Moraga-Sobrante 115 kV Line Reconductor**
Brief Description	• Reconductor the Moraga-Sobrante 115 kV line
Type	Reliability
Objectives	• 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

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 .

Name	**Tesla 230 kV Bus Series Reactor**
Brief Description	The project proposes to: • 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	Reliabiilty
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	• 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	• Breaker upgrades at Tesla 230 kV

Name	**South of Mesa Upgrade**
Brief Description	• Reconductor the Sisquoc - Santa Ynez 115 kV line, • Install 20 Mvar capacitor bank at Cabrillo, and • Install SPS to shed load if P6 occurs under peak load
Type	Reliability
Objectives	• To address P2 and P6 contingency overloads • There are no periors 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	$29.6-59.2 million
Alternatives Considered but Rejected	• 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.

Name	**Round Mountain 500 kV Dynamic Voltage Support**[1]
Brief Description	• The installation of a +/- 500 MVAR dynamic voltage support at Round Mountain 500 kV substation
Type	Reliability
Objectives	• 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	Request Window submissions • Round Mountain Dynamic Reactive 500 kV Transmission System • 500 kV Wells Place Substation on Round Mountain-Table Mountain #1 line

[1] Further review of the engineering detail for the termination of the Round Mountain 500 kV Reactive Project is required due to siting issues at Round Mountain for the project. Board of Governor approval is recommended at this time, and the Management will provide the additional detail regarding the termination of the reactive support at a future meeting. The competitive procurement process for the project will commence after that has taken place.

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	• 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	Request Window Submissions • Gates Substation Voltage Support (three options) • Gates or Diablo Reactive 500 kV Transmission System (three options) • 500/230 kV Chorro Junction Substation on Diable-Gates 500 kV line

Name	**Giffen Line Reconductoring**
Brief Description	• Reconductor the tap from Giffen Junction to Giffen substation
Type	Economic
Objectives	• 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

Name	**East Marysville 115/60 kV Project**
Brief Description	• Loop in the Pease – Marysville 60 kV line into East Marysville 115 kV substation and install a 115/60 kV transformer at East Marysville substation plus 25 Mvar voltage support.
Type	Economic
Objectives	• The Pease Sub-area is a local load pocket with the LCR requirement being for N-1-1 contingencies that result in local area overloads without the generation being on-line. The local capacity requirement for gas-fired generation in the Pease sub-area was eliminated with the project resulting in a reduction of approximately 92 MW. The project provided a benefit to cost ration of 1.62.
Project Need Date	2022
Expected In-service Date	2022
Interim Solution	LCR Reduction
Project Cost	$26-32 million
Alternatives Considered but Rejected	• Install a Direct Transfer Trip (DTT) to trip the load at Harter upon the loss of 115 kV Lines plus 25 Mvar voltage support • Convert Table Mountain – Pease 60 kV Line to 115 kV lines • Looping Palermo – Nicolaus 115 kV line into Pease 115 kV Bus