APPENDIX H: Project Need and Description

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Name	**Valley Center System Improvement**

Brief Description	• New 5-mile double circuit 69 kV line (one pole structure) to create two new lines that will connect to Valley Center substation.
	  ○ One circuit will connect to a de-energized line TL99901 to form a new Valley Center – Escondido 69 kV line.
	  ○ One circuit will tap into TL688 to create Valley Center – Escondido – Lilac 3-terminal 69 kV line.
	• De-energize TL681A Ash – Ash Tap.
	• Reconductor 0.1 miles of TL689E Felicita – Felicita Tap.
	• Reconductor the underground section of the existing TL99901.

Type	Reliability
Objectives	Improve system reliability and avoid thermal overloads of 69 kV transmission lines which occur in scenarios were Valley Center energy storage is dispatched either in charging or discharging mode.
Project Need Date	2028
Expected In-service Date	2028
Interim Solution	Rely on operational actions along with the use of the existing Valley Center RAS to restrict the charging and discharing of Valley Center energy storage.
Project Cost	$51M
Alternatives Considered but Rejected	***Status Quo*** Not recommended since thermal overloads occur in P0 conditions which trigger existing Valley Center RAS, contradicting ISO S-RAS2 standard.

Name	**Mira Loma 500 kV Bus Additional SCD Mitigation**
Brief Description	Replace additional two (2) 40 KA circuit breakers at Mira Loma 500 kV with new 63 kA rated CBs
Type	Reliability
Objectives	*Address the short circuit duty (SCD) concerns on additional two 500 kV circuit breakers at Mira Loma 500/230 kV substation that are loaded to greater than 95% and even 100% of the rated 40 KA SCD capability in the near term and the long term due to system changes*
Project Need Date	2024
Expected In-service Date	Q2 2027
Interim Solution	Limited operation of generation in the area as complex operating procedures to manage overstressed CBs
Project Cost	$5M
Alternatives Considered but Rejected	Status Quo Not recommended due to potential reliability and safety concern for new generation interconnection

Name	**Inyo 230 kV Shunt Reactor**
Brief Description	Install a 25 MVar shunt reactor at Inyo 230 kV substation (SCE side)
Type	Reliability
Objectives	Mitigate real time high voltage issues at Inyo 230 kV bus. The actual bus voltages are far beyond the voltage limits in the CAISO planning standard. Mitigate the NERC Category P5 high voltage identified in plannind study starting in 2025.
Project Need Date	2024
Expected In-service Date	2027
Interim Solution	Utilize the system operating bulletins SOB80 and SOB17
Project Cost	$ 20 Million
Alternatives Considered but Rejected	Control 115 kV Shunt Reactor The project was approved in 2022-2023 TPP. However, upon further evaluation, installing shunt reactor at SCE side Inyo 230 kV bus was more effective in addressing the high voltage issue and was a more viable location for construction. The Inyo 230 kV shunt reactor project will supersede the Control 115 kV shunt reactor project.

Name	**Etiwanda 230 kV Bus SCD Mitigation Project**
Brief Description	Replace twelve (12) 230 kV circuit breakers at Etiwanda currently rated 63 kA tested at X/R ratio of 17 with new 63 kA rated circuit breakers tested at X/R ratio of 35
Type	Reliability
Objectives	Short-circuit duty (SCD) studies indicate that the twelve 230 kV circuit breakers are expected to be loaded to greater than 95% of their rated three-phase SCD capability in the near term (2025) and to 100% in the long term (2035).
Project Need Date	2025
Expected In-service Date	12/31/2027
Interim Solution	None
Project Cost	$15M
Alternatives Considered but Rejected	Develop operating procedure to open 230 kV transmission lines in real-time

Name	**Covelo 60 kV Voltage Support**
Brief Description	Install a 10 MVAR Shunt Capacitor at Covelo 60 kV
Type	Reliability
Objectives	P1 low voltages starting 2025 at Covelo 60 kV substation
Project Need Date	2025
Expected In-service Date	2030 or earlier
Interim Solution	None
Project Cost	$11M - $22M
Alternatives Considered but Rejected	Installing SVC is not recommended because of higher cost

Name	**Martin-Millbrae 60 kV Area Reinforcement project**
Brief Description	Reconductor 7.2 miles on the Martin-Sneath Lane 60 kV line and 2.5 miles on the Millbrae-Sneath Lane 60 kV line
Type	Reliability
Objectives	Mitigate the thermal violations in the Martin-Millbrae 60 kV system under P1 contingencies. Increase the load serving capability and customer reliability in the area.
Project Need Date	2025
Expected In-service Date	2030 or earlier
Interim Solution	Millbrae Reverse Power Relay and Open Sneath Lane 60 kV ring bus by opening CBs 6032 & 6052 during winter peak hours. Load transfer to the Halfmoon Bay area.
Project Cost	$20.0M - $40.0M
Alternatives Considered but Rejected	Energy storage. This alternative is not recommended because the energy storage charging capability is limited by the existing transmission capacity and will be further limited by the expected load increase.

Name	**Atlantic High Voltage Mitigation (Re-scope)**
Brief Description	Install a 200 MVA 3-phase 230/60 kV transformer with LTC at Atlantic substation
Type	Reliability
Objectives	To resolve the NERC category P0 high voltage violations at Atlantic 60 kV Substation starting in 2028 and improve operational reliability.
Project Need Date	2028
Expected In-service Date	May 2029
Interim Solution	None
Project Cost	$20M - $40M
Alternatives Considered but Rejected	Alternative 1: Status Quo • Not recommended due to not mitigating P0 high voltage violations Alternative 2: Install regulator and spare single-phase bank • Not recommended due to missing wider score i.e. improved customer reliability, operational flexibility and providing a back-up source

Name	**Camden 70 kV reinforcement project**
Brief Description	Reconductor Camden-Kingsburg 70 kV and add voltage support
Type	Reliability
Objectives	To reduce base case overloads on Camden-Kingsburg 70 kV line
Project Need Date	2035
Expected In-service Date	2030
Interim Solution	Operating solution and load transfer
Project Cost	$50M - $100M
Alternatives Considered but Rejected	Energy storage and voltage support is not recommended due to space limitation and battery will be a new P1 limitation that needs mitigation

Name	**Gates 230/70 kV Transformer Addition Project**
Brief Description	Add additional 230/70 kV bank at Gates
Type	Reliability
Objectives	To reduce overloads on 70 kV and 115 kV lines due to loss of Gates 230/70 kV bank 5
Project Need Date	2025
Expected In-service Date	2030
Interim Solution	Operating solution
Project Cost	\$36M - \$72M
Alternatives Considered but Rejected	• Energy storatge is not recommended as around 100MW is needed to mitigate all overloads and there isn’t sufficient capacity to charge this size of battery • Converting entire 70 kV to 115 kV is not cost-effective

Name	**Reedley 70 kV capacity increase project**
Brief Description	Add a double circuit between Reedley-Dinuba 70 kV line #2 and upgrade rating of existing Reedley-Dinuba 70 kV line #1 and upgrade Reedley 230/70 kV bank
Type	Reliability
Objectives	Mitigate 70 kV line overloads and bank #4 overloads caused by certain P1 contingencies
Project Need Date	2025
Expected In-service Date	TBD
Interim Solution	Operating solution
Project Cost	TBD
Alternatives Considered but Rejected	Reconductoring the 70 kV lines, upgrade bank with existing Dinuba BESS. This alternative still doesn’t fully mitigate all overloads for 2035 and beyond.

Name	**Diablo Canyon Area 230 kV High Voltage Mitigation Project**
Brief Description	Add 120 Mvar shunt reactor (3X40 MVAR or 4X30 MVAR) and removal of one or two shunt capacitor steps at Mesa 115 kV
Type	Reliability
Objectives	Mitigate high-voltages observed in real time around or right after midnight, during low demand and zero solar output periods at Diablo Canyon 230 kV substation
Project Need Date	Real-time
Expected In-service Date	2027
Interim Solution	Operating Procedures
Project Cost	$35M - $70M
Alternatives Considered but Rejected	Alternatives include STATCOM installations at Mesa 115 kV or 230 kV, or Morro Bay 230 kV, or Diablo 230 kV but were rejected due to large costs associated with the upgrades.

Name	**Crazy Horse Canyon-Salinas-Soledad #1 and #2 115 kV Line Reconductoring Project**
Brief Description	Re-conductor sections of CHCSS-Salinas-Soledad #1 and #2 115 kV lines
Type	Reliability
Objectives	Reduce overloads on CHCSS-Natividad and Natividad-Salinas sections for a Mosslanding-Salinas #1 115 kV line
Project Need Date	2025
Expected In-service Date	2030
Interim Solution	None
Project Cost	$54M - $108M
Alternatives Considered but Rejected	Loop Mosslanding-Del Monte #1 and #2 double circuit into Salinas substation not possible due to space constraint at Salinas

Name	**Vaca-Plainfield 60 kV Line Reconductoring Project**
Brief Description	Reconductor Vaca-Plainfield 60 kV (about 30 miles) to achieve minimum conductor rating of 635 AMPS for summer normal and 741 AMPS for summer emergency rating
Type	Reliability
Objectives	Addressing the near-term overloads on the Vaca-Plainfield 60 kV line resulting from NERC Category P0 and P1 contingencies.
Project Need Date	2025
Expected In-service Date	May 2030 or earlier
Interim Solution	Operating solution
Project Cost	$34M - $68M
Alternatives Considered but Rejected	Alternative 1: Status Quo • This alternative is not recommended, because it does not mitigate the expected capacity constraints due to thermal overload and low voltage without having to rely on dropping or transferring customer load before/after a single contingency event. Alternative 2: • Installing 25 MW of Battery at Winters Substation and reconductoring about 22 miles Winters-Plainfield.This alternative is not feasible due to space limitations at Winters Substation. Alternative 3: • Voltage Conversion and Reconductoring Fulton JCT-VACA 115 kV (about 12 miles) Madison-Vaca 115 kV (about 12 miles).This alternative is not recommended because of higher cost. Alternative 4: • Construct a second Vaca-Plainfield line by changing existing 60kV Line to DCTL. Introducing a new 60 kV source from Vaca Dixon have benefits for reliability. In case of an N-1 outage of one of the Vaca-Plainfield lines, the Winters and Plainfield substations can be served from the other Vaca-Plainfield line. However, due to the higher cost this alternative is not recommended. Alternative 5: • Construct a second Vaca-Plainfield line by converting existing 60kV Line to 115 kV DCTL. This item is same as alternative 4, but the voltage would be 115 kV. The cost in comparison to alternative 4 would be higher, so this alternative is not recommended.

Name	**Rio Oso-W. Sacramento Reconductoring Project**
Brief Description	Reconductoring Rio Oso – W. Sacramento 115 kV line as original re-rate of this line as a part of Vaca Dixon reinforcement project approved in 2017-18 TPP is no longer viable due to aging infrastructure.
Type	Reliability
Objectives	Addressing overloads and voltage criteria violations within the 115 kV and 60 kV transmission system connecting Vaca Dixon, Davis, Rio Oso, and Brighton substations under NERC Category P0 - P7 contingencies.
Project Need Date	2025
Expected In-service Date	2030
Interim Solution	Operational Solution
Project Cost	$48.7M - $97.4M
Alternatives Considered but Rejected	N/A

Name	**Cortina #1 60 kV Line Reconductoring Project**
Brief Description	Reconductoring Cortina-Arbuckle 60 kV and Arbuckle-Dunnigan 60 kV sections on Cortina #1 60 kV line
Type	Reliability
Objectives	Addressing overloads and low voltage criteria violations within the 60 kV transmission system connecting Dunnigan, Arbuckle and Cortina substations under NERC Category P0 contingencies.
Project Need Date	2025
Expected In-service Date	May 2028
Interim Solution	Operating solutions
Project Cost	$47.1M - $94.3M
Alternatives Considered but Rejected	N/A

Name	**Salinas Area Reinforcement Project**
Brief Description	Build new 115 kV station near Chaular; convert existing Salinas-Spence 60 kV network to 115 kV and operate Salinas-Chaular system at 115 kV
Type	Reliability
Objectives	Address reliability driven concerns, including thermal overloads observed on Salinas-Firestone #1 and #2 lines 60 kV and voltage concerns near Spence 60 kV, Firestone 60 kV, and Gonzales 60 kV substations.
Project Need Date	2025
Expected In-service Date	TBD
Interim Solution	None
Project Cost	$226.1M - $452.3M
Alternatives Considered but Rejected	60 kV reconductoring alternative rejected due to large conductor size required, space limitations for voltage support at Gonzales and third transformer bank at Salinas and limited increase in load serving capapcity post upgrades, 115 kV loop-in and 230 kV loop-in alternatives were both rejected mainly due to imminent need for a new distribution station at 60 kV and large costs associated with the upgrades.

Name	**Tejon area Reinforcement Project**
Brief Description	Reconductor of the Wheeler Ridge – Tejon 70kV line, Wheeler Ridge – San Bernard 70kV line, and San Bernard – Tejon 70kV line and replace the limiting disconnect switches
Type	Reliability
Objectives	Mitigate thermal overloads on the Wheeler Ridge – Tejon 70kV line, Wheeler Ridge – San Bernard 70kV line, San Bernard – Tejon 70kV line caused by P3 overloads and additional loading at Tejon substation
Project Need Date	2025
Expected In-service Date	2029
Interim Solution	None
Project Cost	$28M-$56M
Alternatives Considered but Rejected	Option 2: Build a new 115kV source from Wheeler Ridge to Tejon Option 2 provides less (for the radial portion) or equal (for the network addition) load serving capacity to the Tejon area than option 3, still requires some 70kV work, and is more expensive than chosen alternative. Option 3: Build a new 230kV source from Wheeler Ridge to Tejon This option is not recommended for this TPP cycle due to cost and the fact that the current recommended scope is sufficient to address the Tejon area overloads observed in this cycle. However, it may be considered in the future based on load growth projections in the Tejon pocket.

Name	**French Camp Reinforcement Project**
Brief Description	Loop French Camp substation into Bellota-Tesla #2 230 kV line to add a new 230 kV bus at French Camp. The total length of transmission circuit is about 4.4 miles.
Type	Reliability
Objectives	Addressing overloads at Weber 60 kV line #2 (Weber - French Camp) starting in the near-term under NERC Category P1 contingencies.
Project Need Date	2025
Expected In-service Date	May-2030
Interim Solution	Operating solutions
Project Cost	$42.1M-$84.2M
Alternatives Considered but Rejected	Alternative 1 • Loop French Camp Substation into Weber-Tesla 230 kV line. This alternative is not recommended because of higher cost. Alternative 2 • Loop French Camp Substation into Tesla-Tracy 115 kV line. The total cost would be higher than the 230 kV Alternatives. This alternative is not recommended because of higher cost. Alternative 3 • Loop French Camp Substation into Stockton A-Lockeford-Bellota #1 115 kV line. The total cost would be higher than the 230 kV Alternatives. This alternative is not recommended because of higher cost. Alternative 4 • Loop French Camp Substation into Tesla-Tracy and Stockton A-Lockeford-Bellota #1 115 kV lines. The total cost would be higher than the 230 kV Alternatives. This alternative is not recommended because of higher cost. Alternative 5 • Reconductor Weber-French Camp #1 and #2 60 kV lines. This alternative will trigger upgrade on the Weber substation and the Tesla-Bellota 230 kV line. The total cost would be higher than the 230 kV Alternatives.

Name	**Eldorado 230 kV Short Circuit Duty Mitigation**
Brief Description	Split the Eldorado joint-owned 230 kV bus with bus sectionalizing circuit breakers to mitigate short circuit duty (SCD) issues. Scope will include extending the bus and relocating 230 kV lines and other equipment within the substation.
Type	Reliability
Objectives	Reduce the SCD at Eldorado joint-owned 230 kV bus by about 21.4 kA to about 53.9 kA well below the 63 kA breaker rating while retaining operational flexibility and improving safety due to the reduced incident energy
Project Need Date	2023
Expected In-service Date	12/31/2029
Interim Solution	Operating solutions
Project Cost	$67 Million with $48.8 Million be part of the CAISO TAC, $18.2 Million will be allocated to LADWP and NVE
Alternatives Considered but Rejected	Alternative 1: • Construct a new substation. This alternative is not recommended due to high cost, potential licensing issues and long lead time to construct Alternative 2: • Upgrade substation to 80 kA standard to include breakers and associated equipment. This alternative is not recommended due to high cost and long lead time to construct. Alternative 3: • Split the north and south bus and add a 10 ohms reactor. The size of the reactor prevents the installation of required protection and isolation equipment withint the existing switch rack Alternative 4: • Add line reactors to the most impactful line to contributes the short circuit duty. Sufficient reactor impedance for SCD purpose could cause low voltages in the system. Alternative 5: • De-loop lines. It would leave little headroom for any expansion in the area.

Name	**New Humboldt to Fern Road 500 kV Line**
Brief Description	*Construct a 500 kV line from the new Humboldt 500 kV substation to Fern Road 500 kV substation*
Type	Policy
Objectives	Integrate the offshore wind from the Humbodlt call area in the base portfolio
Project Need Date	2034
Expected In-service Date	2034
Interim Solution	None
Project Cost	$980M - $1,400M
Alternatives Considered but Rejected	Alternative A • 2 x 500 kV lines from Humbodt 500 kV susbstation to Fern Road 500 kV substation Alternatvie B • HVDC line from Humboldt 500 kV substation to Conllinsville 500 kV substation Alternatvie C • HVDC sea cable from from Humboldt 500 kV substation to Moss Landing Alternatvie D • HVDC sea cable from from Humboldt 500 kV substation to Bay Hub with 230 kV to Potrero, East Shore and Los Esteros substations

Name	**New Humboldt 500 kV Substation with 500 kV line to Collinsville [HVDC operated as AC]**
Brief Description	*New Humboldt 500 kV station, with a 500/115 kV transformer, and a 500 kV line to Collinsville substation. The line is to be built for HVDC but initially operated as 500 kV AC.*
Type	Policy
Objectives	Integrate the offshore wind from the Humbodlt call area in the base portfolio
Project Need Date	2034
Expected In-service Date	2034
Interim Solution	None
Project Cost	$1,913M – $2,740M
Alternatives Considered but Rejected	Alternative A • 2 x 500 kV lines from Humbodt 500 kV susbstation to Fern Road 500 kV substation Alternatvie B • HVDC line from Humboldt 500 kV substation to Conllinsville 500 kV substation Alternatvie C • HVDC sea cable from from Humboldt 500 kV substation to Moss Landing Alternatvie D • HVDC sea cable from from Humboldt 500 kV substation to Bay Hub with 230 kV to Potrero, East Shore and Los Esteros substations

Name	**New Humboldt 115/115 kV Phase Shifter with 115 kV line to Humboldt 115kV Substation**
Brief Description	*Installation of a 115 kV phase shifting transformer to connect to the Humboldt 500 kV station with a 11k kV line to the Humboldt 115 kV substation.*
Type	Policy
Objectives	Integrate the offshore wind from the Humbodlt call area in the base portfolio
Project Need Date	2034
Expected In-service Date	2034
Interim Solution	None
Project Cost	$40M - $57M
Alternatives Considered but Rejected	Alternative A • 2 x 500 kV lines from Humbodt 500 kV susbstation to Fern Road 500 kV substation Alternatvie B • HVDC line from Humboldt 500 kV substation to Conllinsville 500 kV substation Alternatvie C • HVDC sea cable from from Humboldt 500 kV substation to Moss Landing Alternatvie D • HVDC sea cable from from Humboldt 500 kV substation to Bay Hub with 230 kV to Potrero, East Shore and Los Esteros substations

Name	**North Dublin -Vineyard 230 kV Reconductoring**
Brief Description	reconductor North Dublin -Vineyard 230 kV line with minimum summer emergency rating of 1350 AMPS or highest conductor feasible with existing structure and will include any other limiting elements upgrade to achieve the new line rating.
Type	Policy
Objectives	*To Mitigate overlaods Identified as part of Off shore wind interconnection Option E*
Project Need Date	2034
Expected In-service Date	2034
Interim Solution	N/A
Project Cost	$116.3M - $232.6M
Alternatives Considered but Rejected	RAS

Name	**Tesla - Newark 230 kV Line No. 2 Reconductoring**
Brief Description	reconductor Tesla –Newark #2 230 kV line - From 024/148 to Newark (approximately 4.28 miles), with minimum summer emergency rating of 3428 AMPS, matching other sections of the line or highest conductor feasible with existing structure. Will also include any other limiting element upgrades to achieve this line rating.
Type	Policy
Objectives	To Mitigate overlaods Identified as part of Off shore wind interconnection Option E
Project Need Date	2034
Expected In-service Date	2034
Interim Solution	N/A
Project Cost	\$29M - \$58M
Alternatives Considered but Rejected	RAS

Name	**Collinsville 230 kV Reactor**
Brief Description	adding 20 ohm reactors on the Collinsville – Pittsburg 230 kV lines.
Type	Policy
Objectives	To Mitigate overlaods Identified as part of Off shore wind interconnection Option E
Project Need Date	2034
Expected In-service Date	In conjunction with the Collinsville substation project.
Interim Solution	N/A
Project Cost	$30M - $40M
Alternatives Considered but Rejected	Additional lines out of Collinsville.

Name	**Sobrante 230/115 kV Transformer Bank Addition**
Brief Description	New 230/115 kV Bank at Sobrante Substation with 420 MVA rating. It will also include any bus upgrades and limiting equipment upgrades to achieve this transformer rating.
Type	Policy
Objectives	To mitigate overloads identified in the 23-24 policy study for GBA.
Project Need Date	2034
Expected In-service Date	2034
Interim Solution	N/A
Project Cost	$20M - $40M
Alternatives Considered but Rejected	Upgrading Existing Transformers