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California Energy Commission

Re: Docket No. 22-IEPR-03
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California Energy Commission (CEC) IEPR 2022 Transmission Response of Southern California Edison Company (SCE), dated November 21, 2022

Bulk Electric System Description and Needs (CEC text in black, SCE response in red)

Each LSE or electric transmission system owner shall submit a description of its bulk electric system or its latest long-term transmission expansion plan. They must also provide some discussion of how the SB 100 electric system decarbonization by 2045 requirements will affect the need for new or upgraded transmission. The electric system description shall include:

1. Detailed descriptions of the transmission facilities greater than 100 kV that the transmission owner or LSE needs over the long term to:
 - a. Meet applicable reliability and planning standards.

As a Participating Transmission Owner (PTO) within the California Independent System Operation (CAISO) Balancing Authority (BA), SCE participates in the CAISO Transmission Planning Process (TPP) to address reliability, economic, and policy-driven system expansion. The latest CAISO 2021-2022 Transmission Plan was published in March 2022¹ and includes a reliability analysis per applicable NERC, WECC, and CAISO reliability and planning standards, an economic analysis to estimate costs associated with congestion and costs of mitigation, and a policy-driven study to reflect state policy to meet renewable energy goals and greenhouse gas targets as described in Chapter 3 of the Transmission Plan. In addition to reporting on the current system and study assumptions, the Transmission Plan also includes past approved upgrades along with the status of those upgrades and the year they were originally approved.

- b. Reduce congestion.

See response to 1a above.

- c. Interconnect new generation.

Projecting the transmission needs to interconnect new generation is highly dependent on the location and type of the generation. To aid the state in developing an optimized generation portfolio, SCE

¹ Available at <http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf>, as of November 15, 2022

participates in the California Public Utilities Commission (CPUC) Integrated Resource Plan (IRP)² process. The finalized CPUC IRP becomes an input to the CAISO reliability and policy studies, so the resulting annual CAISO Transmission Plan includes major facilities that are needed to accommodate this generation portfolio. In addition to the latest CAISO Board-Approved Transmission Plan, CAISO also published the latest Transmission Capability Estimate on July 19, 2021³ to summarize potential upgrades that could be utilized to increase megawatts of Full Capacity Deliverability Status (FCDS) and Energy-Only Deliverability Status (EODS) generation by transmission constraint. Many of these upgrades were defined as part of the generation interconnection study process and are provided to estimate the cost for incremental capacity by transmission constraint. They are provided to the CPUC for their use in developing the next resource portfolio.

CAISO established the Transmission Development Forum⁴ in January 2022, which is a quarterly update on the status of projects approved through the TPP or network upgrades through the generation interconnection process. In addition to the annual updates provided in the Transmission Plan, the workbooks for the Transmission Development Forum include more recent updates and information on planned network upgrades.

d. Meet state policy goals such as the Renewables Portfolio Standard, SB100 and state climate goals, or aging power plant/once-through cooling retirements.

See response to 1a above and 4 below.

2. A description of the transfer capabilities for transmission lines or transmission paths delivering electric power into the electric transmission system owner's grid.

a. The description shall include the size (for example, mega voltampere[MVA] or megawatt [MW]) and length of the lines or lines included in the path and the substations to which the line connects.

The CAISO Transmission Plan includes the relevant information. Additionally, the publicly available 2022 WECC Path Rating Catalog⁵ identifies WECC transmission paths, as well as their associated definitions (i.e., lines included in the path and the substations to which the line connects) and transfer limits (i.e., the MW size). The WECC transmission paths that deliver electric power into the electric transmission system of SCE's grid are as follows:

- WECC Path 26: Northern–Southern California
- WECC Path 41: Sylmar to SCE
- WECC Path 42: IID-SCE

² Available at <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2019-20-irp-events-and-materials/portfolios-and-modeling-assumptions-for-the-2021-2022-transmission-planning-process>, as of November 15, 2022

³ Available at <http://www.caiso.com/Documents/WhitePaper-2021TransmissionCapabilityEstimates-CPUCResourcePlanningProcess.pdf>, as of November 15, 2022.

⁴ Transmission Development Forum materials are available on the CAISO User Groups and Recurring Meetings webpage at <http://www.caiso.com/informed/Pages/MeetingsEvents/UserGroupsRecurringMeetings/Default.aspx>, as of November 15, 2022.

⁵ Available at <https://www.wecc.org/Reliability/2022%20Path%20Rating%20Catalog%20Public.pdf>, as of November 15, 2022.

- WECC Path 46: West of Colorado River (WOR)
- WECC Path 49: East of the Colorado River (EOR)
- WECC Path 52: Silver Peak – Control
- WECC Path 58: Eldorado-Mead 230 kV lines
- WECC Path 59: WALC Blythe 161 kV Substation-SCE Blythe 161 kV Substation
- WECC Path 60: Inyo-Control 115 kV Tie
- WECC Path 61: Lugo–Victorville 500 kV line
- WECC Path 62: Eldorado-McCullough 500 kV line
- WECC Path 65: Pacific DC Intertie (PDCI)

b. A description of any planned upgrades to the facilities that are used to import power into the electric transmission system owner’s grid including:

- i. Descriptions of the upgrades including costs, benefits, maps, and the MW impact of the upgrades on transfer capabilities.
- ii. Descriptions of the alternatives considered in developing the upgrades.

As provided in response 1 above, a description of any planned upgrades to the facilities that are used to import power into the electric transmission system of SCE’s grid are identified in: (1) the California ISO’s annual Transmission Planning Process, and (2) the Transmission Development Forum through quarterly public stakeholder calls where SCE provides status updates on the transmission projects previously approved through the Transmission Planning Process and network upgrades identified in the generation interconnection process.

c. Any maintenance or construction that could impact transfer capabilities or the ability to move power over a path between January 2023 and December 2026.

Major planned outages are included and studied within the CAISO Transmission Plan.

d. A description of any planned transmission facilities that would create a new transmission path or transmission line to import electric power into the electric transmission system owner’s bulk electric network including:

- i. Descriptions of the facilities, including costs, benefits, maps, and the MW impact of the upgrade on transfer capabilities.
- ii. Descriptions of the alternatives, including non-wire alternatives, considered in developing the upgrades.

Similar to SCE response in 1 above, all planned new transmission paths or lines would be documented within the Transmission Plan or the Transmission Development Forum.

e. A more general description of any planned upgrades to the transmission network that imports electric power into the electric transmission system owner’s bulk transmission grid that are anticipated to be required to meet California’s long-range 2045 decarbonization goals.

All planned transmission network upgrades are documented within the Transmission Plan or the Transmission Development Forum, though the timeframe for those analyses do not extend to 2045.

The SCE Pathway 2045⁶ study estimated the need for \$13-37 billion in transmission investments to enable imports to meet our state decarbonization goals. The main drivers for investment in Pathway 2045 were to bring out-of-state wind in from other areas of the western US through the Eldorado/Mohave area in southern Nevada, the Colorado River area by the Arizona border, and through PG&E system to the north. There were also assumptions of Sierra Nevada geothermal and Baja California wind. The SCE analysis was completed before more recent resource portfolio interest in offshore wind as documented in the CAISO 20-Year Transmission Outlook⁷, which was published in 2022. The 20-Year Transmission Outlook assumed \$12 billion investment for out-of-state wind integration and \$8 billion for offshore wind integration.

The response to 4 below provides more details on the SCE Pathway 2045 and CAISO 20-Year Transmission Outlook.

3. A description of the transfer capabilities for the bulk transmission lines or bulk transmission paths limiting the delivery of electric power within the electric transmission system owner's grid.
- a. The description shall include the size (MVA, MW) and length of the line or lines included in the path and the substations to which the line connects.

The CAISO Transmission Plan provides information on known constraints limiting the delivery of electric power within the CAISO system as part of their reliability and policy-driven analyses. CAISO also publishes an annual Local Capacity Technical Study⁸ that identifies the limiting component to define the minimum Local Capacity Requirement (LCR) for each of the defined local capacity areas within the CAISO system. The Transmission Capability Estimate further provides information on potential mitigations to remove delivery constraints.

- b. A description of any upgrades to the facilities that are used to deliver power within the electric transmission system owner's grid including:
 - i. Descriptions of the facility or upgrade costs, benefits, maps, and the MW impact of the upgrade on transfer capabilities.
 - ii. Descriptions of the alternatives, such as non-wire alternatives, considered in developing the upgrades.

As provided in response 1 above, a description of any planned upgrades to the facilities that are used to deliver power within the electric transmission system of SCE's grid are identified in: (1) the California ISO's annual Transmission Planning Process, and (2) the Transmission Development Forum through quarterly public stakeholder calls where SCE provides the status updates on the transmission projects previously approved through the Transmission Planning Process and network upgrades identified in the generation interconnection process.

- c. Any maintenance or construction that could impact transfer capabilities within the electric transmission system owner's bulk transmission grid between January 2023 and December 2026.

⁶ SCE Pathway 2045 White Paper and Appendices are available at <https://www.edison.com/home/our-perspective/pathway-2045.html>, as of November 15, 2022

⁷ Available at <http://www.caiso.com/InitiativeDocuments/Draft20-YearTransmissionOutlook.pdf>, as of November 15, 2022

⁸ Available at <http://www.caiso.com/InitiativeDocuments/Final2023LocalCapacityTechnicalReport.pdf>, as of November 15, 2022

Major planned outages are included and studied within the CAISO Transmission Plan. SCE has analyzed challenging outages as part of their reliability planning process and proposed recent projects to make construction and maintenance outages less impactful and easier to schedule. These include the Victor 230 kV Reconfiguration, Devers 230 kV Reconfiguration, New Lugo No. 3 500/230 kV Bank, and New Eldorado No. 6 500/230 kV Bank projects. CAISO approved the Victor and Devers projects in the 2021-2022 TPP and SCE is reevaluating the Eldorado area needs in conjunction with other area short circuit duty challenges. SCE re-submitted the New Lugo No. 3 500/230 kV Bank project in the 2022-2023 TPP Reliability Window to reduce the economic and reliability impact of planned outages to one of the existing 500/230 kV transformer banks, in addition to other reliability, economic, and policy benefits.

- d. A description of any planned transmission facilities that would create a new means to transfer electric power within the electric transmission system owner's bulk transmission network, including:
- i. Descriptions of the facility or upgrade costs, benefits, maps, and the MW impact of the upgrade on transfer capabilities.
 - ii. Descriptions of the alternatives, such as non-wire alternatives, considered in developing the upgrades.

Similar to SCE response in 1 above, all planned transmission facilities that create a new means to transfer electric power with the transmission system of SCE would be documented within the Transmission Plan or the Transmission Development Forum.

- e. A more general description of any planned upgrades to the transmission network that transports electric power within the electric transmission system owner's bulk transmission network that are anticipated to be required to meet California's long-range 2045 decarbonization goals.

The response to 4 below provides more details on areas of possible upgrades for the transport of electric power within the SCE electric transmission system to meet California long-range 2045 goals.

4. A description of the bulk transmission facilities needed for meeting state-mandated electricity policy goals such as SB100 and state climate goals, renewable energy requirements, replacement, or retirement of aging power plants, and complying with the State Water Resources Control Board policies for phasing out power plants that use once-through cooling or eliminating or reducing local capacity requirements.
- a. The description shall include the size (MVA, MW) and length of the line or lines included in the path and the substations to which the line connects.
 - b. A description of any planned upgrades to the facilities in the electric transmission system owner's grid through 2045, including:
 - i. Descriptions of the upgrades including costs, benefits, maps, and the MW impact of the upgrade on transfer capabilities.
 - ii. Descriptions of the alternatives, such as non-wire alternatives, considered in developing the upgrades.

All SCE planned transmission expansion projects are captured in the CAISO Transmission Plan or listed as a network upgrade in the Transmission Development Forum, but SCE and CAISO have also been actively looking at possible future system needs that extend beyond the 10-year planning horizon.

- **SCE Pathway 2045:** In 2019, SCE completed a Pathway 2045⁹ analysis that envisions scenarios to meet California's decarbonization goals. More details on the assumptions are presented in the SCE Pathway 2045 white paper and the appendices. The SCE scenarios indicate that between \$28-48 billion investment in the CAISO-controlled system and neighboring transmission systems would be needed to interconnect and deliver new generation and import capability.
- **CAISO 20-Year Transmission Outlook:** The CAISO published their first 20-Year Transmission Outlook¹⁰ in January 2022, which provides high-level assumptions and study results for future 2040 system needs. The Transmission Outlook estimated \$30 billion would be needed for transmission development on top of the projects already proposed and approved in the Transmission Plan.

The SCE Pathway 2045 and CAISO 20-Year Transmission Outlook do not completely align due to different assumptions and timing, but both show the need for significant transmission investment to meet state goals. SCE has used these future-looking analyses to guide mitigations that are proposed within the CAISO TPP Reliability Window and network upgrades for the generation interconnection studies. The following sections discuss the needs at a high-level by area of the SCE system.

SCE Metro Area

The SCE Metro area contains most of the SCE load and serves Los Angeles, Orange, Ventura counties and the surrounding areas. The Metro area load has historically relied on a combination of local generation such as coastal generation, other gas, hydro generation etc., and imports from the other SCE areas described below. More information on the SCE Metro Area can be found in the 2021-2022 Transmission Plan and the latest CAISO Local Capacity Technical Study.¹¹

SCE and CAISO both identified the need to reinforce the transmission systems between the western LA Basin and eastern LA Basin in order to bring new generation to serve Metro area load. This is driven both by the forecasts in increased load due to electrification as well as reduction/retirement of existing natural gas generation. While the CAISO 20-Year Outlook proposed two new HVDC lines, the SCE analysis assumed the need would be met by reinforcing existing corridors through adding/reconductoring new 500 kV and 230 kV transmission lines and expanding more substations to 500 kV deeper into the LA Basin.

The SCE Pathway 2045 analysis also showed the need for the 4th 500/230 kV transformer bank at Serrano Substation, which SCE proposed in the 2021-2022 and 2022-2023 Transmission Planning Process Reliability Window.

SCE Northern Area

The SCE Northern Area consists of the Big Creek, Tehachapi and Ventura/Santa Barbara counties. The Big Creek Corridor is delineated into north and south of Magunden Substation. The north of Magunden

⁹ SCE Pathway 2045 White Paper and Appendices are available at <https://www.edison.com/home/our-perspective/pathway-2045.html>, as of November 15, 2022

¹⁰ Available at <http://www.caiso.com/InitiativeDocuments/Draft20-YearTransmissionOutlook.pdf>, as of November 15, 2022

¹¹ Available at <http://www.caiso.com/InitiativeDocuments/Final2023LocalCapacityTechnicalReport.pdf>, as of November 15, 2022

consists mostly of Big Creek hydro generation. The south of Magunden consists of gas generation at Omar/Sycamore/Pastoria, and renewable generation at Antelope/Whirlwind/Windhub in the Tehachapi area. The northern Bulk Area is connected with the PG&E area via Path 26.

The CAISO TPP and the 20-Year Outlook showed the reliance of RAS to be adequate for approximately 9500 MW of renewable generation in the Northern area. However, the SCE Pathway 2045 which had higher load and generation forecasts, indicated the need for additional transmission capacity in the Tehachapi and Big Creek areas. A second 500 kV line from the Northern to Metro area and additional AA 500/230 kV transformation were required to deliver the generation into the LA Basin. Assuming the retirement of the existing gas generation in the Big Creek area, reconductoring of several 230 kV lines were required. Dynamic as well as static reactive power resources and new 230 kV lines were also required for Ventura/Santa Barbara counties, which was evident due to the retirement of the coastal units and limited transmission lines in the area.

SCE Eastern Area

The SCE Eastern Area consists of the southern portion of San Bernardino county and Riverside county. It is comprised of 500 kV and 230 kV facilities, including major import transmission paths such as the Colorado River-Palo Verde 500 kV Line and the Imperial Irrigation District (IID) SCE Path 42. There are large amounts of solar generation and battery storage connecting to Colorado River Substation in the Blythe area and Red Bluff Substation in the Desert Center area. In addition, there are large amounts of wind and some gas generation connecting to Devers Substation in the Palm Springs area and additional gas generation connecting to Mountainview Substation in the Redlands area.

Both the 20-Year Outlook and SCE Pathway 2045 identified the need for additional transmission capacity from the Blythe to Palm Springs areas and ultimately into the LA Basin. Options considered are a new 500 kV line from Colorado River to Red Bluff to Devers and either a new HVDC or AC line from Devers into the LA Basin. In addition to strengthening these transmission corridors, additional 500/230 kV transformer banks will be needed at Colorado River and Red Bluff to accommodate additional 230 kV generation interconnections. Moreover, recent queue cluster 14 generation interconnection study results and SCE Pathway 2045 also indicate that additional generation collector stations could be needed in the Eastern Area to accommodate future renewables.

SCE North of Lugo Area

The North of Lugo area serves a large territory extending more than 279 miles, with 115 kV and 230 kV lines traversing through the Mono, Inyo, and San Bernardino counties. Small hydro and geothermal generation is transported south from the Mono and Inyo counties to Kramer Substation located in the west side of San Bernardino county. Modest amounts of solar generation are collected in the Kramer Junction and Daggett areas before being sent south to Victor Substation, which has a large gas generator in the Victorville area. The power continues to flow to Lugo Substation in Hesperia, where it is then delivered to the Ontario area.

Given the aging infrastructure in the North of Lugo Area, both the 20-Year Outlook and SCE Pathway 2045 identified multiple incremental upgrades to support additional renewable generation. Since a large amount of power accumulates at Kramer Substation, the Route 395 transmission corridor must be strengthened between the Kramer Junction and Hesperia areas. Options include reconductoring existing 230 kV lines with high temperature low sag conductor and/or new transmission lines between the Coolwater to Lugo, Kramer to Victor, or Kramer and Lugo substations. Furthermore, since most of the power in the North of Lugo area flows into the Lugo 230 kV Switchrack, additional bulk transformers will be required to step the power up the 500 kV level for export out of the system. SCE has proposed

reconductoring the Lugo-Victor No.1, No.2, No.3, and No.4 230 kV transmission lines, a new Lugo No.3AA 500/230 kV transformer bank, and a new Coolwater 1A 220/115 kV transformer bank in the 2022-2023 Transmission Planning Process Reliability Window.

SCE East of Pisgah Area

The SCE East of Pisgah area contains the transmission facilities roughly between the Henderson, Laughlin, and Newberry Springs areas, which includes the Eldorado, Ivanpah, Mohave, Pisgah, and Primm Substations. This area is a major transmission corridor connecting California, Nevada, and Arizona and is part of the West of River Path 46. It is heavily integrated with the Los Angeles Department of Water and Power (LADWP), Valley Electric Association (VEA), and Gridliance West (GLW) systems and supports solar generation near the California and Nevada border.

Due to anticipated solar resources in the southern Nevada area and Eldorado Substation being a likely injection point for out-of-state wind, both SCE and the CAISO identified the need to strengthen the transmission corridor between the Eldorado and Lugo Substations. Options include an additional 500 kV line between the Eldorado and Lugo or Lugo and Mohave Substations.

5. Identify the power purchase agreements, contracts, and resources that require new or upgraded transmission to serve California loads. For example, if an LSE has a contract with a wind generator in Wyoming but the contract can be fulfilled only if a specific transmission line is completed, such as the TransWestExpress project.

a. For each generator/contract/PPA provide the name of the resource, the size of the resource in MW and expected KWH and the name and owner of the required transmission facilities. The name of the resource should be consistent with the supply forms.

Table 1. SCE resources with new and upgraded transmission

Name of the resource	Size of resource in MW (contracted)	Expected kWh (contracted)	Developer Name	Interconnection Position (project)
Eldorado Valley Storage	60	240,000	174 Power Global	Q-1339
Desert Peak Energy Storage 1	325	1,300,000	NextEra	Q-1295
Condor Energy Storage, LLC	200	800,000	Arevon Energy	WDT-1659
Silver Peak Solar, LLC	109	436,000	174 Power Global	Q-1339
Desert Peak Energy Storage II, LLC	75	300,000	NextEra	Q-1295

Silver Peak Solar, LLC	110	440,000	174 Power Global	Q-1339
Hecate Grid Humidor Storage	115	460,000	Hecate Energy	Q-1629
SBES HoldCo, LLC	68.8	275,200	WPower	WDT-1189/1293, WDT-1697

SCE appreciates the leniency with submitting this delayed report. Should you have questions or require additional information, please feel free to reach out to me anytime.

Very truly yours,

/s/

Dawn Anaiscourt