



CALIFORNIA'S PATH TO DECARBONIZATION

**TRANSMISSION PLANNING, PERMITTING,
AND TIMELY CONSTRUCTION**

JULY 2023

GridLAB

CEERT

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1 INTRODUCTION

Earlier this year, the Center for Energy Efficiency and Renewable Technologies (CEERT) released a report, “Transmission in California”, on the need to build new high voltage transmission projects and upgrade existing transmission lines and substations in order to make substantial progress in the near and medium term in decarbonizing California’s electric system and the economy.¹

This report noted three important trends that have increased opportunities to accelerate decarbonization of California’s grid and economy—first, the rapid decline in costs of clean energy technologies; second, the improved recognition of suitable geographical locations where clean energy technologies can be sited; and third, the increase in electric load expected from the electrification of transportation, heating, and other end uses.

The enactment of the Inflation Reduction Act by Congress with sustained tax incentives for clean energy technologies has resulted in a surge of interest among investors and renewable energy project developers about opportunities in California. This interest can be observed by the flood of interconnection applications that have been submitted in the CAISO’s Cluster 14 and Cluster 15 application periods.

The Cluster 15 window, which closed on April 16, 2023, resulted in 546 new interconnection applications. This quantity exceeded the so-called Supercluster 14, which had 373 applications (a 46% increase). There are currently over 530 GW of interconnection applications in the CAISO queue; an order of magnitude more than is required to meet California’s needs.

Through coordinated efforts, California’s energy policymakers have created the conditions that encourage a high-level of interest in building and operating clean energy resources that will help the State meet its greenhouse gas (GHG) reduction goals. However, California will need to continue to make sustained efforts to ensure that sufficient transmission capacity is permitted and built in a timely manner to leverage this competitive market, and that feasible alternatives also be considered so that the failure to build one project does not result in a failure to achieve the desired capability expansion in a specific planning horizon. Delays in upgrading the transmission system will create irreversible lost opportunities for clean energy development as the need for decarbonization becomes ever more urgent.

In May, 2023, the California Independent System Operator (CAISO) Board of Governors adopted its annual 2022-2023 Transmission Plan. This year’s transmission plan adopts a more comprehensive and strategic approach to coordinate transmission planning with

¹ “Transmission in California”, CEERT. <https://ceert.org/wp-content/uploads/2013/pdf/Transmission-in-California.pdf>

interconnection studies for new resources and with resource procurement by load serving entities.

The zonal focus adopted by the CAISO is a clear strategy for organizing the transmission expansion planning process. Under this approach, the CAISO divides the State into zones and then prioritizes transmission expansion for zones that can provide the largest set of benefits for consumers. This CAISO's zonal approach has multiple benefits, including:

- Ensuring that transmission expansion projects are cost-effective and reduce congestion.
- Reducing the overall environmental impact of transmission expansion.
- Improving the reliability of the grid by reducing congestion and improving the ability to manage contingencies.
- Reducing the cost of electricity by making it easier to integrate renewable energy sources into the grid.
- Improving the efficiency of the wholesale electricity market by making it easier to move electricity from where it is generated to where it is needed.

This report is organized on the following topics: 1) a review of the adopted 2022-2023 Transmission Plan by utility service area with a focus on projects in Imperial County; 2) a focus on the transmission needs of the Central Valley to be addressed in the 2023-2024 Transmission Planning Process; 3) opportunities for phasing out fossil fuel generation in the Los Angeles Basin through transmission expansion; 4) a summary of the CAISO's interconnection queue management reform initiative; 5) an overview of the need for evolution of the CAISO methodology used in determining deliverability across the transmission system; 6) an examination of the need for transmission permitting reform; 7) a survey of the challenges facing California's transmission owners to complete projects approved in previous transmission plans; and 8) a high level overview of the opportunity to use High Voltage Direct Current transmission in California. Finally, this report provides additional conclusions and recommendations.

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THE 2022- 2023 CAISO TRANSMISSION PLAN

The Transmission Plan builds on two resource portfolios developed by the California Public Utilities Commission (CPUC) through its Integrated Resource Planning (IRP) Process. The base case scenario had a GHG reduction target for the electricity sector of 38 million metric tons (MMT) by 2030 and is relied upon for recommending Category 1 transmission projects.² A second portfolio with a 30 MMT GHG target by 2030 and with high electrification assumptions was also analyzed and taken into account to support some recommended projects.

This sensitivity portfolio with some modifications to busbar mapping will be used as the base case portfolio in the 2023-2024 Transmission Plan. The table below compares the resource additions in the two portfolios.³ It also shows that nearly 7,000 megawatts (MW) of new clean energy resources will need to be built annually for a decade to meet California's climate goals. The 2023-2024 Transmission Plan is expected to include additional recommended transmission projects.

TOTAL RESOURCE ADDITIONS IN TRANSMISSION PLANNING SCENARIOS

RESOURCES (MW)	BASE SCENARIO (2032)	SENSITIVITY SCENARIO (2035)
Solar	11,271	33,640
Wind	5,778	12,301
Battery Storage	7,299	20,673
Long Duration Storage	1,000	2,000
Geothermal	1,119	1,746
Bio	129	129
Total	26,597	70,489

2 The CAISO transmission plan identifies specific transmission facilities, which are categorized as either Category 1 facilities, that merit unconditional approval, or Category 2 facilities that may be needed depending on the course of future generation development. Category 1 transmission projects are specified with sufficient detail to allow eligible parties to submit competitive proposals to develop the projects. For Category 2 projects, parties are encouraged to propose alternative solutions that would be evaluated in subsequent annual transmission plans.

3 The resource additions use nameplate capacity. It is expected that many battery storage systems will be paired with renewable sources of generation so that the megawatts at points of interconnection will be less than the sum of the resources.

The CAISO's 2022-2023 Transmission Plan adopts a coordinated strategic approach to transmission planning that follows a memorandum of understanding (MOU) with the CPUC and the California Energy Commission (CEC) that was adopted in December, 2022. Under the MOU, the CAISO develops a transmission plan, initiates transmission projects, and informs clean energy project developers about specific geographic zones that are being targeted for transmission projects that will increase the capacity available in those zones. It is then the CPUC's responsibility to provide guidance to load-serving entities about their energy procurement plans. The CAISO, in its interconnection reform process, will then give priority to interconnection applications to the zones with available transmission capacity.

The following map of California displays the 14 zones used by the CAISO in the Transmission Planning Process (TPP), along with the quantities of new clean energy resources for each zone derived from the base case and sensitivity case provided by the CPUC from its IRP Process to the CAISO. The zone with the most new clean energy resources is the SCE Northern zone, where the Tehachapi Regional Transmission Project (TRTP) was completed in 2016.

As noted in the earlier transmission report, CEERT was instrumental in advocating for the TRTP. Built by Southern California Edison (SCE), it included two new connecting substations (Whirlwind and Windhub) and 173 miles of high voltage transmission lines.

The 2022-2023 Transmission Plan focused on developing transmission projects in three California zones that would enable large-scale development of new clean energy projects. Those zones are East of Pisgah, SCE Eastern, and SDG&E. Not only do the recommended transmission projects in these zones promote the development of solar, geothermal, and battery projects in Southern California, Southwest Nevada, and Western Arizona, but they also will serve as the gateway for wind projects developed in Wyoming and New Mexico. A total of 16,416 MW of clean energy capacity in the base case are tied to these transmission planning zones. For the sensitivity case, the amount increases to 34,720 MW.



CAISO 2022-23 TRANSMISSION PLANNING ZONES AND CAPACITY



The CAISO recommended 21 policy-driven transmission projects for development, with an estimated total of \$5.53 billion, to meet the clean energy requirements set forth in the two resource portfolios. Seven of the projects are located primarily in the SDG&E zone (which includes Imperial County), seven of the projects in the SCE Eastern zone, two projects in the SCE Metro zone, two projects in the PG&E Fresno zone, one project in the SCE North of Lugo zone, and one project in the East of Pisgah zone; one more project is located across the border in Arizona at an Arizona Public Service substation.

The CAISO also identified the need to reinforce the 500 kV network from Southwest Nevada to the Lugo substation in San Bernardino County near the town of Hesperia. The CAISO initially considered recommending a new 500 kV line from the Trout Canyon substation to Lugo, but put that recommendation on hold after receiving a proposal to convert an existing 500 kV line, from Mead to Adelanto, to a high voltage direct current (HVDC) line with two converter stations at each end (MAP Upgrade Project). The CAISO will review this alternative

and make a recommendation either as an extension of the 2022-2023 Transmission Planning Process or in the next planning cycle. Another project deferred with the same condition is a subsea transmission line linking the central coast with the west side of the Los Angeles load center. This line could also be included in the 2022-2023 transmission plan.

A. SDG&E AREA (IMPERIAL COUNTY)

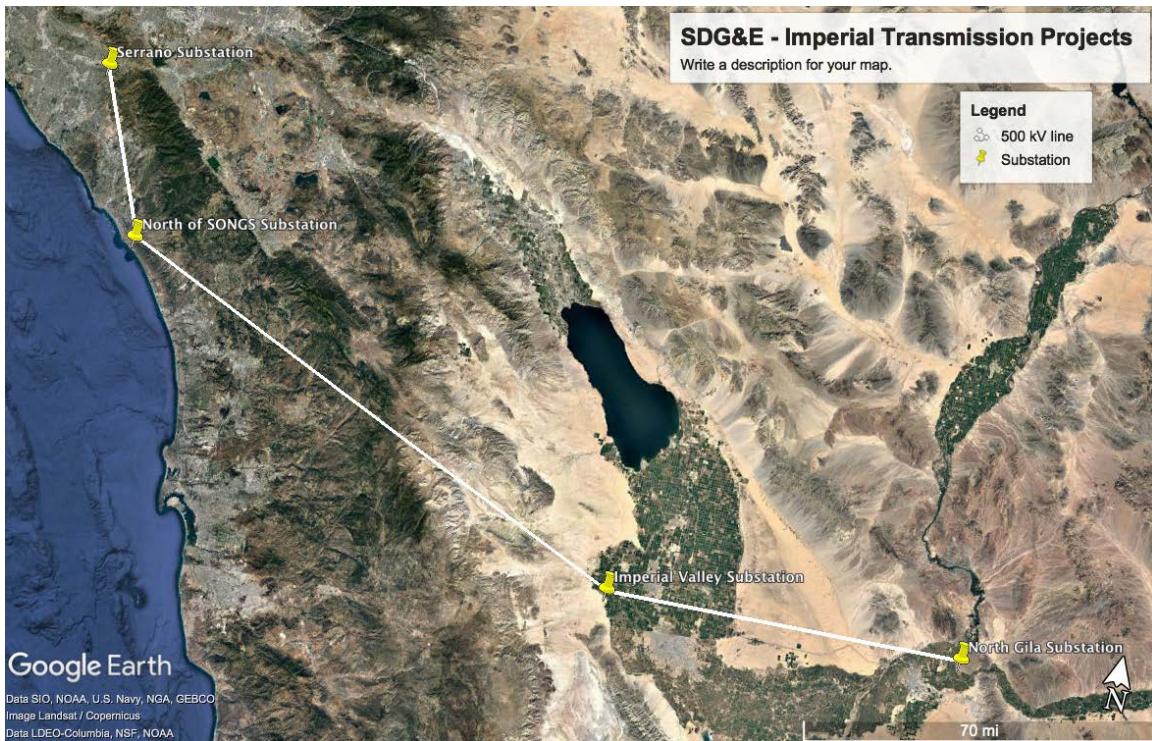
The SDG&E service area includes the CAISO transmission zone that covers Imperial and San Diego Counties. Imperial County is home to the Salton Sea geothermal field, which is one of the largest geothermal fields in the United States. The field has an estimated potential to produce approximately three gigawatts (GW) of geothermal energy, which can be used to generate electricity or provide heat for industrial and commercial use.

As a dispatchable source of clean energy, the development of geothermal energy from Imperial County can address California's need for zero-carbon electricity during periods when other resources are not available. It has the potential to create permanent jobs and careers as well as boost the regional economy. The development of geothermal energy along with new transmission can help to reduce Southern California's reliance on fossil fuels, particularly plants located in the LA Basin.

The CPUC sensitivity portfolio assumes that 900 MW of geothermal generation will be developed by 2035. It also assumes that 653 MW of solar and 375 MW of battery storage would be built in Imperial County. However, the current lack of transmission limits the delivery of power from the Imperial Valley to the San Diego urban area and/or into the SCE area.

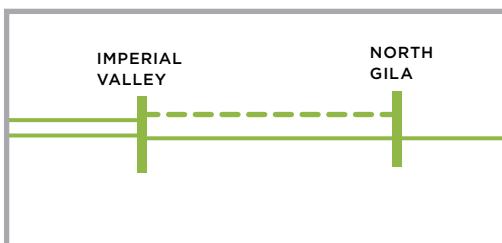
The CAISO recommended three policy-driven projects for approval in the 2022-2023 Transmission Plan that are eligible for competitive solicitation: 1) the Imperial Valley — North of SONGS 500 kV Line and Substation; 2) the North of SONGS — Serrano 500 kV Line; and 3) the North Gila — Imperial Valley 500 kV Transmission Line.

The following Google Earth image illustrates the general location of the three major recommended projects; starting on the right at the North of Gila substation in Arizona, proceeding across Eastern Imperial County on an existing right of way to the Imperial Valley Substation just west of El Centro, then proceeding northwest to a new 500 kV substation north of the closed San Onofre Nuclear Generating Station (SONGS) and onto the Serrano substation in Orange County east of Anaheim.



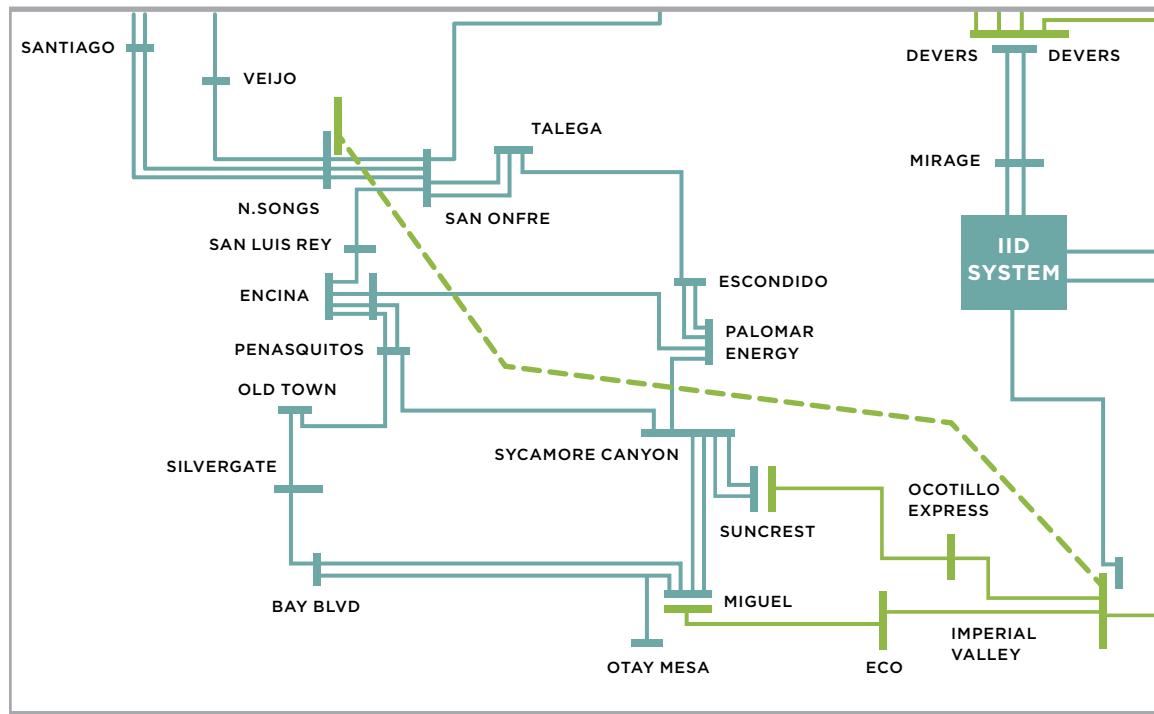
The North Gila — Imperial Valley #2 500 kV Line Project is part of the Southern Area Reinforcement. The following figure provides a schematic diagram of the transmission system in the area. As shown in the figure, the project scope includes a new 500 kV circuit between North Gila and Imperial Valley substations, estimated at 97 miles. The CAISO estimates that the proposed project will cost approximately \$340 million, with an in-service date of June, 2028.

LOCATION OF NORTH GILA - IMPERIAL VALLEY #2 500 KV LINE PROJECT



The Imperial Valley — North of SONGS 500 kV Line and 500/230 kV Substation project is also part of the Southern Area Reinforcement. The next figure provides a schematic diagram of the transmission system in the area. The project scope includes a new 500/230 kV substation north of SONGS with three 500/230 kV transformers, a new Imperial Valley — North of SONGS 500 kV transmission line estimated at 145 miles, and loops in the San Onofre — Santiago 230 kV #1 and #2 lines as well as the San Onofre — Viejo 230 kV line into the new substation.

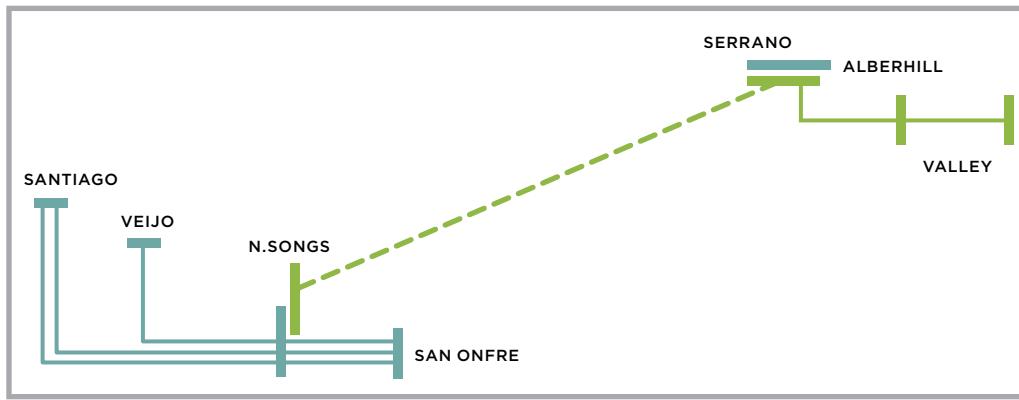
SCHEMATIC DIAGRAM OF THE IMPERIAL VALLEY – NORTH OF SONGS 500 KV LINE AND 500/230 KV SUBSTATION PROJECT



The CAISO estimates that the proposed project will cost approximately \$2,228 million. The CAISO recognizes some uncertainty regarding routing of the 500 kV alternating current (AC) transmission line. In the bidding process, they will seek risk mitigation strategies from project sponsors along with identification of potential alternatives. The project need date is 2030 with an expected in-service date of 2034. The location of the North of SONGS 500/230 kV substation is expected to be approximately 10 miles north of the existing San Onofre 230 kV substation.

The North of SONGS – Serrano 500 kV Line project is part of the Southern Area Reinforcement. The following figure provides a schematic diagram of the transmission system in the area. The project scope includes the new North of SONGS – Serrano 500 kV line, estimated at 30 miles.

SCHEMATIC DIAGRAM OF THE NORTH OF SONGS – SERRANO 500 KV LINE PROJECT



The ISO estimates that the proposed project will cost approximately \$503 million. There may be some uncertainty regarding routing and siting of the 500 kV AC transmission line. The CAISO will seek cost and risk mitigation strategies from project sponsors in their bid applications in the competitive solicitation process along with potential alternatives and mitigation measures if significant undergrounding of the line is required. The project need date is 2033 with an expected in-service date is 2034.

B. SCE AREA

Three major transmission projects emerged from the CAISO studies of the SCE area. The first addresses overloads between the Colorado River substation and the Devers substation in Riverside County, and between the Devers substation and the SCE Metro area. An additional 500 kV transmission line along this corridor was considered to mitigate deliverability constraints in both the base case scenario and the sensitivity scenario and enable large additional amounts of solar and battery projects in the interconnection queue to be developed. With the recommendation by the CAISO of the three SDG&E – Imperial County projects, it was determined at this stage that only upgrades would be required to support the base case clean energy projects rather than an additional 500 kV line.

The recommended upgrades are planned for the 500 kV #1 line from the Colorado River substation to the Red Bluff substations (\$50 million); the 500 kV #1 and #2 lines from the Red Bluff substation to the Devers substation (\$140 million); the 500 kV #1 line from the Devers substation to the Valley substation (\$40 million); and the 500 kV #1 line from the Valley substation to the Alberhill and Serrano substations (\$60 million).

The following Google Earth image illustrates the locations of the various elements of the upgrades in the SCE Eastern area. All of the upgrades occur on existing SCE rights of way. All of the projects are expected to have in-service dates of 2028.

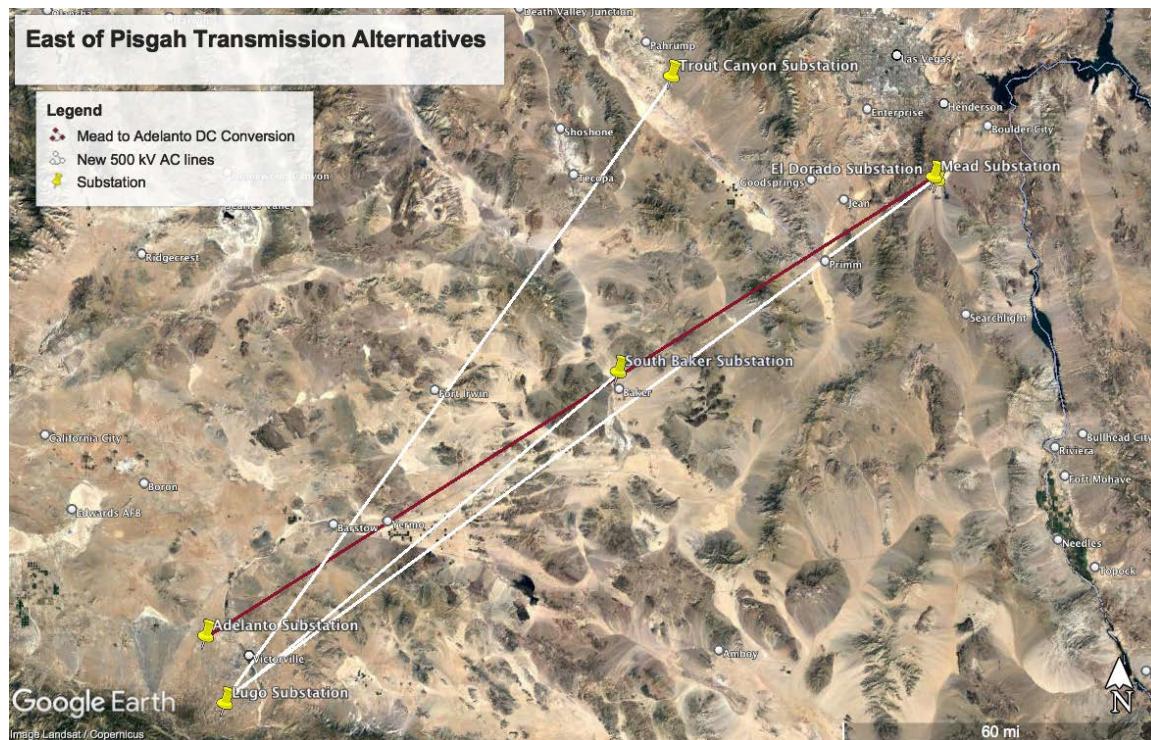


The second large-scale transmission project is intended to address the Lugo-Victorville constraint, which is driven by power coming through Nevada to the Lugo and Victorville substations in San Bernardino County. The CAISO system overloads are parallel to constraints that the Los Angeles Department of Water and Power (LADWP) faces on its transmission system from the McCullough substation in Nevada to the Victorville substation in San Bernardino County.

The CAISO analyzed three alternatives to mitigate the constraint; one involved building a second 180-mile 500 kV line between the Eldorado and Lugo substations, and the other two alternatives involved the construction of new 500 kV lines as well as substation upgrades. As mentioned earlier, the CAISO recommended a new 500 kV line from the Trout Canyon substation in the area, served by the Valley Electric Authority in Nevada, to the Lugo substation in San Bernardino County, but received an alternative MAP Upgrade Project proposal from Lotus Infrastructure Partners in April, 2023. This conversion of an existing 500 kV AC line to HVDC operation would increase capacity from 1,291 MW AC to 3,500 MW DC.

The converted HVDC line would run from the Marketplace substation in Nevada to the Adelanto substation in San Bernardino county. The proposed DC conversion would use existing conductors, towers, and insulators with no significant modifications required to the existing 202 miles of transmission facilities. The Project requires the construction of two HVDC converter terminals: one near the Marketplace Substation in Southern Nevada and the second near the Adelanto Substation in Southern California. The Project also requires some modifications and upgrades to the existing transmission facilities to integrate the new transmission capacity into the transmission system.

A transmission solution is needed to overcome the Lugo-Victorville constraint to enable more power to be imported from solar and battery projects in Southern Nevada and for wind imports from Wyoming and/or Idaho. The CAISO is expected to recommend a mitigation plan for the Lugo-Victorville constraint later this year as part of the 2022-2023 Transmission Planning Process or next year as part of the 2023-2024 Transmission Plan.



The third set of projects are located in the SCE Metro zone which includes portions of Los Angeles, Riverside, Orange, and San Bernardino Counties. Proposed projects are intended to address constraints that were identified through modeling of the base case. Many additional constraints were identified in modeling of the sensitivity portfolio that were not fully addressed among the recommended projects for the SCE metro zone.

The recommended Serrano — Del Amo — Mesa 500 kV Transmission Reinforcement Project consists of 1) a new 500 kV switchyard at Del Amo, complete with three 500/230 kV transformers; 2) extend the existing Mesa — Mira Loma 500 kV line by building a two-mile new section into Mesa and a 13-mile new 500 kV line to Serrano; and 3) interconnect the new Mesa — Serrano 500 kV line with two new 500 kV lines from Del Amo (approximately 13 miles) to form the Del Amo — Mesa and Del Amo — Serrano 500 kV lines.

The primary objective of the Serrano — Del Amo — Mesa 500 kV Transmission Reinforcement Project is to address constraints that were found to limit delivery of clean energy resources located in other parts of Southern California to the SCE Metro load center/LA Basin local

capacity area. The CAISO recommended approval, considering the 10+ year lead time of the project and the need to meet the 2023-2024 TPP portfolios. This recommendation followed the guidance from the CPUC to take under consideration the 2023-2024 TPP base case portfolio based on the 30 MMT GHG target when evaluating transmission needs resulting from the 2022-2023 TPP policy driven sensitivity portfolio.

The SCE Metro projects are also congruent with SB 887 (Becker) guidance to identify the highest priority transmission facilities that are needed to increase transmission capacity into local capacity areas to deliver renewable energy resources or zero-carbon resources that are expected to be developed by 2035.



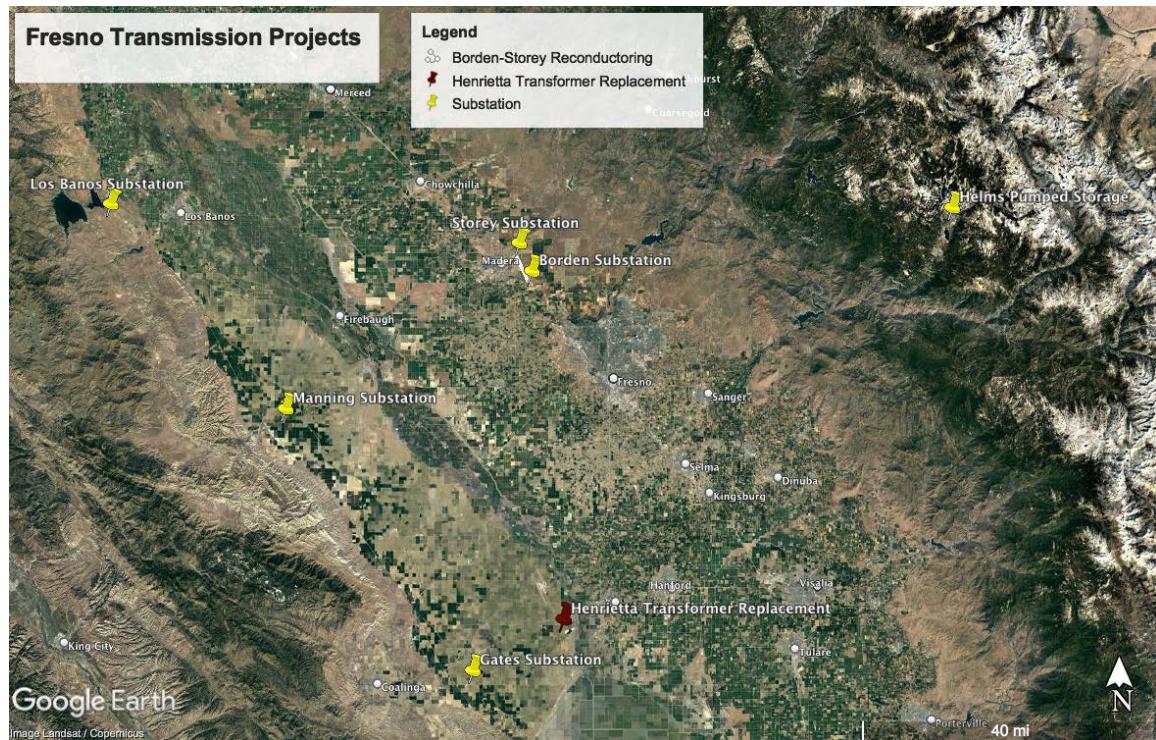
C. PG&E AREA

PG&E's service area includes multiple transmission zones, including the Greater Bay Area, North of the Greater Bay Area, Fresno, and East Kern zones. 16 of the 24 recommended reliability-driven transmission projects are located in PG&E's service area. The estimated costs of these projects totals \$1,134.5 million, which amounts to 64% of the cost of all the recommended reliability-driven transmission projects.

The PG&E service area also includes the locations where offshore wind projects located in the Central Coast and North Coast would land for delivery to the state's load centers. The base case assumed that 120 MW of energy-only offshore wind would be delivered from

Humboldt Bay Wind Area to the North of Bay Area transmission zone, while 1,588 MW of fully deliverable offshore wind from the Morro Bay Wind Area would be delivered to the East Kern transmission zone through the existing Diablo Canyon 500 kV substation. The transmission needs for offshore wind from the North Coast will be examined in more detail in the 2023-2024 TPP.

There were two policy-driven transmission projects in the PG&E service area, both located in the Fresno transmission zone and are relatively minor in scope. One project, at the Henrietta substation near Lemoore, requires the replacement of a 230/115 kV transformer bank. The other, to the east of Madera, requires the reconductoring of two 230 kV lines between the Storey and Borden substations. The total estimated cost of these two projects is \$70 million. The following Google Earth image of the lower Central Valley shows the locations of the recommended projects as well as major substations along Path 15, which is located on the western side of the Central Valley. The image also shows the location of the 1,212 MW Helms Pumped Hydro Storage Project on the Kings River basin.



In the earlier CEERT transmission report, it was noted that there was a major difference between the quantity of solar and battery storage resources contained in the CPUC base case scenario compared to that of the sensitivity case in the Fresno and East Kern transmission zones. The following table compares the resources included in the two cases; it can be seen that the sensitivity case has more than three times the resources as the base case. It should be noted that the sensitivity case will be the base case in the 2023-2024 TPP.

COMPARISON OF RESOURCE PORTFOLIOS IN SOUTH PG&E TRANSMISSION ZONES

TRANSMISSION ZONE	BASE CASE (MW - 2032)	SENSITIVITY CASE (MW - 2035)
Fresno	2,699	8,399
East Kern	2,332	9,553
Morro Bay Offshore Wind	1,588	3,100

CEERT and several other parties expressed concerns about the CAISO solely relying on the CPUC base case in making recommendations for policy-driven transmission projects for the Central Valley in the 2022-2023 Transmission Plan. The CAISO, in response, agreed that there are many additional constraints that were identified in the sensitivity portfolio. The CAISO has committed to assessing mitigation alternatives for these constraints in the 2023-2024 planning cycle.⁴

⁴ Memorandum to CAISO Board of Governors from Neil Millar, Vice President of Infrastructure and Operations Planning, May 110, 2023, Page 12

3

THE CENTRAL VALLEY AND LONGER RANGE TRANSMISSION PLANNING

The Central Valley of California is well known throughout the world as a robust and diverse agricultural region. It produces a wide variety of crops, including fruits, vegetables, nuts, and grains. The Central Valley is also home to a number of major food processing and distribution centers.

In recent years, the Central Valley has been facing many challenges exacerbated by climate change. Climate change is causing the Valley to experience more extreme heat events as well as sustained droughts and major flooding, making it more difficult to grow certain crops and damaging infrastructure. Climate change is also affecting the valley's water supply; for a region already periodically facing water shortages, climate change worsens the problem. The snowpack in the Sierra Nevada mountains, which provides a significant amount of water for the valley, is often melting earlier in the year. Increased variation in weather patterns makes it more difficult to rely on stored water for use in agriculture.

The changing role of agriculture in the Central Valley is a major concern for leaders in the region. The valley's economy is expected to continue to be dependent on agriculture, but longer periods of water shortages will further limit production. There are a number of policies that can be adopted to address the challenges facing the Valley's communities, including investing in new water conservation technologies, planting more drought-resistant crops, and working to bring other sustainable sources of economic activity to the region.

The Central Valley of California is a prime location for solar energy development. The valley receives an average of 300 days of sunshine per year, and the land is relatively flat and open, making it suitable for the development of larger contiguous solar projects, particularly in areas of the valley that are not agriculturally productive.

In recent years, there has been a significant increase in solar energy development in the Central Valley. In 2019, the valley accounted for 20% of all new solar capacity installed in California. This growth is expected to continue in the coming years, if there is the infrastructure to deliver the solar energy to other regions of the State. The development of solar energy in the Central Valley has the potential to create a significant number of jobs.

In June, 2022, the CAISO promulgated a 20-Year Transmission Outlook report to support the SB 100 planning work being carried out by the CPUC and the CEC. A key reason for adopting a 20-year planning horizon was the recognition that resource development, as a

means to meet state policy goals and reliability needs, will accelerate sharply through 2040. This longer-term planning horizon is consistent with the approach being considered by the Federal Energy Regulatory Commission (FERC).⁵

For the 20-Year Transmission Outlook Report, the CAISO staff used a resource portfolio that assumed a total of 15,000 MW of natural gas power plant retirements by 2040. This scenario was referred to as the Starting Point Scenario. The following table provides the resource assumptions for the SB 100 Starting Point Scenario for 2040.

The Starting Point Scenario identified a need for the development of 53,212 MW of utility-scale solar by 2040. In allocating the utility scale solar to geographical locations, the Starting Point Scenario utilized commercial interest together with environmental screens to determine where solar might be suitably located. The following table shows transmission zones where most of utility-scale solar would likely be sited by 2040.

STARTING POINT SCENARIO SOLAR RESOURCES BY TRANSMISSION ZONE

RESOURCE LOCATION	CAPACITY (MW)
SDG&E - (Imperial County - Arizona)	8,759
North of Lugo (San Bernardino County)	2,162
SCE Northern (Tehachapi)	11,610
East of Pisgah (Southern Nevada)	2,024
SCE Eastern (Riverside County)	4,922
PG&E Fresno (Central Valley)	13,734
PG&E East Kern (Central Valley)	6,154

The CAISO studies in the 20-Year Transmission Outlook specifically looked at transmission line overloads in the Central Valley, assuming that only 2,000 MW of local gas-fired generation would be available in the Greater Bay Area. The next table shows transmission elements in the Central Valley that would be overloaded during normal operating conditions during early-afternoon summer conditions.

⁵ FERC Docket No. RM21-17-000

PEAK SUMMER OVERLOADS DURING NORMAL OPERATIONS

OVERLOADED ELEMENT	BASE CASE OVERLOAD
Manning - Gates 500 kV line	163%
Los Banos - Manning #1 and #2 500 kV lines	152%
Los Banos - Tesla 500 kV line	138%
Los Banos - Tracy 500 kV line	117%
Los Banos - Moss Landing 500 kV line	116%
Moss Landing - Las Aguilas 230 kV line	133%
Westley - Los Banos 230 kV line	119%
Panoche - Los Banos 230 kV line	119%

The following Google Earth image shows the general location of the overloaded transmission line in the Central Valley. Mitigation projects will need to be identified in the upcoming 2023-2024 TPP to enable further development of renewable resources in the Central Valley and reduce dependence on gas-fired power plants in the Greater Bay Area.



The Nature Conservancy of California, in partnership with Montara Mountain Energy and E3, recently conducted a study that highlights the scale of available solar resources in least regrets areas of the San Joaquin Valley, including on lands that could be more likely to transition out of agricultural production in the coming years.⁶ Approximately 25% of the statewide solar resources are mapped to the San Joaquin Valley for 2035, and most of this capacity can be developed in least regrets areas. The study both finds a need for new transmission to unlock these resources, and, in parallel, to study further upgrades at the Helm, Le Grand, Tranquility, Borden, Henrietta, Mustang, Storey, Vestal, and Warnerville substations beyond what is currently planned as part of the 2022-2023 TPP. For these parts of the transmission system, solar resource potential and commercial interest exceed planned upgrades.

⁶ The study was shared as part of the docket for the recent Integrated Energy Policy Report (IEPR):

4

OPPORTUNITIES FOR PHASING OUT FOSSIL FUEL GENERATION IN THE LOS ANGELES BASIN

Gas-fired electric generation has been a major part of the Los Angeles Basin's energy mix for many decades. In 2020, local gas-fired power plants generated about 40% of the region's electricity.

Dependence on gas-fired electric generation in the Los Angeles Basin has grown as imports from out-of-state coal generation declined and also following the closure of SONGS. Gas was assumed to be a relatively inexpensive fuel, and it was assumed that it could be delivered reliably and safely to local power plants. Longer-term dependence emerged since gas-fired power plants can ramp up and down quickly to meet changes in demand, which also makes them useful for meeting peak loads.

In recent years, there has been a growing movement led by environmental justice organizations to reduce the Los Angeles Basin's reliance on gas-fired electric generation. This movement is being driven by a number of factors, including concerns about climate change, regional air quality, and a growing awareness of the inequities facing disadvantaged communities, where many of these facilities are located.

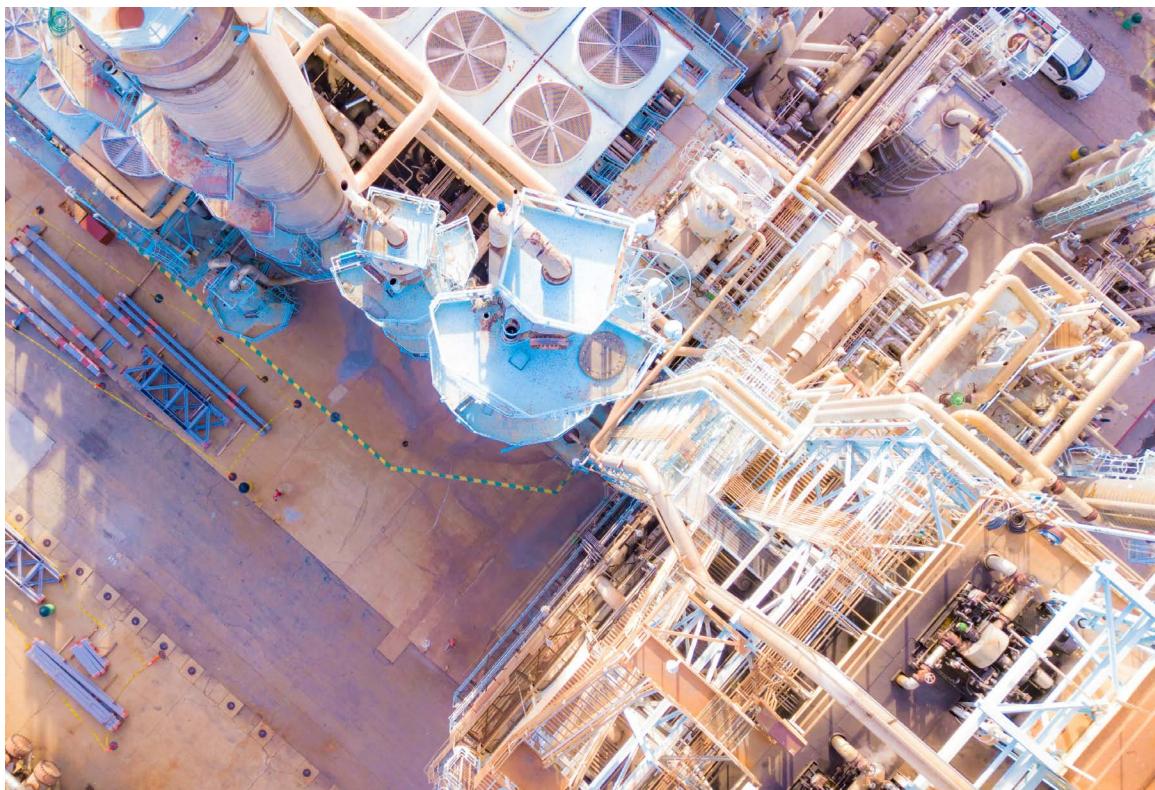
In March, 2021, the LADWP together with the National Renewable Energy Laboratory (NREL) released a study that examined options for reducing and eventually eliminating the city's reliance on gas-fired electric generation.⁷ The purpose of the study was to provide a broad understanding of the opportunities and tradeoffs to achieve a 100% zero-carbon electric system for Los Angeles. The study examined various combinations of renewable energy deployment as well as electrification of transportation and building end-uses.

The study concluded that no-regrets options include new wind, solar, batteries, and transmission deployed in or out of the LA Basin coupled with smart-grid operational practices that make more efficient use of grid investments.⁸

Residents of the LA Basin, which includes all or parts of Los Angeles, Orange, Riverside, and San Bernardino Counties, rely to a significant extent on twelve large-scale gas plants spread out across the region from Huntington Beach in the south, to the San Fernando Valley in the

⁷ LA100: The Los Angeles 100% Renewable Energy Study. www.nrel.gov/docs/fy21osti/79444-ES.pdf

⁸ Key finding from LA100, Page 6. www.nrel.gov/docs/fy21osti/79445.pdf



north, to San Bernardino in the east; six of these power plants are located near the coast with their emissions flowing inland.

With the large quantities of solar and wind generation often paired with batteries being developed to the north in the Antelope Valley, to the east in Riverside and San Bernardino Counties, and to the south in Imperial County, it should be possible over the next fifteen years to significantly reduce the use of these power plants and eventually have them retire. Furthermore, by reducing the use of these power plants, SoCal Gas will be able to reduce its gas inventory stored in the Aliso Canyon gas reservoir in the Santa Clarita Valley, site of one of the biggest gas leaks in the United States.

According to a study done for the California Public Utilities Commission, these twelve power plants will need approximately 288 million cubic feet of gas per day (MMcf/d) in 2027, or approximately the same daily gas use of 15 million average homes.⁹ Reducing demand for gas at these power plants will have the benefit of reducing local air pollution (NO_x and $\text{PM}_{2.5}$), and reducing the amount of methane gas that needs to be stored in the region (and therefore the on-going risk of another catastrophic leak). The table below lists the twelve power plants, their electric capacity, and the projected amount of gas that would be burned to produce the electricity.

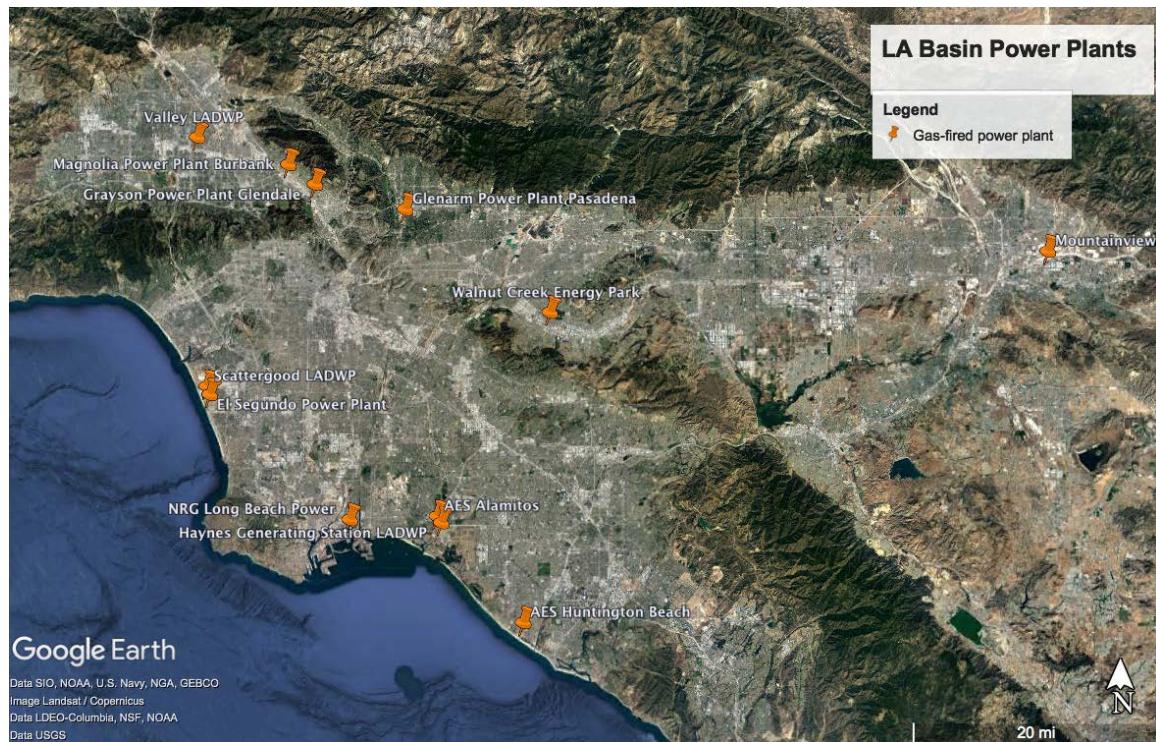
⁹ $288,000,000 \text{ ft}^3 / [(\text{Average home annual consumption} = (7,000 \text{ ft}^3 / 365 \text{ days per year})] = 15,017,143 \text{ homes}$

GAS PLANTS WITH HIGHEST GAS CONSUMPTION IN 2027

AREA	FACILITY NAME	FACILITY CAPACITY (MW)	2027 PROJECTED GAS DEMAND (MMCF/D)
SCE	AES Huntington Beach Energy Project	840	79.150
SCE	AES Alamitos Energy Center	1040	78.179
LADWP	Scattergood Generating Station	830	35.833
SCE	Mountainview Generating Station	1056	25.483
LADWP	LADWP Haynes Generating Station	1580	14.528
SCE	Glenarm Power Plant	102	12.563
SCE	El Segundo Energy Center	526	11.727
LADWP	LADWP Valley Generating Station	512	11.617
LADWP	SCPPA - Magnolia Power Project	323	7.507
LADWP	Grayson Power Plant	260	5.650
SCE	Walnut Creek Energy Park	500.5	4.197
SCE	Long Beach Generation, LLC	177.3	1.652
TOTAL		7746.8	288.086



The following Google Earth image shows the location of the twelve gas-fired power plants located in the LA Basin.



In order to reduce the operation of these twelve power plants, more electricity will need to be imported from outside the region, where wind, solar, and geothermal power plants are being developed. As part of the 2022-2023 Transmission Planning Process, the CAISO conducted a reliability assessment for the LA Basin and San Diego – Imperial Valley areas, assuming the Aliso Canyon gas storage facility was not available for approximately 3,700 MW of gas-fired generation.¹⁰ The study identified 25 transmission lines and other elements, such as transformers, that would be overloaded with the curtailment of 3,700 MW of gas-fired power plants in the SCE and SDG&E areas. To mitigate the impact on these facilities, the CAISO developed and studied 13 alternative transmission scenarios. The CAISO's analysis of the effectiveness of these scenarios narrowed down the transmission alternatives to three options.¹¹

Each of the three options included as an anchoring element a high voltage direct current (Diablo South HVDC) subsea cable that would run from Diablo Canyon to two terminal converter stations in the greater Los Angeles region. The options also include other

¹⁰ The CPUC is studying the possible retirement of the Aliso Canyon facility as part of I.17-02-002.

¹¹ APPENDIX K: Informational Special Study of Reduced Reliance on Aliso Canyon Storage – Assumptions, Study Results and Alternative Analysis

<http://www.caiso.com/InitiativeDocuments/Appendix-K-Draft-2022-2023-Transmission-Plan.pdf>

transmission upgrades in the SCE and SDG&E areas. By adding delivery of energy from the north into the Los Angeles Basin, the Diablo South HVDC cable also provides relief for Path 26 under contingency conditions.

While the addition of Diablo South HVDC cable would not allow for the immediate closure of the Aliso Canyon gas storage facility, it would significantly decrease the use of fossil generation in the LA Basin and increase system reliability by providing an alternative path to Southern California from Path 26. For these reasons, CEERT recommended to the CAISO that it include the Diablo South HVDC cable as a least regrets transmission project.

Fifteen years ago, San Francisco faced a similar challenge with the operation of two gas plants, Potrero and Hunters Point, in low-income neighborhoods of the city. The solution was to build a HVDC cable under the San Francisco Bay, from Pittsburg in the east to an industrial area near the Giants' Oracle Park stadium. This new transmission line greatly improved electric system reliability for San Francisco by allowing two-way power flows into the city's distribution system.

Similarly, a HVDC power line from the north to Los Angeles would reduce the risk of power disruptions over the single north-south power pathway from the Central Valley to Southern California. In addition, this new transmission line could be used for the delivery of energy from planned offshore wind projects along the Central Coast, as well as new solar projects being developed in the lower Central Valley.

To enable this proposed HVDC power line to provide the most benefit to the greater Los Angeles area, the CAISO and LADWP have agreed to work together to examine the costs and benefits of the project. CEERT believes the project should be included in both of their Transmission Plans. If the CAISO and LADWP work quickly, the new subsea cable could become operational before 2035 and help phase out the dependence on gas-fired power plants for electricity in Los Angeles.

5 INTERCONNECTION QUEUE MANAGEMENT REFORM

Transmission expansion planning and the generator interconnection process have always been closely related to one another. However, with the adoption of a zonal focus for transmission planning, the CAISO has explicitly coupled the Transmission Planning Process with queue management reform. This more proactive and coordinated approach reflects the agreement between the CAISO, the CPUC, and the CEC that was reached last December.

The CAISO's TPP is the public process used in California for identifying the need for new transmission lines and upgrades to existing lines and substations. The generator interconnection process determines under what conditions a new generator can be connected to the grid.

The results of the TPP determine the amount of capacity available for new generator interconnection. Without a robust Transmission Planning Process, generator interconnections will be significantly delayed and the costs of area network upgrades can significantly impact transmission costs. The CAISO has committed, as part of its TPP, to communicate to the electric industry which geographic areas are being targeted for renewable energy development.



For renewable energy projects to be financed, they need to have a clear line of sight of when they can be connected to the grid and whether the power they produce can be reliably delivered to customers. The CAISO's interconnection process has slowed in part because of the lack of available transmission capacity for new generators to reliably deliver power to load centers and the need for network upgrades triggered by interconnection applications. While available transmission capacity has become scarcer, there has also been an enormous increase in the number of interconnection applications, particularly for battery storage projects.

The CAISO interconnection process was overwhelmed during the Cluster 14 application cycle, which saw a near tripling from the previous cycle in the number of interconnection applications submitted by the April 2021 deadline. The CAISO responded to this flood of new interconnection applications by, with permission from FERC, delaying the completion of the necessary interconnection technical studies for a year. Also, the timing of the Cluster 15 application window was also delayed for a year, until April, 2023.

The Cluster 15 interconnection request application window was open from April 3rd to 17th this year (2023). The quantity of interconnections was beyond overwhelming, with 546 applications totaling over 346 GW of capacity. The massive volume of interconnection requests highlights the need for interconnection queue reform. The CAISO has proposed to execute reform in two tracks: the first track, approved at the CAISO May 2023 Board Meeting, was to delay the initiation of Phase 1 interconnection studies for the Cluster 15 applicants until after the Phase 2 interconnection studies for Cluster 14 applicants are completed in 2024; the second track, initiated with a CAISO staff white paper with expected completion by the end of the year, seeks to better manage the queue and establish criteria to prioritize certain interconnection requests by limiting the intake of requests. The goal is ultimately to accelerate the development of new clean energy projects by ensuring the interconnection process adapts to California's need for a rapid pace of development.

An interconnection request includes several components: the selection by the developer of a specific point of interconnection, the determination by the CAISO as to whether there is sufficient transmission capacity to deliver power reliably from that location, and the construction of network upgrades by the transmission owner that are financed up-front by the interconnection customer.

Interconnection customers can request a deliverability designation when they submit their interconnection applications; the choices are Full Capacity Deliverability Status (FCDS), Partial Capacity Deliverability Status (PCDS), or Energy Only (EO). They are awarded FCDS or PCDS status to the extent that deliverability is available on the transmission system. Clarity in determining deliverability allocation is critically important to developers. Being designated FCDS or PCDS means that the project can deliver a specific amount of capacity to the grid under highly stressed conditions during periods of gross load and net peak load. An EO designation, on the other hand, means that the generator's delivered output is subject to grid conditions.

Deliverability designations are key to Resource Adequacy (RA) in California. An FCDS or PCDS designation qualifies the generator's output to count towards a load serving entity's RA requirement, whereas an EO resource cannot supply RA.

FCDS and PCDS generators are responsible for the financing costs of constructing Delivery Network Upgrades. These are upgrades to the system designed to relieve transmission constraints. An EO resource is not responsible for deliverability upgrades.

Once an interconnection customer has a deliverability allocation, it must make commercial progress in order to retain the allocation. Generally, all projects must eventually secure a Power Purchase Agreement (PPA) to retain a deliverability allocation. In the future, the CAISO intends to be more aggressive in terminating interconnection agreements that do not meet project milestones.

While interconnection customers provide the initial financing for local delivery network upgrades, they eventually are reimbursed with the cumulative costs going to ratepayers that use the transmission system.

Ultimately, the purpose of allocating deliverability is to allow projects that are most likely to be built and contracted with load serving entities to secure a study attribute that ensures availability during stressed system conditions. Since incremental deliverability on the transmission system is limited, it is important that delivery network upgrades be used to meet procurement portfolios provided by load serving entities.

Limiting interconnection requests and better managing the queue is reasonable. However, queue reform alone is not sufficient to ensure the electric system will be ready to deliver the vast amounts of renewable and zero-carbon energy that is required to meet California's decarbonization goals. The CAISO has recognized through its zonal focus approach to the Transmission Planning Process that transmission expansion will need to accelerate and be more closely coordinated with the interconnection process and the procurement plans of load serving entities.

CEERT intends to participate in the CAISO's track two interconnection reform process. Near-term relief in connecting new generators may be possible through the reform of methodology used in determining deliverability, which is discussed more in the following section.

6

TRANSMISSION PROJECT IMPLEMENTATION CHALLENGES

Once transmission projects and network upgrades are authorized through the TPP or the Generator Interconnection and Deliverability Allocation Procedures (GIDAP), they need to be permitted and built. While large new transmission projects are competitively bid by the CAISO and their development awarded to independent transmission developers, the majority of projects that are currently under construction are the responsibility of incumbent utility transmission owners; i.e., PG&E, SCE, and SDG&E in California, and Valley Electric Association in Nevada.

The completion of many already-permitted transmission projects have been delayed for a variety of reasons. There are currently 166 projects in the CAISO interconnection queue that have executed agreements for interconnection. The generation capacity from these agreements totals nearly 40 GW. Development of a portion of these projects would go a long way towards alleviating near term reliability issues and advancing California's climate goals.

The specific transmission system upgrades needed to connect these 166 projects to the grid have been identified through the CAISO interconnection study process and the costs have already been determined. The next step is for the participating transmission owners to finalize designs, procure equipment, and construct the projects. There are currently 63 network upgrades that have been identified through the CAISO GIDAP process for customers with executed interconnection agreements. Responsibility for building these projects are as follows: Pacific Gas and Electric (PG&E) — 42 upgrades; Southern California Edison (SCE) — 14 upgrades; San Diego Gas & Electric (SDG&E) — 3 upgrades; and Valley Electric Association (VEA) — 4 upgrades.

To monitor progress of the installation of these projects, the CAISO, in conjunction with the California Public Utilities Commission (CPUC), established the Transmission Development Forum, which meets quarterly. At the quarterly meetings, Participating Transmission Owners (PTO's) provide updates on the status of selected projects identified by the GIDAP process and the TPP. The Forum is open to the public through remote access, however, there are no formal minutes of the meetings. A quarterly spreadsheet of projects that includes expected in-service dates and aggregate impacted megawatts for each project is posted on the CAISO website.

The CPUC Public Advocates Office has recommended that a Comprehensive Forum Meeting be held periodically, at which energy policy makers, stakeholders, and the public could get



a fuller understanding of backlogs, reasons for delays, and PTO plans to address problems. The Public Advocates Office also expressed alarm at PG&E’s “massive backlog” of 83 CAISO approved projects, emanating from previous Transmission Plans and interconnection agreements.¹² CEERT agrees that elevation of attention on the delays of transmission projects is needed with a particular focus on PG&E’s problems.¹³

CEERT has reviewed the most recent Transmission Development Forum spreadsheets for projects approved from previous Transmission Plans and for network upgrades identified in interconnection agreements, and confirms that PG&E’s backlog for both types of projects is many times greater than that of other PTO’s.¹⁴

To provide a snapshot of the magnitude of the impact of delays in completing network upgrades on the interconnection of clean energy projects, CEERT has ranked PG&E’s pending projects by the aggregate megawatts in the queue with executed large-generator interconnection agreements. It can be readily observed that delays in the execution of these projects could have a major impact on California’s efforts to meet its climate goals.

¹² Comments of the CPUC Public Advocates Office on January 25, 2023 stakeholder call discussion, CAISO Transmission Development Forum Q1 2023 Reports.

¹³ The draft 2022-2023 CAISO Transmission Plan identifies 24 reliability-driven transmission projects. Sixteen of those project would be assigned to PG&E with a total estimated budget of \$1,134.5 million.

¹⁴ The spreadsheets can be found at: <http://www.caiso.com/informed/Pages/MeetingsEvents/UserGroupsRecurringMeetings/Default.aspx>

PG&E NETWORK UPGRADES RANKED BY IMPACT ON INTERCONNECTION CUSTOMERS

NETWORK UPGRADES	TYPE OF UPGRADE	EXPECTED CPUC PERMIT APPLICATION	EXPECTED IN-SERVICE DATE	AGGREGATE MW IN QUEUE WITH EXECUTED LGIA
Gates 230 kV circuit breakers 352, 362 and 372 overstress mitigation	Reliability	10/24/22	5/23/23	2993
QC8RAS-08 RAS (Deliverability Triggered RNU)	Deliverability		5/3/24	2871
Tesla 500 kV circuit breakers 542 and 642 overstress	Reliability	3/29/24	9/24/24	2680
Gates Substation 230 kV Bus Overstress	Reliability	1/31/24	3/31/25	2300
Metcalf Substation 230 kV capacitor circuit breakers overstress	Reliability	10/22/24	2/26/26	2195
Gates 230kV Bus E and CB 312, 322, 2102, 2202 overload mitigation	Reliability	8/6/21	5/31/23	1994
Vaca-Dixon Substation 230 kV circuit breakers 442, 452 and 462 overstress	Reliability	3/18/24	8/14/25	1841
Metcalf 115kV breakers Overstress (almost all breakers)	Reliability	5/2/25	2/5/26	1145
Re-conductor Los Banos-Quinto SS 230 kV Line	Deliverability	3/3/22	5/10/23	1111
Tesla 500 kV circuit breaker 612 overstress	Reliability	8/22/24	10/28/24	850
Cottonwood Substation 230 kV Circuit Breaker 522 and 542 Overstress	Reliability	8/29/23	9/4/24	700
Re-conductor Dos Amigos PP-Panoche #3 230 kV Line	Deliverability	9/17/24	4/30/25	632
Re-conductor Borden-Gregg #2 230 kV Line	Deliverability	8/8/25	1/16/26	632
Re-conductor Borden-Gregg #1 230 kV Line	Deliverability	1/30/26	5/7/26	632
New 230 kV switching station to loop Dos Amigos-Panoche #3 230 kV	Deliverability		12/31/28	632
Re-conductor Padre Flat SS-Panoche #1 230 kV Line	Deliverability	9/21/23	5/10/24	600

In written comments made in the Transmission Development Forum, the CPUC Public Advocates Office recommended that the CAISO consider market alternatives to alleviate PG&E's problems in their timely completion of transmission projects. CEERT agrees that this problem of continued delays by PG&E merits the attention of the CAISO and other energy policy makers. We believe that it would be appropriate for the Commission to schedule a dedicated workshop to dive deeper into this issue and consider alternative solutions including assignment of responsibility for completing the projects to other capable parties.

Five Transmission Development Forums have been held since the inception in January, 2022. Project developer participants have found the Forums to be helpful and have offered comments suggesting how they can be improved.

A recurring theme among stakeholders over the past year has been the concern about delays by PG&E in their management of transmission projects and network upgrades. For instance, battery storage developer, Broad Reach Power has noted that in PG&E's most recent presentation regarding 14 transmission projects, two of them showed a modest schedule improvement, three showed an in-service delay of 3 or more months, and nine showed a delay of 6 or more months. Likewise, for generation interconnection network upgrades, PG&E lists 42 projects in its workbook. In the Broad Reach Power notes, PG&E has only provided information on 23 projects during the five meetings with 7 projects showing a schedule improvement and 16 showing a delay in the project's in-service date.¹⁵ The average delay is 18 months.

Broad Reach Power states that PG&E's performance in constructing network upgrades has gotten demonstrably worse over the past year and the utility has not offered a plan to get back on course. Broad Reach Power recommended that the CAISO take the following actions to remedy PG&E's performance:

1. Report to FERC and the CPUC specific information on transmission network upgrade delays. They recommend that delays measured from the in-service date be included in Phase 2 interconnection studies or in executed generation interconnection agreements.
2. Take enforcement actions when a transmission owner fails to meet reasonable performance standards in completing transmission project upgrades.
3. Allow third parties to complete network upgrades when it is demonstrated that a transmission owner cannot perform in a timely manner.¹⁶

Westlands Solar Park (WSP) reports that they are constructing several solar projects in the Central Valley that are to become operational in Q3 of 2023 and Q1 of 2024, and have indicated they are concerned that these projects could be detrimentally impacted by the delays in PG&E's transmission network upgrade work. WSP has provided written comments

¹⁵ January 25, 2023 Transmission Development Forum, Broad Reach Power Comment, <http://www.caiso.com/Documents/BRP-Comments-Transmission-Development-Forum-Jan252023.pdf>

¹⁶ Id.

to the CAISO asking for more timely information from PG&E regarding reliability network upgrades in order to plan near-term work to ready the project for interconnection.

WSP has emphasized to the CAISO that renewable project developers need to closely coordinate their project construction schedules with the schedules for reliability network upgrades. Specifically, they informed the CAISO that, while the Transmission Development Forum has been helpful, more timely information is needed from PG&E on delays in project in-service dates.¹⁷

The CPUC Public Advocates Office has also taken notice of PG&E's deteriorating performance, citing a massive backlog of 83 CAISO approved transmission projects. They have asked the CAISO to re-evaluate the need for PG&E's thirteen severely delayed projects that were approved prior to the 2011 TPP. The Public Advocates Office also has recommended that the CAISO consider market alternatives within the context of its tariff to help remedy PG&E's challenges in the timely completion of necessary transmission projects.¹⁸

CEERT believes that a more comprehensive review of PG&E's performance is needed; one that looks at all of PG&E's approved, but not yet built, transmission and interconnection projects.

¹⁷ Jan. 25, 2023 Transmission Development Forum Westlands Solar Park Comments. <http://www.caiso.com/Documents/WSP-Comments-Transmission-Development-Forum-Jan252023.pdf>

¹⁸ Jan. 25 2023 Transmission Development Forum, CPUC Public Advocates Office Comments <http://www.caiso.com/Documents/Cal-Advocates-Comments-Transmission-Development-Forum-Jan252023.pdf>

7

TRANSMISSION PERMITTING REFORM

Once the CAISO determines that a transmission project is needed, the selected project developer is then required to obtain a Certificate of Public Convenience and Necessity (CPCN) or a Permit to Construct (PTC) from the CPUC under Public Utilities Code sections 1001 and 1002.¹⁹

According to the code, the CPUC is required to give consideration to 1) community values; 2) recreation and park areas; 3) historical and aesthetic values; and 4) influence on the environment. Influence on the environment has been interpreted to require compliance with the California Environmental Quality Act (CEQA).

To meet these statutory requirements, a transmission developer, be it a regulated utility or a third-party developer, must submit a Proponent's Environmental Assessment (PEA) and either an application for a CPCN, which applies to transmission lines above 200 kV, or a PTC, which applies to transmission projects between 50 kV and 200 kV and any substation above 50 kV. The environmental review and the CPCN review by the CPUC happen concurrently.

The CPUC's review process is set forth in CPUC General Order 131-D. The CPUC analyzes the need for the project and the economics of the project, in addition to the environmental impact. The CPUC's "need determination" comes on top of the CAISO's determination of need and can add years to project permitting timeline.

Both the CPCN and PTC processes are subject to a public hearing, should a member of the public submit a protest within 30 days of the application's filing. The protest process is led by an Administrative Law Judge (ALJ) and consists of a series of conferences and/or hearings, similar to a court case. Once the CPUC reviews are complete, the ALJ submits a proposed decision to the Commission. The Commissioners will then vote to approve permits for the project at a meeting of the full Commission.

The Clean Air Task Force (CATF), a public interest non-profit organization, recently analyzed the timelines of thirteen transmission projects approved in the CAISO Transmission Plans between 2012 and 2019.²⁰ Nine projects were eligible for competitive solicitation and four

¹⁹ Public Utilities Section 1001 states "No railroad corporation whose railroad is operated primarily by electric energy, street railroad corporation, gas corporation, electrical corporation, telegraph corporation, telephone corporation, water corporation, or sewer system corporation shall begin the construction of a street railroad, or of a line, plant, or system, or of any extension thereof, without having first obtained from the commission a certificate that the present or future public convenience and necessity require or will require such construction."

²⁰ Clean Air Task Force (CATF) and Environmental Defense Fund (EDF), "Growing the Grid: A Plan to Accelerate California's Clean Energy Transition", October 2022. <https://www.catf.us/resource/growing-grid-plan-accelerate-californias-clean-energy-transition/>

were awarded to the incumbent utility transmission owner. Of the thirteen projects reviewed, 2 projects were completed but experienced considerable delays, 2 projects were canceled or put on hold by the CAISO, 8 projects had yet to be completed and were delayed past their anticipated online date, and one project is yet to be completed but is still on track to be constructed on time.

The CATF noted the following trends in transmission permitting: 1) the CAISO's competitive solicitation process is regularly completed within one year and is the only phase of project development that is consistent in duration and 2) delays are particularly acute during the CPUC environmental review process.²¹ Also, for the projects reviewed, those developed by an incumbent transmission owner took much more time to prepare and submit applications to the CPUC than those developed by a third party or jointly developed by the incumbent transmission owner and a third party.

The CATF concluded that the permitting status quo is unsuited to the scale of transmission expansion needed to meet California's climate goals. They recommended that the transmission permitting process be accelerated. They observed that the need for major transmission projects is currently reviewed twice and recommended consolidating the review into a single process at the CAISO.²² They also recommend that the State Legislature consider streamlining the permitting process, as was done for non-fossil power plants in AB 205.

AB 205, which was enacted into law in 2022, established a new certification process for solar photovoltaic, terrestrial wind, geothermal, and other non-fossil power plants with a generating capacity of 50 MW or more, energy storage systems capable of storing 200 megawatt hours (MWh) or more of electricity, and transmission lines from those facilities to a point of connection with an electrical transmission system. The law requires the CEC to review the project application and to determine certification issuance within a specified time period. The law designates the CEC as the lead agency for purposes of CEQA review for these projects.

AB 205 permits the CEC to certify a project as a leadership project under the Jobs and Economic Improvement Through Environmental Leadership Act of 2021. The law requires the State Judicial Council, the policymaking body of the California courts, to establish procedures that require actions or proceedings related to the certification of an environmental impact report or the issuance of the certification for a designated facility be resolved within 270 days.

CEERT recommends that the Legislature consider extending the provisions of AB 205 to transmission projects over 200 kV that are determined to be needed by the CAISO to meet California's GHG reduction and clean energy goals. Two recent bills seek to streamline the

²¹ It took between one to six years for incumbent utility transmission owners to submit CPCN or PTC applications and PEAs to the CPUC. Environmental reviews lasted between 16 months and four years.

²² "Transmission Development in California - What's the Slowdown?" <https://www.catf.us/resource/transmission-development-california-slowdown/>

transmission permitting process in California: SB 619 (Padilla)²³ and SB 420 (Becker)²⁴. It is also CEERT's recommendation that consideration should be given to explicitly narrowing the CPUC's authority to approve transmission projects to those solely applied for by the regulated investor-owned utilities (IOUs), which serve a retail load within a designated geographic area. For all non-IOU developers, legislation should enact that the CEQA review for those projects be conducted by the CEC, which shall also accept the CAISO's need assessment and the successful developer's bid to establish the need and a reasonable cost cap for the project.

23 https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB619

24 https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB420

8

OPPORTUNITIES FOR HVDC CONVERSION ON EXISTING TRANSMISSION CORRIDORS

High-voltage direct current transmission has been recognized as having several advantages over alternating current transmission in certain applications, including: 1) having less loss of power, especially over long distances; 2) being more efficient, as they do not require the use of transformers; 3) being more reliable, as they are less susceptible to interference from weather; 4) having greater flexibility, since they can be used to control power flow in both directions; 5) having a reduced environmental impact, as they do not produce as much noise or electromagnetic interference; 6) having improved power quality, as they are less susceptible to voltage fluctuations; and 7) having increased transmission capacity, which can help to meet the growing demand for electricity.

HVDC transmission has been implemented in a number of countries around the world, including Europe. Some of the most notable examples of HVDC transmission include the NordLink HVDC cable, which connects Norway and Germany; the BritNed HVDC cable, which connects the United Kingdom and the Netherlands; and the IFA-2 HVDC cable, which connects France and Italy.

Developing new transmission can take over ten years to plan, permit, construct, and commission. Longer distance interstate lines frequently take more than 15 years to complete. California's goal of reducing GHG emissions in the electric system to 30 MMT by 2030 will require substantial improvements in the schedules for siting and building high-voltage transmission. Making this goal more challenging, most new transmission corridors often face aesthetic and environmental opposition from members of the public.

An alternative to building new high-voltage power lines is to reconduct existing transmission lines. Wires with higher ampacity can increase the carrying capacity of an AC transmission line by up to 50%. However, there are new alternative reconductoring approaches which can further increase the amount of energy that can be safely and reliably delivered.

According to researchers at the Lawrence Berkeley National Laboratory (LBNL), HVDC conversion is becoming cost competitive for shorter distance transmission lines.²⁵ Historically, HVDC lines have been built over long distances or used for subsea electric transmission.

²⁵ Earlier research indicated that DC lines less than 200 miles were not economic compared to AC lines.

One of the first HVDC lines developed in the United States was the Pacific DC Intertie (Path 65), which transmits power from the Pacific Northwest to Los Angeles. The line's capacity is 3.1 GW and represents a significant portion of the peak capacity needed by the LADWP. The project was completed in 1970 after concerns expressed by investor-owned electric utilities were overcome.²⁶ As previously mentioned, another important California HVDC line was installed in 2010 that connected San Francisco to a substation in Pittsburg across the San Francisco Bay. The Trans Bay Cable improved reliability by allowing two-way power flows in the Bay Area and allowing the retirement of two older fossil fuel power plants in San Francisco.

A major advantage of DC lines over AC lines is that DC current penetrates the entire conductor and allows for more power to be transmitted with the same size conductor. HVDC lines can also help stabilize the power grid from cascading blackouts, since the overhead power flow is controllable. Converter stations are located at each end of the DC line, one to convert AC power to DC, and the other to convert DC power to AC. The Pacific DC Intertie uses line-commutated converters, while the Trans Bay cable uses more modern voltage-sourced converters (VSC).²⁷

Another advantage of HVDC conversion is that it can use existing towers and conductors. LBNL researchers estimate that HVDC conversion using existing lines could increase the total power in a transmission corridor by as much as 3.5 times. High voltage AC conversion to HVDC has not yet been widely considered by transmission planners. As a result, the potential economic advantages of conversion are not well understood.

An even greater opportunity to increase transmission capacity could result from combining HVDC conversion with an upgrade of the electrical conductor to aluminum conductor steel supported (ACSS) or aluminum conductor composite reinforced (ACCR). According to the LBNL researchers, this option has not been fully studied. The combination of DC conversion with conductor upgrades could result in an even greater increase in transmission line carrying capacity. LBNL is planning to examine this potential for DC conversion and conductor upgrades in more detail in a report to be released later this summer.

Given the multiple challenges to developing new transmission lines, there appears to be a significant opportunity to use existing rights of way for cost effective conversion and/or reconductoring with either AC or DC technology.

²⁶ The Pacific DC Intertie was approved in 1961 by the Bonneville Power Administration. Technical objections were resolved at a 1963 meeting of the Institute of Electrical and Electronics Engineers.

²⁷ The TransWest Express Transmission Project, the SunZia Transmission Project and the Intermountain Power Project all of which are HVDC projects that will serve the Southwest and California have achieved important milestones. The Champlain Hudson Power Express is an HVDC project linking clean hydropower in Canada to New York City.

9

SUMMARY OF FINDINGS AND RECOMMENDATIONS

A. FINDINGS

1. California's aging electric transmission system was designed and built to bring energy from fossil fuel, nuclear, and hydroelectric projects to load centers where energy is used.
2. Clean energy technologies have rapidly declined in cost to the point where new projects are competitive with the operating costs of existing fossil fuel power plants.
3. Transmission development in California has not kept pace with reliability and clean energy needs over the past decade.
4. New transmission lines and the upgrading of existing lines is urgently needed to unlock the potential for large-scale development of clean energy technologies.
5. Developing new transmission projects requires close coordination between the CPUC, CEC, CAISO, transmission owners and developers, and the public.
6. The 2022 Memorandum of Understanding between the CPUC, CEC, and CAISO offers an effective framework for transmission planning, permitting and development.
7. The first CAISO 20-Year Transmission Outlook was an informative and comprehensive look at longer-term transmission needs. It helped identify transmission projects which would allow for the retirement of a portion of the State's fossil fuel power plants.
8. The CAISO 2022-2023 Transmission Plan recommended multiple least regret policy-driven transmission projects that need to be expeditiously permitted and built to meet the resource portfolio put forward by the CPUC.
9. The CAISO's 2022-2023 Transmission Plan identified significant transmission constraints in the Central Valley based on the sensitivity portfolio, which will become the base case portfolio in the 2023-2024 Transmission Plan. However, the 2022-2023 Transmission Plan did not identify any significant policy-driven projects in the Central Valley.
10. The special study for reducing reliance on the Aliso Canyon gas storage facility suggested several transmission options, all of which include an HVDC subsea cable between Diablo Canyon and the Los Angeles Basin.

11. The CAISO has begun to implement interconnection queue management reform that would prioritize reliability and deliverability network upgrades for projects committed to load serving entities. Further reform of the interconnection process is required to facilitate the development of needed clean energy projects.
12. Improvement to the methodology for determining deliverability for generators in the interconnection process can increase the amount of generation capacity that can receive full or partial deliverability status which, in turn, will increase needed near-term transactions between clean energy developers and load serving entities.
13. Conversion of existing transmission corridors to high voltage direct current technology has considerable promises but has not been widely studied.
14. California's transmission permitting process has not kept pace with the need for new transmission projects. Permitting reform is urgently needed.
15. PG&E has experienced recent challenges in making progress on necessary transmission projects and network upgrades that are required to timely interconnect clean energy projects to the grid. This puts both the generation and transmission development needed for California to meet its decarbonization goals in jeopardy.

B. RECOMMENDATIONS

1. The CPUC and CEC should continue to support and facilitate the CAISO's zonal approach to transmission planning by prioritizing clean energy integrated resource planning and procurement in low conflict renewable resource areas. This approach will help California to cost-effectively meet its decarbonization goals.
2. The CAISO should be recognized as the lead organization regarding determination of transmission needs, which should then drive necessary state permitting and avoid duplicative need determination processes at the CPUC.
3. A longer-term planning horizon (15-20 years) is needed for load forecasting and resource planning by state agencies and by the CAISO for the identification of needed transmission projects.
4. The CAISO should continue to engage stakeholders, including regional offshore wind developers, in the update of its 20-Year Transmission Outlook.
5. Priority for transmission expansion in the 2023-2024 Transmission Planning Process should be given to the following areas:
 - a. The Central Valley, where the 20-Year Transmission Outlook has identified 30 GW of solar that can be developed and where Central Coast offshore wind will flow, and which will require a significant increase in transmission capacity to deliver solar and wind energy to the Los Angeles Basin and the Greater Bay Area load centers.

- b. The Imperial Valley Area, where vast geothermal potential can be developed with coordinated transmission system expansion to improve power deliverability to the CAISO controlled grid.
 - c. The Los Angeles Basin, where efforts need to be accelerated to reduce the region's dependence on gas-fired generation. One promising transmission project is a subsea HVDC cable to the LA Basin that would deliver clean energy resources from the Central Valley and Central Coast.
- 6. Reform of the CAISO interconnection process is necessary and should build on the zonal approach adopted by the CAISO for Transmission Planning. Prioritization of interconnection should be given to projects that are in zones where additional transmission capacity is being developed, including new transmission development in the priority transmission zones discussed above (i.e., the Central Valley) in order for the desired future resources to be interconnected in a timely manner.
- 7. Further investigation is needed of the opportunities to use HVDC technologies for upgrading transmission carrying capacity in existing transmission corridors.
- 8. CPUC transmission permitting reform is urgently needed to streamline and expedite the permitting of transmission projects in California. Reforms that remove duplicative assessment of need and focus only on pertinent environmental protection issues can ensure environmental protections are upheld while expediting future transmission development.
- 9. Policymakers should investigate the causes and potential remedies to PG&E's challenges in completing necessary transmission and interconnection network upgrades projects.