CALIFORNIA'S PROGRESS IN ADVANCING TRANSMISSION PLANNING AND PERMITTING

A 2023 REVIEW

GridLAB CEERT

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1
INTRODUCTION

The Center for Energy Efficiency and Renewable Technologies (CEERT) has released two reports earlier this year on the need for expansion of the high voltage transmission system and for reform of the state's permitting process to overcome delays in transmission project permitting and construction over the past decade. The transition to a zero-carbon grid and economy depends on expanding and modernizing California's transmission system and building ties to the rest of the West.

The Federal Inflation Reduction Act[1] and the Bipartisan Infrastructure Law[2] have stimulated a surge of investment in clean energy projects in California and elsewhere throughout the nation. This level of interest has overwhelmed the CAISO's interconnection process and driven the need for interconnection reform. Interconnection reform are under way and are discussed further in this report.[3]

The 2023 legislative session was notable for the advancement of bipartisan legislation to reform the CPUC transmission permitting process and reduce the amount of time it takes to obtain permits necessary to begin construction. Three bills, SB 420 (Becker), SB 619 (Padilla) and AB 1373 (Garcia) passed the Legislature and were sent to the Governor. Unfortunately, the Governor vetoed SB 420 and SB 619. This report will discuss the reforms included in each bill and examine prospects for advancing permitting in the upcoming session of the Legislature.

In May 2023, the California Independent System Operator (CAISO) adopted its 2022-2023 Transmission Plan. This Transmission Plan adopts a new strategic framework to coordinate transmission planning with the interconnection of new generation and energy storage and with the procurement of clean energy by load serving entities.[4] The CAISO's zonal focus prioritizes transmission expansion to specific zones where new clean energy resources can be built that will accelerate the transition to a zero-carbon grid and economy.[5]

1 https://www.whitehouse.gov/cleanenergy/clean-energy-tax-provisions/#:~:text=Provides%20a%20tax%20credit%20for,marine%20and%20hydrokinetic%20renewable%20energy.

2 BIL Provision 40106 - Transmission Facilitation Program (TFP) is a revolving $2.5 billion fund program that will provide federal support to overcome the financial hurdles in the development of new large-scale transmission lines and upgrading existing transmission

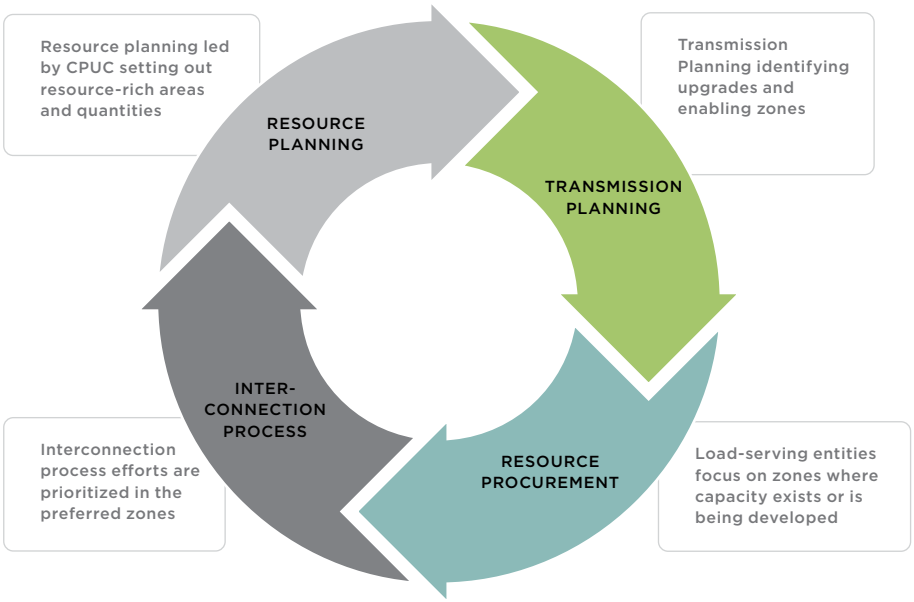
3 There are currently over 530 gigawatts of interconnection applications in the CAISO queue; an order of magnitude more than is required to meet California's needs.

4 Load serving entities include investor owned utilities, publicly owned utilities, rural electric cooperatives, community choice aggregators and electric service providers.

5 The 2022-2023 transmission plan will enable the development of renewable generation and storage capacity, including: ~17 GW of solar generation distributed in the Westlands area of the Central Valley, the Antelope Valley in Kern and Los Angeles Counties, the Kramer area of San Bernardino County, eastern Riverside County, and in southern Nevada and western Arizona; ~3.5 GW of in-state wind generation in existing wind regions, including the Antelope Valley; ~1 GW of geothermal development, primarily in the Imperial Valley and in southern Nevada; the import of ~ 4.5 GW of out-of-state wind generation from Idaho, Wyoming and New Mexico, by enhancing corridors and ~ 3 GW of central coast offshore wind generation.

Figure 1 shows how resource planning, transmission planning, the interconnection process, and resource procurement are interrelated and can be coordinated through a zonal planning process.

Figure 1. *Interrelationship between resource planning, transmission planning, the interconnection process, and resource procurement*



This report is organized by the following areas and topics:

1. The CAISO 2023-2024 Transmission Planning process and plans for the development of an updated 20-Year Transmission Outlook report
2. The need to address transmission expansion for clean energy development in the Central Valley
3. Planning for phasing out fossil fuel generation in the Los Angeles Basin
4. Issues related to the CAISO's interconnection process reform initiative
5. The need for transmission permitting reform
6. Regional transmission planning efforts and linkages to California
7. The potential for new technologies and advanced conductors to improve the efficiency of the transmission system

At its conclusion, the report will summarize key findings and recommendations related to transmission planning, permitting and execution.

2
THE 2023-2024 CAISO TRANSMISSION PLAN AND UPDATED 20-YEAR TRANSMISSION OUTLOOK

The 2023-2024 Transmission Planning Process (TPP) kicked off at the end of 2022 with the assembling of data from the Western Electricity Coordinating Council (WECC), neighboring balancing authorities, and other interested parties to develop a study plan for the TPP. The CAISO transmission planning process consists of three phases – 1) development of a study plan; 2) analysis of alternative transmission projects and adoption of an actionable Transmission Plan; and 3) solicitation of proposals to develop and construct specific transmission projects.

As of the end of October 2023, the CAISO has completed reliability studies and publicly reviewed reliability projects submitted by transmission developers. CEERT submitted stakeholder comments which identified areas in the Central Valley and the Salinas Valley that could benefit from more robust upgrades to the lower voltage PG&E transmission system to improve reliability and create opportunities for local clean energy resource development. This issue of transmission development to unlock renewable energy potential and increase economic opportunities in underserved regions needs to be further prioritized by the CAISO and transmission owners. Opportunities for clean energy development in the Central Valley will be discussed further in this report.

The TPP framework also includes the evaluation of transmission projects that are needed to support state public policy requirements. Policy-driven projects are those that respond to California's climate policies and are necessary to meet greenhouse gas emission reduction targets in compliance with Senate Bill 350 and Senate Bill 100. The TPP also studies which projects can improve the economic delivery of energy throughout the year, to support Resource Adequacy (RA) fand avoid the curtailment of clean energy resources.

The CPUC submitted a base case portfolio and a sensitivity portfolio of clean energy resources for use in the 2023-2024 TPP.[6] Annually updating resource portfolios is part of the CPUC Integrated Resource Planning (IRP) process and is a key input to the CAISO's transmission planning process. The portfolios include new and future resources, including those that have been contracted for or have recently come online, as well as additional generic resources that are selected to achieve policy and reliability targets.

6 CPUC Decision 23-02-040.

The base case portfolio used in the 2023-2024 transmission plan is designed to meet a 30 MMT GHG emissions target by 2030.[7] The sensitivity portfolio, based on the same GHG emissions target and load forecast assumptions, is intended to examine transmission needs associated with the development of 13.4 GW of offshore wind (OSW). The CPUC includes busbar mapping for all resources in the resource portfolios it submits to the CAISO.

The resource portfolios include biomass/biogas, geothermal, solar (in-state and out-of-state), offshore wind resources, and battery and long duration energy storage. The portfolios consist of resources with Full Capacity (FC) and Energy Only (EO) deliverability status. Only FC resources are modeled in the on-peak deliverability assessment for determination of eligibility for the state's Resource Adequacy program.

The base case portfolio that is used for both reliability and policy-driven requirements identifies 85 GW of new resources to be built by 2035 to meet a 30 MMT greenhouse gas target.[8] The sensitivity portfolio, which includes more offshore wind and less solar, battery and long duration storage resources, totals 74 GW of new resources. The table below provides an accounting for each resource type in 2035. It also includes the 2045 resource portfolio that will be used in the 20-Year Transmission Outlook report, which will be discussed further in the section below.

TABLE 1A

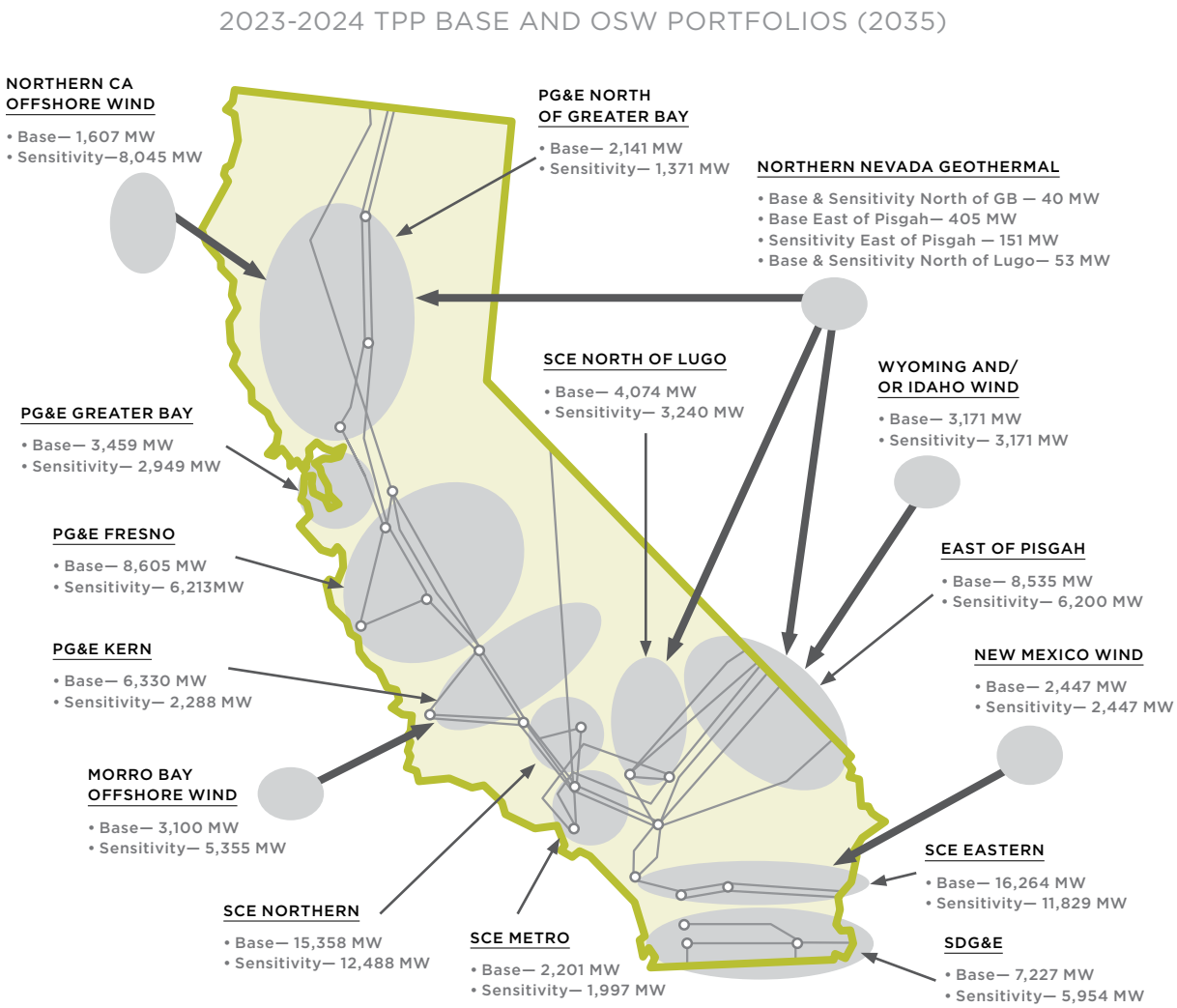
RESOURCE TYPE *VALUES IN MW	2023-2024 TPP BASE CASE (2035)*	2023-2024 OSW SENSITIVITY CASE (2035)*	20-YEAR TRANSMISSION OUTLOOK (2045)*
Natural Gas Power Plants	-	-	-15,000
Utility Scale Solar	38,947	25,746	69,640
Distributed Solar	125	125	125
In-State Wind	3,074	3,074	3,074
Offshore Wind	5,497	13,400	20,000
Out-of-State Wind	5,618	5,618	12,000
Geothermal	2,037	1,149	2,332
Biomass	134	134	134
Battery Storage	28,373	23,545	48,813
Long-Duration Storage	2,00	1,00	4,000
Generic Clean Firm Energy	-	-	5,000
Total New Resources	85,805	73,791	165,118

7 The portfolio was developed with updated assumptions from California Energy Commission's 2021 Integrated Energy Policy Report, including using the additional transportation electrification (ATE) scenario of the demand forecast.

8 The resource capacity is the nameplate capacity. Many of the battery resources will be co-located with other resources, primarily solar. The amount of transmission needed for the deliverability of these resources will be determined by the busbar mapping for the combined resources.

The following map of California from the CAISO shows the amount of new clean energy resources that will be required for each transmission zone by 2035, including imports from out-of-state and offshore wind projects.

Figure 2. *California clean energy zones and major transmission paths proposed by 2035 in the 2023-2024 TPP Process*



The CEC, CPUC, and CAISO also developed a 2045 resource scenario to be used in the updated 20-Year Transmission Outlook to integrate potential renewable and zero-carbon resource and storage opportunities. The projected peak load for 2045 is estimated to 61,900 MW with annual energy demand of 313,000 GWh. The overall energy output includes generation from behind the meter photovoltaics.[9]

9 The demand scenario includes approximately 42 GW of BTM PV capacity in 2045.

The 2045 scenario, shown in the previous table, includes 165 GW (nameplate capacity) of new resources that will need to be built by 2045. The trajectory to zero greenhouse gas emissions by 2045 will require 7,000 to 8,000 MW of new clean energy resources to be built each year for the next twenty years.

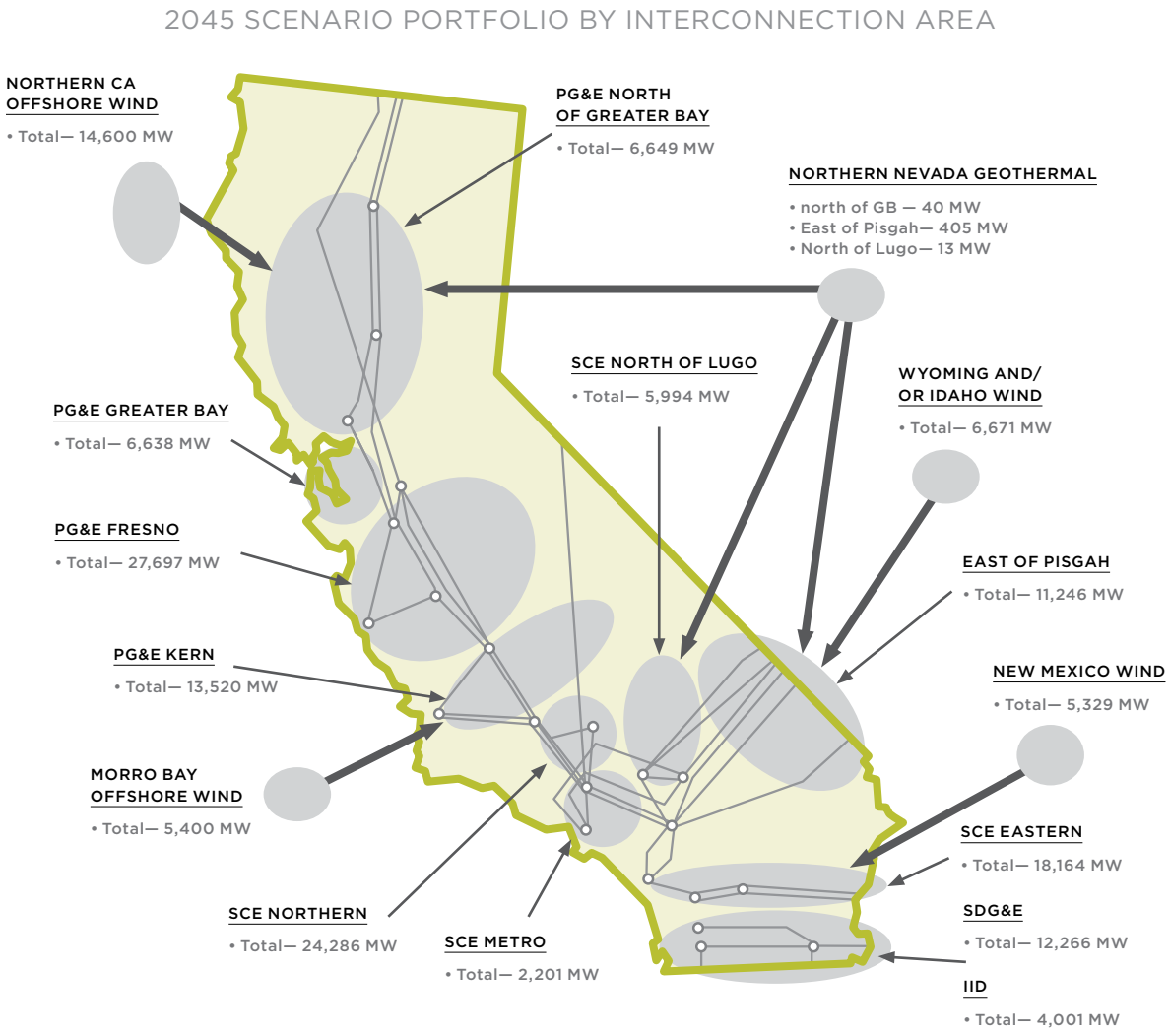
The 2045 scenario includes 20 GW of offshore wind, which is consistent with a request from Governor Newsom to the Chair of the California Air Resources Board.[10] It also assumes the retirement of 15 GW of gas-fired resources. At least 3,000 MW of the gas retirements are assigned to power plants that rely on the Aliso Canyon storage facility, with a priority on the oldest power plants and those that are in or near disadvantaged communities.

To meet peak energy requirements with the reduction in gas capacity, the CPUC and CEC estimated that an additional 5,000 MW of generic clean firm resources or long-duration energy storage would be needed. Examples of these resources include geothermal, biomass, and resources that generate electricity from zero-carbon hydrogen or derivatives. Long-duration energy storage includes pumped storage, compressed air, iron-air batteries, and other battery storage technologies.

10 In August 2022, the CEC published the Offshore Wind Energy Development report, which established an aspirational planning goal of 25,000 MW for 2045

The following map of California shows the amount of new clean energy resources that will be required in each transmission zone, this time by 2045, including those that will be imported from out-of-state and from offshore per the 20-Year Transmission Outlook study.

Figure 3. *California clean energy zones and major transmission paths proposed by 2045 in the 20-Year Transmission Plan*



The following two tables compare the amount of land-based and offshore wind resources that are included in the base case scenario for 2035 and in the 20-Year Transmission Outlook study for 2045.

TABLE 1B

WIND AREA *VALUES IN MW	2023-2024 TRANSMISSION PLAN (2035)*	20-YEAR OUTLOOK (2045)*
California	2,072	2,072
Baja California	600	600
Wyoming	1,500	5,000
Idaho	1,000	1,000
New Mexico	2,328	5,210
Southern Nevada	403	403
Other Southwest	790	790

TABLE 1C

OFFSHORE WIND AREA *VALUES IN MW	2023-2024 TRANSMISSION PLAN (2035)*	20-YEAR OUTLOOK (2045)*
Humboldt Bay	1,607	2,700
Cape Mendocino	-	4,900
Del Norte	-	7,000
Morro Bay	3,100	5,400

CEERT is pleased with the CAISO stakeholder engagement process and is looking forward to continuing work with other stakeholders throughout the 2023-2024 Transmission Planning Process. Our expectation is that several additional policy-driven transmission projects will be approved. We encourage the CAISO to focus on projects that will enable new solar and battery projects to be developed in the Central Valley and to reduce reliance on fossil fuel resources in the Los Angeles Basin.

3
THE CENTRAL VALLEY AND TRANSMISSION PLANNING

The Central Valley of California is recognized as a vital and diverse agricultural region producing over 250 food crops valued at more than $17 billion annually. It is estimated that a quarter of the nation's food comes from the Central Valley. In recent years, Central Valley communities have been facing increasing challenges from the impacts of climate change. These communities, and particularly those employed in agriculture, are experiencing more extreme heat events as well as sustained droughts and major flooding, making it more difficult to sustain thriving communities and growing economies.[11]

The Public Policy Institute of California has found that new groundwater regulations, combined with climate change and other environmental regulations, could lead to a 20 percent drop in annual average water supplies in the San Joaquin Valley by 2040.[12] It estimates that as much as 900,000 acres of farmland could be idled.

The Center for Law, Energy & the Environment at the University of California Berkeley School of Law conducted a study in 2016 that identified approximately 470,000 acres of low-conflict lands that could be suitable for the development of solar energy.[13] Large-scale solar projects typically require from five to ten acres per megawatt of solar nameplate capacity. This would suggest that there is the potential to develop nearly all the needed solar capacity identified in the 2045 resource portfolio (64.5 GW) on low-conflict lands in the Central Valley.

Recently, Stanford University's Woods Institute for the Environment, the Solar Energy Industries Association, and The Nature Conservancy brought together representatives from the U.S. solar industry, land conservation and environmental non-governmental organizations, tribal nations, agricultural interests, environmental justice and community groups, and government agencies to forge a landmark agreement on integrating climate, conservation, and community in large-scale solar development.[14] The agreement acknowledged that solar projects can vary significantly in cost and impact depending on site characteristics and how development is pursued.

The agreement advises solar developers to engage with communities and stakeholders in early development of large-scale projects. It encourages the timely sharing of information

11 https://ca.water.usgs.gov/projects/central-valley/climate.html
12 https://www.ppic.org/publication/policy-brief-the-future-of-agriculture-in-the-san-joaquin-valley/
13 https://www.law.berkeley.edu/wp-content/uploads/2016/05/A-PATH-FORWARD-May-2016.pdf
14 https://woodsinstitute.stanford.edu/system/files/publications/Solar_Uncommon_Dialogue_Agreement_-101223.pdf

and an equitable sharing of project benefits. The agreement recommends that project development enhance public involvement and address the concerns and needs of tribal nations, environmental justice, and disadvantaged communities. Community involvement in the development process can also advance the creation of new jobs and business opportunities. Likewise, innovative approaches to large-scale solar project siting, design, construction, and operations can help reduce land-use conflicts and disturbances and preserve working and natural lands.

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. In recent years, there has been a significant increase in solar energy development in the Valley. The potential for further growth in solar development in the coming years is very large.

Research conducted by the Department of Land, Air and Water Resources at UC Davis is looking at ways to optimize food and energy production on agricultural land. In a recent study, researchers found that frequencies on the light spectrum that benefit plant growth are different from those needed for optimal solar production, suggesting opportunities for agrivoltaic projects, where both food and energy can be harvested.[15] Co-location of solar and food production has the potential to provide Central Valley communities increased resilience against economic and environmental threats while providing California with the space needed to develop non-carbon emitting energy resources.

The resource scenario developed for the updated 20-Year Transmission Outlook study envisions over 25 GW of solar development and 14 GW of battery development in the lower Central Valley. The following table specifies amounts of solar and battery development by areas of the Central Valley.

TABLE 2A

CENTRAL VALLEY RESOURCE AREA *VALUES IN MW	SOLAR CAPACITY (2045)*	BATTERY CAPACITY (2045)*
Los Banos	3,391	1,846
Westlands	14,065	7,899
Kern	6,396	3,603
Greater Carrizo	1,630	1,050
Total	25,482t	14,398

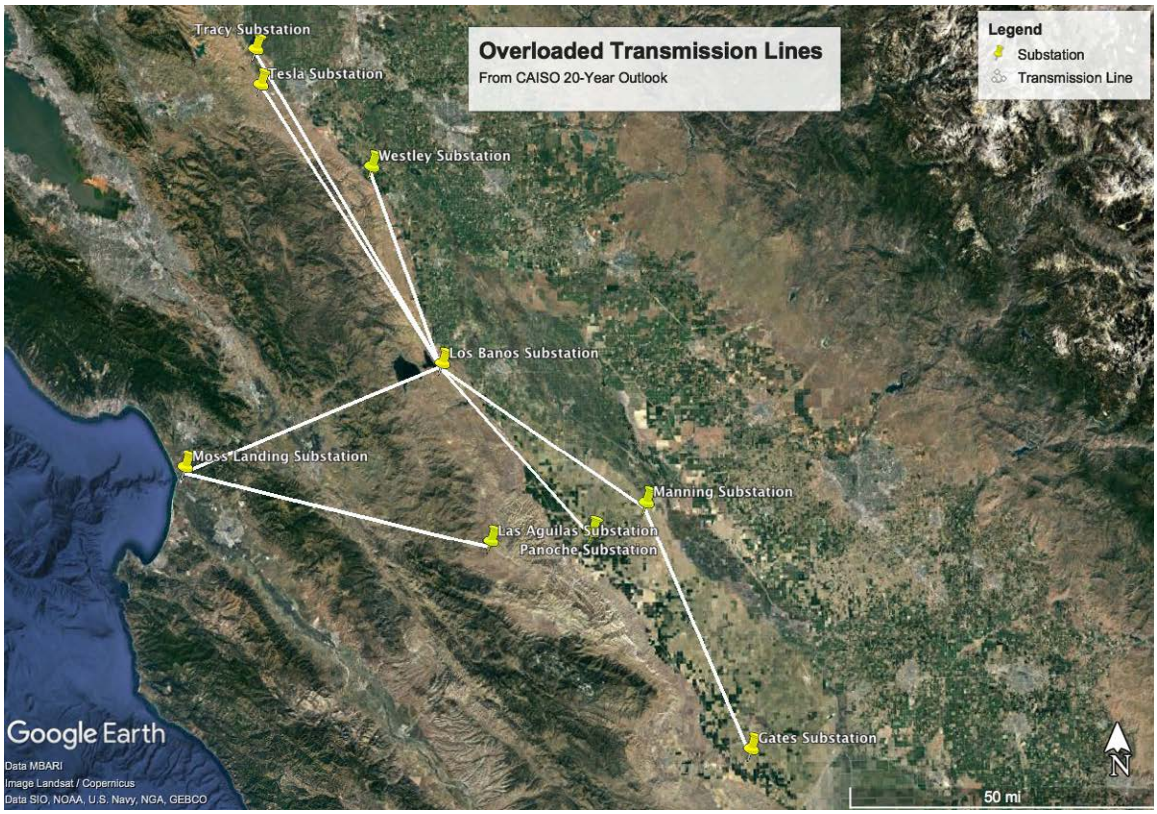
15 https://www.ucdavis.edu/climate/news/harvesting-light-grow-food-and-clean-energy-together

A key reason for adopting a 20-year planning horizon for transmission planning was the recognition that the amount of resource development needed to meet state policy goals and reliability needs will continue at least through 2045. Using a longer-term planning horizon is consistent with best practices recommended by the Federal Energy Regulatory Commission (FERC).[16]

The first 20-Year Transmission Outlook, issued in 2022, looked at transmission line overloads in the Central Valley, assuming that only 2,000 MW of local gas-fired generation would remain available in the Greater Bay Area. The study found overloads during normal operations on most of the 500 kV and 230 kV systems in the Central Valley.

Figure 4 below shows the general location of the overloaded transmission lines in the Central Valley. Transmission projects are expected to be identified in the 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.

Figure 4. *Map of the general location of the overloaded transmission lines identified in the 2022 2-Year Transmission Study*



16 FERC Docket No. RM21-17-000

Many rural areas in the PG&E service area are served by older 70 kV overhead transmission lines. PG&E has struggled to maintain and upgrade these lines across their service area. One of the notable aspects of the CAISO's reliability analysis for PG&E is the large number of previously approved transmission projects that are still under development and construction. Many are assumed to be completed over the next five years. Completing these projects is essential to assuring reliable electric service to PG&E's customers. CEERT believes increased oversight is needed of PG&E related to its transmission project management.

The CAISO, in its 2023-2024 Reliability Study, identified 102 previously approved transmission projects and eight voltage-support projects in the PG&E service area. Many of the reliability projects are located in rural or agricultural regions of the state, including the Greater Fresno Area (18), the Kern Area (8), and the Stockton/Stanislaus area (10) of the Central Valley. Each of these areas has the potential for the development of solar and battery projects. CEERT believes that reconductoring these aging projects and sectionalizing longer lines can both improve electric service and create opportunities for economic growth in the Central Valley.

As part of the 2023-2024 TPP, PG&E identified several new reliability projects in rural agricultural areas, as well as alternative solutions that could be more robust and durable. However, PG&E's presentation of their analysis of alternatives to the CAISO and other stakeholder was rudimentary. A PG&E representative acknowledged at the September 27, 2023 stakeholder meeting that several of PG&E's projects were conceptual in approach because they only had one month to develop project solutions. Unlike Southern California Edison and San Diego Gas & Electric, PG&E provided cost estimates for all proposed projects with a budget contingency of 100%.[17]

Three PG&E projects stood out in the need for additional analysis of alternatives – 1) the French Camp Reinforcement Project, 2) the Spence 60 kV Area Reinforcement Project, and 3) the Gates 230/70 kV Transformer Bank Addition Project. For the French Camp Reinforcement Project, CEERT recommended that PG&E further evaluate looping in a higher voltage transmission line (Bellota-Tesla 230 kV) to the French Camp substation in Stanislaus County. For the Spence 60 kV Area Reinforcement Project in the Salinas Valley, CEERT recommended that PG&E further evaluate building a new 115 kV substation near the community of Chualar.

In Fresno County, PG&E identified a weakness at the Gates substation that impacts the reliability of service for a broad area surrounding the community of Huron. PG&E is contemplating adding a new transformer at the Gates substation to mitigate this weakness. However, a more robust alternative would be for PG&E to also upgrade the 70 kV network surrounding the community of Huron to a 115 kV network. CEERT has recommended that PG&E fully evaluate this alternative, including reaching out to the local community. The single-line diagram below shows the impacted area.

17 PG&E supports its cost estimate range by noting that it used the Association for the Advancement of Cost Engineering Level 5 estimates which have an estimated accuracy range of up to 100% because the estimates "are generally prepared based on very limited information."

Figure 5. *Fresno area transmission single-line and contingency issues, as observed in the CAISO Reliability Assessment. CEERT is recommending PG&E consider converting the legacy 70kV system to 115kV*

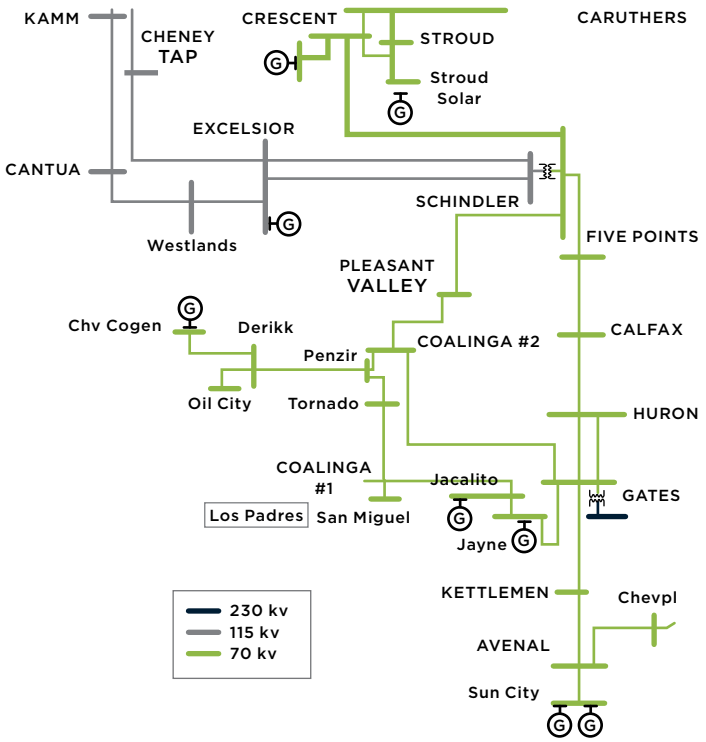
Fresno 115/70 kV Results Summary

OBSERVATIONS

1. P1 OVERLOADS:
   - Schindler 115/70 kV bank 1
   - For loss of Gates 230/70 kV bank 5
2. P2 OVERLOADS:
   - Schindler 115/70 kV bank 1
   - For loss of Gates 230 kV section 2D
3. P6 OVERLOADS:
   - Excelsior-Schindler #1 and #2 115 kV lines for loss of Gates 230/70 kV bank and Excelsior-Schindler 115 kV line
   - Panoche-Schindler #1 115 kV for loss of Gates 230/70 kV bank and Panoche-Ecelsior #2 115 kV line
4. P1 OVERLOADS:
   - Schindle-Huron-Gates 70 kV line and Five points-Huron-Gates 70 kV line
   - For loss of Gates 230/70 kV bank 5

POTENTIAL MITIGATIONS

1. Project: Additional Gates 230/70 kV bank will address these issues



4
PHASING OUT FOSSIL FUEL GENERATION IN THE LOS ANGELES BASIN

Community organizations in Los Angeles have been petitioning state and local policy makers for years to develop a plan for phasing out Los Angeles Basin fossil power generation, which requires maintenance of methane storage facilities near residential neighborhoods.[18] Unfortunately, earlier this year, the state decided to give permission to the owners of three very old gas-fired power plants along the South Coast to operate for another three years.[19] Subsequently, the CPUC voted to allow the Southern California Gas Company to store 68.6 billion cubic feet of methane at the Aliso Canyon gas storage field near Porter Ranch in the Santa Clarita Valley. Eight years ago, a four-month leak at the facility released this potent greenhouse gas into the atmosphere at a level estimated to be twice the amount released annually in the entire Los Angeles region.[20]

The decisions to extend Los Angeles's dependency on fossil fuels for electricity production were made despite the declaration of ambitious goals for the development of clean energy and zeroing out of greenhouse gas emissions.[21]

In 2022, the Legislature enacted SB 887 (Becker), which memorialized the commitments that the State made to build clean energy resources and declared that "build rates are not achievable without additional electrical transmission lines and facilities connecting new resources to consumers in the state's load centers." The law further observed that there are load pockets where there is insufficient transmission to import already available renewable energy resources and declared that these constraints should be promptly fixed.

SB 887 noted that the CAISO's 20-Year Transmission Outlook identifi ed multiple transmission projects that would be needed over the next 20 years to integrate clean energy to the grid, particularly resources requiring long-lead times to develop, such as offshore wind. The Legislation directed the CPUC to provide transmission-focused guidance to the CAISO, as soon as possible, but not later than March 31, 2024, that would enable transmission expansion and reduce dependence on fossil fuel resources in local capacity areas such as the Los Angeles Basin.

18 https://regeneratecalifornia.org/#:~:text=Power%20Down%20Dirty%20Gas.,and%20just%20clean%20energy%20enomy

19 The California Energy Commission voted on August 9, 2023 to extend the life of the Ormond Beach Generating Station, the AES Alamitos and the AES Huntington power plants through 2026.

20 https://www.science.org/doi/10.1126/science.aaf2348

21 https://www.energy.ca.gov/publications/2021/2021-sb-100-joint-agency-report-achieving-100-percent-clean-electricity

In January 2023, the CPUC sent a letter to the CAISO specifically requesting that the CAISO identify "the highest priority transmission facilities that are needed to allow for increased transmission capacity into local capacity areas to deliver renewable energy resources or zero-carbon resources that are expected to be developed by 2035" into these areas.[22] The letter also urged that the CAISO include these projects in its 2022-2023 Transmission Plan.

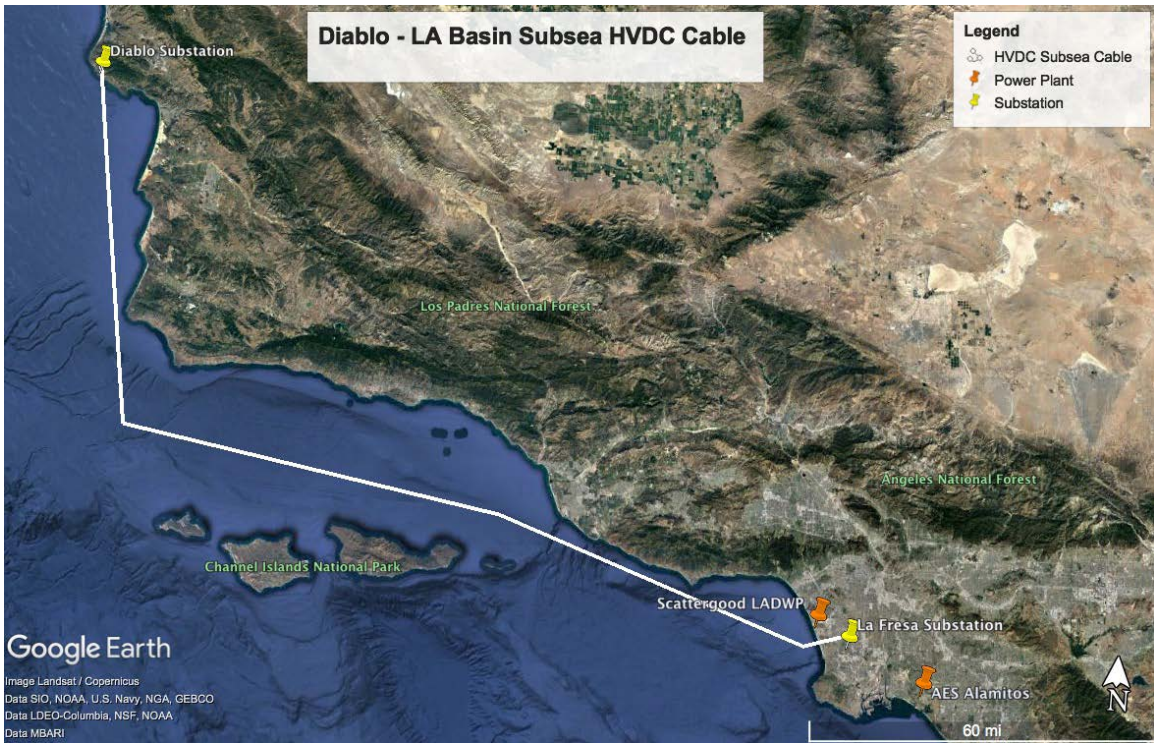
Dependence on gas-fired electric generation in the Los Angeles Basin and elsewhere in California has grown over the past decade as imports from out-of-state generation have declined.[23] Resource modeling used in integrated resource planning at the CPUC has concluded that most of the current fossil fuel fleet of power plants will need to be kept available through at least 2050 to meet peak loads.[24] In fact, the CPUC's draft 2019-2020 Integrated Resource Plan recommended that additional gas-fired capacity be built to maintain grid reliability. However, that recommendation was unanimously rejected by the Commission after a concerted campaign by environmental justice organizations and further analysis.[25]

In its earlier transmission report, CEERT noted that the CAISO, in its 2022-2023 Transmission Plan, identified transmission facilities that would reduce the region's dependence on the Aliso Canyon gas storage facility, which is used to supply multiple gas-fired power plants in Southern California.[26] A high voltage direct current (HVDC) subsea cable, that would run from the Diablo Canyon switchyard in San Luis Obispo County to a terminus near the Los Angeles Airport (LAX), was a fundamental part of a solution that would reduce the use of fossil fuel generation in the Los Angeles Basin.

22 http://www.caiso.com/InitiativeDocuments/Letter-2022-2023-Transmission-Planning-Process-Jan%2013,%202023.pdf
23 https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2022-total-system-electric-generation
24 https://www.ethree.com/wp-content/uploads/2019/06/E3_Long_Run_Resource_Adequacy_CA_Deep-Decarbonization_Final.pdf
25 https://regeneratecalifornia.org/the-california-public-utilities-commission-needs-to-plan-now-for-a-clean-healthy-future/
26 The CPUC is studying the possible retirement of the Aliso Canyon facility as part of I.17-02-002.

Investment in this transmission solution, called the Pacific Transmission Expansion Project,[27] is already underway. CEERT recommended that the project be included in the CAISO 2022-2023 Transmission Plan, but was told that the CAISO needed a direct recommendation from the CPUC stating that the project was needed to reduce dependence on gas-fired generation in the Los Angeles Basin. That recommendation has not been forthcoming from the CPUC. It now appears that the project will be considered as part of the 2023-2024 Transmission Plan.

Figure 6. *Diablo Canyon to LA Basin Subsea HVDC cable conceptual map*

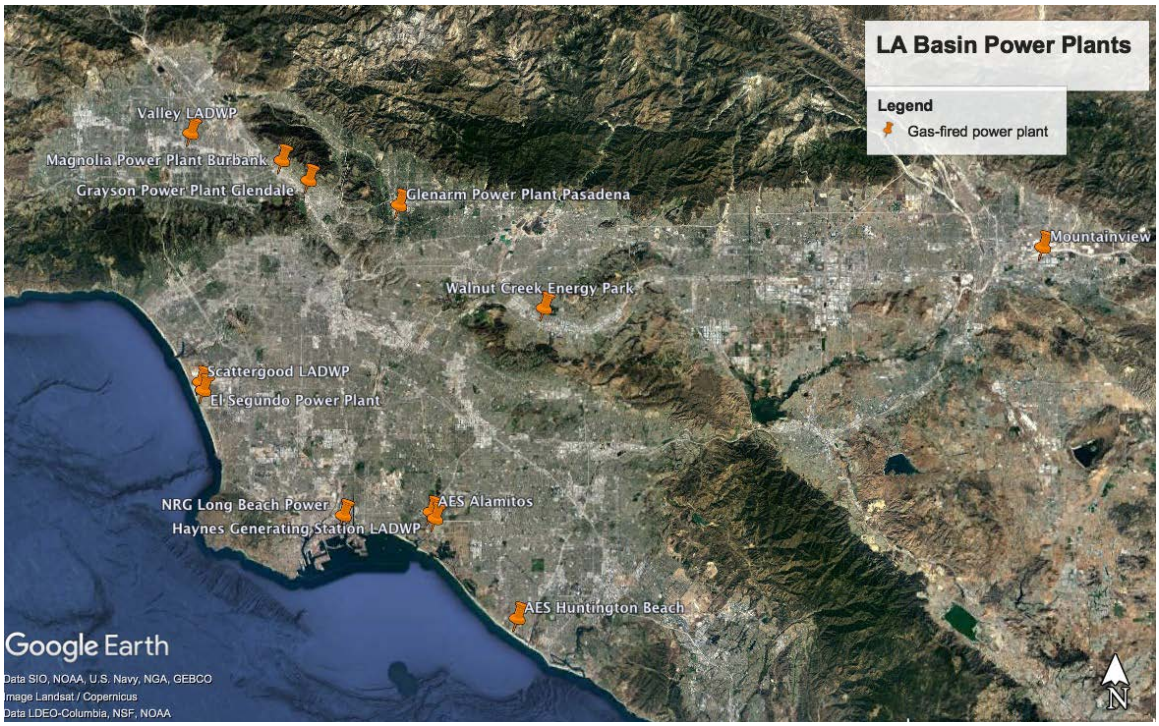


For the next several years, residents of the LA Basin, which includes all or parts of Los Angeles, Orange, Riverside, and San Bernardino Counties, will continue to rely to a significant extent on twelve large-scale gas plants spread out across the region from Huntington Beach in the south, to the San Fernando Valley in the north, to San Bernardino in the east. If new and expanded transmission projects are not built, that dependence could continue through 2035 and beyond.

27 The Pacific Transmission Expansion Project is a 2,000 MW controllable HVDC subsea transmission cable that will enable any new or existing supply of renewable power and energy available at the Diablo Canyon 500 kV switchyard to be delivered to the West Los Angeles Basin and Big Creek Ventura areas.

Figure 7 below shows the locations of the twelve gas-fired power plants located in the LA Basin.

Figure 7. *Locations of the twelve gas-fired power plants located in the LA Basin.*



In order to reduce the operation of these 12 power plants, more electricity will need to be imported from outside the region, where wind, solar, and geothermal power plants are being developed. In our last transmission report, we urged the CAISO and the Los Angeles Department of Water and Power (LADWP) to work together to fully examine the costs and benefits of the project and include the project in their transmission plans. With a focused commitment, the HVDC subsea cable could become operational before 2035 and reduce dependence on gas-fired power plants for electricity in Los Angeles.

5
INTERCONNECTION PROCESS ENHANCEMENT REFORM

There is a broad consensus that the CAISO's interconnection process is broken. Extremely high levels of interconnection requests have overwhelmed existing procedures for conducting meaningful engineering studies to determine what network upgrades are needed for reliability and deliverability. A 2022 analysis by Lawrence Berkeley National Labs determined almost 200 GW of renewable generation was backlogged in the CAISO interconnection queue awaiting study.[28] Reform is urgently needed to enable the deployment of new clean energy generation to assure reliability, affordability, and decarbonization.

The key to interconnection reform is the zonal approach that has been adopted for transmission planning. This zonal approach will improve the interconnection process if clean energy developers can obtain timely information about transmission capacity and deliverability by zone, and then submit interconnection requests that target appropriate resource areas. As part of its reform process, the CAISO proposes to identify the amount of available transmission capacity for each transmission zone. Projects which are not located in priority zones will be relegated to a separate, lower-priority study process.

The recently adopted FERC Order 2023 on interconnection reform now requires that grid operators, like the CAISO, establish clear interconnection requirements for site control, study entry fees and security deposits. In addition to these requirements, the CAISO is proposing to adopt a scoring system to rank the viability of interconnection requests. Projects in each transmission zone will be ranked based on their viability.[29]

The CAISO is currently working with stakeholders to develop a final set of clear and verifiable criteria for determining project viability.[30] If the amount of viable interconnection requests still exceed the limits on capacity that can be effectively studied, the CAISO proposes to conduct a market-clearing, sealed-bid auction to determine which projects will be studied.

The CAISO has also proposed a limitation on the quantity of megawatts that are included in the aggregated interconnection requests to be studied for each priority area.

28 https://emp.lbl.gov/queues

29 The proposed scoring criteria include: 1) Contracting status, 2) Commercial readiness, 3) Permitting status, 4) Project attributes (contribution to resource adequacy), 5) Project location (not requiring area deliverability network upgrades), 6) Expansion of an existing facility (not requiring a new gen-tie and 7) Developer viability.

30 The CAISO proposes to convene a working group to work out the scoring criteria details.

Stakeholders have raised a number of issues regarding the CAISO straw proposal. The following section reviews some of those issues in front of the CAISO.

INCORPORATING PROCUREMENT PRIORITIES IN PROJECT SCREENING

One of the scoring criteria that needs work is how to meaningfully incorporate the procurement activities and preferences of load serving entities (LSEs) into the process that determines which projects will be studied in the interconnection process. Three LSEs, Sonoma Clean Power (SCP), the California Community Choice Association (CalCCA), and Southern California Edison (SCE), have made suggestions in stakeholder comments.

SCP and CalCCA support incorporating LSE interests into the interconnection scoring criteria. They believe that the scoring mechanism needs to go beyond a simple showing of letters of interest from project developers or power purchase agreement status. They argue that these documents are not particularly meaningful without an understanding of the costs of network upgrades. They recommend that an effective scoring system needs to result in the study of projects that creates a potential resource portfolio that reflects the performance characteristics and portfolio diversity that LSEs desire.

SCP and CalCCA understand that LSE interests need to be balanced with other criteria, such as network reliability and deliverability constraints and project commercial viability. They argue that the zonal approach and FERC viability criteria will help screen out projects that do not have site control or cannot demonstrate sufficient financial or technical capabilities. SCP and CalCCA advocate that combining LSE procurement interest with other scoring criteria will advance viable projects into the interconnection study process and will enable competitive procurement of projects that, in the aggregate, meet California's decarbonization and reliability goals and local resource preferences.

SCE agrees with the proposal to allow LSEs to express interest in specific projects. They suggest an LSE bonus scoring, which would assign "bonus points" based on LSEs' share of statewide load. Each LSE would allocate their bonus points to specific projects that they would like to see in the interconnection study process. Those weighted points would be added to the scoring based on other criteria.

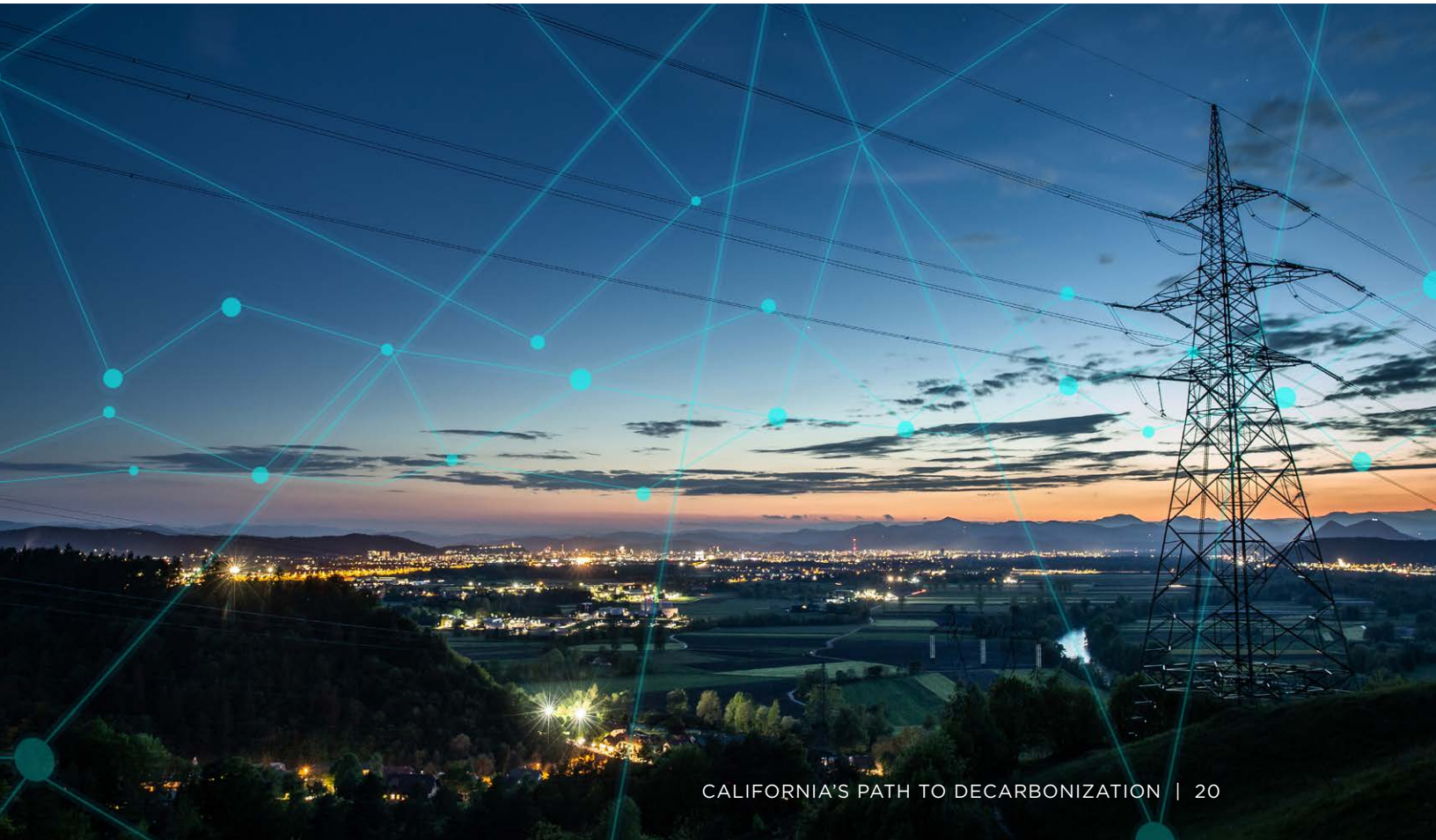
In addition, SCE recommends that the CAISO provide LSEs with access to interconnection facility upgrade costs early in the process that would facilitate decisions about how to use their bonus points.

CAPPING OF INTERCONNECTION REQUESTS TO BE STUDIED

The CAISO has proposed two criteria to limit the amount of interconnecting capacity that will be studied in future clusters. The first would be to limit the number of requests each developer may submit in a cluster window to 25 percent of the available transmission capacity across the CAISO footprint. The second would limit the amount of interconnection capacity the CAISO studies for each zone to 150 percent of available transmission. The 150% limitation would be established using the scoring criteria to select the most viable projects.

The first criterion attempts to resolve the CAISO's concern about the possibility of reduced competition among developers competing for contracts with LSEs if only a small number of developers are selected to be studied. The second criterion (studying up to 150 percent of available transmission) is intended to make the interconnection engineering studies more manageable and the results more meaningful.

Many stakeholders are opposed to the limit on the number of interconnection applications that a single developer can submit. Some argue that the limitation is arbitrary and has not been supported by any underlying analysis. The limit would also be difficult to implement, given different project ownership structures such as joint ventures. Stakeholders also argue that the restriction would be unnecessary with an effective scoring system that would reduce the ability for any one developer to overwhelm the system with speculative interconnection requests. They note that the goal of an effective screening process should be to advance the most viable projects into the interconnection study process.



Stakeholders have a mix of positions on the cap of 150% of available transmission capacity for each transmission zone. Parties generally acknowledge the CAISO's need to limit the number of megawatts to be studied in each zone, in order to have meaningful study results regarding network upgrades. However, many parties are concerned about how the cap will be fairly enforced if there are equally scored projects that exceed the cap. The CAISO has proposed to use an auction as a tie-breaking mechanism. Some parties have suggested a pro rata reduction among the interconnection requests. Some parties have argued for a higher cap such as 200%.

USE OF AN AUCTION MECHANISM TO CAP STUDIED INTERCONNECTION REQUESTS

The CAISO's proposed auction mechanism is unpopular among many stakeholders. The Independent Energy Providers Association (IEP) argues that the development of an auction process is premature. They believe that detailed scoring criteria will limit the need for an auction. They suggest that if a tie does arise, then an auction should be between only the tied bids. They argue that requiring bids prior to a tie could slow the study process and require a lot of effort for little value. Intersect Power points out that there would be little information available prior to submitting an interconnection request on which to base a bid price in the auction.

The Large-Scale Solar Association (LSA) argues that an auction will be complicated and likely rarely used when the scoring results in ties at the 150% cut-off level. They believe that simpler solutions should be considered, such as allowing interconnection studies for zones with projects that slightly exceed the 150% threshold or a downsizing of projects that are tied. When a tiebreaker is required, the CAISO should allow the bid submission later in the process after the "tied" projects are identified.

SCE argues that the auction mechanism should be independent of the scoring system and that use of an auction should be minimized. NextEra Resources observes that if the CAISO adopts a well-defined scoring criteria that sets a minimum score to qualify for study, then an auction process is not needed. They recommend that the CAISO allow all projects meeting the minimum score to enter the queue, because they have demonstrated that they are ready to proceed to development.

SUMMARY

The goal of the interconnection process enhancement is to bring forward a set of reforms that can be adopted by the CAISO governing board at its February, 2024 meeting. CEERT believes that the stakeholders have made good progress through the CAISO's collaborative process and that the deadline can be met. It is important that the reform process move forward expeditiously so that the interconnection studies can begin for Cluster 15 interconnection requests in a way that provides for competitive solicitations by LSEs to work effectively.

6
TRANSMISSION PERMITTING REFORM

Transmission permitting reform was an important priority in the past legislative session. Three bills passed the Legislature that advanced proposals to streamline the permitting process currently in place at the CPUC. Those bills were AB 1373 (Garcia), SB 420 (Becker), and SB 619 (Padilla).

AB 1373 establishes a rebuttable presumption in favor of the determination of a transmission project's purpose and need by the CAISO. This would streamline transmission permitting by eliminating duplicative analyses of a project's purpose and need by both the CAISO and the CPUC. A presumption is established once a project has been recommended by the CAISO in its Transmission Plan. It is assumed, subject to being rebutted, that the project meets the threshold standards for issuance of a Certificate of Public Convenience and Necessity (CPCN). AB 1373 also requires that the CAISO be a party to the CPCN proceeding for the rebuttable presumption to hold. Governor Newsom signed AB 1373 into law in September 2023.

SB 420 would have raised the threshold voltage for projects that require a CPUC permit to construct (PTC). Currently, CPUC regulations require a PTC or a CPCN for all non-exempt projects at voltages of 50 kV or greater. SB 420 would increase the permitting threshold to 138 kV for utility projects that are located on previously disturbed land or in an urbanized area, and for projects that have already been analyzed as part of a separate CEQA analysis. This legislation was intended to streamline the development of power line and substation projects that can be expected to cause only minor environmental impacts. The bill contained safeguards that would require permitting for projects between 50 kV and 138 kV that are located in sensitive environmental areas.

Governor Newsom vetoed SB 420. His veto message[31] said he was directing his "infrastructure strike team" to accelerate the development of needed electricity infrastructure. The infrastructure strike team was established by Executive Order N-8-83.[32] Next activities of the "strike team" do not appear to be set yet.

SB 619 would have provided applicants for PTCs or CPCNs the option to seek expedited environmental review by the California Energy Commission, while also ensuring that the CPUC still retains discretionary authority over licensing. The bill was intended to facilitate faster licensing proceedings and alleviate CPUC workload. Governor Newsom also vetoed SB 619.

31 https://www.gov.ca.gov/wp-content/uploads/2023/10/SB-420-Veto.pdf
32 https://www.gov.ca.gov/wp-content/uploads/2023/05/5.19.23-Infrastructure-EO.pdf

The vetoes of SB 420 and SB 619 put the issue of transmission permitting reform directly in front of the CPUC. The CPUC's permitting process is set forth in CPUC General Order 131-D.[33] 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" has added years to project permitting timelines.

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 is similar to a court case. Once the CPUC reviews are complete, the ALJ submits a proposed decision to the Commission. The Commissioners then vote to approve or disapprove permits for the project at a meeting of the full Commission.

Recently, Southern California Edison (SCE) conducted an analysis of the amount of time it has taken the CPUC to review SCE applications for a CPCN or PTC.[34] SCE's analysis found that for the 28 applications submitted between 2003 and 2018, the average time for review and approval was 836 days.

The amount of time it has taken to review and approve SCE permits for transmission projects has extended to 1,013 days for the eight projects submitted from 2012 to 2018. SCE observed that the increase in time to review projects was largely driven by CPCN applications. The CPUC took an average of 1,206 days (almost 3.5 years) to review and approve three CPCN applications submitted after 2012.

The length of time the CPUC has taken to review and approve PTC applications has also increased. The average time to review and approve PTC applications between the 2003-2011 time frame and the 2012-2018 time frame increased from 766 days to 897 days.

SCE observed that there has been a substantial decrease in the use of mitigated negative declarations (MNDs) in the permitting process. For the nine PTCs with MNDs, the average time from the filing of the application until the application was approved was 548 days.

SCE argues that the time to review and approve CPCN and PTC applications is unreasonable. GO 131-D contemplates a 90-day period for application completeness, review, and data supplementation. Once the application is deemed complete, CEQA states that a lead agency should complete either the mitigated negative declaration preparation and adoption process within 180 days or an Environmental Impact Report preparation and certification process within one year.

33 https://docs.cpuc.ca.gov/PUBLISHED/Graphics/589.PDF

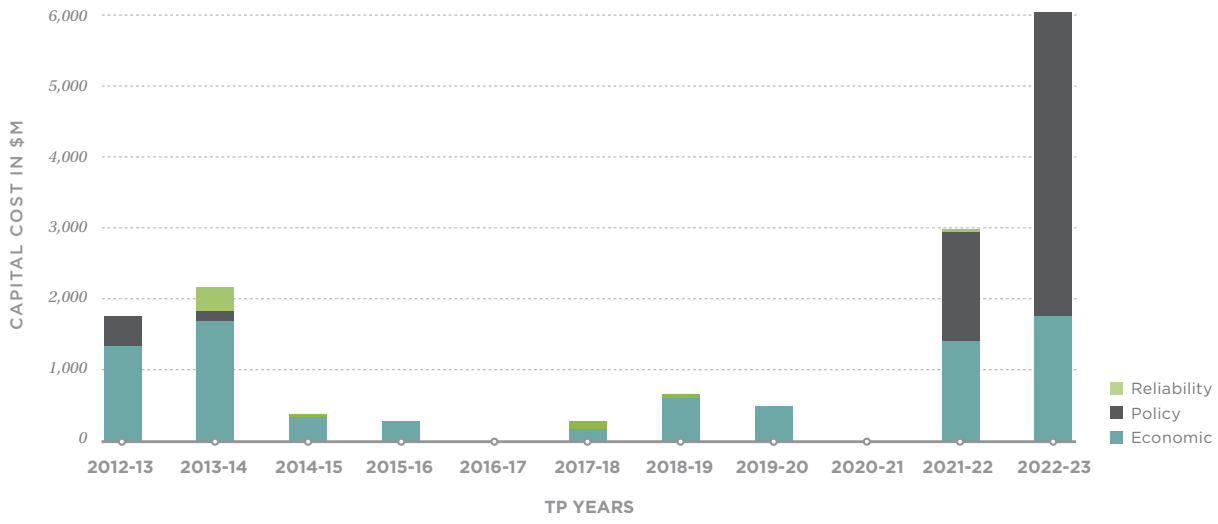
34 Southern California Edison Company's Comments on Order Instituting Rulemaking to Update and Amend General Order 131-D. June 22, 2023

In 2022, SB 529 (Hertzberg) was enacted into law to address the excessive time that it has taken the CPUC to permit transmission projects. State Senate analysis of the bill recognized that the current Commission CPCN process "hampers the ability of deploying necessary transmission projects in a timely fashion to support deployment of zero-carbon and renewable energy resources."[35]

SB 529 requires that the CPUC review projects consisting of extensions, expansions, or upgrades, of transmission projects under the PTC review and approval process. The intent of SB 529 is to preserve the environmental protections of the California Environmental Quality Act while enabling certain types of transmission projects to be approved in a more timely fashion.

Reform of the CPUC transmission permitting process is urgently needed as the quantity of transmission projects that need to be reviewed and approved is increasing. In the 2022-2023 Transmission Plan, the CAISO approved a total of 45 transmission projects. They range in projected costs from $4 million to $2.3 billion, for a total infrastructure investment of an estimated $7.3 billion. The table below shows the magnitude of the increase in the value of projects that have been approved by the CAISO since the 2012-2013 Transmission Plan. A large number of transmission projects is expected to emerge from the 2023-2024 plan, which is currently under development and expected to be approved in May, 2024.

Figure 8. *Projects approved by the CAISO over the last decade, showing an increase in the value of projects*



35 https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=202120220SB529

One path forward on permitting reform would be for the CPUC to reform the regulations and procedures for GO 131-D along the lines proposed by CEERT and 17 other parties in a proposed Settlement Agreement.[36] However, CEERT is very disappointed to learn that this avenue for permitting reform appears to be delayed or even closed off, as reflected in a recent proposed decision by the in the GO-131-D proceeding[37].

The key features of the 18-party Settlement Agreement are summarized below:

- Implementation of SB 529 (Authorizing applicants for specific projects to proceed under The PTC process)
- Allowing applicants to prepare CEQA documents rather than CPUC consultants
- Recognition of CAISO transmission planning decisions, as required by AB 1373
- Setting deadlines for the CPUC CEQA review processes
- Clarifying procedures for filing, processing, and disposition of protests
- Clarifying language regarding exemption for projects in a utility right of way

The opportunity for timely permitting reform at the CPUC may be closing. It appears to increasingly necessary that the Legislature examine alternative solutions for transmission permitting reform. Other states, including New Mexico and Colorado, have embraced new approaches for rapidly advancing the permitting and construction of new transmission facilities.

The New Mexico Renewable Energy Transmission Authority (RETA) was created by the New Mexico Legislature in 2007 to facilitate the development of electric transmission and storage projects. [38] The purpose of RETA is to 1) promote economic development in New Mexico through the development of renewable energy resources, 2) assure reliable and affordable sources of electricity for New Mexico consumers and 3) reduce New Mexico's reliance on fossil fuels and greenhouse gas emissions.

RETA has a number of powers to develop new transmission lines, including the authority to:

- Plan, finance, develop, permit, and acquire high voltage electric transmission and energy storage projects.
- Enter into agreements with private developers on a joint venture or other basis for the development of transmission and storage projects.
- Issue and sell bonds to finance projects.
- Exercise the power of eminent domain to acquire property or rights-of-way necessary for projects.

36 The Settling Parties are SCE, PG&E, SDG&E, San Diego Gas & Electric Company (SDG&E), Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), Bear Valley Electric Service, Inc., Liberty Utilities (CalPeco Electric) LLC, PacifiCorp, American Clean Power, Independent Energy Producers Association, Center for Energy Efficiency and Renewable Technologies, Environmental Defense Fund, LS Power Grid California LLC, REV Renewables, LLC, Large-Scale Solar Association, California Energy Storage Alliance (CESA), Horizon West Transmission, LLC, Trans Bay Cable LLC, and GridLiance West LLC.

37 https://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&docid=520613347

38 https://nmreta.com

While RETA is still a relatively new organization, it has already made significant progress in developing new transmission infrastructure in New Mexico. The organization's work is considered as essential to meeting New Mexico's clean energy goals.

The Colorado Legislature created the Colorado Electric Transmission Authority (CETA) in 2021 to enable the development of electric transmission facilities that will deliver clean energy resources to Coloradans and neighboring states.[39] The Colorado Legislature recognized in the creation of CETA that new transmission lines were essential to meeting the state's clean energy goals and maintaining reliable electric service.

CETA has a number of powers to develop new transmission lines, including:

- Establishing corridors for the transmission of electricity within the state.
- Negotiating with entities outside of Colorado for the establishment of interregional transmission corridors.
- Investigating alternatives technologies to increase the use of the existing transmission system.
- Issuing electric transmission bonds to undertake projects.
- Exercising the power of eminent domain for acquiring rights-of-way necessary for transmission projects.
- Entering into partnerships with public or private entities to develop projects.

CETA is considered to be a "transmission developer of last resort," meaning that it will only develop a transmission line if no other entity is willing to do so.

Given the shortcomings of the CPUC in permitting transmission infrastructure and its current reluctance to advance permitting reform CEERT recommends the Legislature revisit the issue of permitting reform in the next Legislative session. The Legislature should consider establishing an new transmission siting authority along the lines of what has been established in New Mexico and Colorado.

39 https://www.cotransmissionauthority.com/about

7
REGIONAL TRANSMISSION PLANNING AND OPPORTUNITIES FOR BETTER COORDINATION WITH THE REST OF THE WEST

A recently released report from Southern California Edison entitled Countdown to 2045[40] forecasts a need for an additional 191.8 gigawatts of generation and storage to power a highly electrified economy in 2045. SCE expects electric consumption to grow by 82% over the next 20 years, driven by building and transportation electrification, as well as growth in new industries like artificial intelligence.

A large amount of the 39.9 gigawatts of new solar capacity will be located in the Central Valley, the Imperial Valley, and Inland Southern California. Offshore wind from the Central Coast and Northern Coast of California will total 18.6 gigawatts. Much of the 24.4 gigawatts[41] of battery storage systems will be co-located with solar. Most new standalone battery systems will be located nearer to load in urban areas.

The Countdown to 2045 Report also foresees a need for an additional 23.1 gigawatts of onshore wind, 1.4 gigawatts of geothermal, and 4.3 gigawatts of clean firm resources, which includes advanced geothermal generation. To capture these resources, a significant amount of new transmission will need to be built into resource rich regions in surrounding states.

Two large merchant transmission projects are already underway. The TransWest Express Project will run from Wyoming, through Utah, to Southern Nevada, where it will connect to the CAISO system.[42] The SunZia Wind and Transmission Project will run from New Mexico to central Arizona, where it will connect with the grid operated by Arizona Public Service.[43] From there, the power can be imported into California. Both of these projects will recover their costs from transactions with load serving entities, rather than through the CAISO's transmission access charge. While these projects will provide significant new wind capacity to California, they are not sufficient to meet California's growing need for zero-carbon electricity.

The Countdown to 2045 Report calls for additional transmission projects to Wyoming, Utah, New Mexico, the Pacific Northwest, Southern Nevada, Arizona, and Baja California. The map below shows the general locations of the additional transmission projects and the associated wind, geothermal, and solar resources.

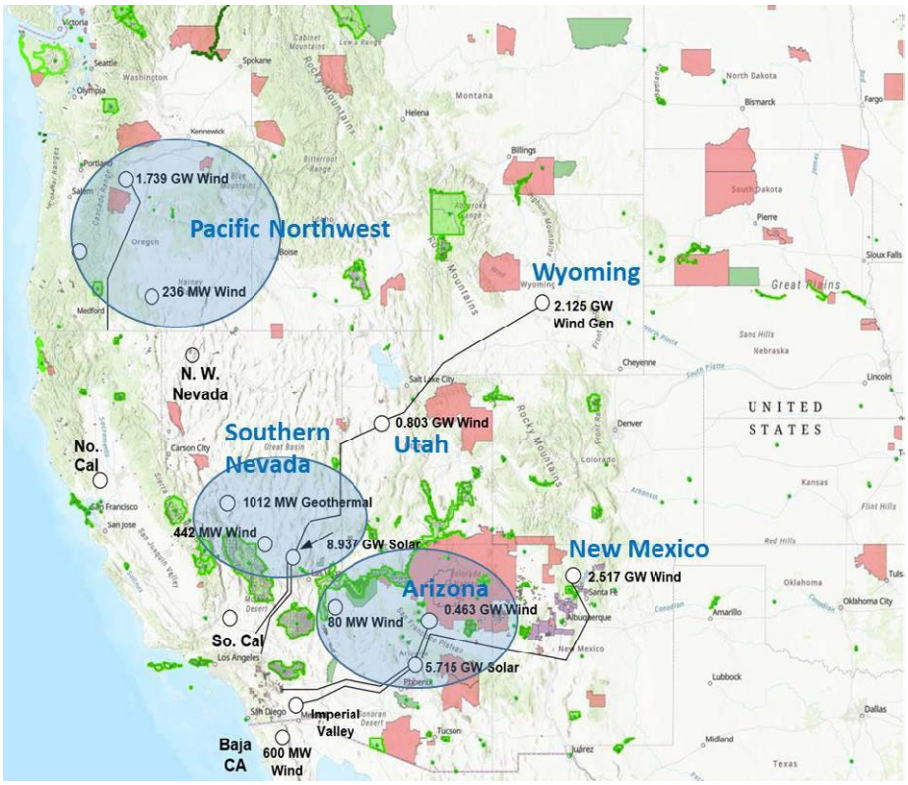
40 https://www.edison.com/our-perspective/countdown-to-2045

41 SCE categorizes battery energy storage into four-hour systems and eight-hour systems with the longer duration storage coming in after 2032.

42 https://www.transwestexpress.net

43 https://patternenergy.com/projects/sunzia/

Figure 9. *Map of major transmission development needs identified in SCE's Countdown to 2045 Report*



Building more regional transmission will increase the diversity of resources, which will allow the CAISO to access and schedule the lowest-cost generation to meet customers' electric needs. Regional transmission will also increase system reliability by connecting different regions of the west that have different mixes of generation and load profiles. More opportunities to exchange power can help to reduce the risk of outages caused by extreme weather events.

Despite these obvious benefits, it has been very difficult to build interregional transmission projects throughout the West. There are many reasons for this failure to mutually optimize benefits among the regions' many balancing area authorities and the CAISO. A major barrier is the reluctance for many utilities and the federal power marketing agencies to enter into agreements to share costs. Also, the Pacific Northwest is heavily reliant on the Bonneville Power Agency, which is not required to participate in regional transmission planning with entities that are regulated by the Federal Energy Regulatory Commission (FERC).

FERC Order 1000 was issued in July of 2011 and requires transmission planning regions to identify and jointly evaluate interregional transmission projects that may be more efficient or cost-effective solutions to regional needs. However, since the order was issued, no interregional transmission projects have been recommended by the planning regions.[44]

44 The planning regions in the Western United States are Northern Grid, Westconnect and the California Independent System Operator.

Several important initiatives are now underway to improve transmission planning across the western United States. One is being led by the Western Power Pool (WPP), which historically coordinated utilities on reliability issues associated with the operation of the electric grid in the Pacific Northwest. It was recently given the authority by FERC to implement the Western Resource Adequacy Program (WRAP) across the broader west-wide grid.[45]

In 2022, the WPP launched a new initiative called the Western Transmission Expansion Coalition (WTEC) to develop a West-wide transmission plan. At the initiative of the Bonneville Power Administration (BPA), an informal group was formed to discuss the concern that current transmission planning did not adequately support future grid needs. A concept paper was released, calling for a broader group of stakeholders to develop an actionable transmission plan to address inter-regional needs. WPP is coordinating this work.

Another regional transmission planning initiative, called the Western States Transmission Initiative (WSTI), was launched through the Committee on Regional Electric Power Cooperation (CREPC)[46] while working with the non-profit organization GridWorks.[47]

The WSTI (pronounced "wisty") is a regional collaborative effort to build understanding about transmission opportunities and barriers for western state energy policy leaders and regulators, and to identify actionable steps to develop transmission across the western interconnect. The WSTI is expected to produce a report in early 2024 that will be presented to CREPC and state energy officials for their consideration.

Separate from the WSTI, GridWorks and GridLab have convened an expert advisory committee to support a technical study for transmission expansion plan across the Western US. The Connecting the West: Transmission for Reliability and Decarbonization study will include a cost-benefit analysis of new transmission lines and upgrades while avoiding sensitive natural areas and working lands, and will be building off the CAISO's 20-Year Transmission Outlook and the Nature Conservancy's Power of Place–West report.[48]

CEERT intends to participate in regional transmission planning efforts to the extent feasible and encourages other clean energy advocates to also be involved. CEERT will work in 2024 to support the dissemination of the GridLab and GridWorks Connecting the West: Transmission for Reliability and Decarbonization study.

45 https://www.westernpowerpool.org/about/programs/western-resource-adequacy-program

46 CREPC is composed of an energy office official and a regulatory utility commissioner from each of the Western states and Canadian provinces and focuses on regional cooperation on electric power issues in western North America.

47 https://gridworks.org

48 https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_Power-of-Place-WEST-Executive_Summary_WEB_LR.pdf

8
OPPORTUNITIES FOR THE ADOPTION OF GRID ENHANCING TECHNOLOGIES AND ADVANCE RECONDUCTORING OF EXISTING TRANSMISSION CORRIDORS

Grid enhancing technologies (GETs) are a suite of hardware and software solutions that can be used to improve the performance and reliability of the electric grid. GETS can be used to increase the capacity of the grid, improve its efficiency, and make it more resilient to disturbances.

Some of the most common GETS include:

- Dynamic line ratings (DLRs): DLRs use real-time data to monitor the condition of transmission lines and adjust their carrying capacity. DLRs can allow grid operators to safely allow more power to flow over existing lines.
- Advanced power flow controllers (APFCs): APFCs can be used to redirect power flow around congested areas of the grid. APFCs can help to improve the efficiency of the grid and reduce the risk of outages.
- Topology optimization: Topology optimization is a software tool that can be used to identify the more efficient configurations for the grid. This software can help to reduce the cost of building and operating the grid.

GETs are becoming increasingly important as the electric grid transitions to a cleaner and more diverse energy system. GETS can help to integrate more renewable energy into the grid, improve its efficiency, and make it more resilient to disturbances.

GETs are used to varying degrees across the United States. Some utilities have been more willing to test and adopt the technologies than others. However, the use of GETS is increasing as utilities recognize the benefits they can offer.

Most of the U.S. high voltage electric system uses aluminum conductor steel reinforced (ACSR) wires. There are several reasons why most of the US power grid is wired with the century-old technology. ACSR is made of a steel core surrounded by aluminum strands, which makes it resistant to corrosion and other forms of damage. Much of the U.S. power grid was built in the early 20th century, when ACSR was the most common type of conductor available.

While ACSR has some advantages, it also has important disadvantages. ACSR is not as conductive as some other types of conductors. This means that ACSR lines need to be larger in diameter than other conductors. ACSR lines are also more susceptible to sagging than some other types of conductors which can cause wildfires.

There is a growing interest in using new types of conductors for transmission lines. New advanced conductors are more conductive and less susceptible to sagging than ACSR. These new conductors have generally been more expensive than ACSR. However, as the cost of new conductors comes down, it is likely that more reconductoring opportunities will be available in the future.

Advanced conductors swap out the conventional steel core for a composite-based core, allowing more conductive aluminum to fit within an equivalent diameter, thus enabling higher operating temperatures and higher ampacities. Some examples of alternative conductors include the aluminum conductor composite reinforced (ACCR) by 3M, aluminum conductor composite core (ACCC) by CTC Global, and the Advanced Encapsulated Core Conductor (AECC) by TS Conductor.

These advanced conductors create the potential to leverage existing rights of way (ROW) to add transmission capacity. Reconductoring replaces a transmission line's existing conductors with advanced conductors, leveraging existing towers and ROW. Depending on the configuration of existing infrastructure, terminal upgrades (i.e. protection systems and transformers) may be required.

The Electric Power Research Institute (EPRI) estimates that reconductoring may increase line capacity by 30-100%. Combined with increased voltages, capacity may increase by 80-150%.[49] However, real-world uptake of advanced conductors has been limited in the US, and the economic opportunity for reconductoring with advanced conductors has not been fully evaluated.

49 https://www.epri.com/research/products/000000003002023335

GridLab is supporting a technical study by staff at the Lawrence Berkeley National Laboratory and UC Berkeley on the potential for reconductoring with advanced conductors nationwide. The study is expected to be released in November, 2023. CEERT plans to support GridLab in the dissemination of this report to California energy policy makers.

The state of Montana recently enacted a law requiring the state public utility commission to develop advanced conductor cost effectiveness and allowing advanced conductor rate basing.[50] The law defines advanced conductors as those of equal size that reduce electrical resistance by 10% or more. One reason for enacting the law was that low-sag advanced conductors will reduce the risk of wildfires in Montana.[51]

In 2024, CEERT will seek to encourage state energy officials, including Legislative leaders, to advance policies that will enable the more efficient use of existing transmission resources and rights of way.

Another opportunity to improve grid efficiency that the researchers at LBNL looked at was sectionalizing some transmission lines. Sectionalizing can be used as part of grid expansion planning to assess the impact of different transmission scenarios on the grid reliability and performance.

Sectionalizing can be used to mitigate reliability risks such as thermal overloads and voltage instability. It can reduce grid congestion and increase the amount of renewable energy that can be delivered. Sectionalizing enables multiple pathways for clean energy to flow to load centers.

CEERT looks forward to discussing with the CAISO staff and transmission owners in California opportunities to more fully study sectionalizing opportunities, particularly where they would be beneficial for disadvantaged regions that experience high fault rates.

50 Montana House Bill 729

51 https://energycentral.com/c/tr/montana-legislature-supports-use-advanced-conductors-improve-td-efficiency

9
SUMMARY OF FINDINGS AND RECOMMENDATIONS

A. FINDINGS

1. The California Independent System Operator has made important improvements in its forward planning for transmission expansion by adopting a zonal focus.
2. Clean energy technologies need to be integrated into the grid at a rate of 7,000 to 8,000 megawatts a year for the next 20 years.
3. Transmission development in California has not kept pace with reliability and clean energy needs over the past decade.
4. The first CAISO 20-Year Transmission Outlook was an informative and comprehensive look at longer-term transmission needs. An update of the 20-Year Outlook will help the development of actionable plans, particularly for the integration of offshore wind and out-of-state clean energy resources.
5. The CAISO 2022-2023 Transmission Plan deferred on recommending two important policy-driven projects - a project to increase transmission capacity from Southern Nevada into California and a subsea HVDC cable from the Diablo Canyon switchyard to Los Angeles that would reduce gas consumption at power plants in the Los Angeles Basin.
6. The CAISO has made progress in identifying solutions to enhance the study process for interconnection requests. A number of key issues still need to be resolved before February, 2024.
7. Using grid enhancing technologies, reconductoring transmission lines with advanced conductors and sectionalizing power lines have the potential to cost-effectively increase energy delivery on existing transmission and expand transmission capacity on existing rights of way.
8. California's transmission permitting process is not up to the challenge of efficiently reviewing the magnitude of transmission projects in the pipeline. Legislative permitting reform was stymied by vetoes of SB 420 and SB 619.

B. RECOMMENDATIONS

1. The CAISO's zonal approach to transmission planning needs to continued to be emphasized for clean energy procurement by load serving entities.
2. The longer-term planning horizon used in the CAISO's 20-Year Transmission

Outlook can be used to inform the CPUC's integrated resource planning process and future procurement orders.

3. The CAISO needs to engage stakeholders in a process to coordinate the development of the 2023-2024 transmission plan with the update of its 20-Year Transmission Outlook.
4. Priority for transmission expansion in the 2023-2024 Transmission Planning Process should be given to the following areas:
    a. The Central Valley, where significant quantities of solar and battery projects are expected to be developed and through which offshore wind energy will require transmission capacity to deliver energy to the Los Angeles Basin and the Greater Bay Area.
    b. The Imperial Valley Area and San Diego, to ensure that its geothermal and solar potential can be developed in a timely manner.
    c. The Los Angeles Basin, where efforts need to be accelerated to reduce the region's dependence on gas-fired generation.
5. The CAISO should strive to complete its interconnection enhancement process by February 2024.
6. Legislation should be developed to support the use of grid enhancing technologies and encourage the use of advanced conductors to expand the transmission capacity on existing rights of way.
7. The CPUC should expeditiously reform its transmission permitting order, GO-131-D, by supporting the recommendations of a Settlement Agreement proposed by CEERT and 17 other parties.
8. The Legislature should lead on transmission permitting reform including investigating the creation of a renewable energy transmission authority to advance the permitting and finance of needed transmission facilities.