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INFORMATIONAL HEARING

Envisioning the Grid of 2045: How Much Transmission Is Needed?

SB 100 (De León, Chapter 312, Statutes of 2018) established the state policy that renewable and zero-carbon resources supply 100% of retail sales and electricity procured to serve all state agencies by 2045 (the 100% Clean Energy Policy).¹ The legislation also increased the state's Renewables Portfolio Standard (RPS) target to 60% of retail sales by December 31, 2030 and required all state agencies to incorporate these targets into their relevant planning. These ambitious targets require an equally ambitious strategy to ensure the targets are met.

A subsequent Joint Agency SB 100 Report was prepared in order to determine how best to implement the 100% Clean Energy Policy.² The first SB 100 report was finalized in March 2021, and found that in order to meet the policy, California will need to roughly triple its current electricity power capacity.³ In order to achieve this, the report found 6 gigawatts (GW) of new solar, wind, and battery storage resources were needed annually, roughly triple the build rate for solar and wind and an eightfold increase for battery storage.⁴ Recent actions at the CPUC have already signaled this procurement ramp up, with two orders calling for 3,300 megawatts (MW) by 2023 and an additional 11,500 MW by 2026.⁵

While the SB 100 analysis is still in its initial phases, it demonstrates that the 100% Clean Energy Policy is technically achievable so long as construction of clean energy resources occurs at an unprecedented clip. While not explicitly stated, a consequence of these procurement projections is the unprecedented level of supporting infrastructure upgrades and new construction needed to connect these new resources to the power grid. The debate is ongoing over how much new infrastructure is needed to accommodate California's transition

¹ Public Utilities Code §454.53

² CEC, CPUC, & CARB; *2021 SB 100 Joint Agency Report: Achieving 100 Percent Clean Electricity in California: An Initial Assessment*; March 2021.

³ Pg. 10, CEC, CPUC, & CARB ; "Achieving 100% Clean Electricity in California," *2021 SB 100 Joint Agency Report Summary: An Initial Assessment*, March 2021.

⁴ Pg. 11, *Ibid.*

⁵ D. 19-11-016 and D.21-06-035.

to a clean energy economy; however most agree that the answer is greater than zero. Moreover, if the pace of new energy resources must quicken significantly to meet our goals, then it is logical to assume the associated infrastructure upgrades must also occur at a similar pace. A recent study by the Clean Air Task Force and the Environmental Defense Fund concluded a doubling—at minimum—of transmission capacity is needed to interconnect new renewables by 2045.⁶ If new high-voltage transmission takes, on average, a decade to build,⁷ a concern arises whether we are doing enough *today* to ensure we are well positioned for *tomorrow*.

For its part, the California Independent System Operator (CAISO)—which operates and plans the majority of high-voltage transmission in the state—embarked on a 20-Year Transmission Outlook, in collaboration with the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC), to address this lingering question. The goal of the 20-Year Outlook was to explore the longer-term grid needs and options for meeting statewide energy objectives reliably and cost-effectively. The Outlook estimated total costs arising from upgrades and new build of the high-voltage bulk transmission system needed to meet 2045 goals would be roughly \$30 billion dollars.⁸

In addition to these changes on the supply-side, enormous changes on the demand-side of the electricity sector are simultaneously occurring. Reducing emissions in the economy as a whole has changed—and will continue to change—the demand for electricity,⁹ from the growth in building decarbonization and transportation electrification to further distributed energy resources coming online. Planning a grid for 2045 requires accommodating all these changes. With the right policies, technologies, and price signals, the state can be well positioned to accommodate such a future. However, given the steep annual growth needed over the next two decades, time is of the essence to ensure we are adequately planning today to meet our future needs, especially when it comes to transmission projects.

This hearing seeks to explore how well the state is planning for that future by examining not only how we're positioning today to meet the needs of tomorrow, but also whether small problems exist today that are poised to balloon into future obstacles as the pace of development quickens. This is the first of multiple hearings planned by this Committee to discuss transmission, and will be narrowly focused on statewide planning efforts and actions

⁶ Lucid Catalyst, Clean Air Task Force, and the Environmental Defense Fund, “California’s Clean Energy Transition: Understanding Today’s Challenges to Reach Tomorrow’s Goals,” presentation January 18, 2022.

⁷ As reported by the Clean Air Task Force *Ibid*, “the past five 500kV transmission projects in California over 100 miles have taken, on average, a decade to build.”

⁸ Approximate \$11 billion for upgrades; \$8 billion for offshore wind integration; and \$11 billion for out-of-state wind integration; pg. 3, CAISO, *20-Year Transmission Outlook*, January 31, 2022. DRAFT. Note: just focused on high-voltage bulk transmission; local transmission needs will be addressed subsequently.

⁹ “Energy planners estimate that such electrification will increase California’s peak demand for electricity from 50 GWs today to 100 GWs by 2050.” Pg. 2, Long, Jane., et al., “Clean Firm Power is the Key to California’s Carbon-Free Energy Future,” *Issues in Science and Technology*, National Academies, March 24, 2021.

of load-serving entities (LSEs)¹⁰ operating in the CAISO footprint. Actions of the federal government,¹¹ other California Balancing Authorities outside CAISO, and transmission-constrained publicly-owned utilities (POUs) inside CAISO are unique to this discussion and will be topics for a future hearing. As CAISO represents approximately 81% of California load, of which 90% is CPUC-jurisdictional, this focus will represent a reasonable slice of transmission issues in the state.

Findings

- *The state is moving aggressively to meet our clean energy and GHG reductions targets, but estimates suggest a rapid construction ramp up of both generation resources and associated electric infrastructure is necessary to meet our future targets.*
- *California has a complicated but robust electric planning regime spread across multiple agencies. Agencies have begun to plan along longer timelines in order to gain clarity on what is needed today to achieve our clean energy goals by midcentury. Regulators must be mindful of the limitations of their models, though, and update them against empirical evidence.*
- *The gap between transmission plans and transmission build-out can be broad. Correcting current bottlenecks to transmission development today is essential to best position California's grid to meet the future ramp up; this is especially true for the interconnection processes of both the CAISO and the transmission operators.*
- *Future planning should direct more attention to cost containment strategies and land-use impacts.*

What is Transmission? The transmission system is a grouping of electrical components, circuits, and associated hardware that carry electric energy at relatively high voltages, usually above 69 kilovolts (kV).¹² The system is interconnected in order to move or transfer electric energy in bulk from generation sources (power plants) to delivery over the distribution system to consumers. If electrons were like cars on the road, the transmission system would be the highways and freeways, while the distribution system would be the surface streets. Transmission lines may be owned and operated by investor-owned utilities, publicly-owned utilities, or even independent third-party transmission owners that competitively bid for transmission projects. As the transmission system is the connecting point between generation resources (supply) and consumers (demand), planning for transmission construction—both new and upgrading old—requires an understanding of both future generation resource needs

¹⁰ Defined in statute as: investor-owned utilities (IOUs), community choice aggregators (CCAs), and electric service providers (ESPs)

¹¹ Both the Department of Energy and the Federal Energy Regulatory Commission

¹² Though this is not a hard-and-fast rule, some utilities designate circuits >60kV “transmission.” >69kV is NERC's definition, as provided by the U.S. Energy Information Administration glossary of terms. <https://www.eia.gov/tools/glossary/index.php?id=T>

(capacity and location) and consumer demand changes. Therefore, transmission planning requires a robust planning process that considers all aspects of electricity supply and demand.

The Web of Electricity Planning. California has a complicated but robust electric planning and procurement regime spread across the California Air Resources Board (CARB), the CPUC, the CEC, and the CAISO. Much of this regime focuses on resource procurement needed to meet our clean energy goals, however the direct downstream effect of the procurement planning is planning for the transmission needed to accommodate the new generation. The main elements of the regime are the Scoping Plan at CARB, the Integrated Energy Policy Report (IEPR) at the CEC, the Integrated Resource Plans (IRP) and Resource Adequacy (RA) process at the CPUC, and finally the Transmission Planning Process (TPP) at CAISO.

The Scoping Plan – In 2006, the Legislature passed the California Global Warming Solutions Act of 2006,¹³ which created a comprehensive, multi-year program to reduce GHG emissions in California. The Act required CARB to develop a Scoping Plan that describes the approach California will take to reduce GHGs to achieve the goal of reducing emissions to 1990 levels by 2020; this goal has since been updated to be a reduction of 40 percent below 1990 levels by 2030.¹⁴ Each Scoping Plan has included a suite of policies to help the State achieve its GHG targets, in large part leveraging existing programs whose primary goal is to reduce harmful air pollution.

For the electricity sector, the Scoping Plan establishes a target range for the sector’s GHG emission reductions that reflect its proportional role in achieving the economy wide GHG reductions.¹⁵ In its most recent draft plan, CARB set the electric sector targets at 38 million metric tons of carbon dioxide equivalent (MMTCO₂e) in 2030 and 30 MMTCO₂e in 2045.¹⁶ These sector-wide targets establish the planning goal that informs all subsequent electricity procurement and transmission planning. Chiefly, the CPUC takes the Scoping Plan target range for the electric sector and uses it to establish GHG targets for all LSEs during the IRP process.

The IRP – Since 2015, with the passage of SB 350 (De León, Chapter 547, Statutes of 2015), California regulators have worked to identify a diverse mix of resources to achieve our clean energy goals. SB 350 requires the CPUC to adopt a process for each LSE to file an IRP with the goal of reducing the cost of achieving GHG emission reductions by looking broadly at system needs, rather than at individual LSEs or resource types.

The IRP operates on a 2-year planning cycle, and forecasts system need 10 years into the future. The most recent IRP analysis identified almost 20 GWs of new resources needed by

¹³ AB 32, Nunez, Chapter 488, Statutes of 2006

¹⁴ SB 32, Pavley, Chapter 249, Statutes of 2016

¹⁵ Public Utilities Code § 454.52(a)(1)(A)

¹⁶ Pg. 60, CARB, “DRAFT 2022 Scoping Plan Update,” May 10, 2022.

2031, arising from a mix of geothermal, land-based wind, solar, battery storage, and long-duration storage resources.¹⁷ The CPUC also conducts sensitivity analyses for the IRP for emerging resources whose pricing data and availability are not robust enough for inclusion as a main resource, but whose sensitivity analysis can provide more insight into how the technology may contribute to the overall portfolio.¹⁸

SB 100 Report – While the IRP focuses on what energy mix is best suited to meet our GHG and reliability goals 10 years into the future, the Joint Agency SB 100 Report looks at a planning horizon 23 years out, to determine how best to implement the 100% Clean Energy Policy.¹⁹ The first SB 100 Report was finalized in March 2021, and included analyses of many pathways to achieve the state’s 2045 clean energy goal.²⁰ As noted above, the Report found that California will need to roughly triple its current electricity power capacity,²¹ installing approximately 6 gigawatts (GW) of new solar, wind, and battery storage resources annually.²² The SB 100 Report will be updated every four years, with future work focused on system reliability,²³ among other considerations.

The IEPR – Alongside the IRP and SB 100 Report, which focus on potential mid- and long-term procurement needs for the electricity system, the CEC conducts an IEPR to forecast all aspects of energy industry supply, production, transportation, delivery, distribution, demand, and pricing. The CEC is then required to use these assessments and forecasts to develop energy policies that conserve resources, protect the environment, ensure energy reliability, enhance the state's economy, and protect public health and safety. To carry out these assessments, “the Commission may require submission of demand forecasts, resource plans, market assessments, and related outlooks from electric, natural gas utilities, transportation fuel and technology suppliers, and other market participants.”²⁴ The CEC is also required to publish a strategic plan for California’s transmission grid and include it in the IEPR.²⁵ The CEC adopts an IEPR every two years with updates every other year. The information generated from the IEPR’s demand forecast informs the IRP and RA processes at the CPUC.

RA – Running concurrently with these planning streams is the RA process at the CPUC and CAISO. While the IRP, SB 100 Report, and IEPR focus on potential future needs, RA is designed to identify resources needed to ensure reliability *today*. Following the California

¹⁷ 38 MMT scenario resource stack; CPUC, “Proposed Resource Planning Portfolios from CPUC’s Integrated Resource Planning Process for use in CAISO’s 2021-2022 Transmission Planning Process,” January 20, 2021, pg. 9.

¹⁸ Pg. 26, D. 21-02-008, *Decision Transferring Electric Resource Portfolios to California Independent System Operator for 2021-2022 Transmission Planning Process*; R. 20-05-003; issued February 17, 2021.

¹⁹ CEC, CPUC, & CARB; *2021 SB 100 Joint Agency Report: Achieving 100 Percent Clean Electricity in California: An Initial Assessment*,” March 2021.

²⁰ Pg. 12, *2021 SB 100 Report*.

²¹ Pg. 10, CEC, CPUC, & CARB ; “Achieving 100% Clean Electricity in California,” *2021 SB 100 Joint Agency Report Summary: An Initial Assessment*, March 2021.

²² Pg. 11, *Ibid*.

²³ Pg. 1, *2021 SB 100 Report*.

²⁴ California Public Resources Code Section 25301(a)(2)

²⁵ California Public Resources Code Section 25324

energy crisis of 2000-01, the California Legislature enacted AB 380 (Nunez, Chapter 367, Statutes of 2005) to prevent future incidents of widespread blackouts and rolling brownouts due to lack of electricity. This statute required the CPUC to work in consultation with the CAISO to establish RA requirements for all LSEs. The current RA program consists of system, local, and flexible requirements for each month of a compliance year. System requirements are determined for each LSE based on the CEC's IEPR electricity forecast plus a planning reserve margin.²⁶ Local requirements are determined based on an annual CAISO study using a 1-10 (once in ten years) weather year and an N-1-1 contingency.²⁷ Flexible requirements are based on an annual CAISO study that currently looks at the largest three-hour ramp for each month needed to run the system reliably. In October, LSEs must demonstrate that they have procured 90% of their system RA obligations for the five summer months (May-September) of the following year, as well as 100% of their local requirements, and 90% of their flexible requirements for each month of the coming compliance year. There is an additional monthly reporting requirement for RA, where LSEs must demonstrate they have procured 100% of their monthly system and flexible RA obligation.

The TPP – Each year, the CAISO conducts its TPP to identify potential system limitations as well as transmission projects in need of upgrades or new infrastructure in need of construction to improve reliability and efficiency.²⁸ The TPP relies on the CPUC's IRP process²⁹ to identify the optimal mix of system-wide resources capable of meeting GHG planning targets for the electric sector.³⁰ CAISO receives the IRP results as inputs into its TPP. In February 2021, the CPUC transferred the electric resource portfolios to the CAISO to begin the CAISO's 2021-2022 TPP.³¹ The CAISO also receives the CEC's demand forecast of electricity and natural gas sales, consumption, and peak and hourly electricity demand.

The plan is updated annually, and culminates in a CAISO Board of Governors approved transmission plan that identifies the needed transmission solutions³² and authorizes cost

²⁶ The CPUC has recently adopted changes to RA, including increasing the planning reserve margin from 15% to 17.5% and in some cases to 19%.

²⁷ N-1-1 Contingency: A sequence of events consisting of the initial loss of a single generator or transmission component (Primary Contingency), followed by system adjustments, followed by another loss of a single generator, or transmission component (Secondary Contingency).

²⁸ There are other transmission planning efforts, including local capacity requirements, special studies, interregional transmission project, and others that are not mentioned here for sake of clarity.

²⁹ Called for under SB 350 (De León, Chapter 547, Statutes of 2015)

³⁰ Via the Reference System Plan (RSP) and Preferred System Plan (PSP). The CPUC creates the Reference System Plan (RSP) to meet the electric sector target informed by the California Air Resources Board Climate Change Scoping Plan. The CPUC uses this RSP to establish filing requirements for the load-serving entities. The second year considers the procurement each load-serving entity proposes to meet these GHG targets. As each load-serving entity has its own local constraints to consider, each files its own plan. The CPUC reviews, modifies, and aggregates these individual load-serving entities' plans into a preferred system plan (PSP). Based on the approved PSP, the CPUC considers authorizing load-serving entities to procure resources within the next 1-3 years to meet GHG planning targets.

³¹ D. 21-02-008 *Decision Transferring Electric Resource Portfolios to California Independent System Operator for 2021-2022 Transmission Planning Process*; R. 20-05-003; issued February 17, 2021.

³² as well as identifying non-transmission solutions that will be pursued in other venues as an alternative to building additional transmission facilities

recovery through CAISO transmission rates, subject to federal regulatory approval. There are three main categories of CAISO approved transmission projects:

- Reliability projects to meet federal standards;
- Policy projects to meet state policy goals (i.e., RPS-needed projects);
- Economic projects that reduce congestion, production costs, transmission losses, capacity requirements or other electric supply costs.

How Transmission Gets Approved. Following the CAISO Board’s approval of a TPP, new projects that are identified as necessary go through a competitive solicitation process. Transmission developers—which may be POU, IOU, or private, for-profit entities—apply for the project solicitation and those applications are evaluated on a number of qualifying criteria, including cost. The CAISO Board recently approved its 2021-2022 TPP on March 17, 2022,³³ and identified 23 projects—at an estimated \$2.9 billion—needed for reliability and to meet state policy goals; four of these projects are eligible for competitive solicitation.³⁴

Once a transmission developer’s project proposal is selected in the competitive solicitation, it undergoes two application processes at the CPUC: a California Environmental Quality Act (CEQA) review and a Certificate of Public Convenience and Necessity (CPCN) review. The CEQA review requires the examination of particular environmental issues such as water and air quality, noise, land uses, and agricultural, biological, mineral, and cultural resources, among others. As part of the CEQA review, alternatives to the proposed transmission project must be evaluated. The CPCN review considers the need for the project based on economic, reliability, and/or renewable goals. The CPCN review also requires the examination of alternatives, with a focus on cost-reduction. CAISO is often a party to these CPCN proceedings at the CPUC, making the case for why a particular transmission project is necessary, per their TPP.

The vast majority of transmission upgrades, however, are exempt from project permitting at the CPUC; typically, only extremely large projects with significant new rights of way are subject to CPUC permit and environmental review. As there can be hundreds of upgrades in development at all times, and most upgrades fall outside the CPUC’s established triggers for permitting, it can be challenging to track whether specific projects are delayed and whether transmission owners are prioritizing the upgrades needed for new generators.³⁵

Chicken or the Egg: Challenges of the Planning Regime. This planning regime is intimately interconnected, with updates and modifications in one stream impacting the results in the

³³ Kavya Balaraman, “CAISO approves nearly \$3B of transmission projects to prepare for California’s clean energy goals,” *Utility Dive*, March 18, 2022.

³⁴ See CAISO Notice from March 22, 2022, “2021-2022 Transmission Planning Process: Competitive Solicitation Key Selection Factors Posted,” <http://www.caiso.com/Documents/2021-2022-Transmission-Planning-Process-Competitive-Solicitation-Key-Selection-Factors-Posted.html>

³⁵ Gill, Liz, Aleecia Gutierrez, Le-Quyen Nguyen, and Terra Weeks. 2021. *Report to the Governor on Priority SB 100 Actions to Accelerate the Transition to Carbon-Free Energy*. California Energy Commission. Publication Number: CEC-200-2021-008

others. If one planning target is adjusted—such as the recent updates to CARB’s Scoping Plan—it may take years before that target percolates through the entire planning regime. Transmission planning, as the end point in the process, is usually the last to be updated. As new transmission in California can take a decade, on average, to build, there is growing concern that our planning processes are too cumbersome to quickly adapt to the ramp up necessary to meet our clean energy and climate goals.

Moreover, stakeholders have raised concerns about the historical treatment of generation and transmission build as one-off projects, with CEQA and CPCN review considering only the individual project (and the potential mitigation if the one project did not exist) rather than the project’s larger role in meeting statewide clean energy goals. Advancing a standardized process, such as a uniform framework that all projects go through, has been suggested³⁶ as a potential solution for taking a system-wide approach.

The need for transmission is also dependent on the need for new generation, but given the long-lead times for both transmission and generation construction regulators must orchestrate project development such that the need for both arises near-simultaneously. Otherwise, there is a risk of overbuilding transmission infrastructure in locations where no developer wishes to put power plants; or there is a risk that power plants are sited and developed in locations where it may be a decade or more before transmission reaches it. This chicken-or-egg character of transmission projects isn’t isolated to new construction; interconnection often requires an orchestrated timeline. Generation developers need certainty about transmission access to move projects forward, while transmission developers need certainty about commercial generator interest in a specific location before moving forward with development.

Interconnection Presents Complications. Before a project developer/generator may serve customer demand, it must connect to the larger electric system. This occurs through a process aptly named interconnection. Resources newly interconnecting to the CAISO controlled grid must undergo an interconnection request through CAISO.³⁷ The interconnection process at the CAISO can take anywhere from weeks to years, depending on the type of project seeking application. Generally, for large projects, greater than 20 MW, their interconnection applications are grouped into “cluster studies.” Clusters are formed when interconnection requests are received during an application window, after which no new applications are received, and all projects are assigned a queue number. The CAISO then studies the requests as a group to determine what is needed for the system, and assigns a “deliverability” allocation to certain projects, a short-hand way of recognizing whether or not a resource can meet future reliability needs by having access to transmission capacity.³⁸

³⁶ Niskanen Center and Clean Air Task Force, “How are we going to build all that clean energy infrastructure?” August 2021.

³⁷ Per Section 25 of CAISO’s FERC-approved tariff

³⁸ Foster, Jason, et al., CAISO presentation, “Interconnection Application Options and Process,” March 11, 2020.

Unfortunately, the structure of the CAISO queue system does not fare well when there is aggressive competition for clean energy project development. The CAISO is currently on Cluster 14 of its interconnection process, which has almost 600 projects in queue, some with interconnection requests dating back to 2004. While CAISO's 2022 TPP calls for 2,700 MW per year over 10 years, and current drafts being proposed for 2023's TPP calls for over 4,000 MW per year,³⁹ Cluster 14 has over 237,000 MW in queue. Such orders of magnitude of proposed projects over-and-above what is needed both bog down the CAISO review process and also make it difficult to distinguish realistic projects from a list of otherwise aspirational applications.

Beyond the queuing system at the CAISO, some projects that require a transmission system network upgrade to interconnect and are dependent on transmission system owners to ensure such upgrades happen in a timely manner. Recently, transmission system owners—particularly some of the state's IOUs—have experienced issues with keeping interconnection requests and associated transmission network upgrades on schedule, in some cases leading to delays in the delivery dates for new resources.⁴⁰ In addition, LSE procurement activities do not always prioritize procurement from projects that have viable and timely paths to interconnection and network upgrades. In some instances, transmission network upgrades or interconnection upgrades trigger local government and environmental permitting processes, some of which can be difficult to predict and further delay project timelines.

To address these issues, a recent joint effort between the CAISO and the CPUC has been established, known as the Transmission Development Forum. The Transmission Development Forum creates a single forum to track the status of transmission network upgrade projects that affect generators and all other transmission projects approved in the CAISO's TPP. The effort seeks increased transparency for all stakeholders about transmission projects and enhances accountability of transmission owners by having them explain schedule changes, delays, and address stakeholders' questions.⁴¹

Understanding current challenges of transmission development and project interconnection—and addressing those challenges *today*—is essential to best position California's grid to meet the ramp up of generation and infrastructure development needed to achieve our clean energy goals into the future.

Looking into the Future. As mentioned earlier, the CAISO embarked on a 20-Year Transmission Outlook for the electric grid, in collaboration with the CPUC and the CEC, with the goal of exploring longer-term grid requirements. The CAISO intends for the

³⁹ Pg. 6 CAISO, *20-Year Transmission Outlook*, January 31, 2022. DRAFT

⁴⁰ See March 11, 2022 letters from CPUC President Alice Reynolds to Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E). Subject: Prioritization of Interconnection to Ensure Grid Reliability

⁴¹ Pg. 12-13, Gill, Liz, Aleecia Gutierrez, Le-Quyen Nguyen, and Terra Weeks. 2021. *Report to the Governor on Priority SB 100 Actions to Accelerate the Transition to Carbon-Free Energy*. California Energy Commission. Publication Number: CEC-200-2021-008

expanded planning horizon to provide a longer-term context for pertinent issues in the CAISO’s annual 10-Year transmission plans. This 20-year effort in transmission planning mirrors the longer-term planning undertaken for procurement in the Joint Agency SB 100 Report. Such long-term planning efforts are essential to prepare for the electric grid’s transition to a clean energy future, but also are not without risks as the projections of future demand and supply grow more uncertain the further a planning target date is from the present. Regulators must be mindful of the limitations of their models, and constantly update them against empirical evidence, before major, costly decisions are made based on needs projected decades into the future. Two potential points of needed attention for future planning arise from costs and land-use impacts.

Costs. The transmission rate component of an IOU electric bill is associated with the bulk transmission lines owned by the utilities. Transmission rates are set by FERC, and are comprised of four sub-components: 1) Base Transmission, which recovers the costs associated with transmission assets under CAISO operational control and subject to FERC’s jurisdiction; 2) Transmission Revenues, which are paid directly by wholesale customers who use the transmission system; 3) Reliability Services, which arise from contracts signed by the CAISO with certain generators needed to maintain system reliability; and 4) the Transmission Access Charge which reflects the net contribution by IOU customers to the transmission revenue requirements of all participating transmission. As reported in the CPUC’s latest report on utility costs and rate increases, the transmission rate component of the three largest IOUs⁴² have been increasing—sometimes sharply—over the last six years.⁴³

Given the continued growth projected for both new generation and transmission infrastructure over the next decades, cost containment should be prioritized alongside system planning efforts. This Committee has spent previous hearings examining cost drivers in electric rates, as well as potential mitigation efforts. Some costs solutions unique to transmission include the removal of wildfire mitigation costs from rates; examining alternative financing models for new transmission, such as merchant projects where the financing is borne by subscribers (generators) using the line; or the creation of a transmission authority.

In September 2021, the CEC, CPUC, CARB, and CAISO published a *Report to the Governor on Priority SB 100 Actions to Accelerate the Transition to Carbon-free Energy*. Among the many issues included in the report was a discussion regarding transmission planning, permitting, and interconnection. The report notes that the build out of new electric transmission lines and upgrades to existing lines is “essential to support the interconnection of new resources.” However, the report noted that over the past 10 years the cost of transmission for the average California ratepayer has increased by over 150%. Large transmission projects were identified as driving much of the increase. As a cost-cutting

⁴² PG&E, SCE, and SDG&E

⁴³ Pg. 23-28, CPUC, 2022 *Senate Bill 695 Report: Report to the Governor and Legislature on Actions to Limit Utility Cost and Rate Increases Pursuant to Public Utilities Code Section 913.1*, published May 2022.

measure to help mitigate against increasing electric utility rates, the report recommended considering “statutory changes for the formation of a new entity for energy and transmission financing.” The report specifically noted creation of a “California transmission authority as a new public benefits corporation that can, either on its own or through public private partnerships, fund and build new transmission projects needed to meet clean energy goals.”⁴⁴

Land-Use Concerns. Because renewable and zero-carbon energy technologies often have large footprints and may require new supporting infrastructure to deliver power (i.e., transmission), incorporating land use into planning is necessary to minimize adverse societal and environmental impacts. It will be critical to incorporate land-use planning into electric system planning in order to consider trade-offs between energy development and conservation of land for agricultural, natural lands, or housing, especially as electric sector infrastructure development ramps up over the next decades.

Several geospatial studies—such as NREL’s GIS mapping of renewable energy resources⁴⁵—have already screened for locations with high renewable energy resource potential in California. However, energy-planning processes have not yet been fully integrated with land conservation values to evaluate the environmental and system cost and benefit implications of clean energy policies and siting decisions.

Planning should reflect the “Garamendi Principles,” as outlined in SB 2431 (Garamendi, Chapter 1457, Statutes of 1988), which declare that it is in the best interest of the state to conduct transmission siting according to the following:

1. Encourage the use of existing right-of-way (ROW) by upgrading existing transmission facilities where technically and economically justifiable.
2. When construction of new transmission lines is required, encourage expansion of existing ROW, when technically and economically feasible.
3. Provide for the creation of new ROW when justified by environmental, technical, or economic reasons, as determined by the appropriate licensing agency.
4. Where there is a need to construct additional transmission capacity, seek agreement among all interested utilities on the efficient use of that capacity.

The CPUC's IRP process includes environment and land-use screens as part of its modeling. The land use and environmental information assembled from those efforts is then mapped with selected resources to substation busbars for input into the CAISO's TPP. The CAISO leveraged the SB 100 Report land use information as a starting point for its 20-Year Outlook.

Beyond incorporating land use to address environmental concerns, incorporating it as a reality-check for the modeled scenarios is equally important. Specifically, whether the

⁴⁴ Pg. 18, Gill, Liz, Aleecia Gutierrez, Le-Quyen Nguyen, and Terra Weeks. 2021. *Report to the Governor on Priority SB 100 Actions to Accelerate the Transition to Carbon-Free Energy*. California Energy Commission. Publication Number: CEC-200-2021-008

⁴⁵ National Renewable Energy Laboratory Geospatial Data Science Web page, <https://www.nrel.gov/gis/>.

infrastructure development being proposed by the model is in a location where locals are receptive. As highlighted in analysis from The Nature Conservancy, just because a large area of land is *available* does not mean it is *developable*.⁴⁶ City, county, and tribal governments influence statewide energy decisions through their permitting authority for transmission lines, thermal power generators under 50 MW, and renewable power generators, including solar and wind operations on nonfederal lands. Resource plans that propose development in areas with communities hostile to that development run the risk of quickly becoming obsolete.

A recent budget proposal suggested as part of the May Revision seeks to respond to these concerns by “providing a new streamlined permitting option [outside of local permitting] at the California Energy Commission for qualifying projects. This proposal prioritizes the development of projects needed to enhance energy reliability while also providing opportunities for public, tribal, and local government engagement and environmental review.”⁴⁷ While the details of the proposal are still unknown, such an action could impact the amount of developable land, not just during planning but during actual project development.

More to Come. California’s electricity sector is in a period of transition. It will be necessary to develop policies that ease the transition so that the electric sector may meet its clean energy and GHG reduction goals as efficiently and affordably as possible. This hearing will provide an opportunity to examine how prepared the state is to meet our future transmission needs. But transmission is just one slice of the larger energy-wide transition—a transition that must occur across the electricity sector simultaneously and rapidly.

As noted above, this is the first of multiple hearings planned by this Committee to focus on transmission, and as a result is focused narrowly on statewide planning efforts for and actions of LSEs operating in the CAISO footprint. Impacts to transmission development including supply chain constraints, workforce availability and training pipelines, engineering review delays, deliverability of resources, and a western-wide regional grid operator are all important topics worthy of more attention at a future hearing. Additionally, a wider net of participants from the federal government, other California Balancing Authorities outside CAISO, and transmission-constrained publicly-owned utilities inside CAISO all provide unique perspectives and influence on this transmission discussion and will be considered at a future date.

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⁴⁶ Wu, Grace, et al., “Power of Place: Land Conservation and Clean Energy Pathways for California,” June 2019.

⁴⁷ Pg. 63, “May Revision,” Gavin Newsom, Governor, 2022-23.

Appendix A – Lead Entities

CAISO – a nonprofit public benefit corporation created by California statute as part of the effort to deregulate the electricity market in the late 1990s. The CAISO manages the flow of electricity across the high-voltage bulk power system that makes up 80 percent of California's, and a small part of Nevada's, electric grid. CAISO is registered as both a transmission operator and BA under federal reliability requirements. Transmission operators direct the operations of transmission facilities and are responsible for their reliability. BAs ensure electric reliability over an area that includes the generation, transmission, and loads, balancing electricity supply and demand at every moment. As with other BAs, the CAISO is regulated by federal statute, with oversight by FERC and the North American Energy Reliability Corporation.

CARB – promotes and protects public health, welfare, and ecological resources through effective reduction of air pollutants while recognizing and considering effects on the economy. CARB is the lead agency for climate change programs and oversees all air pollution control efforts in California to attain and maintain health-based air quality standards. Relevant to this paper, CARB is the lead for the statewide Scoping Plan, which provides GHG reductions targets specific to the energy sector.

CEC – formally the Energy Resources Conservation and Development Commission, has many electricity planning and policy functions, including forecasting electricity and natural gas demand, investing in energy innovation, setting the state's appliance and building energy efficiency standards, and planning for and directing state response to energy emergencies. Among the CEC's key responsibilities is the preparation and adoption of electricity demand forecasts for the CAISO. As part of its IEPR process and in consultation with the joint entities, the CEC develops a set of forecasts to support the needs of CAISO transmission planning, CPUC Integrated Resources Planning, and CPUC and CAISO resource adequacy.

CPUC – has many regulatory responsibilities for energy, telecommunications, water, transportation, and safety in California. Relevant to this paper, the CPUC is the lead for energy resource planning and procurement through primarily the IRP, RPS, and RA programs. It additionally sets reliability requirements for the LSEs that participate in the CAISO markets and comprise the majority of the CAISO footprint. Electric utilities regulated by the CPUC represent approximately 80% of the electricity demand in California and 91% of the electricity demand in the CAISO system.

Appendix B – Select Transmission-Related Legislation

Bills currently before the Legislature touch on many of the transmission topics discussed here. These include:

AB 2696 (E. Garcia) – requires the CEC to conduct a study that reviews lower cost ownership and alternative financing for new transmission facilities. Additionally, requires the CPUC to find the construction of new transmission by an IOU necessary if the new transmission will achieve the 100% Clean Energy Policy of SB 100 (De León, Chapter 312, Statutes of 2018). Status: *suspense file* – Assembly Committee on Appropriations.

AB 887 (Becker) – adjusts the planning horizon for the annual electricity transmission plan from 10-years to 15-years, and requires consideration of approval of transmission projects that will reduce reliance on carbon-emitting resources in transmission-constrained urban areas as part of the CAISO’s 2022-23 transmission planning process. Status: *suspense file* – Senate Committee on Appropriations.

SB 1032 (Becker) – requires the CPUC to submit a study identifying proposals to accelerate the development of, and reduce the cost to ratepayers of expanding, the state’s electrical transmission grid to meet state goals and requirements for GHG emission reductions. Status: *suspense file* – Senate Committee on Appropriations.

SB 1174 (Hertzberg) – requires the CPUC to identify interconnection or transmission projects necessary to address potential capacity shortfalls and to execute an accelerated approval and completion process for these projects, among other things. Status: *suspense file* – Senate Committee on Appropriations.

SB 1274 (McGuire) – would include, as a project eligible for streamlining benefits related to CEQA certification, a clean energy transmission project that upgrades existing transmission infrastructure to bring renewable energy from an offshore wind project located within or adjacent to the County of Humboldt that meets specified requirements. Status: *pending* – Senate Committee on Environmental Quality.