

AB 2779 Grid Enhancing Technologies

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1 Introduction

In compliance with Assembly Bill (AB) 2779 (Petrie-Norris, 2024),[1] the California Independent System Operator Corporation (ISO) is providing this update to the California Public Utilities Commission (CPUC) and relevant legislative policy committees on the deployment and approval of Grid-Enhancing Technologies (GETs) within the ISO's planning and operational framework. This report reflects the ISO's ongoing efforts to address transmission system constraints and optimize the grid's performance through innovative, lower-cost alternatives to conventional infrastructure expansion.

In the 2025-2026 Transmission Plan,[2] the following projects included approval of three GETs solutions:

- Mesa – Laguna Bell 230 kV #2 Upgrade (Advanced conductor);
- Ames Distribution – Palo Alto 115 kV Line (Re-scope) (Advanced conductor); and
- Lugo 500 kV Reactive Power Reinforcement (Dynamic reactive device).

More details about these projects, as well as information about other projects under consideration, and those approved in previous ISO Transmission Plans, are included in this update.

2 Grid-Enhancing Technologies (GETs)

GETs encompass a range of technologies designed to increase the capacity, flexibility, and efficiency of the electric transmission system.[3] Currently, the term is used to describe:

- **Advanced Conductors** – Wiring capable of operating at higher temperatures with low sag and increased load-carrying capabilities.
- **Dynamic Line Ratings** – Hardware or software that more accurately determines the thermal limits of existing lines based on real-time environmental conditions.

[1] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240AB2779

[2] The Board Approved 2025-2026 Transmission Plan includes more detail about these projects, and is available at https://stakeholdercenter.caiso.com/InitiativeDocuments/updated-board-approved-2025-2026-transmission-plan.pdf

[3] AB 2779 and Senate Bill (SB) 1006 utilize the term GETs, while the Federal Energy Regulatory Commission's (FERC) Order No. 1920 utilizes the term Alternative Transmission Technologies (ATTs). For the purposes of this report, the ISO is using the term GETs to align with how state laws use the term, though notes some technologies included are not traditionally considered GETs but are considered ATTs. The ISO's proposed Section 24 Tariff revisions to comply with Order No. 1920 include specific ATTs that it will consider in its Transmission Planning Process.

- **Power Flow Controllers** – Hardware and software that can actively manage power flow, pushing or pulling electricity to manage congestion and improve reliability.
- **Topology Optimizations** – Software tools that identify alternative power routing to alleviate transmission bottlenecks.

The ISO has long-supported appropriate application and deployment of these technologies when considering a wide array of technical options in the transmission planning process. The ISO evaluates a range of solutions, ranging from conventional transmission additions, reinforcements or upgrades to existing facilities to fully utilize existing infrastructure, and GETs that can, where feasible, increase capacity more economically than building new transmission lines. The ISO considers potential applications to each transmission need on a case-by-case basis in its annual transmission planning process.

The ISO typically considers advanced conductors and power flow controllers as planning tools providing an alternative to other capital expenditures. The ISO also considers dynamic thermal line ratings and topology optimizations in accessing operational benefits through additional capacity providing economic or emergency measure uses. Since the efficacy and value of dynamic thermal line ratings and topology optimizations are highly dependent on weather and system conditions, these tools are better utilized in the operational timeframe.

The ISO has studied and approved both advanced conductors and flow controllers in previous transmission planning cycles and will continue to consider all GETs and seek their appropriate applications.[4] In addition to cost considerations, it is important to keep in mind other factors that have an impact on whether GETs can provide an appropriate solution to the need for transmission upgrades, including:

- Reconductoring often requires taking circuits out of service to conduct the work. This presents additional challenges when transmission constraints already exist or suggests live-line work.
- While some conductors show lower line loss savings when run at the same level of loading as the existing aluminum conductor steel reinforced (ACSR), the losses climb exponentially as the loading continues to increase.

[4] FERC Orders No. 1920 and 1920-A require consideration of GETs. In addition, FERC Order No. 2023 requires transmission providers to consider opportunities to deploy GETs in the resource interconnection process.

3 Senate Bill 1006 Submittals from PG&E, SCE and SDG&E

SB 1006 (Padilla, 2024)[5] required the three large investor-owned utilities to submit reports to the ISO, and post publicly, by January 1, 2026, with components of the reports to be updated every two years and others every four years going forward.

The ISO received the following reports from Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E), pursuant to their SB 1006 obligations:

- PG&E – SB 1006 Compliance Report;[6]
- SCE – A Study of the Feasibility of Projects using Grid-Enhancing Technologies and Reconductoring with Advanced Conductors;[7] and
- SDG&E – A Study of the Feasibility of Projects Using Grid-Enhancing Technologies and Reconductoring with Advanced Conductors.[8]

In assessing mitigation alternatives for the needs identified in the reliability, policy, and economic assessments conducted in the 2025-2026 transmission planning cycle, the ISO coordinated with the transmission owners on the feasibility of GETs, as an alternative, particularly application of advanced conductors and flow control devices with the projects recommended using GETs, along with those approved in previous planning cycles. Pursuant to SB 1006, the ISO reviewed each transmission utility's results as a part of its annual transmission planning process.

4 Overview of Approved GETs Projects

As noted above, the 2025-2026 Transmission Plan included approval of three GETs solutions.[9] This section provides additional information about (1) the GETs projects approved in the 2025-2026 Transmission Plan, (2) those that are currently being evaluated, and (3) GET's approvals to date. Transmission plans identify and plan the

[5] California-2023-SB1006-Chaptered

[6] http://pgera.azurewebsites.net/Regulation/ValidateDocAccess?docID=858547

[7] https://www.sce.com/sites/default/files/Regulatory/SB1006-FinalStudiesFor2025-PublicVersion.pdf

[8] https://www.sdge.com/sites/default/files/documents/2025-12/SDGE_SB-1006_12292025_Clean.pdf

[9] Dynamic Line Rating (DLR) refers to transmission line rating varying based on local conditions, such as ambient air temperature, wind speed, cloud cover, solar heating, and precipitation, etc., rather than a static rating assumption. DLR can provide additional capacity for a transmission line. FERC Order No. 1920 requires transmission providers to consider more fully the alternative transmission technologies of dynamic line ratings in long-term transmission planning. In this planning cycle, dynamic line ratings were not modeled in production cost modeled (PCM) cases, since it not only requires operational history data of weather conditions and line ratings, but also requires software and modeling enhancement to accommodate the data in PCM. The ISO will coordinate with the ISO's participating transmission owners, the Western Electricity Coordinating Council, and the software vendor of GridView, to explore the feasibility and possibility of implementing dynamic line rating in PCM model in future planning cycles.

development of the most cost-effective solutions to comprehensively meet the future needs of the ISO-controlled transmission grid, including GETs, where appropriate.

2025-2026 Transmission Plan Approved GETs

Mesa–Laguna Bell 230 kV #2 upgrade

The advanced conductor project was submitted by SCE to eliminate the Mesa–Laguna Bell 230 kV #2 line overloads and increase load serving capability to accommodate additional energy storage resources that can be charged and subsequently deployed to offset local capacity deficiencies through 2035.

The project involves reconductoring 4.9 miles of the Mesa–Laguna Bell 230 kV #2 line using advanced conductor technology.

Ames Distribution – Palo Alto 115 kV line (Revised Scope)

This advanced conductor project was originally proposed in the previous 2024–2025 Transmission Plan to address two main concerns in the Santa Clara region: preventing overloads in the Ravenswood–Palo Alto 115 kV line and adding a new connection to the Palo Alto substation. This connection aims to improve system reliability by diversifying the sources that supply power to the City of Palo Alto, including the connection to the Ames Distribution substation in the De Anza division, thereby reducing dependence on the Ravenswood side. However, due to significant increases in the load forecast, the initially proposed reconductor capacity for these lines is insufficient to prevent overloads in longer-term scenarios. As a result, the 2025-2026 Transmission Plan revised the project scope.

The revised scope still includes the construction of the Ames Distribution–Palo Alto 115 kV line, but it now utilizes advanced conductors to achieve a summer emergency rating of 3,000 A or higher. Furthermore, to leverage the proposed higher capacity from the new link connecting to the De Anza and Peninsula areas, the revised scope also incorporates the reconductoring of 0.1 miles of the Ames Distribution 115 kV line to ensure it achieves at least 3000 A.

Lugo 500 kV Reactive Power Reinforcement

The project was submitted by SCE to address the low-voltage conditions identified on multiple 500 kV buses of the SCE bulk system under Categories P0, P1, and P7 contingencies in the near-term and the long-term planning scenarios. In addition, the P7 contingency of Vincent – Mesa 500 kV and Vincent – Rio Hondo 230 kV lines could potentially result in post-transient voltage instability in the SCE main area in the long-term summer off-peak case. These issues are driven by renewable generation

development along with limited voltage support from conventional generation resources in the SCE area.

The project consists of a ±300 MVAr STATCOM (Static Synchronous Compensator) combined with 3x 200 MVAr switchable capacitor banks located at or near by the Lugo 500 kV substation, providing a total of (+900 to –300) MVAr of steady-state and dynamic reactive power support to the SCE 500 kV bulk system. The scope of this project may need to be revisited in the next planning cycle if the proposed Trout–Canyon–Lugo 500-kV line is approved by the ISO Board during the current cycle.

2025-2026 Transmission Plan GETs under Evaluation

The 2025-2026 Transmission Plan also included projects that are being evaluated to determine if the structures are adequate to accommodate advanced conductors without replacement:[10] SDG&E will need to provide its analysis of these two alternatives in the next planning cycle and seek approval from the ISO on the final scope of the project.

- TL623C Reconductor; and
- TL600B Reconductor

ISO-Approved GETs Projects to Date

Table 1**Error! Reference source not found.** provides a list of GETs projects approved in previous Transmission Plans.

Table 1: Flow Control, Advanced Conductor and Dynamic Reactive Support Approved Projects

Projects	Transmission Plan approved	In-Service Date (planned or achieved)
Flow Control		
Series Reactor on Warnerville-Wilson 230 kV	2012-2013	2018
Series compensation on Eldorado-Lugo-Mohave	2012-2013	2024
Imperial Valley phase shifters	2013-2014	2017
Wilson 115 kV SVC/Statcom	2015-2016	2021

[10] Replacement refers to assessing existing structures, like towers and other transmission equipment, to see if they could be compatible with planned advanced conductors. If they are not suitable for replacement, a large-scale upgrade, such as new towers, may be needed.

Projects	**Transmission Plan approved**	**In-Service Date (planned or achieved)**
San Jose-Trible 115 kV Series Reactors	2017-2018	2019
Vaca Dixon-Lakeville 230 kV Corridor Series Compensation	2017-2018	2026
Series Compensation on Los Esteros-Nortech 115 kV Line	2021-2022	2025
San Jose HVDC project - Metcalf-San Jose B	2021-2022	2028
Lone Tree – Cayetano – Newark Corridor Series Compensation	2022-2023	2027
Humboldt Phase Shifting Transformer (Part of New Humboldt 500 kV Substation with 500 kV line to Collinsville)	2023-2024	2034
Advanced Conductors		
Big Creek Rating Increase Project	2016-2017	2020
Moorpark-Pardee No. 4 230 kV Line[11]	2017-2018	2022
Laguna Bell – Mesa No. 1 Line Rating Increase Project[69]	2021-2022	2024
San Bernardino-Vista 230 kV 1 Line Upgrade[69]	2022-2023	2028
San Bernardino-Etiwanda 230 kV 1 Line Upgrade[69]	2022-2023	2031
Reconductor Lugo–Victor 230 kV No. 1, 2, 3 & 4 lines	2022-2023	2032
Metcalf-Piercy & Swift and Newark-Dixon Landing 115 kV Upgrade	2024-2025	2027
Julian Hinds-Mirage 230 kV Advanced Reconductor	2024-2025	2030
Dynamic Voltage Control		
Rio Oso SVC	2011-2012	2025

[11] Selection of advanced conductor was done by the PTO in their conductor optimization to meet the ISO requirements.

Projects	Transmission Plan approved	In-Service Date (planned or achieved)
SVC at Suncrest	2013-2014	2017
Synchronous condensers in LA/San Diego area (loss of SONGS)		
Round Mountain 500 kV Dynamic Voltage Support (Fern Road Substation)	2018-2019	2026
Gates 500 kV Dynamic Voltage Support (Orchard Substation)	2018-2019	2025

5 Potential Cost Savings and Build-out Deferral

Where it makes sense to utilize them, GETs offer a cost-effective and flexible means of increasing system capacity and improving reliability without requiring extensive new transmission infrastructure. The ISO's deployment of GETs can mitigate the need for traditional capital-intensive buildout in several ways:

- **Unlocking Latent Capacity in Existing Assets**

  Technologies such as advanced conductors and dynamic line ratings allow existing transmission lines to safely carry more power by reflecting real-time weather and loading conditions. This enables greater utilization of the current infrastructure without physical expansion, deferring the need for new lines or substations.

- **Reducing Construction and Permitting Costs**

  Installing GETs—such as flow control devices or series compensation—typically involves shorter deployment timelines and less permitting complexity than new transmission development. This is particularly valuable in dense urban areas or environmentally sensitive regions, where securing new rights-of-way would be costly or infeasible.

- **Targeted Reliability Upgrades**

Reactive support elements like Static VAR Compensators, Static Synchronous Compensators, and synchronous condensers help stabilize voltage and support local grid needs, eliminating the need for broader system upgrades. These solutions address location-specific issues more precisely than large-scale infrastructure additions.

- **Congestion Management and Renewable Integration**

  By improving power flow and relieving bottlenecks, GETs facilitate greater integration of renewable resources and reduce curtailment. This lowers reliance on costly fossil fuel peaker plants and improves system-wide efficiency, providing ratepayer value.

6 Conclusion

The ISO provides this update to the CPUC and relevant legislative policy committees, as set forth in AB 2779. In each transmission plan, the ISO considers a number of social, economic, and policy-related drivers in the resource planning, transmission planning, and infrastructure development process, including evaluating GETs, as required by FERC Orders No. 1990/1920-A and 2023, and encouraged in California legislation. In its most recently adopted Transmission Plan, the ISO evaluated reports submitted by PG&E, SCE, and SDG&E. The ISO ultimately approved three projects to utilize advanced conductors and GETs.

The ISO seeks opportunities to enhance flexibility and optimize the transmission system through GETs and will continue to evaluate and consider them in annual transmission plans.