



**WECC**

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White Paper

**Long-term Transmission Planning Task Force  
Recommendations**

February 13, 2025

### Executive Summary

The Long-term Transmission Planning Task Force (LTPTF) was established in July 2023 to address the need for 20-year transmission studies, the need for which was confirmed in May 2024 when FERC issued its Order No. 1920. This white paper outlines the LTPTF's approach to developing long-term datasets, modeling assumptions, and planning methodologies to support WECC stakeholders in meeting regulatory requirements and ensuring grid reliability.

WECC will produce a Year-20 production cost model (PCM) dataset and a Year-20 reference power flow case that extend beyond the current 10-year models, providing a standardized foundation for long-term planning. Transmission providers will use these datasets to identify major transmission projects, evaluate long-term system trends, and integrate resource and transmission planning processes.

A primary focus of the LTPTF is to ensure that long-term transmission planning accounts for evolving industry challenges, such as increasing electrification and the rapidly changing resource fleet. The framework outlined in this document provides guidance on load forecasting, generation assumptions, and transmission topology considerations, and ensuring a comprehensive and consistent approach to long-term planning.

To facilitate compliance with Order No. 1920, WECC will collect and validate data from member entities, ensuring that the Year-20 models reflect the best available information. The LTPTF recommends aligning the development of the Year-20 dataset with the existing four-year planning cycle to maintain consistency with regional and interregional planning processes.

This white paper serves as a foundational document for WECC's role in long-term transmission planning, supporting stakeholders in adapting to policy and other changes in their operating environment, while ensuring a reliable and resilient bulk power system.



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### Introduction

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The Long-term Transmission Planning Task Force (LTPTF) was established to address the increasing need for long-term transmission planning in response to regulatory changes, evolving industry structural changes, and grid reliability concerns.

This white paper outlines the LTPTF's framework and recommendations on how WECC can support Year-20 planning efforts, in ways that leverages WECC's support of 1 to 10-year modeling efforts. By developing standardized Year-20 production cost model (PCM) dataset and power flow case, this initiative seeks to provide transmission providers with a reliable foundation for identifying long-term infrastructure projects, analyzing system trends, and integrating resource planning. Additionally, the framework may enable others to perform scenario-based planning that accounts for expected technological advancements, increasing electrification, and state policies.

This document serves as a foundational guide for WECC stakeholders engaged in long-term planning efforts, offering structured methodologies and data requirements to support coordinated regional and interregional planning initiatives.

### Background

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In response to WECC leadership recognizing the need for Year-20 interconnection-wide modeling datasets, the LTPTF was established in July 2023.

Subsequently, FERC issued Order No. 1920, titled *Building for the Future Through Electric Regional Transmission Planning and Cost Allocation*, that mandates long-term regional transmission planning (LTRTP), emphasizing scenario-based analysis and benefit assessments. The primary goal of Year-20 analysis is to examine bulk power system challenges, assuming that local issues will be addressed within the 10-year horizon. National and regional long-term planning efforts:

- FERC Order No. 1920<sup>1</sup> – Establishes LTRTP requirements.
- PJM Interconnection<sup>2</sup> – Implements scenario-based LTRTP.
- NERC's Interregional Transfer Capability Study<sup>3</sup> – Assesses long-term system transfer needs.

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<sup>1</sup>FERC Order 1920, FERC, <https://www.ferc.gov/media/e1-rm21-17-000>, May 13, 2024

<sup>2</sup> PJM To Move Forward With Long-Term Planning Scenarios, PJM, <https://insidelines.pjm.com/pjm-to-move-forward-with-long-term-planning-scenarios/>, June 27, 2024

<sup>3</sup> ITCS Final Report, NERC, [https://www.nerc.com/pa/RAPA/Documents/ITCS\\_Final\\_Report.pdf](https://www.nerc.com/pa/RAPA/Documents/ITCS_Final_Report.pdf), November 2024



- CAISO 20-Year Transmission Outlook<sup>4,5</sup>— Incorporates long-term planning in its 15-year case<sup>6</sup>.
- Connected West<sup>7</sup> Initiative & WestTEC<sup>8</sup>— Evaluate interregional transfer and transmission challenges in the West.

### Use Cases for Western Interconnection Stakeholders

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WECC will develop a PCM dataset and power flow case for transmission planning entities to use as a starting point for transmission planning studies in the long-term planning horizon. Since most datasets generally extend up to 10 years into the future, datasets representing system topology and conditions further into the future will be needed. Several potential use cases for the long-term (20+ year) dataset have been identified. Some potential use cases are:

1. Transmission planning entities to propose new major transmission projects: Due to the time it takes to build large transmission projects, they need to be identified and proposed many years before the project is built. This dataset could be used to conduct studies to understand and assess potential system reliability needs beyond the existing 10-year dataset. With such information, project sponsors can identify projects earlier to allow adequate time for studies to support the projects through approval and implementation to the in-service date.
2. Transmission planning entities to develop longer views of system issues and trends that can affect the scopes for mitigations identified through conventional transmission planning processes: understanding how reliability needs and economic benefits evolve beyond the next 10 years may help system operators, utilities, and developers to propose tailored mitigations. Without a future map of needs and benefits, interim mitigations may be sub-optimal and result in re-work projects or missed opportunity.

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<sup>4</sup> 20-Year Transmission Outlook, California ISO <https://stakeholdercenter.caiso.com/initiatedocuments/draft20-yeartransmissionoutlook.pdf>, January 31, 2022.

<sup>5</sup> 2024 20-Year Transmission Outlook, California ISO <https://stakeholdercenter.caiso.com/InitiativeDocuments/2024-20-Year-Transmission-Outlook-Jul-31-2024.pdf>, July 31, 2024.

<sup>6</sup> 2024-2025 Transmission Planning Process Unified Planning Assumptions And Study Plan, California ISO <https://stakeholdercenter.caiso.com/InitiativeDocuments/Final-Study-Plan-2024-2025-Transmission-Planning-Process.pdf>, June 25, 2024

<sup>7</sup> Connected West Exploring “Next Generation” Transmission Investments to Support a Clean, Electrified, and Reliable Western Grid Final Report, Gridworks, <https://gridworks.org/wp-content/uploads/2024/09/Connected-West-Final-Report-240918.pdf>, September 2024

<sup>8</sup> WESTERN TRANSMISSION EXPANSION COALITION, <https://www.westernpowerpool.org/about/programs/western-transmission-expansion-coalition>,



3. Transmission planning entities to meet FERC Order No. 1920 requirements: FERC Order No. 1920 requires transmission providers under FERC jurisdiction to conduct a 20+ year Long-term Regional Planning process. While the order includes many requirements on scenario development that are specific to the transmission provider, such as stakeholder outreach and feedback, these scenarios would presumably be built from the Year-20 WECC models and datasets. The ability for WECC to gather data from its members and create base cases could provide significant value by building a 20-year power flow base case and Year-20 production cost model for transmission providers to start from and by establishing a consistent reference dataset from all WECC members with information relevant to the requirements of FERC Order No. 1920.
4. Transmission planning entities explore technology needs: With planned retirements of conventional generators, increased electrification, more inverter-based resources, and introduction of other new devices, it is expected that the technology of the future Western Interconnection will behave differently than that of the past. A future dataset may help understand what requirements are needed on these technologies (or what new technologies will likely be needed) to maintain overall grid reliability, such as the needs for frequency support or grid-forming inverters.
5. Resource planning entities and transmission planning entities can work together to iterate on the integrated resource plan (IRP) process. Plan the transmission system based on the resources, then look at how the transmission system will allow additional resources. Locate resources where expected transmission is available. Allow the results of the base model to inform future IRP development processes.

The type of analysis needed to identify long-term system deficiencies for use cases 1 through 3 is primarily steady state. The analysis is expected to look at all equipment in service and high impact outage scenarios, such as EHV lines and transformers. Potential of use cases beyond steady-state analysis are out of scope: the LTPTF decided not to consider dynamics because: (1) the uncertainty on dynamic models is too great for a Year-20 case; and (2) the incremental work to create such a dataset is significant. Therefore, a dataset with enough detail to perform steady-state analysis was determined to be adequate for the purposes of long-term transmission planning. However, this decision does not preclude entities from using the dataset to create dynamic models for their own studies.

## Timeline

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The timeline is in the Excel file on the LTPTF team site:

<https://collab.wecc.org/teams/LTPTF/Shared%20Documents/4%20year%20planning%20process.xlsx?d=wc4cc6cc0824442e0bcbfefcd4406d676>



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			Year 0	Year 1A, Even-Numbered Year, FERC 1000				Year 2A, Odd-Numbered Year, FERC 1000				Year 1B, FERC 1000 Year 3, FERC 1920				Year 2B, FERC 1000 Year 4, FERC 1920				
			Q3/Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
WECC	Data Submittal to WECC	Power Flow data	Year 1A 10-year PF Year 1 20-year PF							Year 1B 10-year submittal				Year 2B 10-year submittal					Next Cycle 10-year data submittal	
		Production Cost L&R data	Year 1A 10-year PCM Year 1 20-year PCM	Year 1A L&R data submittal (Due Mid February) includes year 20 forecasts																
	10-year Model	Power Flow	Year 1A 10-year PF available								Year 1B 10-year PF Available				Year 2B 10-year PF Available					10-year PF available
		Production Cost Model						Year 1A 10-year PCM Available	Year 2A Update to Year 1A 10-year PCM						Year 1B 10-year PCM available					Year 2B update to Year 1B 10-year PCM
	20-year Model	Power Flow		10-year Year 1A case available to start building 20-year																
		Production Cost Model													20-year PCM Available					
FERC	Order 1000			Regional Planning Data submittal window for 10-year data, Cycle A					Data Submittal Window for data updates to 10-year Cycle A					Final 10-year plan FERC 1000 for Cycle A	Regional Planning Data Submittal Window for 10-year data, Cycle B				Data Submittal Window for data updates to 10-year Cycle B	
	Order 1920			Regional Planning Data submittal window for 20-year data				Scenarios Developed 20-year power flow case modifications/analyses start							20-year production cost modeling starts				Draft 20-year Plan	Final FERC 1000 Plan for Cycle B

Two of the three Western Interconnection FERC Order No. 1,000 planning regions have committed to performing the FERC Order No. 1920 analysis on a four-year cycle. Given that year 1A will begin January 1, 2026, for the FERC Order No. 1000 process, the LTPTF recommends that the development FERC Order No. 1920 dataset process be given the same start date.

### Long-term Data

The availability of data for a long-term horizon (greater than 10 years) is one of the substantial challenges the LTPTF has identified for building Year-20 models. These include behind-the-meter resources, generation interconnection and transmission service status, resource retirements, and all other considerations specified in Order No. 1920. The LTPTF has discussed the appropriate data sources for several types of data that will allow the creation of a long-term model. The LTPTF recommends that, to build a Year-20 PCM dataset and Year-20 power flow case, the Year-10 Anchor Data Set (ADS) and Year-10 heavy summer planning case will be the best starting points. The following data sources would be used to build the Year-20 ADS PCM dataset and power flow case.

### Load Assumptions

The LTPTF has determined the best source of the load forecasts and assumptions is the load serving entities. Based on information provided to the LTPTF, most load serving entities create a Year-20 outlook for load, and that information is the best information available. The expectation would be to provide the Year-20 1-in-2 forecast for peak load and energy via the L&R submittal process for the PCM



dataset and submit an expected Year-20 heavy summer 1-in-2 load profile in the power flow case. Because this dataset must represent all systems in the Western Interconnection, since not all systems would peak at the same time, the 1-in-2 forecast for peak load would be the most appropriate for the starting case. As required in Order 1920, a full-year 8,760 hourly load profile will be needed to create production cost models. In addition, the LTPTF understands that some entities would forecast their loads with transmission losses included as an assumption, others would forecast their loads excluding transmission losses. The LTPTF recommends that documentation of the load forecast approach be provided with the load forecast, so the data can be correctly understood and used in the base case development. If an organization does not forecast out to 20 years, an approximation will be made based on the data they provide through the loads and resources.

The LTPTF also recommends that we request other load forecasts to be made available in addition to the 1-in-2 load forecast to be used in the base case. To support individual entities who would need to develop power flow cases to study their own and surrounding transmission systems, the LTPTF recommends that the data requests for both PCM and power flow include 1-in-5 and 1-in-10 as well. WECC is developing a Year-20 base case. The any additional scenario cases will be developed by others.

The data should include specific forecast assumptions on behind-the-meter categories, including installed distributed generation and/or energy storage, output at peak for distributed generation and/or energy storage, demand side management, energy efficiency, transportation electrification, and building electrification. Several Factor Categories in FERC Order No. 1920, in particular Factor Categories Two<sup>9</sup>, Three<sup>10</sup>, and Four<sup>11</sup>, specifically reference the impact of these categories on demand and on long-term transmission needs. Assumptions on new large loads, such as data centers, should

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<sup>9</sup> FERC 1920 440: “We clarify that this category of factors includes legally binding obligations, incentives, and/or restrictions that affect long-term transmission needs in different ways than Factor Category One, for example, by limiting the carbon intensity of electricity generation or electrifying energy end uses and thereby significantly increasing electricity use in certain sectors of the economy, such as transportation and building heating and cooling.”

<sup>10</sup> FERC 1920 447: “Further, incorporation of Factor Category Three into Long-Term Scenarios will ensure that transmission providers properly account for resource planning and anticipated changes to demand, including increased integration of distributed energy resources.”

<sup>11</sup> FERC 1920 458: “...we clarify that trends in fuel costs and in the cost, performance, and availability of generation, storage, and building and transportation electrification technologies may include, but are not limited to, cost and technology trends for: utility-scale generation construction costs for different generating technologies; distributed energy resources; storage technologies with differing duration limitations; carbon capture and sequestration; small modular nuclear; light-, medium-, and heavy-duty electric vehicles and electric vehicle supply equipment; and ground- and air-source heat pumps.”

also be included. Load data could be submitted in a table format with both the overall peak load forecast and the specific breakout by category.

1. Data submitters should provide their Year-20 load forecast to WECC as follows:
  - a. For power flow base case, a 1-in-2 peak load for all entities will be submitted as part of the WECC base case building process. Data submitters who do not submit a Year-20 forecast will incur the risk of not having their specific data represented by the Year-20 model building team. If the Year-20 load forecast is not readily available, the data submitter should determine a scaling factor and apply it to the Year-10 forecast. If available, the data submitter should also submit forecasts of 1-in-5 and 1-in-10 peak load forecast. This will be needed to support individual entities that need to study peak load conditions in their system and surrounding systems.
  - b. For production cost provide, if available, hourly load profiles for the expected Year-20 future. If no hourly load profile is provided, WECC will use the Year-10 load profiles based on the peak provided above.
  - c. All data submittals will include documentation with descriptions of the following:
    - i. Whether the load forecasts include assumed transmission losses. If so, the magnitude of the transmission losses included. This information is needed to ensure accuracy in the load modeled in the base case.
    - ii. Disaggregated behind-the-meter assumed amount (as load modifiers) of installed distributed generation and energy storage, output of distributed generation based on the hour being used in the power flow data, energy storage, demand side management, energy efficiency, transportation electrification, and building electrification, contact person
    - iii. Any load assumptions that are not included in the 10-year case. This information will help entities needing to develop scenario cases for their own compliance submission and studies.

### Generation Assumptions

LTPTF recommends that WECC adopt the following philosophy with regard to resource placement: Data submitters are expected to submit complete and detailed data submissions and acknowledge that they have the authority and responsibility of providing the location of generating resources. Data submitters will supply balanced load and resource portfolios for a Year-20 future. Resource placement will happen solely at the discretion of the data submitter providing the Year-20 forecasts. Data Submitter will use the NERC Codes for generation additions. Data Submitter will place all resources on buses specific to the seed base case being utilized for the Year-20 case build. Data submitter shall include all necessary considerations in alignment with their resource planning, per Order No. 1920. These considerations include behind the meter resources, generation interconnection and transmission



service status, resource retirements, or other considerations specified in the Order. Any resource placement should be guided by the Data Preparation Manual. The data submitter will be responsible for correcting any mapping issues with submitted data.

### Transmission Topology Assumptions

Transmission assumptions for the produced datasets will need to align with the modeling requirements detailed in FERC Order No. 1920, and as such, the data submitters must use “best available data inputs” that are developed from best practices to produce reasonably probable and plausible scenarios. It should be noted that the process data submitters will be using to produce “best available data inputs” must incorporate the input on stakeholders and prior 1920 studies.

To aid in developing datasets with “best available data inputs” topology the LTPTF recommends the following:

Prior Power Flow Case and Production Cost Model Dataset Building:

- Work with data submitters and with either WECC or regional entities to develop a standard of project inclusion. This will provide clarity to transmission developers on the requirements for projects to be included in the datasets.
  - Potential Criteria Elements:
    - Project description, kV, length, type of conductor, route, points of interconnection with the transmission system, etc., project data in the format suitable for inclusion in WECC base case models.
      - DOE Project list.
      - Path Rating Process Progress.
    - Path Rating Catalog.
    - WestTEC study inclusion.
      - Identified or considered in any Regional Transmission Plan.
      - Identified in a Local Transmission Plan.
        - If available, Project study reports with information similar to WECC Comprehensive Progress Report.
    - Provide a submittal window for transmission developers to submit topology projects for consideration. LTPTF is recommending that the review and inclusion of projects not provided by Data Maintainers in the standard SRS base case building process is done outside the SRS base case build of the Year-20 base case, but with the help of SRS. Transmission providers in the impacted area of submitted projects should be part of the review and inclusion process.
  - Projects should be limited to higher voltage levels (~200 kV+).
  - Time should be provided for evaluation of the projects and opportunity for submitters to correct any inclusion criteria data deficiencies.

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- WECC will document the submitted projects and their status with the elements of the inclusion criteria.

As Part of the Year-20 Dataset Building:

- Utilize the most recent Year-10 WECC produced planning case(s) as a starting point for the Year-20 datasets builds.
  - Request from the data submitters a list of all high voltage (~200 kV+) topology projects that were included in the Year-10 case and would inherently be contained within the commensurate Year-20 dataset.
- Request from the transmission providers, as part of their data submittals for the Year-20 datasets, a list of all high voltage (~200 kV+) topology projects that were included in the Year-20 dataset builds and the status of the projects.

Data submitters will document the submitted projects and their status with the elements of the inclusion criteria.

### Data Submission

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The LTPTF determined that the current WECC data collection practices are adequate, provided the timelines are extended to include a Year-20 future.

### Tools and Software

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No new tools or software are needed to develop Year-20 cases. The techniques build on the Year-10 cases.

### LTPTF Task Force Members

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Name	Organization	Role
Auld-Hill, Allison	Southern California Edison Company	Co-Chair
Augustin, Philip	Salt River Project	Member
Cardoza, Lorissa	Bonneville Power Administration—Transmission	Member
Davies, Enoch	WECC	Staff Liaison
Dorland, Kanya	California Public Utilities Commission	Member
Dobson-Mack, Gordon	Powerex, Inc.	Member
Galaway, Jennifer	Portland General Electric Company	Co-Chair



## Long-term Transmission Planning Task Force

Garcia, Miguel	Sacramento Municipal Utility District	Member
Gopi, Biju	California Independent System Operator	Member
Gross, John	Avista Corporation	Member
Harris, Gerald	Quantum Planning Group	Member
Loomis, Chelsea	Western Power Pool	Member
Marrs, Richard	Quantum Planning Group	Member
Olson, Erik	PUGET SOUND ENERGY	Member
Richardson, Jacob	Western Resource Advocates	Member
Thomas, Chifong	Thomas Grid Advisor	Member
Tilghman, Henry	Tilghman and Associates	Member
Van Uytven, Guy	Guy Van Uytven	Member
Young, Jonathan	Bonneville Power Administration – Transmission	Member
Mackin, Peter	Qualus	Active Participant

## Long-term Transmission Planning Task Force

Approving Committee, Entity, or Person	Approval Date
Long-term Transmission Planning Task Force	February 13, 2025
Reliability Assessment Committee	February 2025

*WECC receives data used in its analyses from a wide variety of sources. WECC strives to source its data from reliable entities and undertakes reasonable efforts to validate the accuracy of the data used. WECC believes the data contained herein and used in its analyses is accurate and reliable. However, WECC disclaims any and all representations, guarantees, warranties, and liability for the information contained herein and any use thereof. Persons who use and rely on the information contained herein do so at their own risk.*



## Appendix A: Year-20 Data Submission Checklist

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- **Required Load Data:**
  - 1-in-2 peak load and energy forecast.
  - Transmission loss assumptions.
  - Behind-the-meter generation/storage assumptions.
  - Load modifiers (e.g., energy efficiency, electrification trends).
- **Optional Load Data:**
  - 8760 hourly load profiles.
  - 1-in-5 and 1-in-10 peak load forecasts.
  - Large industrial load growth projections (e.g., data centers).
- **Required Generation Data:**
  - Balanced Year-20 resource portfolios.
  - Resource retirements.
  - New interconnections and transmission service requests.
  - Behind-the-meter generation details.
- **Required Transmission Data:**
  - Transmission topology assumptions and modifications for High-voltage (200 kV+) transmission projects.
  - Project status—what processes has the project completed to date?
  - Word description of the topology changes (major transmission projects) between the Year-10 case and the Year-20 case.

## Appendix B: Year-20 Data Submission Guidelines

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The following should be considered when preparing the Year-20 data submission:

1. Coordinate with your ownership partner(s) regarding all shared ownership of Year-20 resources additions and/or retirements or transmission projects.
2. Conform to all federal, federally recognized Tribal, state, and local laws and regulations affecting the resource mix and demand.
3. Conform to all federal, federally recognized Tribal, state, and local laws and regulations on decarbonization and electrification.
4. Include approved integrated resource plans and expected supply obligations.
5. Include trends in fuel costs and in the cost, performance, and availability of generation, electric storage resources, and building and transportation electrification technologies.
6. Consider whether resource retirements are consistent with internal expectations for a Year-20 resource fleet.
7. Consider generation interconnection requests and withdrawals.
8. Conform the utility or corporate commitments to federal, federally recognized Tribal, state, and local policy goals that affect long-term transmission needs.
9. Reflect any resources that have signed LGIA and transmission service agreements.

