Original Energy-Related Research: Energy Reports to Review

Reports ready for review, expected ~ January 2026

I. Climate Analytics to Support Natural Gas Sector Utilities: Actionable, Responsive and Open Solutions for historical Climate Needs in California (PIR-19-006)

The project develops a data assimilation platform to serve as a publicly available central resource providing historical weather observations for the Western Electricity Coordinating Council (WECC) region, integrating data from over two dozen weather observation networks. The research project includes development and application of quality assessment and quality control protocols designed to ensure high quality data, including accurate representation of extreme events. The platform is expected to integrate near real-time integration of weather data as well and will be available through Cal-Adapt. In so doing, this project helps resolve an abiding gap in the availability of high-quality historical weather observation data.

While special emphasis has been placed on the needs of gas system stakeholders, this resource is expected to be invaluable to other energy and non-energy sector stakeholders, both public and private. For example, the high-granularity, high-quality data offered by the platform provides an improved basis for downscaling of climate projection data and for estimating renewable electricity generation potential. For further information, see the Recipient's web page: Historical Observations Data Platform.

II. Climate-Informed Load Forecasting & Electric Grid Modeling to Support a Climate Resilient Transition to Zero-Carbon Goals (EPC-21-041)

The project will provide a foundation to assess and improve the climate resilience of California's electricity system in transition through the creation of novel climate-informed load forecast datasets and electric grid modeling tools that support energy system planning. The load forecasts will consider both climate and decarbonization impacts on projected demand from now to mid-century based on different policy conditions, while updates to energy system models will include

incorporation of climate-informed zero-carbon generation datasets, increased spatial extent to better capture regional climate impacts, and uncertainty and risk functionality to address climate variability and uncertainty.

III. Climate-Informed Generation Capacity Modeling to Support a Climate Resilient Transition to a Clean Electricity System (EPC-21-037)

California's energy decarbonization goals are at once necessitated and challenged by the changing climate, which will affect the spatiotemporal availability of zero-carbon energy sources and introduce unprecedented grid stress by intensifying extreme climate and weather events. To support the build-out of a reliable, cost-effective, and safe electricity grid, insights into the responses of zero-carbon generation capacity to a more variable and extreme future climate is needed. This research will develop actionable and usable data products to enable climate-informed development of a zero-carbon electricity grid and support California's ambitious climate statutory goals.

High resolution historical climate projections will be used to generate hourly resource availability profiles for solar and wind and weekly profiles for hydroelectric resources across California and the WECC and will perform novel analyses of weather and climate impacts on zero-carbon generation capacity including stresses from compound and cascading extreme events. This work will provide valuable insight into the temporal and spatial variability of generation capacity and the implications for a reliable decarbonized grid in California. Rapid transfer of results to stakeholders and tight coordination with other EPIC-funded research teams are facilitated by leveraging the Cal-Adapt: Analytics Engine. Related Jupyter Notebooks will be available for users to access, analyze, and visualize the renewable profiles data. Each step of the project is being informed through extensive engagement with external parties including research partners, regulators and policymakers and Investor-Owned Utilities.

IV. Advancing California's Electricity Resource Planning Tools to Assess and Improve Climate Resilience (EPC-22-001)

Due to the complexity and constraints of resource planning processes, electricity resource planning models have been challenged to keep pace with California's rapid policy and technology advancements towards deep renewables penetration, scalable storage, and more distribution- and customer-sited resources. The models

also face challenges in keeping pace with the realities of extreme grid stressors due to climate change and how that impacts electricity supply and ratepayers. As a consequence, the state's planning models need further adaptation to evaluate climate resilience and to reasonably reflect the operability and affordability of the electricity grid to customers.

This project addresses those challenges by developing new inputs, assumptions, and tools to capture the impacts of climate change on electricity supply and demand of the electricity system in transition. This includes re-parameterization of tools currently used in California's electricity system planning to better reflect historic and projected climate data, as well as creating a novel probabilistic loss-of-load resilience evaluation model. This latter model assesses different types of climate-linked resilience events at geographically granular level and will be publicly available for stakeholder users. In addition, the project is evaluating the resilience of state resource planning output portfolios. The results will help advance the state's electricity resource planning model framework to reflect the impact of climate projections and environmental extremes on electricity supply, demand, and the resulting resilience of electricity service to ratepayers.

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