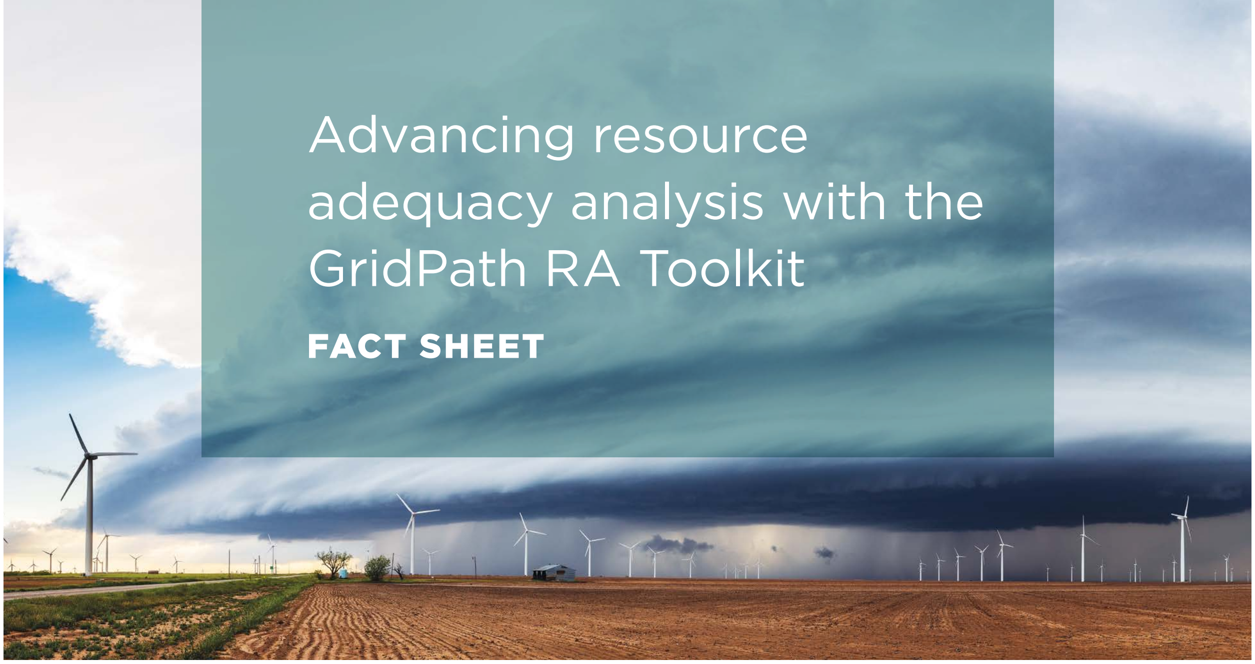

Advancing resource adequacy analysis with the GridPath RA Toolkit

FACT SHEET

WHAT WAS THE MOTIVATION FOR CREATING THE GRIDPATH RA TOOLKIT?

Robust resource adequacy (RA) analysis will be increasingly critical as the power sector undergoes the clean energy transition. However, current analytical methods may be insufficient for analyzing RA of power systems that rely heavily on renewable energy and energy storage, and have limited transparency and application across jurisdictions. This work focuses on improving the characterization of three components that are critical to understanding RA: (1) weather-driven relationships between load and resource availability; (2) capabilities and constraints of energy limited resources; and (3) transmission flows and regional coordination across large geographic areas. The work also advances transparency of RA analysis by leveraging publicly available data and an open-source power system model (GridPath).

GridLAB

MOMENT ENERGY INSIGHTS

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WHAT IS THE GRIDPATH RA TOOLKIT?

The GridPath RA Toolkit refers to both the datasets and the algorithms that were developed as part of this initiative, applied towards a 2026 Western US case study. The datasets include, for example, hourly profiles of renewable generators for multiple weather years, thermal generator derate information, and load profiles. The algorithms to support RA analysis were developed within an existing open-source modeling tool called GridPath. GridPath is a versatile power system planning platform that supports production-cost and capacity-expansion modeling, and with the additions in this initiative, resource adequacy modeling. The Toolkit can be accessed via GridLab's website.

HOW DOES THE GRIDPATH RA TOOLKIT ADDRESS EMERGING POWER SYSTEM CHALLENGES AND OPPORTUNITIES?

Weather correlations. The Toolkit offers two alternative modes to capture key weather correlations between load and resource availability over very large geographical areas: **Monte Carlo** Simulation and **Weather-Synchronized** Simulation. The Monte Carlo mode samples historical weather conditions and generates plausible combinations of load,

This fact sheet is adapted from the report *Advancing resource adequacy analysis with the GridPath RA Toolkit: A case study of the Western US.*

renewable availability, and thermal derate conditions. The Weather-Synchronized mode directly tests all weather conditions for which coherent high resolution data are available.

Energy-limited resources. The Toolkit dynamically dispatches energy-limited resources, like hydropower, energy storage, and hybrid resources to avoid lost load.

Transmission and regional coordination. The Toolkit allows for both region-wide simulations subject to transmission constraints and simulations of individual entities over the same sets of conditions. This provides additional transparency into weather-coherent and transmission-constrained market availability for individual planning entities.

WHAT WAS INVESTIGATED IN THE WESTERN US CASE STUDY?

The report describes a near-term (2026) analysis of the western United States, which included all balancing authority areas (BAAs) in the United States that are part of the Western Interconnection. Transmission was represented by zonal constraints on flows between BAAs. The analysis reflected a physical model of the Western power grid and did not account for contractual agreements, resource ownership, or institutional barriers to coordination. Detailed assessments of resource availability and load assumptions were developed, using publicly available data sources, for each BAA for 2026. Three scenarios, each reflecting a different portfolio of resources in 2026, were tested in Monte Carlo mode: the **No Additions Scenario**, which incorporated planned retirement and no planned resource additions; the **California Additions Scenario**, which layered resources based on the California Public Utility Commission's Preferred System Plan; and the **Less Coal Scenario**, which was based on the California Additions Scenario but also retired about 11 GW of additional coal across the West. The report also includes subregional analysis for areas approximating the CAISO and Western Resource Resource Adequacy Program (WRAP) footprints to demonstrate how the Toolkit can be used to account for regionally-informed weather-coherent and transmission-constrained imports for individual RA programs.

WHAT WERE THE KEY FINDINGS FROM THE WESTERN US CASE STUDY?

Near term RA challenges: The No Additions Scenario indicated that without any incremental resource additions, the Western United States power system could face a resource adequacy shortage in 2026. However, the California Additions Scenario suggested that current California procurement plans include sufficient new capacity to eliminate this shortfall.

Additional coal retirements: The Less Coal scenario suggested that **additional coal retirements do not seem to pose an insurmountable RA challenge in the near term, if utilities execute on current plans to deploy clean energy resources.** Deployment of additional batteries and renewable resources in California mitigated much of the needs associated with retiring a large portion of the Western US coal fleet, even before considering capacity additions from utility plans in the rest of the West. The remaining RA events were generally short in duration, with battery storage and flexible load well-suited to address them.

Subregional analysis: When analyzing a particular system or RA program, failure to account for regional dynamics can distort the nature of the identified resource adequacy challenge and potentially result in plans that do not align with true RA needs. As an example, when the WRAP footprint was tested without any coal resources in the Less Coal Scenario and treated as an islanded system, shortages lasting several hours were observed in almost all months, suggesting that long duration solutions would be needed to replace retiring coal plants. However, allowing for weather-coherent and transmission-constrained imports based on the West-wide simulation eliminated most of the shortages and resulted in relatively modest and short-duration RA needs. Even without full West-wide planning coordination, **utilities and RA programs will benefit from adopting market access policies that are informed by West-wide analysis in order to properly account for interregional dynamics.**

WHAT OTHER INSIGHTS DOES THE STUDY OFFER?

Key RA drivers: **In the near-term, high temperature conditions continue to be the biggest driver of RA risk in the West.** The recent historical record reflects weather trends that could have implications for future RA risk. Examining a longer historical period may underestimate heat-driven risk and detrending the historical weather record may distort physical weather distributions. Without information about future weather from climate-driven simulations, the decision to rely on a set of historical weather data or to detrend the historical weather record in RA analysis is effectively a policy decision.

Monte Carlo vs. Weather-Synchronized simulation: Weather-Synchronized simulation offers greater transparency and improved treatment of weather correlations, but is limited by data availability. The report explores the benefits and drawbacks of

both methods using a deep dive on the No Additions Scenario.

Data needs: Regardless of the RA analysis approach, the availability of more high-resolution hourly power system data as well as information about likely future weather conditions would greatly improve our understanding of RA challenges. In particular, **the expansion of publicly available hourly wind power datasets to more recent years is a high priority**.

HOW CAN STAKEHOLDERS USE THE GRIDPATH RA TOOLKIT?

A core purpose of this initiative was to develop an advanced, publicly available, and transparent toolkit for resource adequacy analysis. **The GridPath RA Toolkit can be leveraged by regulators, utilities, researchers, and other stakeholders to conduct independent and publicly accessible RA analysis.**

The GridPath RA Toolkit offers a ready-to-use platform for analyzing resource adequacy in 2026 for the three scenarios described in this report, but the algorithms and datasets can be readily adapted to explore different systems, assumptions, and study years. The Toolkit can be customized to analyze decisions made by specific load serving entities or resource adequacy programs by layering ownership and contractual information onto the physical dataset used in the Toolkit. And researchers and analysts may leverage the Toolkit to answer questions that were not explored in this study, for example, future climate sensitivities and increased electrification scenarios.

More information can be found at gridlab.org/GridPathRAToolkit.