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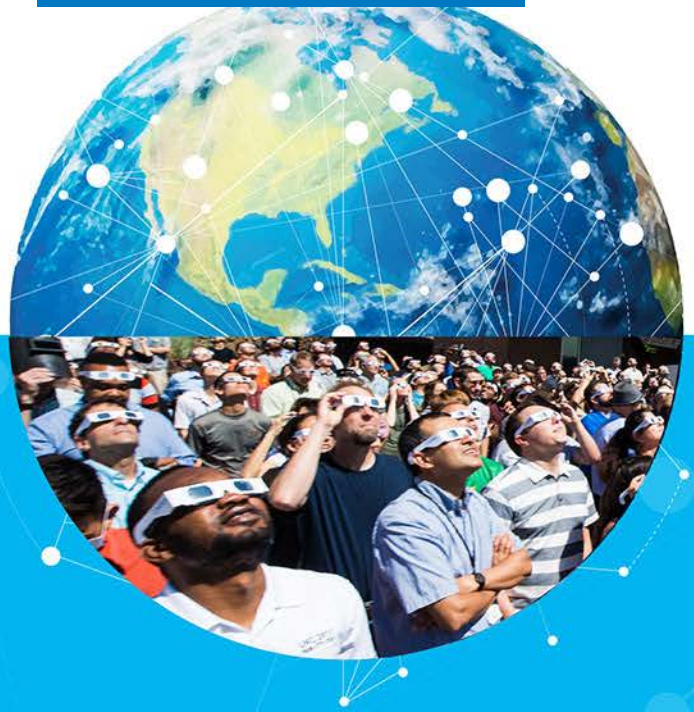

Beginner's Guide to Understanding Power System Model Results for Long-Term Resource Plans

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February 7, 2024
NASEO Energy Policy Outlook Conference

Photo by Dennis Schroeder, NREL 46840

Context

- Utilities typically rely on power system planning models to identify a portfolio of assets that meet all system and customer requirements
- Inadequate modeling can lead to a proposed portfolio with reduced system reliability, higher costs, or poor sustainability, relative to other portfolio options
- With a better understanding of the modeling process, you can identify potential shortcomings, understand the risks of a given portfolio, and gain more confidence in decisions backed by model results

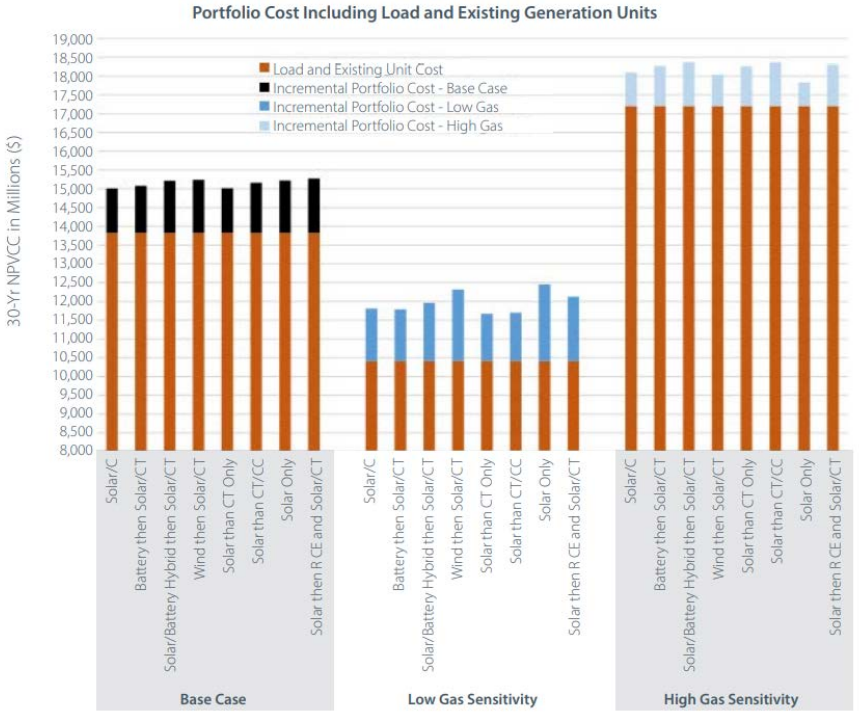
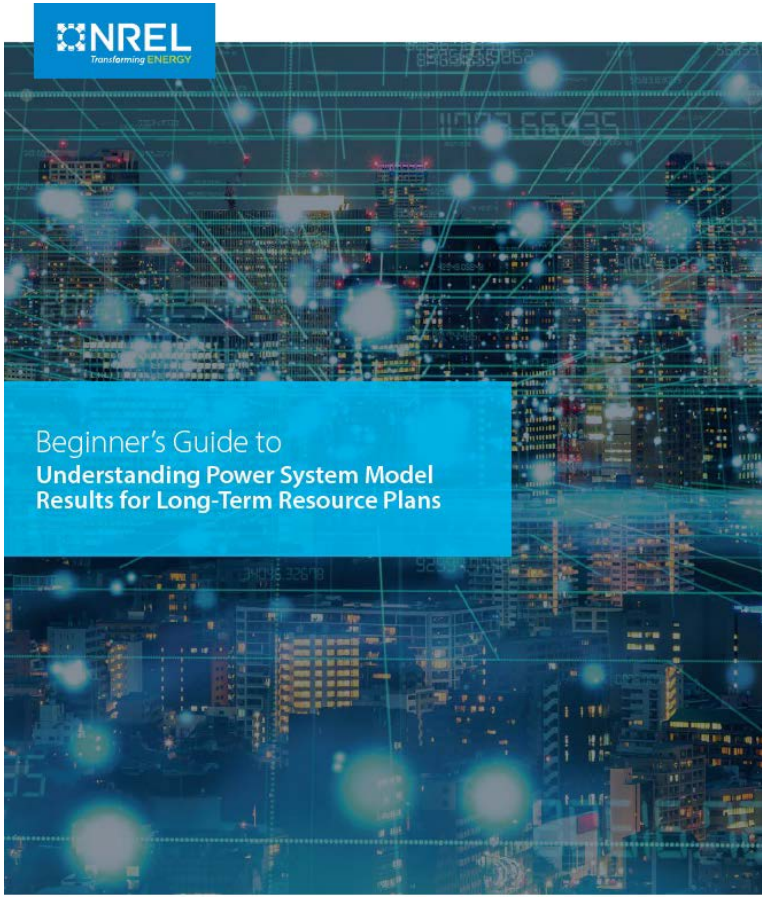


Figure 14. Net present value of customer cost (NPVCC) of potential portfolios from the Oklahoma Gas & Electric 2021 Integrated Resource Plan. CT = combustion turbine, CC = combined cycle, RICE = reciprocating internal combustion engine.

Source: Oklahoma Gas & Electric (2021)

A New Resource

- **Goal:** Improve decision-making in the electricity planning process by strengthening dialogue between system planners and relevant stakeholders
- **Approach:**
  - Provide an overview of electricity models (and associated terminology)
  - Propose questions to ask utilities, grounded in recently published grid planning studies
  - *Keep it short!*



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https://www.nrel.gov/docs/fy24osti/87105.pdf

Content

Modeling in Electricity Planning

Overview of Electricity Models

Assumptions and Data

Key Model Outputs

Methods

Assumptions and Data

- Load growth
- Technology cost and performance
- Fuel prices
- Policies
- Existing resources
- Transmission cost and availability
- Distributed energy resources and demand-side management
- Financing
- Electricity supply technologies
- Uncertainties

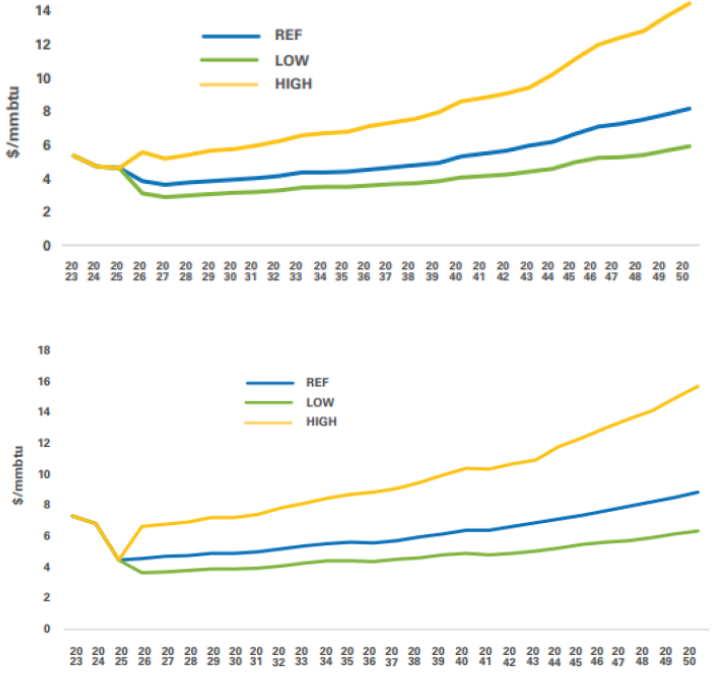
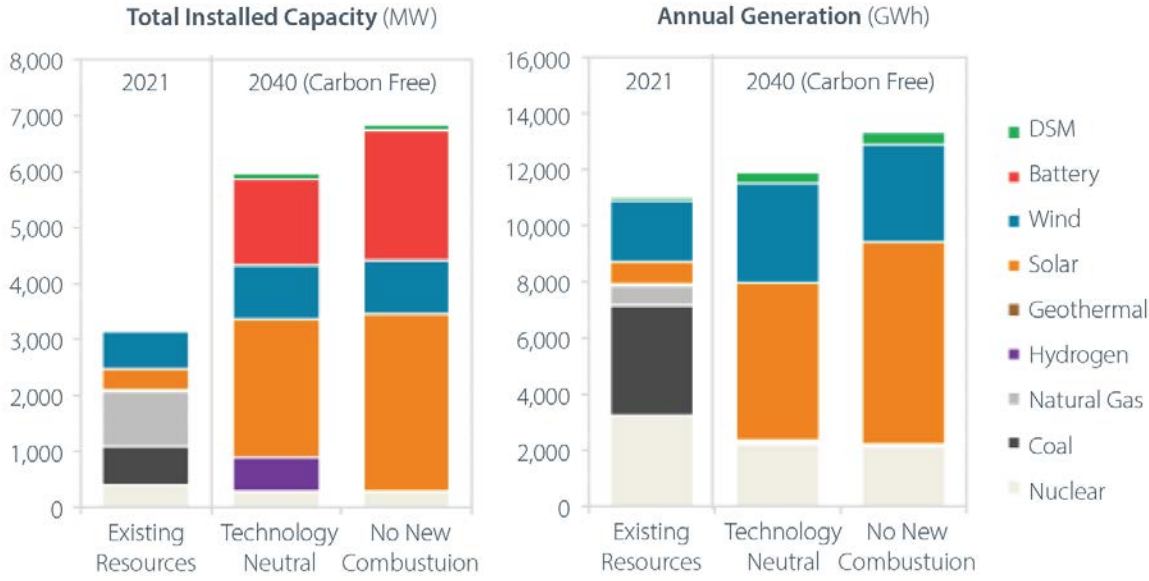


Figure 5. Fuel prices from the Dominion Energy South Carolina 2023 Integrated Resource Plan (the upper figure is natural gas, and the lower figure is coal). The prices include low, reference, and high assumptions to capture a range of potential prices.

Source: Dominion Energy (2023)

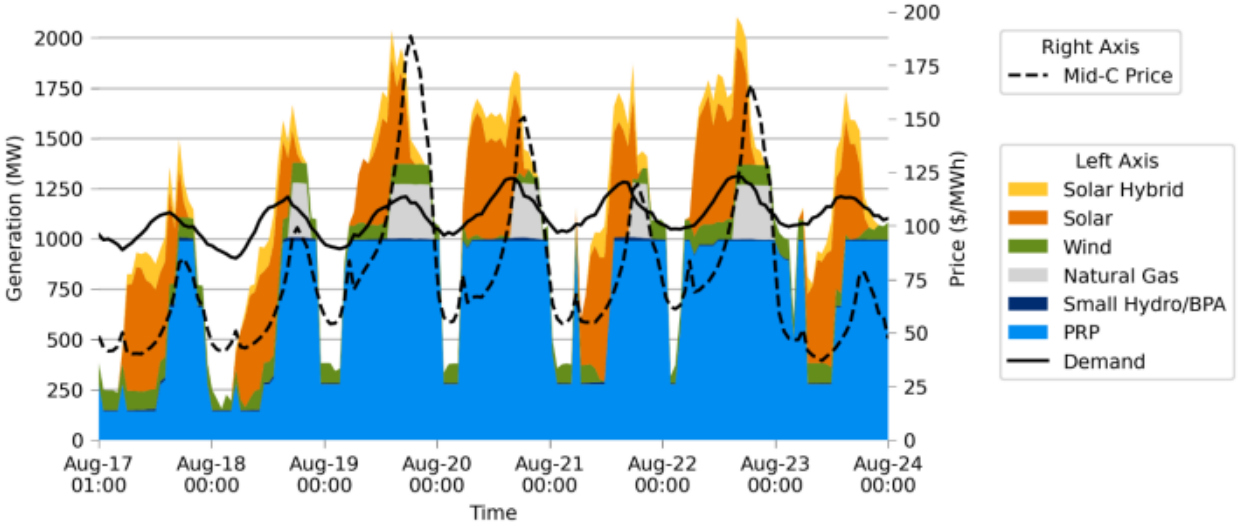
Key Model Outputs

- What resources are being proposed to be built and/or retired?
- How are total costs impacted by the selected portfolio?
- How does the system operate during high-risk periods?
- Do existing generators experience any significant changes in operation?
- Is the proposed portfolio consistent with policies that are specific to the electric sector?
- Are caveats and limitations of the work discussed?



Proposed portfolios for a 2040 system from the PNM 2020–2040 Integrated Resource Plan. DSM = demand-side management.
Source: PNM (2021)

Methods

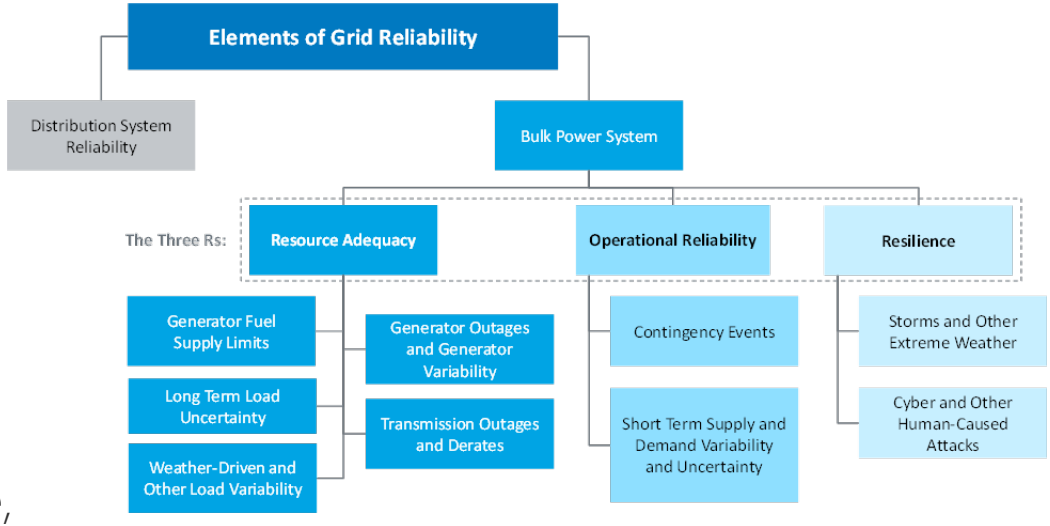


Simulated hourly dispatch for the week with the highest summer peak net demand using a 2030 portfolio, from the Grant (Washington) Public Utility District 2022 Integrated Resource Plan. Mid-C = mid-Columbia, BPA = Bonneville Power Administration, PRP = Priest Rapids Project (a hydropower project).
Source: EES Consulting (2022)

- How are resources selected within the model?
- How does the model determine the availability of weather-dependent and storage resources during system stress periods?
- How does the model know whether the mix of resources selected will be sufficient to meet load during all hours?

Advanced Guide Coming Next!

- A follow-on guide is being developed, which dives deeper into topics that are becoming more prominent in the electricity planning process but have methods and approaches that are still in development
- Detailed treatment of electricity demand evolution, demand-side resources, and resource adequacy (including metrics, valuation, data, and methods)
- Introduction to emerging topics such as clean energy scenarios, justice, resilience, integrated T&D planning, transparency in modeling and assumptions



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