Northwest **Power** and **Conservation** Council

February 3, 2026

MEMORANDUM

TO: **Council Members**

FROM: **Jennifer Light, Director of Power Planning**

SUBJECT: **Primer on Scenario Modeling Results**

BACKGROUND:

Presenters: Jennifer Light, John Ollis, Tomás Morrissey, and Jake Kennedy

Summary: Staff is anticipating that the final set of results from the scenario modeling will be available for presentation to the Council in March. In advance of that discussion, staff wanted to provide more context to the members around the OptGen/SDDP model that will be used in this final step of analysis.

OptGen/SDDP is a new tool in the Council's modeling suite that will support understanding of in-region resource optimization. At the February meeting, staff will provide an overview of this model. While this tool brings several enhancements to our modeling, it also requires some refinement to the methodology. Staff will walk you through the basic mechanics of the model and some key methodological assumptions.

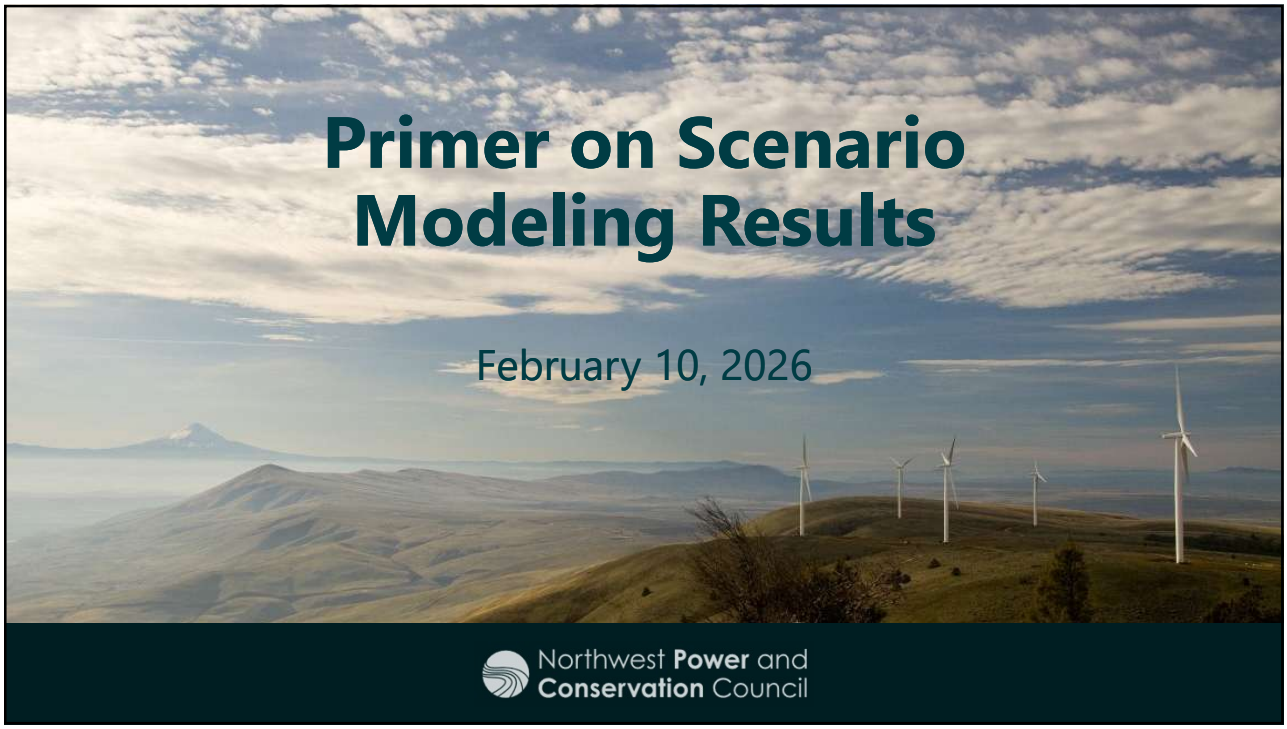
Additionally, staff will give some context of the type of data available from the modeling, and how the Council may use that data to inform recommendations in the draft Power Plan. The purpose of this discussion is to gain some common understanding of the modeling capabilities and outputs, and to solicit feedback from members on potential areas of interest to guide staff's upcoming analysis.

Relevance: Under the Northwest Power Act, the Council is required to include in the power plan "a scheme for implementing conservation measures and developing new resources", which will guide resource decisions of the Bonneville Power Administration and provide insight into resource decisions of others. The Council's OptGen/SDDP model is one of the final stages of scenario modeling that will provide data and analysis to inform this ultimately resource strategy development.

Workplan: B.3.3. Conduct scenario analysis to inform regional resource and reserve needs.

More info: The following material will provide useful background on the selection of the tool, a primer on the use of the tool, and SAAC discussions of the methodology updates to be discussed:

- Initial recommendation to the Council on new capital expansion model, September 2023 (presentation, video)
  Follow-up presentation to Council recommending OptGen as new regional capital expansion model, October 2023 (presentation, video)
- Primer on regional strategy analysis toolset, April 2025 (presentation, video)
- System Analysis Advisory Committee meeting on January 29, 2025



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Presentation Overview

- **What is this model even doing?**
  High level description of the OptGen/SDDP model used for the regional resource optimization
- **How are we running modeling?**
  Discussion of some key approaches used in modeling to balance the scope of analysis with resource requirements (staff time and cloud computing costs)
- **What will we learn from the model?**
  Preview of the type of information that staff can analyze and present and the how that information can inform the Council's consideration of new resource recommendations for the region

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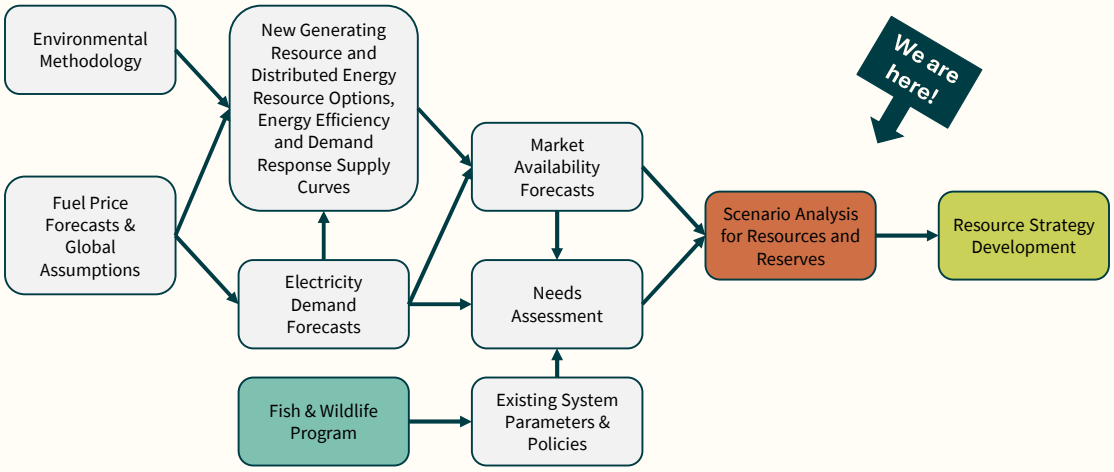
Power Plan Process Flow



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Reminder on Scenario Modeling

Aurora	GENESYS	OptGen/SDDP	GENESYS
Market Availability Study	Regional Needs Assessment	Regional Resource Optimization	Strategy Adequacy Check
Conduct a study for each sensitivity where **new resource** and transmission options change.	Conduct a study for each sensitivity where **existing system** operations change.	Conduct a study for **every** sensitivity.	Conduct a study for **every sensitivity & final recommended strategy**.

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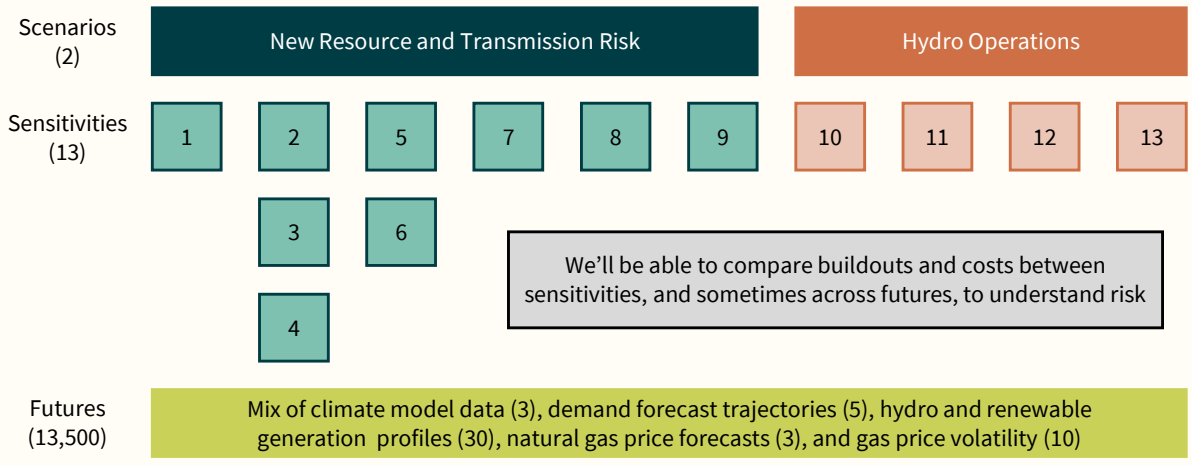
Capturing Uncertainty through the Scenario Modeling



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What is the model even doing?

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Regional Optimization Model: OptGen/SDDP

- SDDP is a production cost software from PSR
  - SDDP minimizes WECC-wide power supply costs while meeting demand within system operating constraints including reserves, emissions pricing, and hydro system operation requirements
  - The reserve module within SDDP can address specified reserves by percentage of demand and by forecasted availability of variable energy resources
- OptGen is a capital expansion module from PSR that uses a simplified version of SDDP to provide production costs of existing and new resources
  - OptGen co-optimizes the investment and operation decision making simultaneously, one year at a time, seeking to minimize costs
  - Additionally, OptGen can address other constraints, including policy or adequacy needs
  - OptGen can solve for an investment strategy that minimizes costs over a range of futures

Data Considered in Optimization

Data are translated into MW and costs, guiding decision making

Resource costs (capital and ongoing)

Resource availability (online dates, min/max generation requirements, resource profiles)

Adequacy requirements (energy and capacity reserve margins)

Reserves (dynamic probabilistic reserves, planning, contingency, etc.)

Hydro system constraints (spill, storage, outflows, irrigation, etc.)

Policy requirements (emissions costs & energy targets)

As the model steps through years and futures, it is seeking to meet the needs (MWs) at the least cost, across the range of futures tested

Regional Buildout

Big Drivers for Resource Builds

Economics

Model is seeking least cost buildout across the range of uncertainty

Adequacy

Model is ensuring loads are met and sufficient reserves are held

Policy

Model is ensuring policies are met, including hydro operations requirements

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How are we running the model?

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So Much Data, So Little Time

- We have 13 sensitivities (across our 2 scenarios) to model
- For each sensitivity, we have 20 years we want to study (2027 to 2046)
- For each sensitivity, we also want to account for all 13,500 futures we have created to cover a range of climate years, load trajectories, hydro and renewable generation, and gas prices and volatility
- And, we want to get information for 17 zones!
- To meet our timelines, we have made some strategic simplifications around how we model the 20-year horizon and the range of futures

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Model Years

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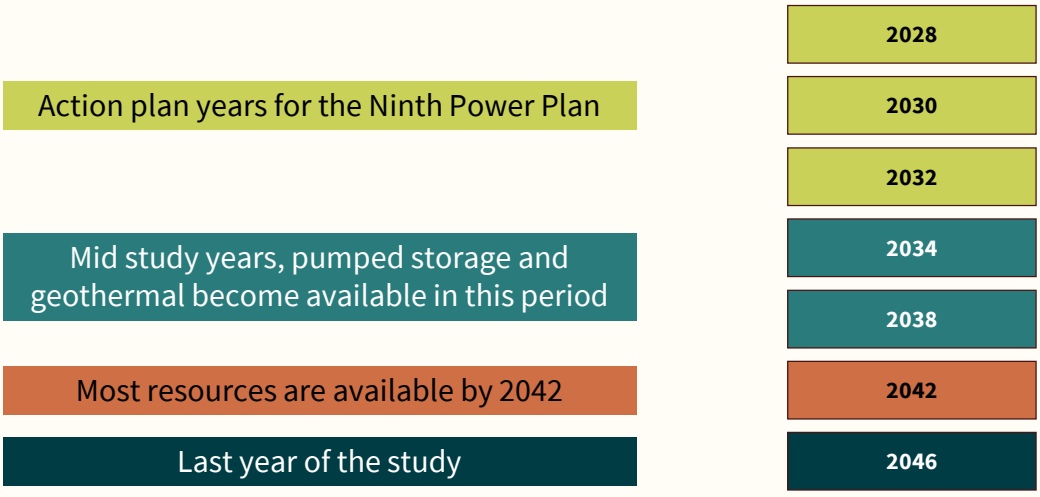
Selecting the Years to Model

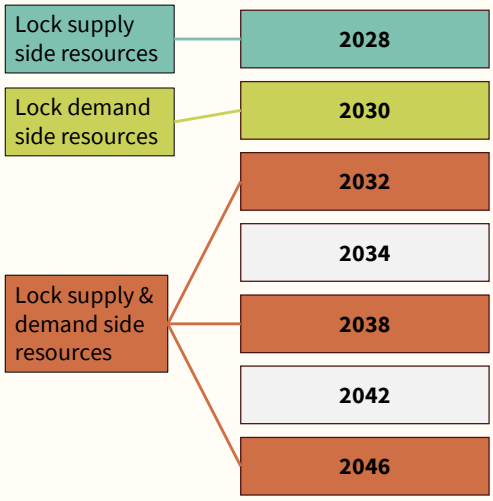
- Staff needed an approach to develop "snapshot" years to capture information on development decisions over time, while balancing computing requirements
- We wanted an approach that could appropriately account for:
  - Investment decisions made early in the study to meet adequacy and informed by resources available at the time of those decisions
  - Important dates in existing policies, which might driver different decisions over the years
- Snapshot years allow the model to consider different resources options over time, being informed by decisions made earlier in the study

Years Selected for Modeling



Capturing Resource Decision Across the Years

- Resource decisions in certain years will be "locked in" to guide decisions in later years
  - This helps ensure adequacy in the buildout
  - For example, resource acquired in 2032 will still be available in 2046, so we want to provide that information to the model
- We are not locking in every year to allow the model some foresight



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Futures

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Representing Futures through Clustering

- Staff needed an approach to represent the range of potential uncertainty/risk informed by the 13,500 futures in a manageable number for modeling
- We wanted the approach that could provide:
  - Cover the economic risk space from uncertainty in load, generation, gas price forecasts, and climate trajectories
  - Preserve a reasonable model run time, with a reasonable amount of clusters
- Result is 10 different "future clusters" modeled per year, with the specifics of the clusters changing between each year modeled, resulting in broad sampling from the futures
- Clustering approach is used to inform the economic risk, but keep in mind that the GENESYS model (via both the needs assessment and final adequacy check) help to ensure final buildouts are adequate accounting for the range of uncertainty

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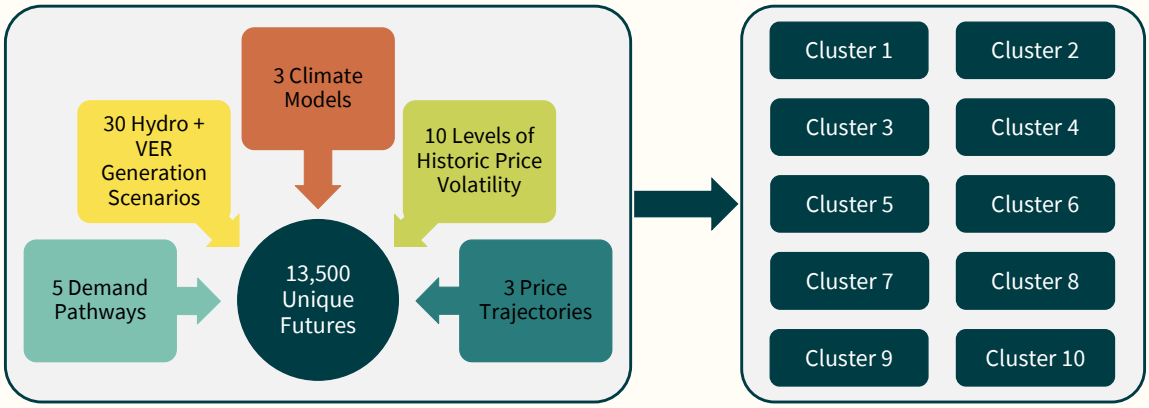
Developing Clusters



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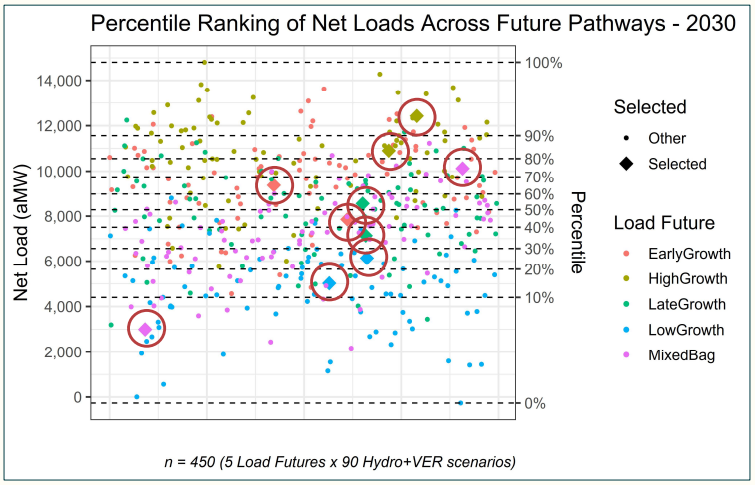
High Level Approach

Use a linear program to pick ten "futures" for the model following a series of rules:

- An even selection of **net-load** variation (1 year from every 10-percentile bin)
- An even selection of **hydro** conditions (1 year from every 10-percentile bin)
- An even selection of **gas prices** (targeting 4 mid, 3 high, and 3 low price futures)
- Balanced **gas price volatility**
- A balance of the **load** pathways (2 high pathways, 2 low, 2 early, etc.)
- Set number of **climate** scenarios (4 model A futures, 3 C, 3 G)

Example: Net Load Selection

- Net load represents annual energy load minus existing annual energy hydro and VER generation
- Picking 1 year from each 10-percentile bin (10 total)
- After the hard constraints are met, the linear program also tries to get to the average net-load of each percentile bin



Example: Putting it All Together

Load pathway	Year	Load (aMW)	Net load	Net-load rank	Gas future	Gas Vol.	Hydro rank	Climate
High Growth	2030	30,103	12,428	1	1	1	2	G
High Growth	2030	29,813	10,903	2	3	3	4	C
Mixed Bag	2030	26,254	10,120	3	17	7	1	C
Early Growth	2030	28,926	9,370	4	28	8	7	A
Late Growth	2030	27,543	8,561	5	30	10	5	G
Early Growth	2030	28,649	7,856	6	29	9	9	C
Late Growth	2030	27,557	7,136	7	4	4	8	A
Low Growth	2030	24,102	6,135	8	16	6	3	G
Low Growth	2030	24,097	5,021	9	15	5	6	A
Mixed Bag	2030	26,530	2,995	10	2	2	10	A

Methodology Discussed with the SAAC

- Staff have been connecting with regional experts to discuss the modeling methodology
  - Several one-on-one conversations with utilities and key organization
  - System Analysis Advisory Committee meeting on January 29
- Feedback has been positive, with general support of the approach
- SAAC members provided some suggestions for small tweaks that staff has incorporated

Data, data, and more data!!

What will we learn from the model?

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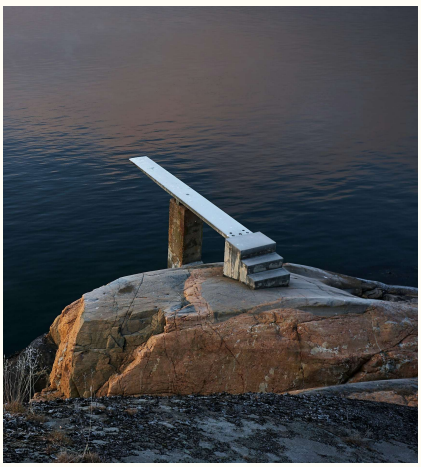
A Couple Notes Before Diving In…

- We will be walking through the type of data staff plan to present to the Council in March once we have results
- The goal is to provide a better sense of the type of data available and what can be gleaned from the analysis
- We also want to hear what questions you might have, so that we can seek to provide answers when we bring results
- All graphs included are **EXAMPLES** based on made up data, which is why staff has intentionally excluded values
- No inferences should be made based on these examples



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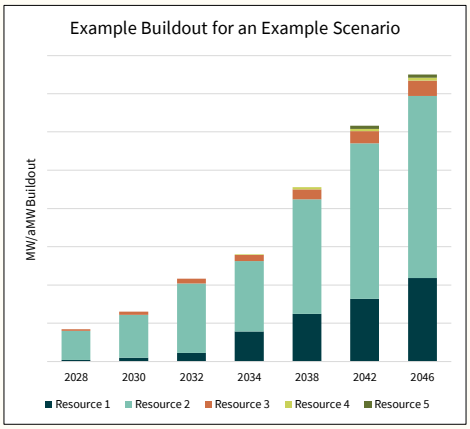
Resource Buildout

This information will be available for the region as a whole, as well as by zone. Differences between zones can inform the locational value of resources.

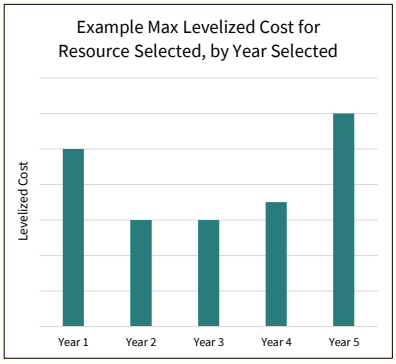
- For each sensitivity, OptGen will develop a resource buildout for each year being modeled
- We can extrapolate between years to get the overall build required
- Comparing the buildout between two different sensitivities will provide information on:
  - What resources, and in what amounts, are robust across the uncertainty?
  - What resources are built under certain worlds, and what does that mean about the attributes that resource has in mitigating the risk/uncertainty being tested?



Levelized Costs of Resources

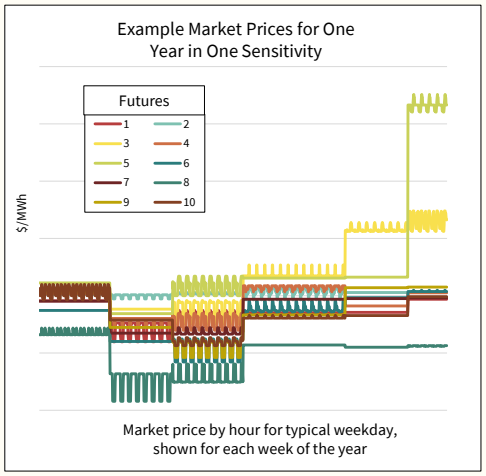
For demand side resources, this data will be available by zone

- OptGen will provide information on the levelized costs of resources being acquired
- This will provide some insight as to why certain resources are being purchased, especially when the decision is guided by economics
- Understanding the investment level needed in both the near-term and long-term will be important for developing a robust strategy
- **Important caveat:** Economics are one key driver of builds, but economics alone (i.e. lowest levelized cost) does not necessarily mean the best resource. Sometimes a resource may be purchased at a higher costs because its attributes support adequacy and/or policy needs.



Market Prices

- OptGen will produce the market prices for each sensitivity
- This is available for every future and each year analyzed, and is available by zone (although staff uses the average of the Mid-C to represent the region)
- This information can provide insights as to why certain resources are being purchased at what levelized cost
- The range of the market prices across the futures can provide some insights on the range of risk seen in that scenario

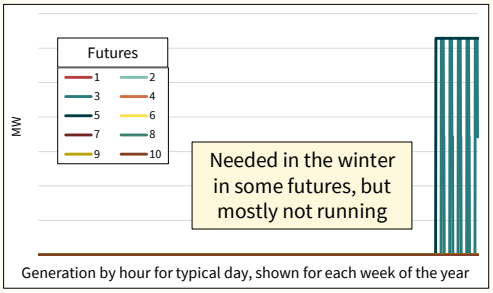


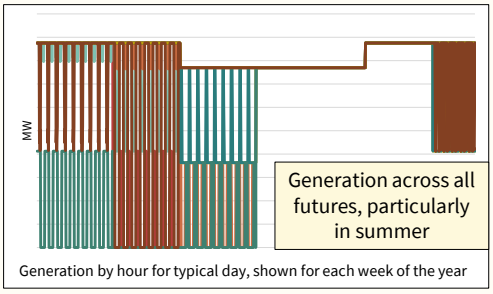
Thermal Utilization

- OptGen provides data on the utilization (both generation and reserves) of all the thermal plants included in the model, both existing system along with any new thermal options if selected by the model
- Staff can share information on thermal utilization over time, by zone or state, and how that differs across the different futures within a sensitivity or how it differs across the sensitivities

We can provide this for other resources as well.

Example Generation from Two Thermal Plants, Existing System



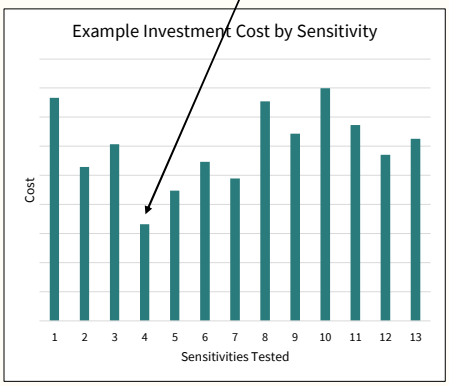


Investment Cost

- OptGen provides the investment cost for the region, which represents the cost of the buildout for the specific sensitivity being tested
- Each of the 13 sensitivities will have an investment cost
- Comparing these costs across sensitivities will provide insight into overall economics of the different strategies, as well as what factors might help lower costs
- **Important caution:** This comparison is a comparison between very different worlds in some cases, and therefore the Council should use caution and not just focus on the sensitivity that results in the lowest investment cost

We also have lots of other cost components we can dig into, including some costs by future within a sensitivity

In this example, just because this sensitivity shows the lowest cost does not mean that we should focus on that strategy. The risk/uncertainty that we are exploring in that sensitivity might not represent the most likely path forward.



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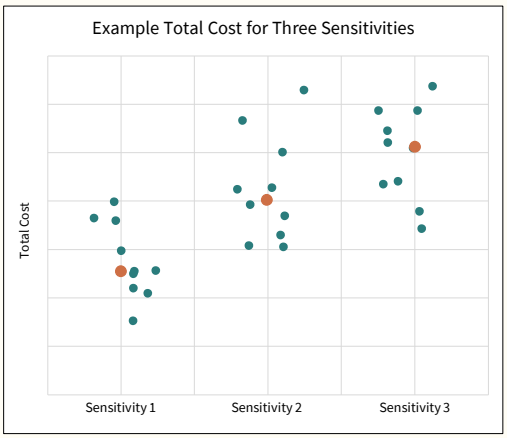
Total Costs

- OptGen calculates the total cost for each sensitivity: regional investment cost + WECC-wide production cost
- This is calculated for each future within each sensitivity
- The range of costs within each sensitivity can provide some insight on risk
- **Important cautions:** Similar to the investment costs, comparing across sensitivities might not be useful, as they are very different worlds. Additionally, since this is a WECC-wide cost, and we don't change assumptions around WECC builds within a sensitivity, some of the risk signal is dampened



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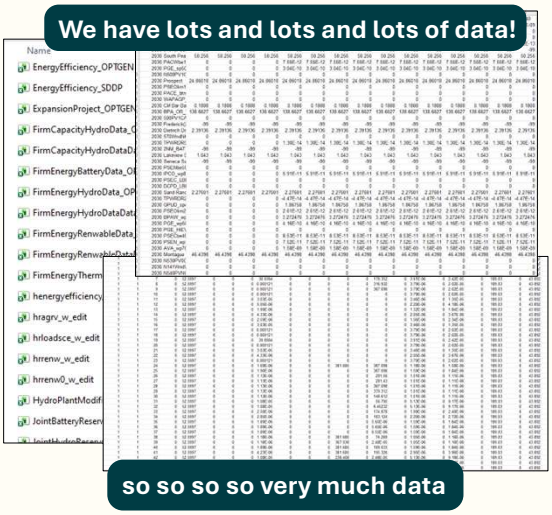
Other Potential Outputs

- There is even more data we can analyze from the OptGen results
- These include:
  - Insights on why resources are being build, i.e. if not for economics, is it to meet a policy or a specific adequacy signal in the model?
  - Emissions for WECC
  - Imports and exports



Additional Data from Adequacy Check

- For every sensitivity, staff will put the resources selected by OptGen back into GENESYS to conduct an "adequacy check"
- The purpose of this check is to ensure that all buildout meet the Council's adequacy criteria
- Using the data from this check will provide useful insights that could inform strategies for addressing risk
- Specifically, staff can dig into the shortfalls that remain (i.e. the 1 in 10-year events) to understand the drivers for the shortfalls, which in turn will provide insights on the type of resources that may be useful for mitigating the shortfalls if needed