MEMORANDUM

TO: Power Committee
FROM: Ben Kujala
SUBJECT: First Look at Baseline Conditions RPM Results

BACKGROUND:

Presenter: Ben Kujala and John Ollis

Summary: The Regional Portfolio Model looks at resource strategies for the region and evaluates the cost and risk of those strategies. This presentation will share with the committee some early results from the model when looking at the baseline conditions for the 2021 Power Plan.

While the model has been updated with information from the electricity price forecast, staff is still evaluating the adequacy information to see if there is a need to update the assumptions currently used in the RPM which are based on runs in the classic GENSYS model. Though these results are preliminary, staff believes that they are indicative of what we will see even if updates are needed based on results from the redeveloped GENESYS model.

Relevance: The Regional Portfolio Model is used to test regional resource strategies and evaluate the cost and risk of those strategies to the region.

Workplan: A.6.5. Model-based Analysis

More Info: Substantial portions of this presentation are being shared and vetted with the System Analysis Advisory Committee (SAAC) on December 9th, one
day after the packet is posted. To allow for feedback from the SAAC to be incorporated into this presentation, the PowerPoint slides will be posted and sent to the Power Committee members before the Power Committee meeting but are not included in this packet.
First Look at Baseline Conditions RPM Results

Draft Results based on classic GENESYS adequacy information
What are baseline conditions?

• Baseline conditions are a basis for comparison when developing scenarios

• Baseline conditions are assumptions that are common between 2 or more scenarios

• Baseline conditions are not:
  • Business as usual
  • Most likely scenario
  • Default forecast
  • Recommended regional resource strategy
What is a **scenario** in the Council’s Power Plan?

High-level questions help build a future **landscape** which we examine and compare to alternative outlooks to **learn** and create a narrative that informs the audience for the Power Plan.
How do we create a scenario?

1. Ask what conditions and processes would change
2. Alter inputs and logic in the models and analyses to consistently implement those changes
3. Look at downstream processes and determine if those changes have material impacts
4. Compare the outcome to alternative outlooks
How do scenarios get used?

Scenarios provide the Council with analysis to inform decision-making when developing a final resource strategy for the region and Bonneville.
Building the 2021 Power Plan

Baseline Conditions

- Existing system policies
- Add SCC to final cost (NPV) of all scenarios as a damage cost

Starting Point

Scenario Analysis

- Analyze the Bonneville portfolio
- Early retirement of coal gen
- GHG cost tipping points
- Paths to decarbonization
- Change reliance on extra-regional markets for RA
- Organized markets for energy and capacity
- Test robustness of energy efficiency

Qual. + Quant. Analysis

Develop a resource strategy
Impact of Electricity Price Forecast

Off-peak Electricity Prices

Off-peak prices are negative for a full year on average by the end of the study.
Resource Build

Large near-term build of many different types of resources
Natural Gas Generation Build

Gas Peakers - 753 MW Nameplate by 2026

Gas CCCT - 1054 MW Nameplate by 2026
Renewable Build

Over 9 GW by 2026
Renewable Curtailment

On average producing less than 40% of potential energy in many future quarters for 20 hours of the day.

Onshore Wind - SE Washington Dispatch
RPS Requirements

Rec Shortfalls - Infrequent but possible

Because of renewable curtailment, RPS requirements are not always met
Market emissions from AURORA fall throughout the plan.
GHG Emissions

GHG emissions in the region similarly fall throughout the plan.
Imports Are Infrequent

Probability of Imports / Exports

Emissions Associated with Imports
EE Build

Small Build of around 500 aMW by 2026

Around 55% of potential supply
Negative Value of EE

Negative electricity market prices make EE particularly expensive for the portfolio.
Feedback from the SAAC

This was presented to the SAAC on December 9\textsuperscript{th}. So far they have raised the following concerns:

1. Market prices are driven down by limited exports, in the environment we’re forecasting should we allow for more exports

2. The amount of gas generation built is inconsistent with the limits implemented in AURORA for the electricity price forecast

3. Hydro does not have the ability to curtail which may also drive down market prices
Import / Export Limits

First look import and export limits are based on what was in the 7th plan:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Import (MW)</th>
<th>Export (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,732</td>
<td>5,795</td>
</tr>
<tr>
<td>2</td>
<td>3,472</td>
<td>6,835</td>
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<tr>
<td>3</td>
<td>3,456</td>
<td>7,062</td>
</tr>
<tr>
<td>4</td>
<td>3,266</td>
<td>5,829</td>
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</table>
Potential Basis for Change

- Limits were previously based on fifth percentile of available transmission capacity on the COI and DC Intertie – this was a proxy for the market seen as predominantly California.
- Staff tested adding in the ability to export on the BC Intertie and adding export capability for Path 20 (Southern Idaho to Utah).
- Updated data based on 15 minute ratings from BPA on COI + DC Intertie + BC Intertie ratings from 2016 to 2019.
- For WECC Path 20, we didn’t have 15 minute ratings so added 1000 MW based on WECC document.
Potential Update to Import / Export Limits

• With this approach the results would be:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Import (MW)</th>
<th>Export (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>7,800</td>
</tr>
<tr>
<td>2</td>
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<td>6,850</td>
</tr>
<tr>
<td>3</td>
<td>9,750</td>
<td>7,097</td>
</tr>
<tr>
<td>4</td>
<td>5,100</td>
<td>5,850</td>
</tr>
</tbody>
</table>
Potential Change in Import / Export Limits

- For a difference of

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Import (MW)</th>
<th>Export (MW)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2,005</td>
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<td>2</td>
<td>4,738</td>
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<tr>
<td>3</td>
<td>6,294</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>1,834</td>
<td>21</td>
</tr>
</tbody>
</table>
What’s with the imports?

• These imports are for economics only, the imports for adequacy are determined by GENESYS and the Adequacy Reserve Margin

• Updated data show higher import transmission ratings and adding BC and Path 20 imports results in significant increase to import limits

• In the first look RPM run, import limits were infrequently hit so generally we wouldn’t expect increasing them to have much impact in this setup – it may matter for scenarios
Why didn’t that add more to exports?

• Updating to 2016 to 2019 reflects more recent operations which look to have lower ratings for available transmission

• Adding up line ratings misses transmission system dynamics that impact multiple paths

• Fifth-percentile may be conservative but reasonable for imports but not reflect a reasonable assumption for exports

• More to come – we sent details of this analysis to the SAAC and will discuss this at the next meeting
Impact on RPM results?

- Minimal impacts:
  - Prices still negative
  - Reduces resource build in 2030s
  - EE very slightly increases

- Hourly shapes still drive renewable curtailment but less curtailment moves infrequent REC shortfalls to later in the study
Small Seasonal Increase in Electricity Prices
Less Renewables in the 2030s

The graph shows the cumulative new resource capacity (nameplate MW) over time. The resources include Solar PV, Onshore Wind, Gas CCCT, and Conv. Geothermal. The graph indicates a significant increase in the cumulative capacity over the years.
Later Infrequent REC Shortfalls

![Graph showing RPS/Clean Comparison (MWh/OverYear) over time with different probability levels represented by different line styles.]

Probability:
- 0
- 0.05
- 0.5
- 0.95
- 1

NORTHWEST POWER PLAN
Decrease in Natural Gas Generation Build

Around 1200 MW Nameplate by 2027
Similar but Slightly Increased EE Build

Cumulative Conservation by FY (MWa, Peak MW)

Simulation FY

Probability
- 0
- 0.05
- 0.5
- 0.95
- 1

THE 2021 NORTHWEST POWER PLAN
Natural Gas Generation

• RPM builds substantial new natural gas generation in the first look
• Council and advisory committee direction pushed for limited gas in the electricity price forecast
• To test the impacts, we removed the options for new natural gas generation
Impact on RPM results?

- Without alternative resources removes RPM’s ability to respond to adequacy signals
- Higher resource adequacy penalties occur later in the run
- Likely to be highly sensitive to updated ASCC and ARM study
- Preliminary runs show a very slight increase in EE – too many outstanding questions to read much into this yet
Minimal Reduction in GHG Emissions (MMT)

Preliminary runs show 4.9 MMT additional emissions over the 20-year horizon when including options to build new natural gas generation.
Hydro Curtailment

- Still exploring options in RPM

- Likely to require fidelity of GENESYS, with RPM resource build added to understand how much this could impact regional resource strategy
Questions?
Let’s open RPM...
Extra slides for reference
CAVEAT...

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Penalties and End-Effects

Resource Adequacy penalties cause large cost jumps

End-effects excluding these penalties
Penalties and End-Effects

• Agent-based logic in the model is unable to resolve all Resource Adequacy penalties
• Higher occurrence of penalties toward the end of the study make averaging the tail of the study with penalties overstate end-effects
• Excluding penalties from end-effects misses potential costs and challenges that could occur in the end-effect period
• Including penalties in end effects and/or lengthening the period for end-effects drives larger builds throughout the study including in the action plan period
REC Shortfall Example

Required vs Actual
- Required
- Actual
- REC Withdrawal
- REC Shortfall (for Penalty)