MEMORANDUM

TO: Council Members  
FROM: John Ollis, Manager of Planning and Analysis  
SUBJECT: 2021 Power Plan Draft Wholesale Electricity Price and Avoided CO₂ Emissions Rate Forecast Part 2  

BACKGROUND:  
Presenter: John Ollis  
Summary: This presentation will continue to update the Council on the status of the 2020 wholesale electricity price forecast and avoided emissions rate study updates for the 2021 Power Plan, and the most recent response from the System Analysis Advisory Committee. Staff continues to attempt to improve the forecast and incorporate the significant stakeholder feedback. Several additional methodological changes have been implemented relating to the modeling in AURORA and interpretation of the avoided market emissions rate data. Staff will report on the current status of these studies per these changes.  
Relevance: The Council periodically updates a 20-year forecast of electric power prices and avoided emissions rate studies using the AURORA model. The AURORA model dispatches all resources in the WECC generating a fundamentals-based wholesale electricity price forecast. The study of avoided carbon dioxide production rates of the northwest power system will evaluate what the implied avoided carbon emissions rate is in the WECC and the implications for regional conservation replacing the need for that production.
Since the development of the midterm and previous avoided emissions rate study, more baseload plant retirements have been announced and further clean policies and goals have been announced. These municipal, utility and state policies/goals along with the retirements and pressures on conventional fossil fuel resources continue to fundamentally change the wholesale market dynamics in the WECC, and this updated price forecast helps Staff incorporate the effects of these changes on Mid-C market prices and the implied avoided market emission rate.

For the 2021 Power Plan, the Regional Portfolio Model will use the power prices from this study to develop electricity price futures which are used as a starting point for resource valuation in the resource strategy analysis. Additionally, the avoided market emissions rate is used in the resource strategy analysis to determine the emissions associated with reliance on the market.

Workplan: Forecast Wholesale Electricity Prices (A.6.3)

Background: The Council’s wholesale electricity price forecast is a fundamentals-based, forecast that reflects actual power system operation, relationships of supply and demand for, and transmission of electricity. In addition, underlying a wholesale electricity price forecast in this region would be an understanding of the operating characteristics of future and existing supply and demand-side resources, as well as unit commitment, ancillary services, fuel prices, hydro, wind and solar conditions. The AURORA software captures many of these characteristics of the power system well and has a periodically updated WECC database, and thus, AURORA has been the Council’s wholesale market electricity price forecasting model.

Additionally, the cost of future carbon dioxide regulation has been a significant factor in resource planning in the Pacific Northwest. To avoid making higher cost resource choices, a direct evaluation of this risk requires an estimate of the carbon dioxide emissions avoided by purchasing conservation or another resource. The Council has periodically updated this study using the AURORA model to help inform Council staff and regional stakeholder analysis.

More Info: Slides for this presentation are pending on ongoing studies and recommendations from the September 2nd, 2020 System Analysis Advisory Committee meeting and since the previous power committee presentation.

Previous presentations on this forecast:

Updated Proposed Price Forecast Discussion in September 2 SAAC

Discussion of Price Forecast in August 2020 Power Committee

Discussion of Price Forecast in August 2020 SAAC
Previous studies:

2019 Wholesale Price Forecast Update

Wholesale Price Forecast in 7th Plan Midterm (see 3-10 through 3-17)

Avoided Carbon Dioxide Production Rates in the Northwest Power System
Update on 2021 Power Plan
Draft Wholesale Electricity Price Forecast

Power Committee
9/15/2020
John Ollis
Timeline – Wholesale Power Price and Market Emissions Rate Forecast

Updated price forecast per new state policies in late 2019 (presented to SAAC in Oct. and Council in Nov.)

In region demand and WECC-wide statewide policies updated mid-July 2020

Present baseline study results at the August 2020 power committee meeting

Follow-up meeting with SAAC yielded further concerns

Generating resource fixed costs, fuel prices and external to the region WECC loads updated as of March 2020

Get updated guidance from SAAC about AURORA setup and methodologies for 2021 Power Plan runs

(1) Use power prices and avoided CO2e emissions rates to inform RPM of external market information.

(2) Use buildout to guide construction of GENESYS external market bins.
Review: Building out the WECC to Regional Reserve Margins

- Before we can run prices, we need to simulate likely plant buildout in all of the WECC.
- Key reasons to build.

1. **Planning Reserve Margins for each reserve sharing group.**
   - Southwest Reserve Sharing Group
   - Rocky Mountain Reserve Sharing Group
   - California ISO (includes part of Baja California)
   - Northwest Power Pool US
   - Northwest Power Pool Canada

2. **WECC clean and RPS policy levels.**

3. **Peaking capability/need timing**
Review: WECC coal units in operation, decreasing over time...

Additional major retirements scheduled:
- Diablo Canyon 2,300 MW
- Other units 5,800 MW*

*Over 1,300 MW of gas units in CA replacing OTC retirements
Without some interpolation the model has a hard time solving the problem.

Requirements jump by 20 aGW and 15 aGW, in 2030 and 2045, respectively.
## Buildout Comparison Presented at the SAAC/Power Committee

*Cumulative Buildout in Nameplate MWs by Year*

<table>
<thead>
<tr>
<th>Year</th>
<th>Solar</th>
<th>Natural Gas</th>
<th>4 Hour Battery</th>
<th>Wind Battery</th>
<th>Solar with Battery</th>
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<td>8,100</td>
<td>102,400</td>
<td>22,800</td>
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</table>

*too many gas builds for current policy*

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### Limited Gas per Regulatory and Policy Climate (August 2020)

<table>
<thead>
<tr>
<th>Year</th>
<th>Solar</th>
<th>Natural Gas</th>
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<td>12,100</td>
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</table>
Review: Primary Methodology Changes After First SAAC

1. Incorporated Dynamic Peak Credit to top 8 hours
2. Further limited gas everywhere but primarily in Desert SW where builds were limited to 1 per period and maxed out around 7000 MW
3. Let batteries meet reserve needs in Mountain West and Desert SW where there are reserve shortages.
### Limited Gas per Regulatory and Policy Climate (September 2, 2020)

<table>
<thead>
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<th>Year</th>
<th>Solar</th>
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### Buildout Comparison per Most Recent Buildout

<table>
<thead>
<tr>
<th>Cumulative Buildout in Nameplate MWs by Year</th>
</tr>
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</table>
| Still too many gas builds for current policy but better, wind builds way higher and battery way lower than expected.

Last month this is where we were...
Since September 2nd SAAC, More Methodology Changes and Corrections

- With further help and collaboration with the stakeholder community and some closer validation of results...

1. **California demand forecast correction**
   A. Previous forecast did not include EE (lowered forecast 1 aGW)
   B. Some PG&E load was counted twice during zonal breakout (lowered forecast 5 aGW)
   C. Lowered clean requirements in the WECC by around 6 aGW by 2045

2. **Clean/RPS constraints correction**
   A. Inputs were offset by a year

3. **Methodology change on carbon content on imports to California**
   A. Default treatment static and likely overestimating emissions associated with imports

4. **Started using partial build logic for renewables and batteries.**
   A. Renewable and battery installations vary considerably in size and can be more easily right sized to meet needs. This also reduces overbuilds and speeds up the modeling.
### Limited Gas per Regulatory and Policy Climate (October 2019)

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### Limited Gas per Regulatory and Policy Climate (September 2020) DRAFT

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<th>Year</th>
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<td>34,956</td>
<td>27,849</td>
<td>112,431</td>
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</tbody>
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Where and what new resources are built by 2025?

During Action Plan time period buildout is of similar magnitude with more new gas resources filling in for thermal retirements and load increases.
During Action Plan time period buildout is of similar magnitude with more new gas resources filling in for thermal retirements and load increases. New gas mostly displaces existing gas.
Where and what new resources are built by 2045?

NW hydro contributes less and the NW demand is higher during times when the rest of the WECC is peaking leading to more builds in the NW.
Where and what new resources are built by 2045?

NW hydro contributes less and the NW demand is higher during times when the rest of the WECC is peaking leading to more builds in the NW.
Imports and Exports

- California increases its reliance on other regions.
- NWPP (Pacific NW, Utah and Nevada) send a lot of power to CA.
- Southwest Reserve Sharing Group sends the rest.
- Seasonal reserve margins in all pools degrade over time.
- Summer reserve margins go negative in California and Desert SW.

When striving for annual clean/RPS targets, what drives adequacy?
Clean and renewable capability are between 6,000 and 40,000 aMW over the policy requirements.
Fixed Costs Over **Two** Times Production Costs for this Buildout

This is “only” half a trillion dollars.
Attempting to Itemize Build Reasons

- **Economics (energy only)** –
  - 6,600 MW of gas plants (mostly plants in Alberta replacing coal retirements) and 1,600 MW of solar (mostly backfilling for retirements)

- **Economics (energy, capacity)** –
  - 1,300 MW of solar, 1,200 MW of solar plus storage and 22,400 MW of gas (mostly in NWPP and Baja CA).

- **Clean/RPS Policies**
  - 19,600 MW of solar, 56,000 MW of solar plus storage and 112,400 of wind (~90 to 100 aGW of renewable energy) qualify.
  - Using just accounting over 12 aGW too much, but due to timing some of the output must be curtailed.

- **Planning Reserve Margin, Load Growth and Ancillary Services**
  - Approximately 6 GW of Battery, almost 180 GW of renewables (mostly wind and solar with storage) and 5.6 GW of gas built to maintain peak reserve margins
  - Additional 16 GW of Battery built for flexibility capacity
Buildout Summary

• Buildout seems about as reasonable as we will get it without slowing the Plan down considerably.

• Major takeaways:
  1. Gas builds are backfilling for thermal retirements AND displacing less efficient gas plants.
     • But is this much build possible?
  2. Renewables are keeping up with load growth, reserve margins and policies.
  3. California choices in how they meet policy will really effect WECC adequacy and prices in the future.
  4. Much higher fixed cost than variable costs.
  5. Enough builds to send a reasonable price signal to the RPM.
Wholesale Power Price Forecast – Sample Daily Shapes
Preliminary Price Discussion

• Previous study pricing for context

• Price forecast is a starting point for developing RPM price futures

• Do not have to be perfect, but need a buildout in AURORA that is resource sufficient and complies with policies to get realistic pricing.

Note: All prices are in 2016 dollars per MWh.
Price Ranges in Midterm and Seventh Power Plan
Sample Daily Mid-C Price Shape - Winter Quarter 2025 and 2040
Daily Mid-C Price Shape - Spring Quarter 2025 and 2040
Daily Mid-C Price Shape - Summer Quarter 2025 and 2040
Daily Mid-C Price Shape - Fall Quarter 2025 and 2040
Overall Conclusions

1. Initial stakeholder response to current buildout seems positive.
2. With a vast renewable buildout Mid-C power prices will likely decrease over time, become negative on a seasonal basis by late 2030’s and be very volatile intra-day.
3. Emissions rate methodology revision approved by SAAC.
John Ollis
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