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

August 8, 2017

MEMORANDUM

TO: **Council Members**

FROM: **John Ollis, Power System Analyst**

SUBJECT: **Marginal Carbon Emissions Rate Study Draft**

BACKGROUND:

Presenter: John Ollis

Summary: This presentation will be a discussion of the stakeholder comments from the previously released draft of the Marginal Carbon Emissions Rate Study and to update the Power Committee members on the current status of the study.

Relevance: The study of marginal carbon dioxide production rates of the northwest power system will evaluate what resources are marginal in every hour of four years (2016, 2021, 2026 and 2031) and the implications for conservation replacing the need for that production. The results will summarize the findings into an annual average marginal carbon dioxide rate (lbs per MWh) for the years of the study for two scenarios analyzed in the 7th Power Plan: Existing Policy and Average Social Cost of Carbon.

Workplan: N/A

Background: 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

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the carbon dioxide emissions avoided by purchasing conservation or another resource. The Council has periodically produced this study using the AURORAxmp model to help inform Council staff and regional stakeholder analysis.

Per the discussion in the January and February 2017 Power Committee, AURORAxmp has been used as the Council's wholesale market electricity price forecasting model. Since the wholesale electricity price is determined by the variable costs of the most expensive, available supply or demand-side resource necessary to meet the load, the Council can also use AURORAxmp, to determine the average CO2 emission rate of the marginal unit.

In April 2017, staff presented the results of the draft study and opened the study for stakeholder comment until June 30, 2017. Utility representatives, regulators and other interest groups commented on a variety of topics including the following:

- Selection of marginal resource as the metric to evaluate avoided emissions when adding a low or no-emissions energy resource.
- Availability and accessibility of underlying data and assumptions used in the analytics

Staff has followed up with many of the regional stakeholders to better understand the comments and answer any questions in the interim before going ahead with further analysis. In response to the comments and updated information about system resources since the analysis was started, staff proposes assessing the marginal unit for only generation units providing discretionary energy, and has scheduled a System Analysis Advisory Committee to discuss with stakeholders the updated data assumptions and analytical methods used in this study.

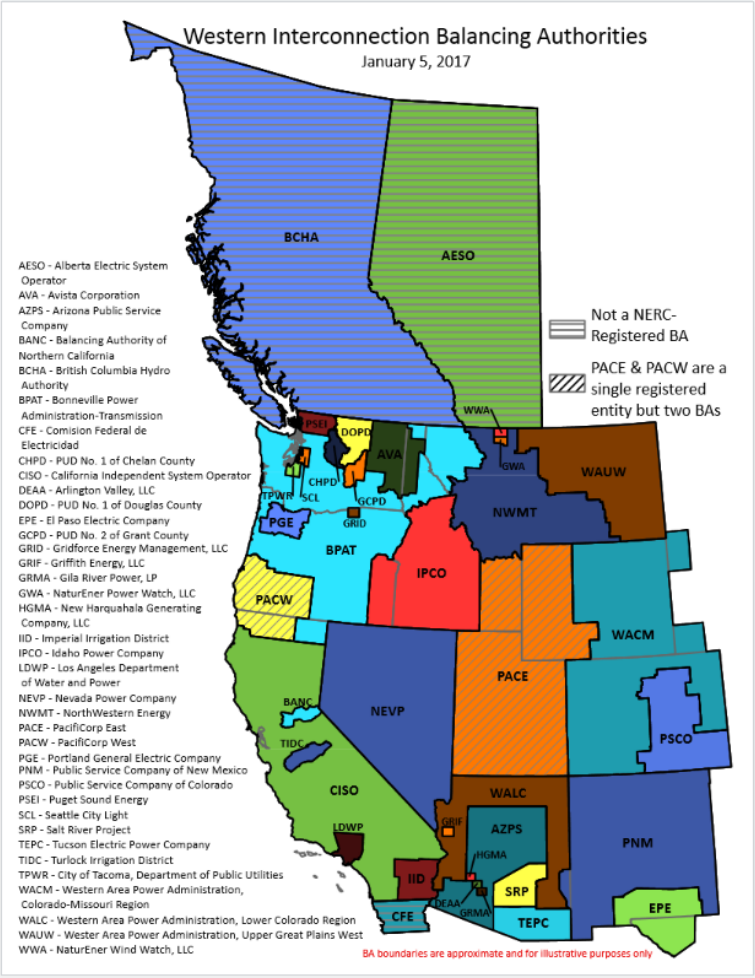
More Info: Marginal CO2 Rate Draft

2008 Marginal Carbon Emissions Study:
https://www.nwcouncil.org/media/29611/2008_08.pdf

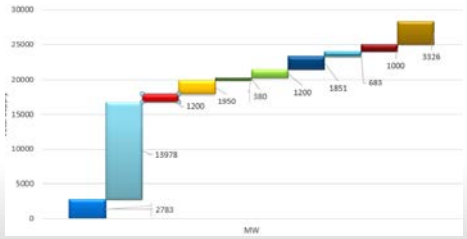
Links below are internal Council use only:
Stakeholder Comments

Marginal Carbon Emissions Study scope

For more information, please contact John Ollis



Marginal Carbon Dioxide Production Rate Report: Updates and Stakeholder Comments



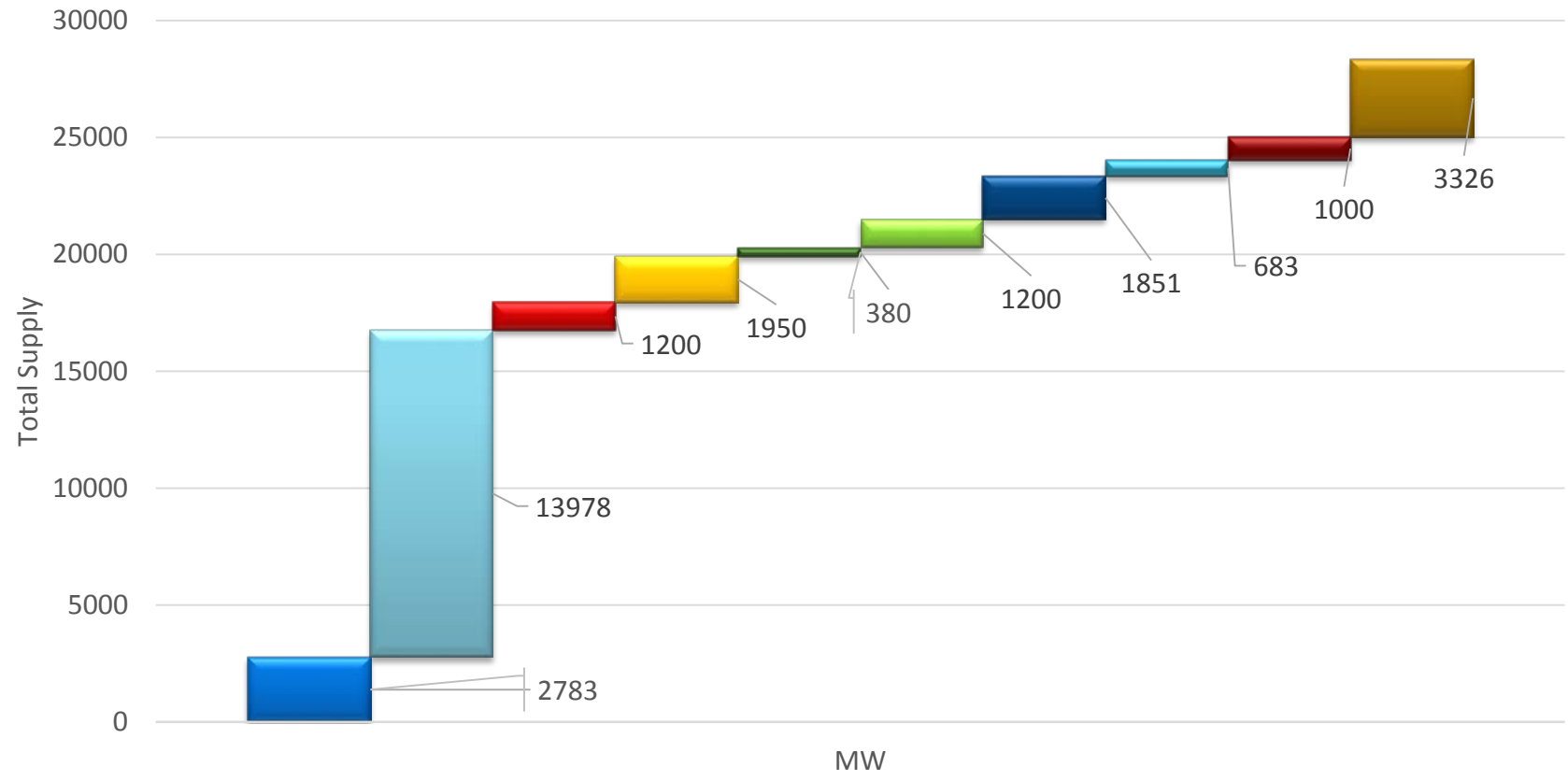
John Ollis

August 15, 2017

Draft Study Response

- Staff released its updated draft marginal carbon study in April 2017
- Significant stakeholder response
- Concerns included:
  1. Metric used for evaluation
  2. Low prices in spring not implying hydro as marginal
  3. Less stakeholder involvement than most Council processes

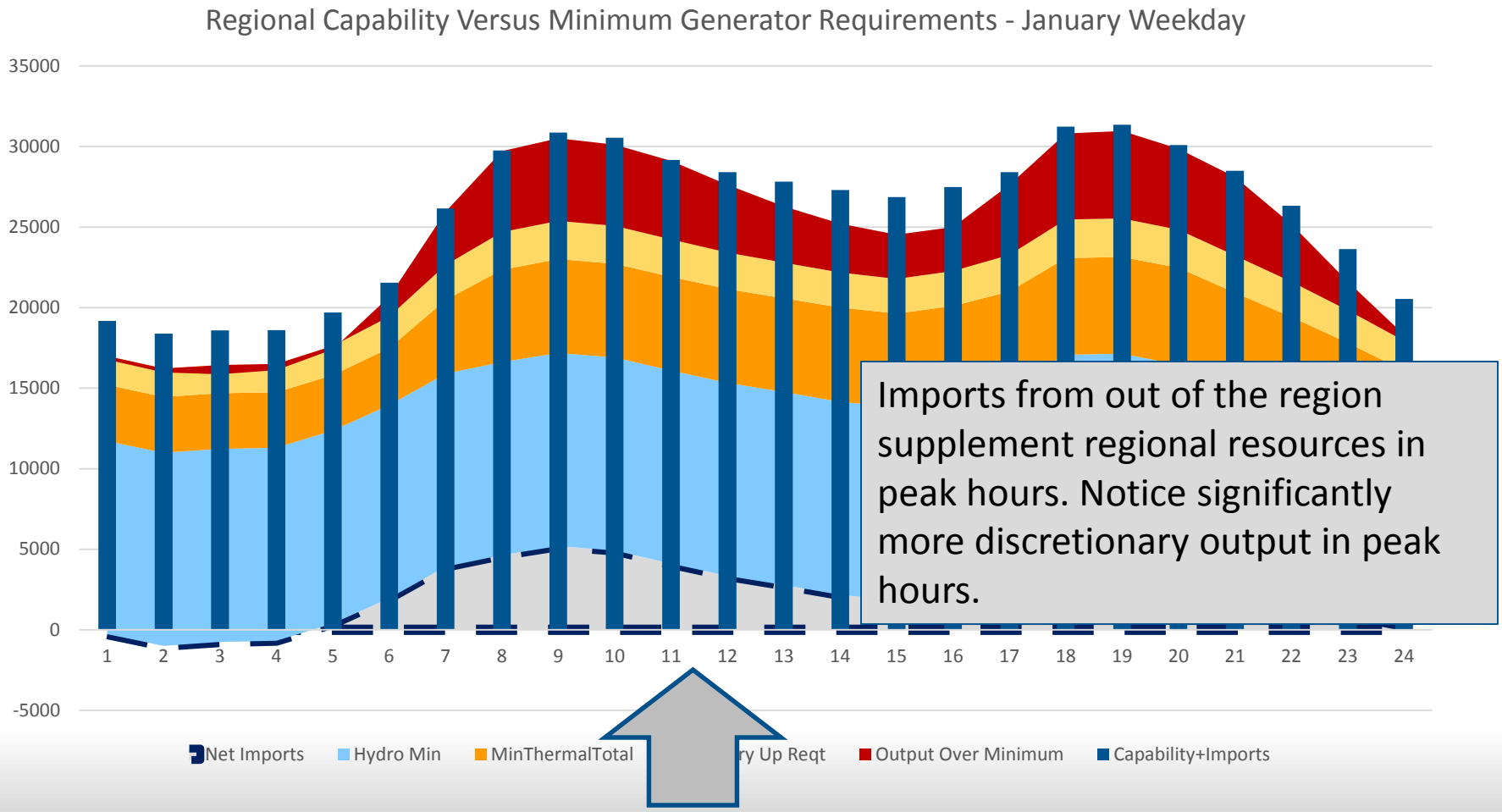
Resource Stack - Average Hydro, only PNW region



Metric Used to Evaluate Marginal Unit

- In a resource stack, where units are only used to provide energy, the avoided CO2 from additional energy efficiency or cogeneration can estimated by the CO2 emissions rate of a marginal resource.
  - Every added unit of energy in the stack below the marginal displaces it.
- In a resource stack where some units are used to provide ancillary services and have a minimum generation requirement, a more subtle metric is required...

How Much Regional Generation is Actually Discretionary?



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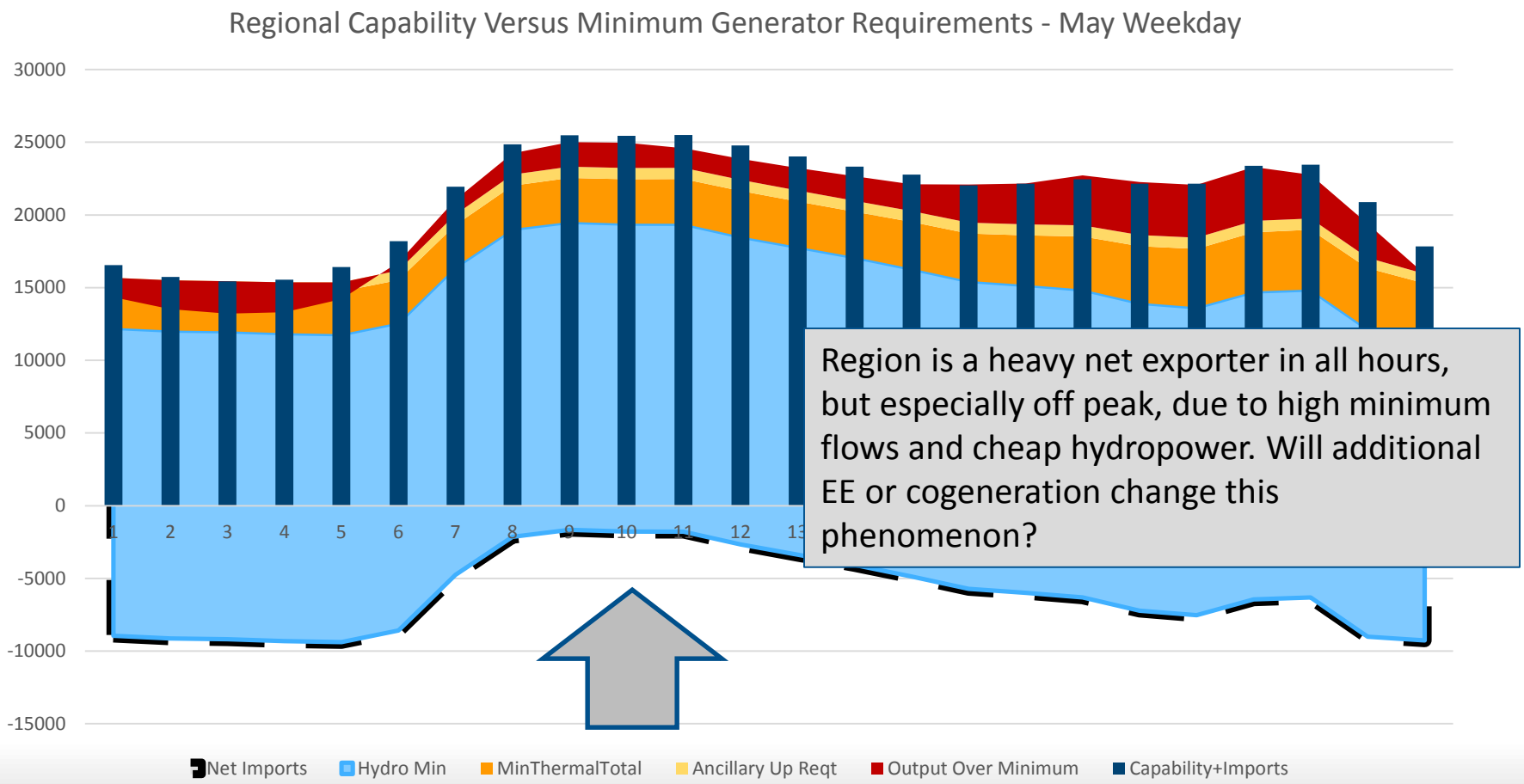


Region is a heavy net exporter in all hours, but especially off peak, due to high minimum flows and cheap hydropower. Will additional EE or cogeneration change this phenomenon?

What is the right metric?

- **Marginal resource**
  - The next least *variable* cost resource available.
- The avoided carbon emissions rate should be the emissions rate of the last unit of generation that energy efficiency, or cogeneration (i.e. a unit of energy farther down the resource stack) could replace.
- This minimum generation level required by a unit that is assigned to providing operating reserves (contingency and balancing) would likely NOT be replaced by energy efficiency or cogeneration.

Discretionary Energy

- **Discretionary energy** is the generation of a unit that is dispatched to meet part of the hourly energy obligation of the system, but is NOT required by the physical limitations of the unit.
  - All sub-hourly demands to the system we will call: *operating reserves*
  - Cannot be part of the minimum operating level of a generator.

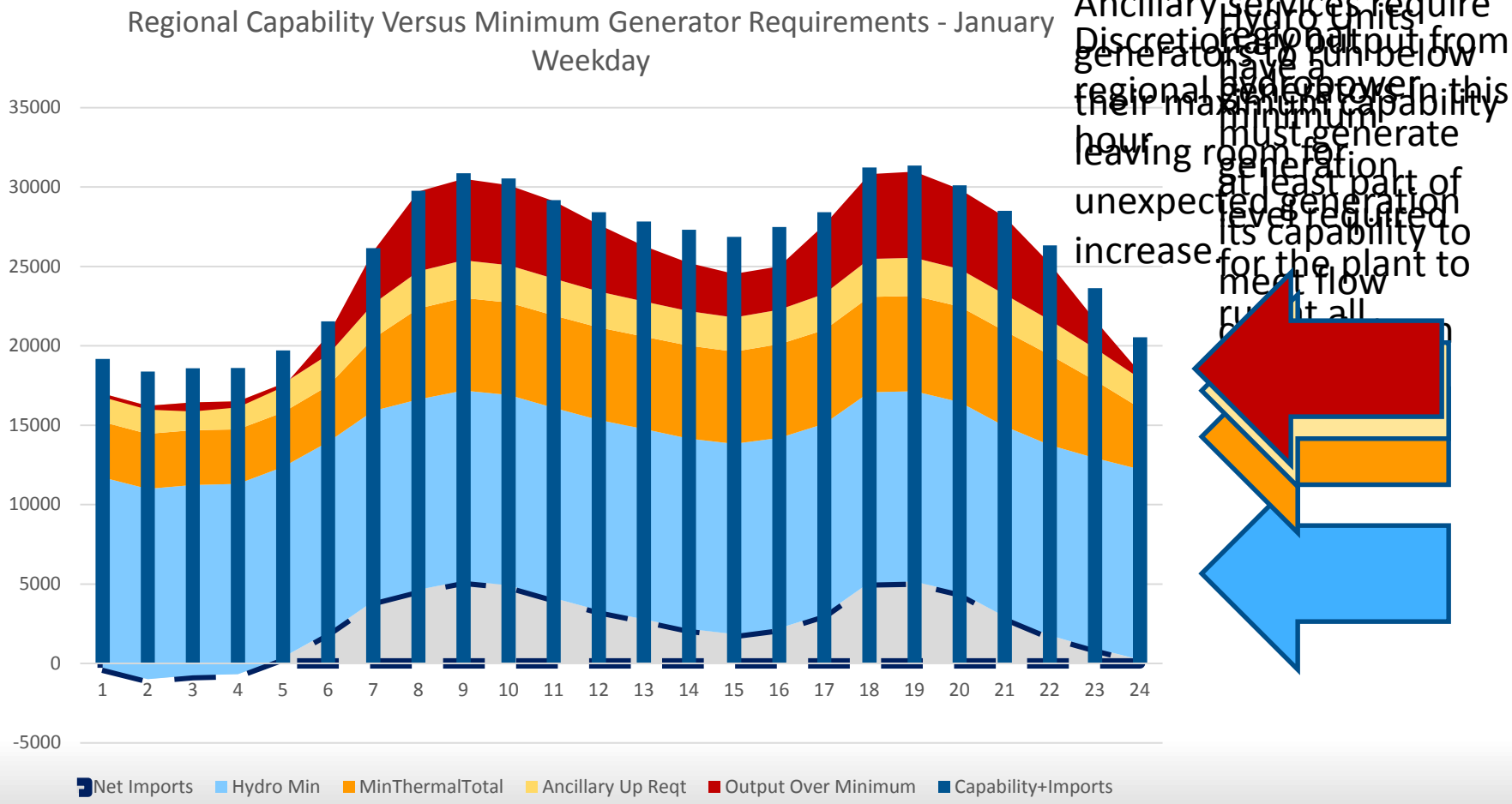
Highest Cost Unit Providing Discretionary Energy

- The CO2 rate of the highest cost unit that is providing discretionary energy to the system is the CO2 rate that *could be avoided* by adding additional EE or cogeneration in the region.

Should we only consider in-region units?

- If EE is added to the region, it may be replacing power provided by out-of-region generators (imported power).
  - In-region dispatch would not change.
- Then the avoided carbon emissions rate would be the rate of an out-of-region generator.

The **next unit of energy efficiency or cogeneration** is most likely to *replace discretionary dispatch of a unit within the region* and/or *reduce net imports to or increase net exports from the region*.



Proposed Revision to Metric Evaluated

- Continue to use AURORAxmp to determine the avoided carbon emissions rate by adding EE or cogeneration within the region.

- Evaluate CO2 emissions rate of the generator producing the highest cost discretionary energy in the WECC.

Review of Study Methodology

- Instead of using AURORAxmp for resource expansion within region, use RPM results from 7th Power Plan.
- Each of the 10 scenarios will be considered under all 80 hydro conditions instead of just average hydro conditions.
  - 2016, 2021 (Min and Expected DR), 2026, 2031 run with No Carbon Price and Social Cost of Carbon
- All scenarios will be run with regional reserve requirements and hydro methodology similar to what was used the 7th Power Plan Balancing and Flexibility study.

Why is Hydro Never on The Margin?

- Low to negative power prices in spring would seem to imply hydro power is on the margin.
  - Hydro is never on the margin for the **entire** region in this study.
  - Some biomass and cogeneration in the region, while technically *must-run*, is at least partially, dispatched economically and slightly more expensive than hydropower.
    - What is the emissions rate of biomass?

Next Steps

Continue Stakeholder Involvement

- Meet with System Analysis Advisory Committee to vet methodology and assumptions, and discuss results.

- Update report to reflect stakeholder feedback, revised methodology and results.