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June 7, 2022

MEMORANDUM

TO: Council Members

FROM: John Ollis, Manager of Planning and Analysis

SUBJECT: Primer on the Wholesale Electricity Price Forecast

BACKGROUND:

Presenters: John Ollis

Summary: This presentation will review some plan observations about market fundamentals, describe the process used to create the upcoming market price forecast and how the forecast fits into the plan implementation.

Relevance: Wholesale power markets outside the region were highlighted as a key data point to monitor coming out of the 2021 Power Plan in which policy changes throughout the western states impacted not just wholesale power markets in the long term, but also in the short term. This update reviews the process of the next wholesale power price forecast study for which some work has already commenced and how the results support the Council's upcoming adequacy assessment.

Workplan: B.5 Complete Wholesale Electricity Price and Avoided Emissions Rate Study

Background: The Council has periodically updated its wholesale electricity price study using the AURORA model to help inform Council staff and regional stakeholder analysis.

The Council's 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.

Due to significant clean and RPS policies and less dependence on new baseload generation to meet growing loads, the market price forecast studies from the 2021 Power Plan scenarios consistently showed extremely large buildouts of new resources, especially solar generation outside the region. These buildouts implied a persistence of market fundamentals that seemed to be just emerging at the time of the plan's development, like significant renewable generation curtailment and negative pricing mid-day. This market update is an early look at how the plan work compares to current market behavior and highlights some of the data sources the staff uses to monitor this behavior for reference.

More Info: [Wholesale Power Price Forecast](#) from the 2021 Plan

Primer on the Wholesale Electricity Price Forecast

June 14, 2022

Power Committee

John Ollis

Leading into 2021 Power Plan: The Energy Landscape Changing

Many changes since the Seventh Power Plan release

- **Emissions reduction policies across WECC** resulting in:
 - Significant coal retirements
 - Large renewable builds
- Dramatic **decrease in price** for alternative resources:
 - Market prices are rapidly decreasing and frequently negative by ~2030
 - Renewable generation fixed costs have come down significantly
 - Natural gas generation fixed costs have come down significantly
 - Decrease in gas prices
- Meanwhile, **less low-cost energy efficiency**
- Increased renewable generation results in **dispatchability** becoming increasingly important

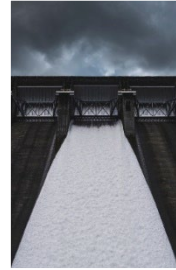


2021 Power Plan: Regional Resource Strategy



Renewables: >3.5 GW by 2027

- Significant renewable build recommended (>3.5 GW by 2027), due to low costs, being interruptible, and carbon reduction benefits. This build out will impact the transmission system.



Existing System: More flexibility

- Greater potential flexibility in the hydro system and the ability to more effectively use our thermal fleet to provide reserves is needed, collectively reducing regional needs and supporting the integration of renewables



Energy Efficiency: 750 aMW by 2027

- Significantly less acquisition than prior plan due to greater cost-competitiveness with other resources, not being dispatchable, and being sensitive to market prices



Demand Response: Low-cost capacity

- Products that provide highest value to the system are those that can be regularly deployed at low cost and with minimal to no impact on customer (e.g. DVR, TOU)

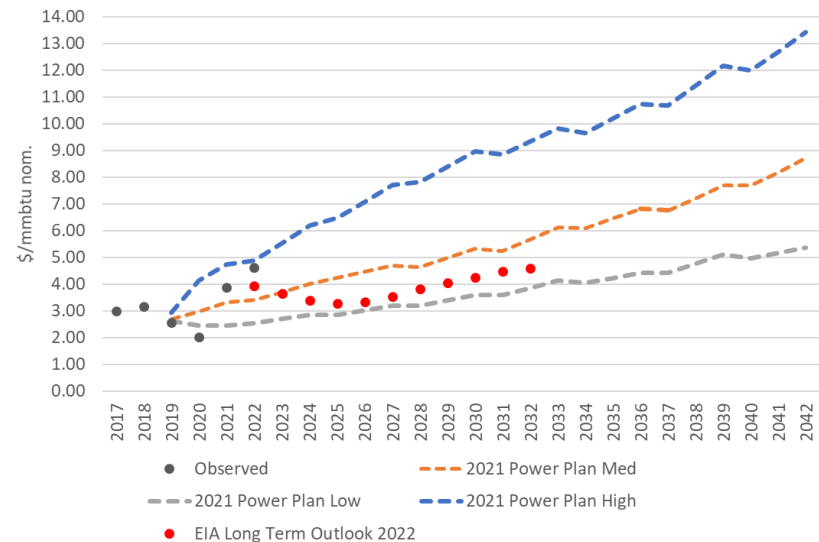
Note: Plan includes projected impacts of climate change on future loads, hydro availability, and temperatures

Changes During and After the Plan

- Changes in state policies resulting in a slight increase of emissions reduction policies
- Increase expectations of electrification demand throughout the WECC
- Supply chain issues in many sectors
- Fuel price uncertainty
- Updates in resource retirement schedules, coal to gas conversions and new online resources



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This is the First Step to Update Resource Strategy Check

- Update fuel prices, WECC demand forecast, existing resource retirements/additions and new resource availability to check to see whether plan assumptions on WECC-wide market are still reasonable.
- Use updated buildout implied by above assumptions to guide market supply and demand parameters in adequacy assessment.
- Use updates and buildouts to investigate resulting range of power prices.



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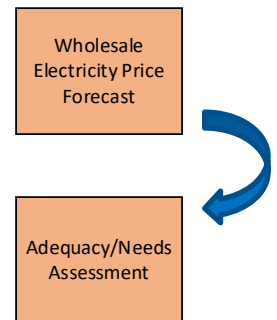
Checking Market Fundamentals and Adequacy of Resource Strategy of 2021 Plan

Extended Review of 2021 Plan Discussions in Anticipation of Deja Vu

2021 Plan Review: How Market Fundamentals Ties into Resource Adequacy

- Develop the market price forecast to allow updated fundamentals to inform the adequacy assessment
- Review: Council and staff iterated for several months in the 2021 Plan developing the wholesale electricity price forecast
 - WECC-wide builds and resulting market prices were surprising, despite seeing early indications things were moving in that direction
 - Clean policies were driving significant renewable builds
 - Council (and stakeholders) felt initial natural gas builds were too large, resulting in iterations that limited new natural gas
- This process led into the market supply available in the plan needs assessment.
 - Similarly, as we check the resource strategy the 2022 forecast will be used to inform the 2022 adequacy assessment

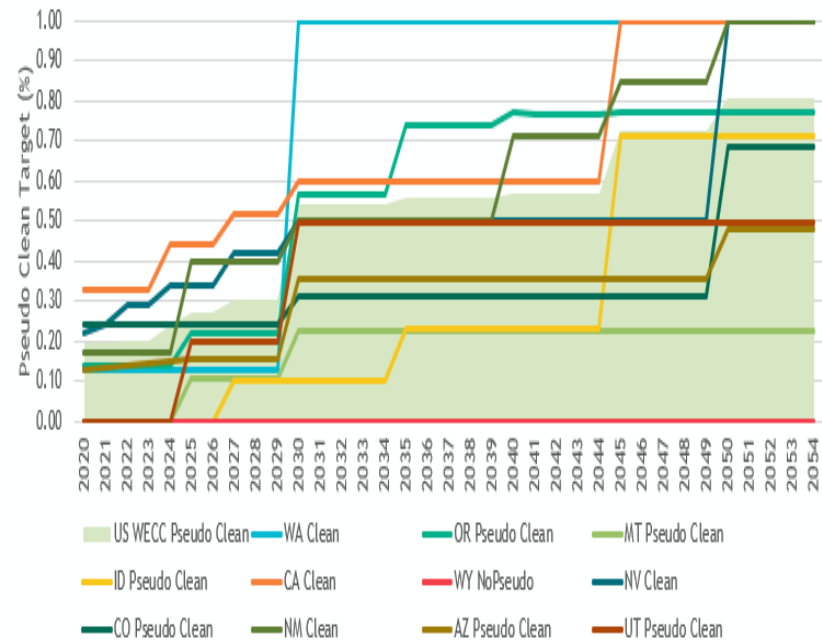
Understanding
Resource Needs
and Markets



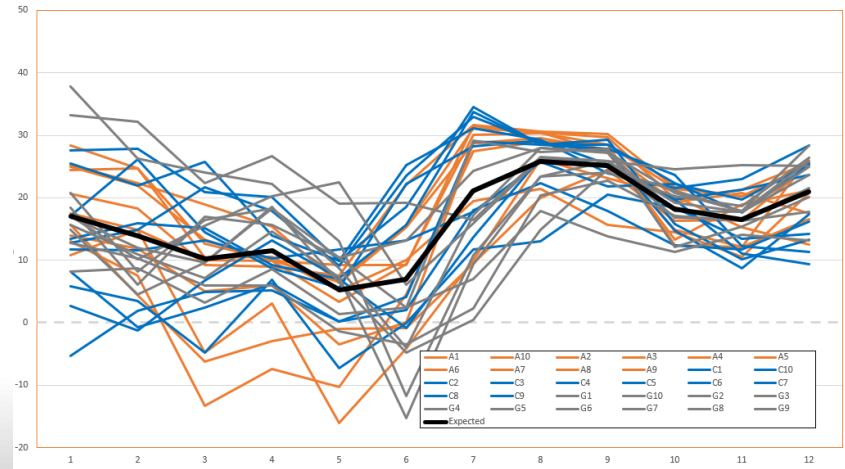
Two Main Steps in the Updated Forecast

1. Build to Load Growth/Reserve Margins and Policies
 - Main drivers of resource expansion throughout the WECC
2. Test different fuel prices and hydro conditions to get range of potential prices and avoided market emissions rates.

US WECC Pseudo Clean - Assuming 100% state sales (upd. Jul 2021)



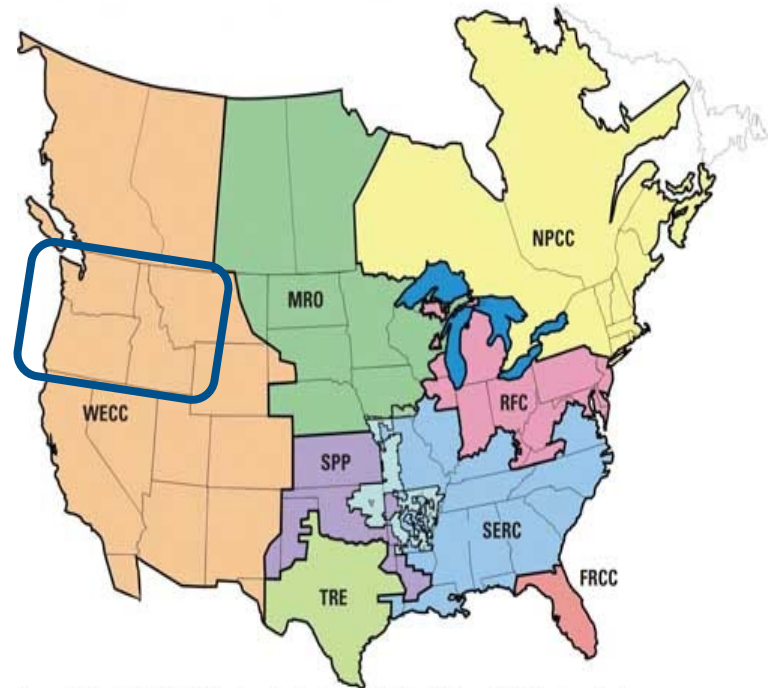
2026 Mid-C Prices by Hydro Condition (2016 dollars per MWh)



2021 Plan Review:

Much Discussion About Effect of Policies and Resource Buildout External to the Region

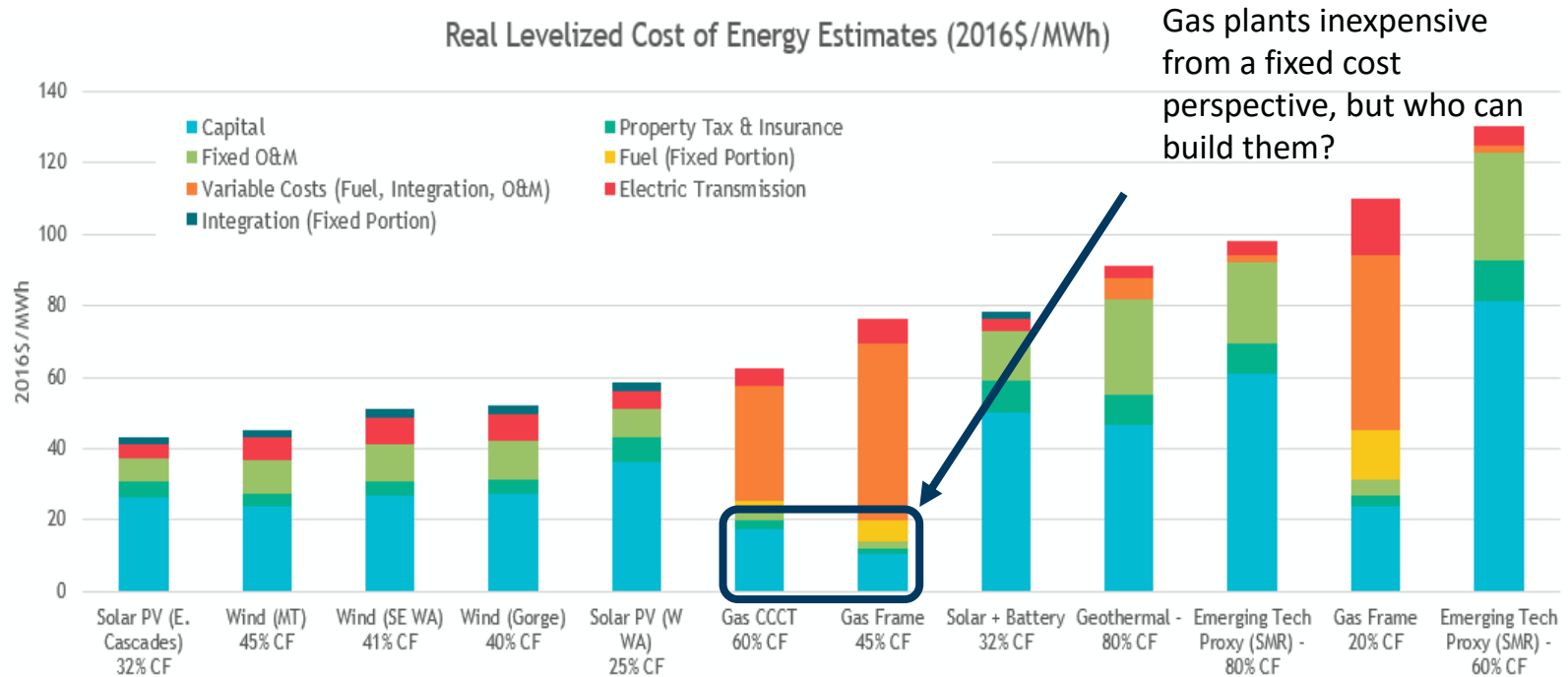
- In both the advisory committees and council meetings there was much discussion about the expectations of supply of the wholesale market outside the region.
- Main points of discussion:
 1. Limitations of new gas plan builds based on recent policies by states and local regulators.
 2. Size of renewable build to meet policies and planning reserve margins
 3. Interpretation of California/WECC policy related to electrification



Notes: FRCC = Florida Reliability Coordinating Council, MRO = Midwest Reliability Organization, NPCC = Northeast Power Coordinating Council, RFC = Reliability First Corp., SERC = SERC Reliability Corp., SPP = Southwest Power Pool, TRE = Texas Regional Entity, WECC = Western Electric Coordinating Council.

2021 Plan Review:

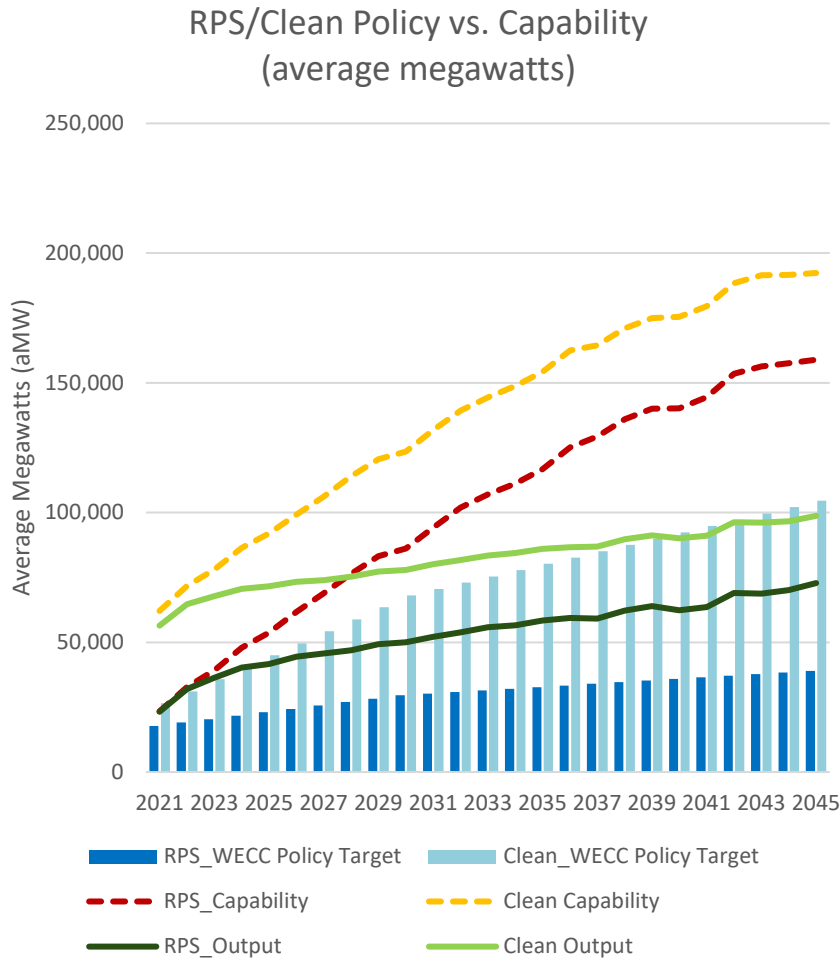
Reminder of Cost of Generating Resource Options



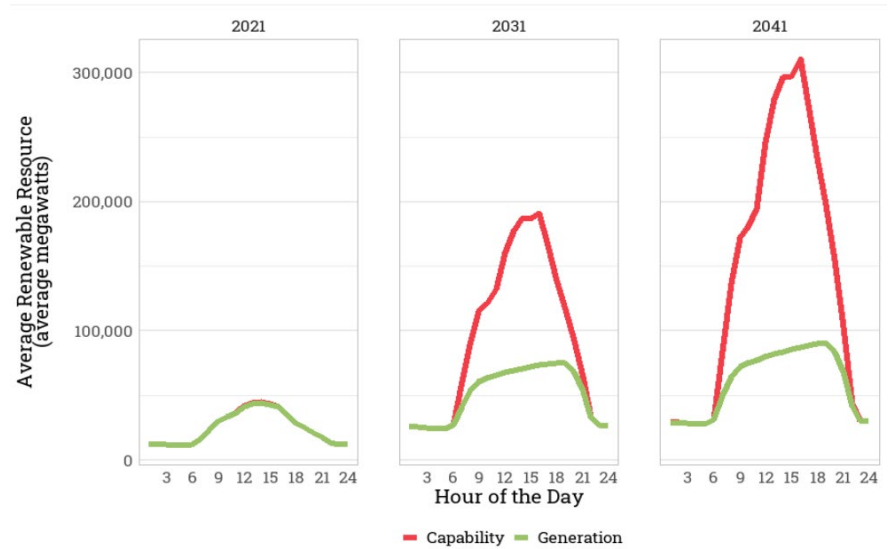
CF = average annual capacity factor (expected electricity output compared to maximum output available)

Supporting Materials: [LCOE](#)

2021 Plan Review: Building for Planning Reserve Margins Around Seasonal Peaks With Clean/RPS Resources Creates Surplus Energy During Some Times of Day and Some Seasons



Clean policies based on annual targets drive renewable builds throughout WECC creating surplus generation, renewable curtailment mid-day, low prices due to foregone credits for clean generation and subsequent operational challenges.



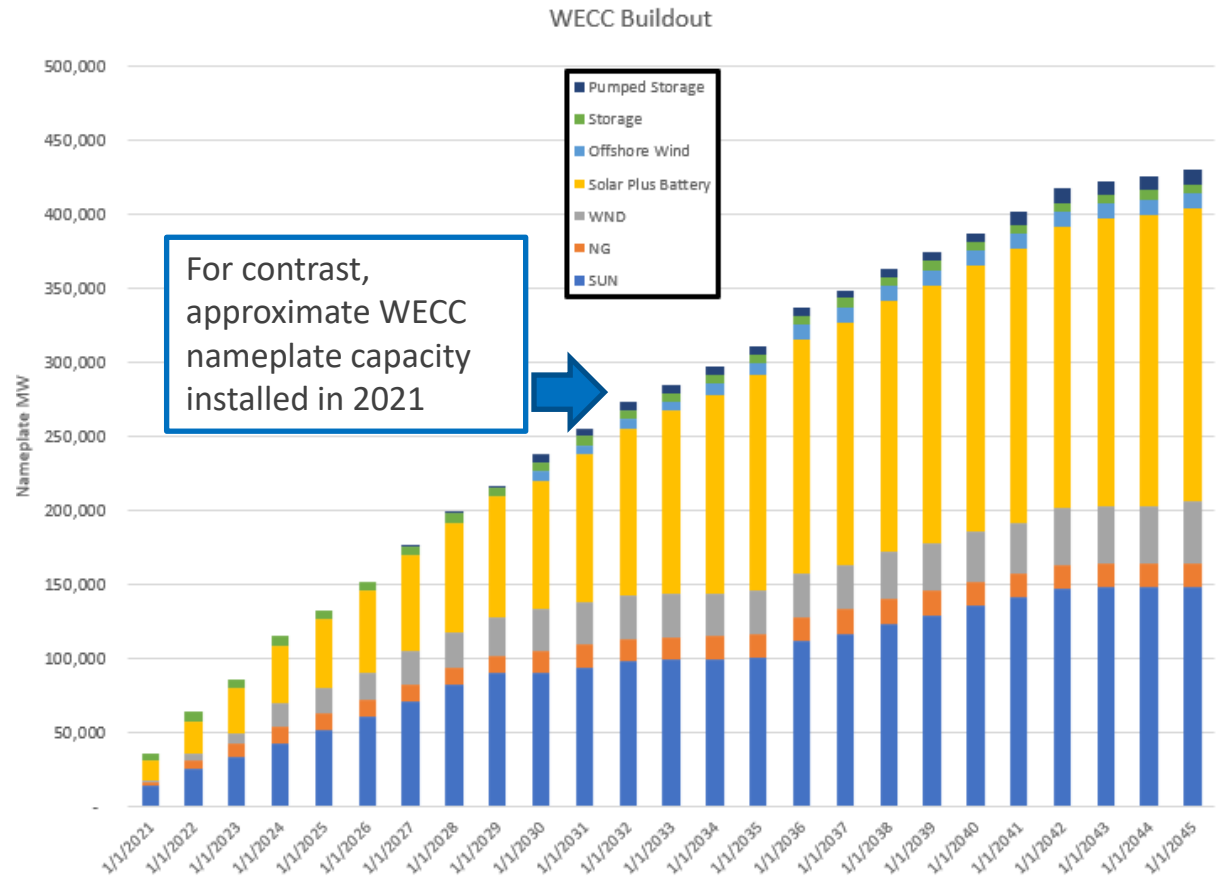
Supporting Materials: [Baseline Conditions, WECC](#)

2021 Plan Review:

WECC-wide Buildout of Projected New Resources (*baseline conditions*)

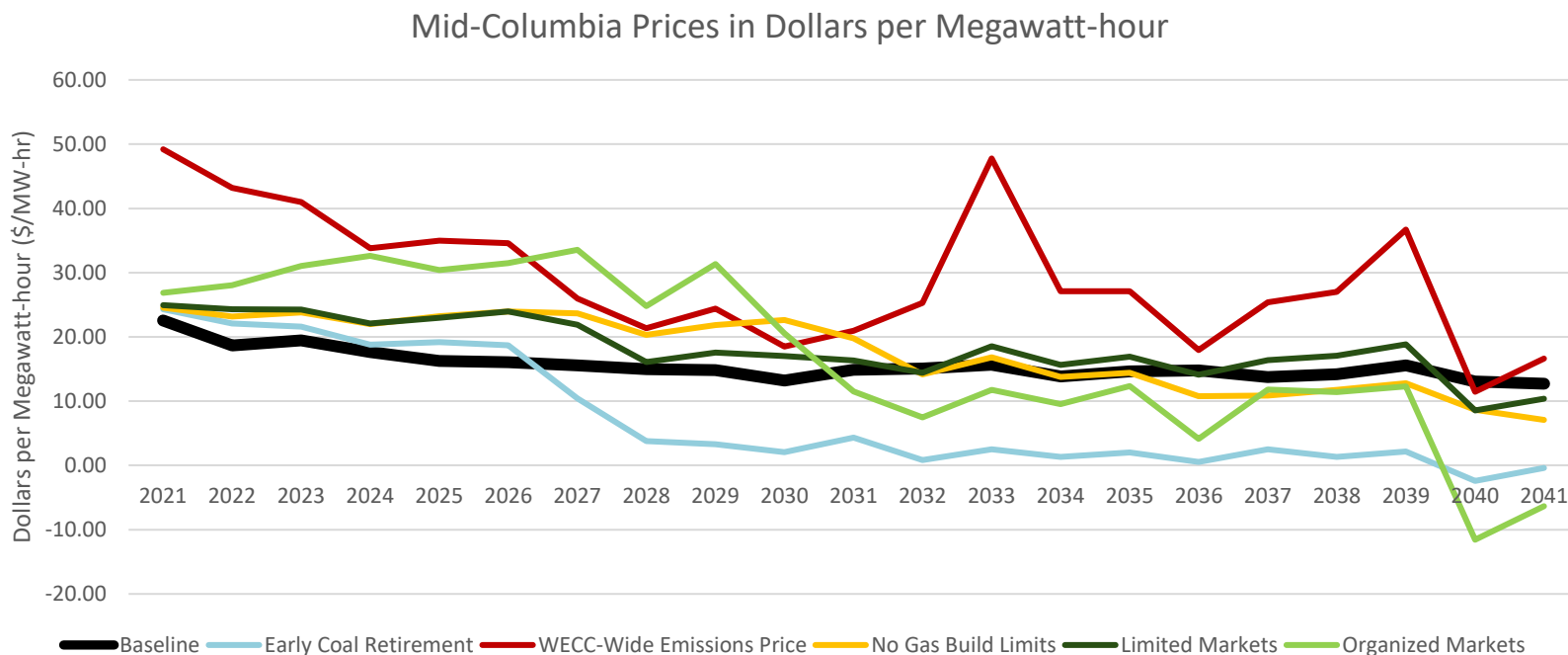
Adequate system throughout WECC, but due to renewable energy curtailment does not meet clean requirement in every year.

Key factors: Limitations on gas plant builds, planning reserve margins, clean policies



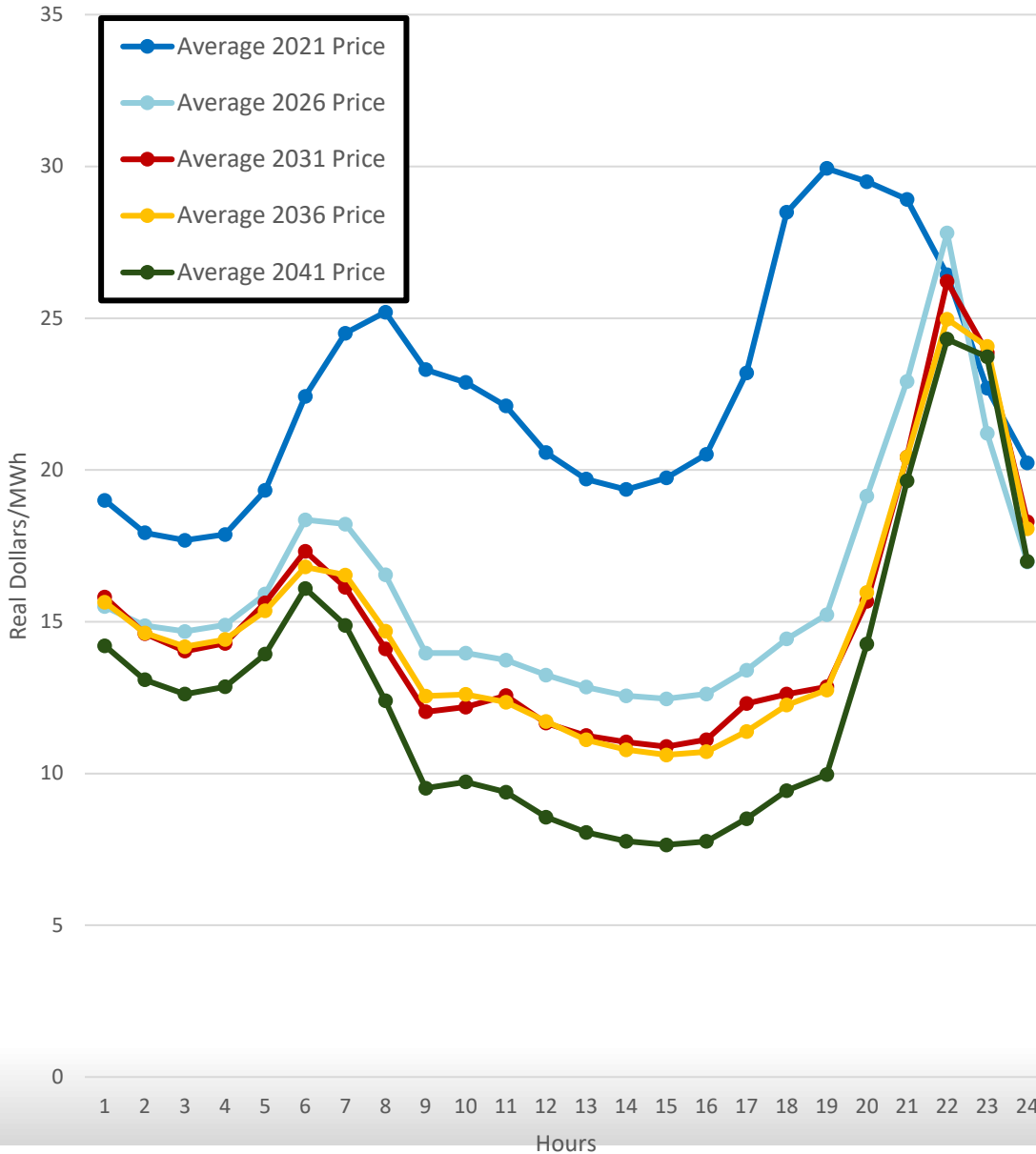
Supporting Materials: [Baseline Conditions, WECC](#)

2021 Plan Review: Annual Mid-Columbia Prices Decrease Over Time In All Scenarios



Supporting Materials: [Production Cost Simulation Results](#)

Mid-Columbia Average Hourly Prices
(2016 Real Dollars Per Megawatt Hour)



2021 Plan Review:
Gas and Coal Plants Consistently Setting Market Price During Morning and Evening Ramp Hours.

Renewables Often Marginal During Midday and Overnight by 2040's

Supporting Materials: [Production Cost Simulation Results](#)

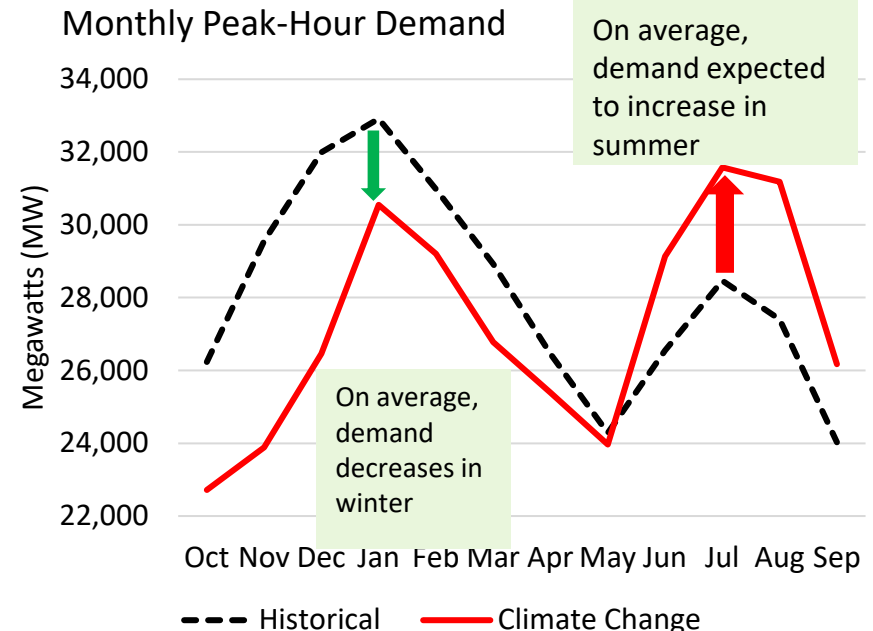
2021 Power Plan Resource Needs Different Than Previous Plans



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- Offsetting dynamics drive the resource adequacy
 - Resource retirement both in the region and external
 - Policy-driven resource additions external to the region cause massive surpluses during certain times but supply challenges during others
- Climate change effects timing of regional peak demand and hydro runoff
 - Northwest shifting to summer peak needs
 - More precipitation falling as rain in the winter tends to cause earlier runoff and drier summers.

Illustration of Climate Change Shift in
Monthly Peak-Hour Demand



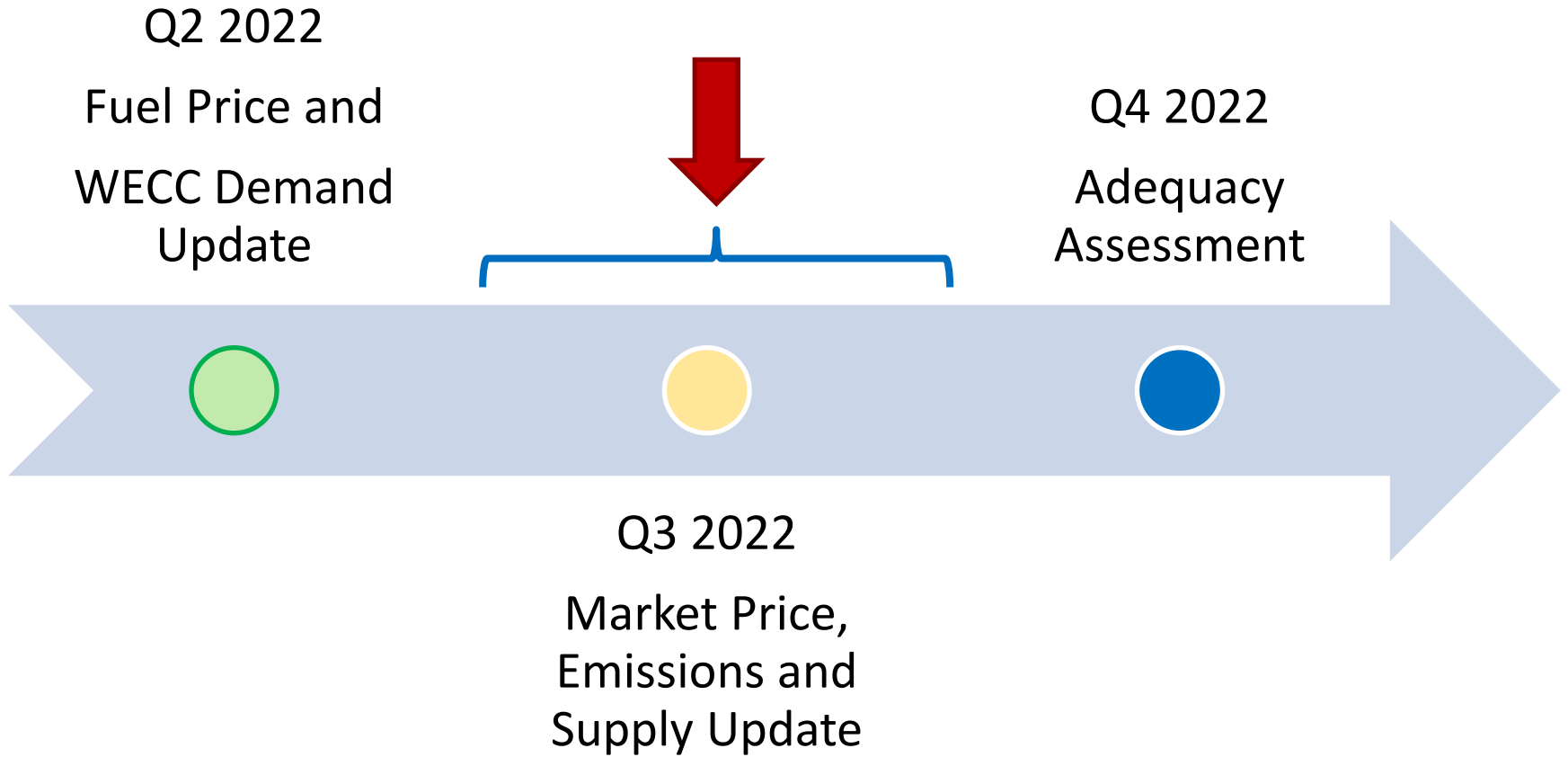
Supporting Materials: [Resource Adequacy Assessment](#)



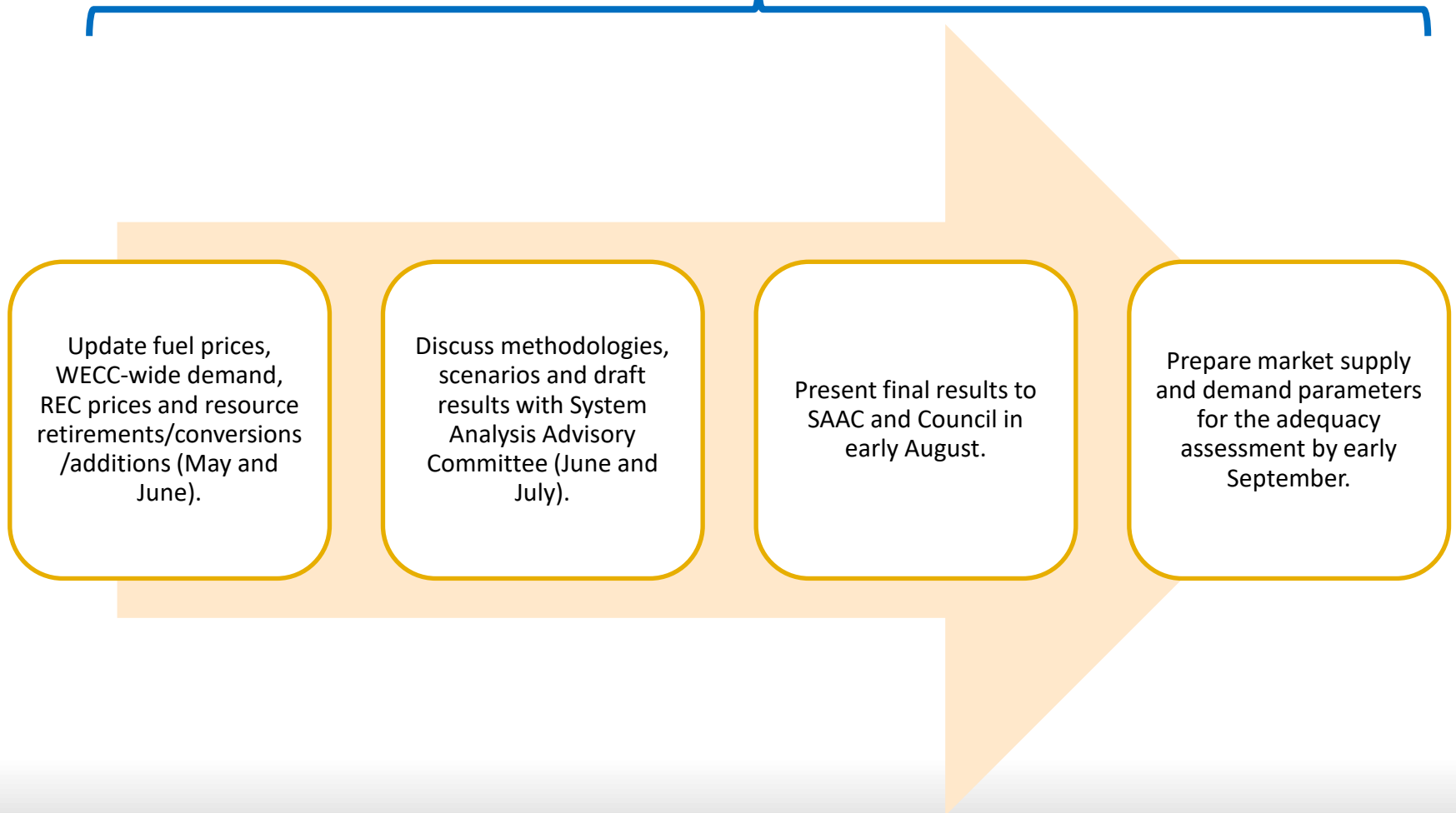
Process to Update Forecast

How we intend to update and use the market price forecast

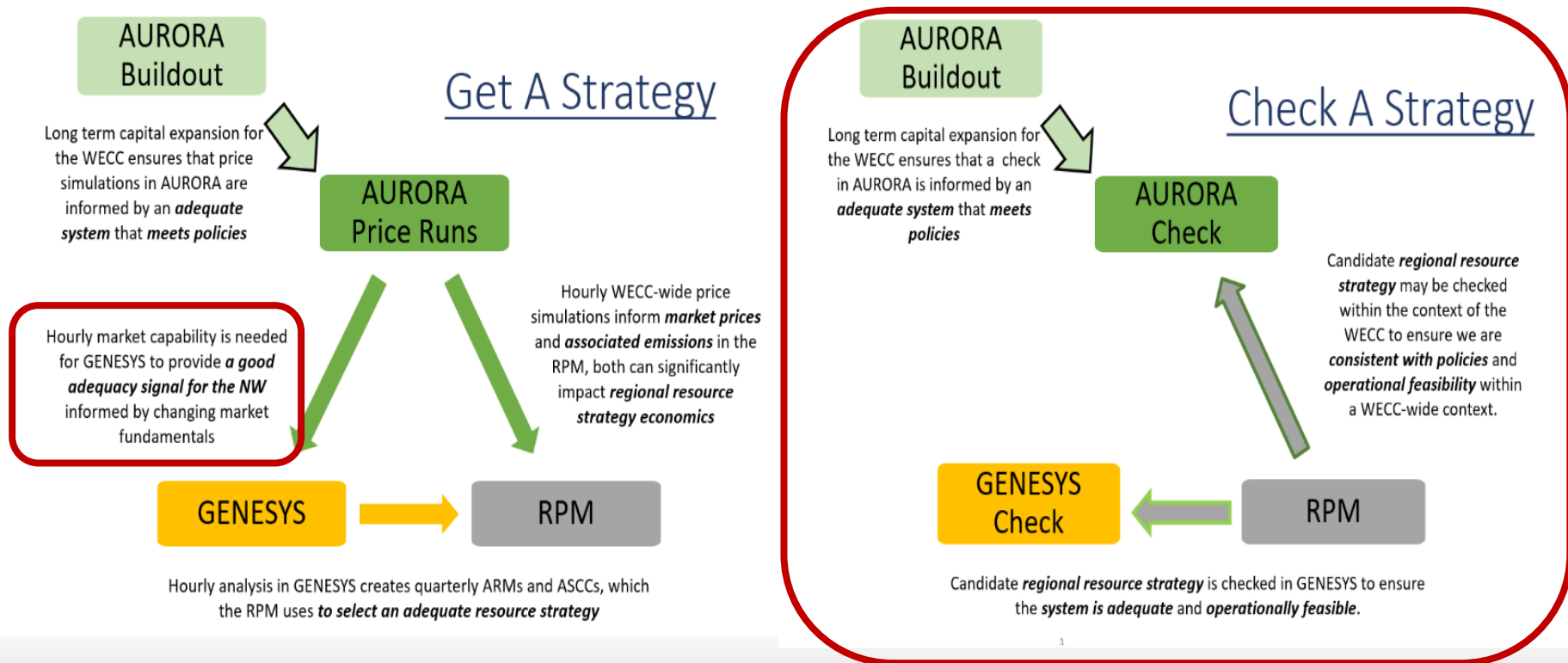
2022 Timeline



High-Level Market Price Forecast Project Plan



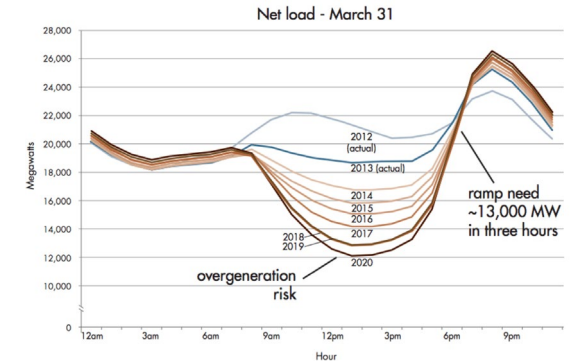
Using Power System Models and the Updated Inputs to Continue to Check a Proposed Resource Strategy



Establish Market Supply Curve for GENESYS

What do we do?

- Convert long-term buildouts (reflecting existing policies) in AURORA to a reasonable supply curves for GENESYS.
- Speeds up adequacy runs by simplifying external to the region economic calculations to supply blocks.
 - Still considers flexibility and operations external to the region via seasonal shape of electricity price blocks
 - Economic signals external to the region will be considered in adequacy analysis



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Why do we do it?

- Scheduling and dispatching all the plants in the WECC in GENESYS would likely increase run time without gaining much more fidelity than we get from AURORA.
 - Staff is testing inputting WECC-wide renewable resources in GENESYS, but for now, this is staff methodology
- Council's staff focuses primarily on resources in the region when considering planning and adequacy (less focus on data external to the region)
- And hydro scheduling and dispatch under constraints is computationally intensive, but a key focus for the Council

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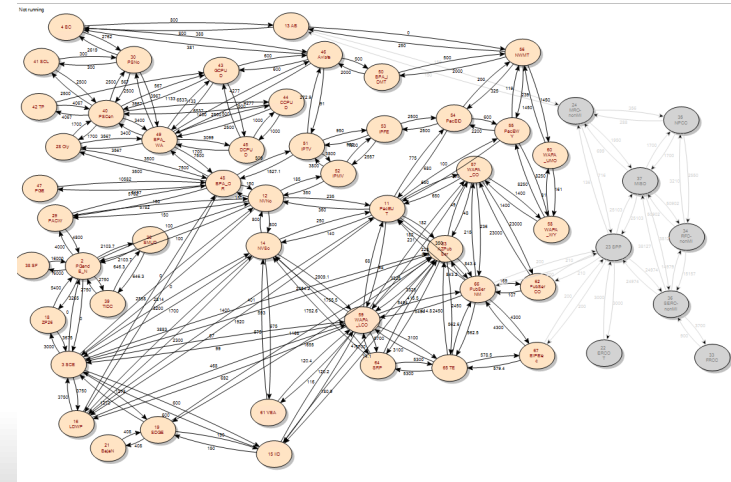
High-Level Overview of AURORA Capabilities

Two Use Cases for Council Work

- Long Term Capital Expansion
 - Building to load resource balance plus planning reserve margins
 - Meeting policy constraints
- Production Cost Model
 - Simulates thermal unit commitment, dispatch of all resources and zonal transmission operation based on least cost of producing power and providing reserves
 - The power price in each zone set by marginal unit.



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Adequacy Assessment Annual Check Up on Plan Strategy

- Resource strategy **is included** in adequacy assessment (unlike the needs assessment).
- Make sure the resource strategy leaves the region with an adequate system with enough time for regional entities to respond (traditionally ~5 years).
- Will likely include updates on the following:
 - Fuel prices
 - Market supply/price
 - New existing, sited and licensed resources
 - Resource Retirements
 - WECC loads (as necessary)



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Update from June 8th System Analysis Advisory Committee

Notes on member feedback from meeting

- Staff proposed scenarios that would help inform the adequacy assessment, spurring conversation on how much or what market builds should be assumed in an adequacy assessment.
- Most feedback generally focused on questions exploring how market fundamentals will feed into the adequacy assessment
 - *Noted that traditionally adequacy assessments consider only regional resources that are existing or “sure” to be built.*
 - *When policies imply a certain number of new builds for compliance, how should we plan for those in an adequacy context?*

Setting up Scenarios to Inform Adequacy Assessment

Staff Proposal

Set up scenarios that will help the RAAC frame market risk in 2027 time period

- Plan Scenarios:

- Baseline
- Limited Markets (No PRM enforcement, policy compliance) ←

- New Scenarios:

- Increased Electrification Throughout WECC (High WECC Demand) ←
- Supply chain issues (delay and limit early builds)
- Alternative compliance (less incentive for renewable builds early)
- *CA/Desert SW Drought (no or low hydro)*
- *Gas Pipeline Issues Desert SW (gas plants not available)*
- *No new WECC builds (per SAAC/RAAC request)* ←

Scenarios in black require a buildout, those in red do not

SAAC Discussion

Questions?



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Explore the 2021 Power Plan and Supporting Materials



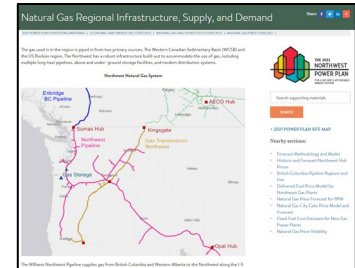
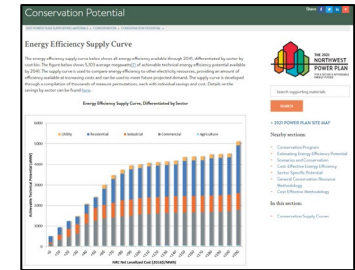
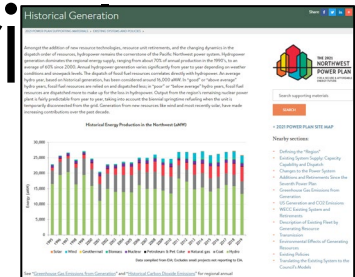
<https://www.nwcouncil.org/2021-northwest-power-plan>



[2021 Power Plan document \(pdf\)](#)



[Supporting Materials Site Map](#)



Over 100 pages of supporting documents, datasets, and graphics