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

March 4, 2025

MEMORANDUM

TO: **Council Members**

FROM: **John Ollis, Manager of Planning and Analysis**

SUBJECT: **Primer on Market Availability Study**

BACKGROUND:

Presenter: John Ollis

Summary: This presentation will review the process used to create the market availability forecast and how that process ties into the Ninth Power Plan analysis.

Relevance: The wholesale market availability study develops a 20-year set of out of region market supply inputs that, in conjunction with out of region load, can be used in regional resource strategy analysis. One of the key processes in developing an out-of-region market supply is simulating a capital expansion of new resources that coupled with the existing system is sufficient for meeting needs and obligations for outside the region load serving entities. This presentation will focus on the setup and use of those simulations.

Workplan: B.3.1. Develop WECC wide market availability studies to inform scenario modeling.

Background: The Council has periodically updated its wholesale market study using the AURORA model to help inform Council staff and regional stakeholder analysis. The Council relies on the System Analysis Advisory Committee to help provide expert feedback on market fundamentals and power system modeling assumptions related to the market availability and price studies.

The Council's forecast is a Western Electricity Coordinating Council (WECC)-wide fundamentals-based forecast that reflects power system operation, relationships of supply and demand for, and transmission of electricity. In addition, understanding the underlying of wholesale electricity prices in this region requires an understanding of the operating characteristics of potential future and existing supply and demand-side resources, as well as unit commitment, ancillary services, fuel prices, hydro, wind and solar conditions both in this region and out of the region. 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.

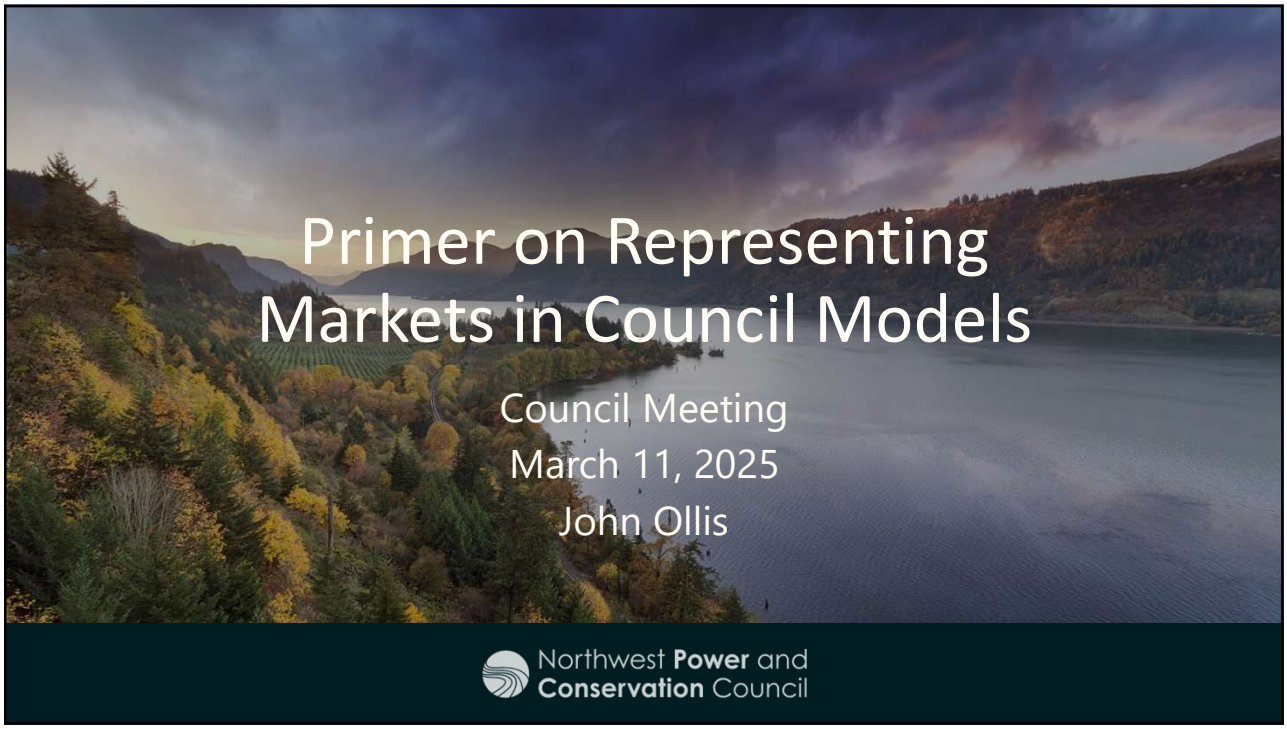
Due to significant clean and Renewable Portfolio Standard policies and less dependence on new baseload generation to meet growing loads, the market price forecast studies from the 2021 Power Plan scenarios to today have consistently shown extremely large buildouts of new resources, especially solar generation 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. We have continued to monitor these fundamentals in the subsequent years since the plan and have discussed the developments with the Council periodically.

More info: Previously, the information about market availability, as determined through the AURORA capital expansion modeling, was primarily passed to the regional strategy modeling as power prices and avoided emissions rates. Thus, the information related to the buildout outside the region was presented as part of the wholesale price forecast. See the buildout sections in the following presentations for historical context.

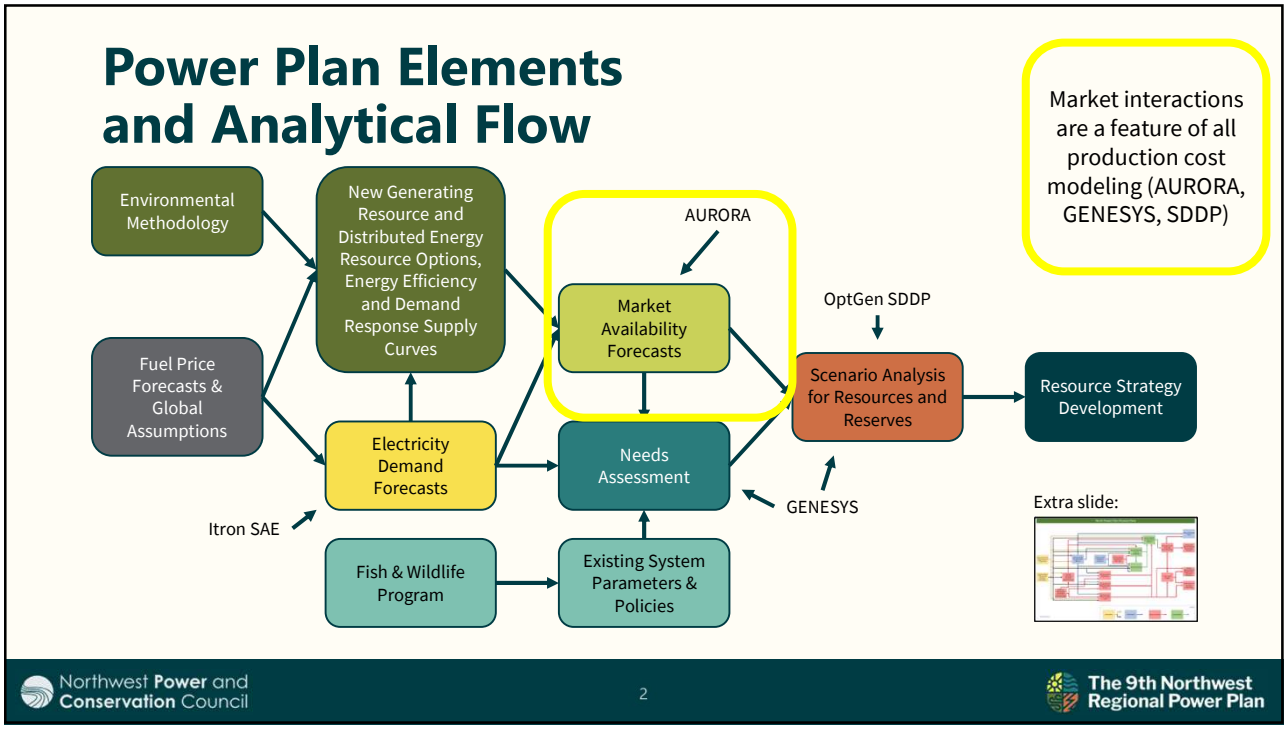
Wholesale Power Price Forecast from the 2024 Market Study Update

Wholesale Power Price Forecast from the 2023 Market Study Update

Wholesale Power Price Forecast from the 2021 Plan


Primer on Representing Markets in Council Models
Council Meeting
March 11, 2025
John Ollis
Northwest Power and Conservation Council

1


Power Plan Elements and Analytical Flow
Market interactions are a feature of all production cost modeling (AURORA, GENESYS, SDDP)
Environmental Methodology
New Generating Resource and Distributed Energy Resource Options, Energy Efficiency and Demand Response Supply Curves
AURORA
Market Availability Forecasts
OptGen SDDP
Scenario Analysis for Resources and Reserves
Resource Strategy Development
Fuel Price Forecasts & Global Assumptions
Electricity Demand Forecasts
Needs Assessment
GENESYS
Extra slide:
Itron SAE
Fish & Wildlife Program
Existing System Parameters & Policies
Northwest Power and Conservation Council
2
The 9th Northwest Regional Power Plan

2

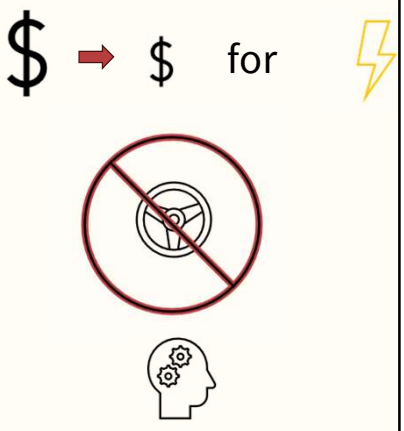
Agenda

- Why Do We Care About Markets?
- Wholesale Power Markets Review
- Market Availability Forecast Review
- Initial Methodology for Incorporating into Council Analysis

3

Why Do We Care About Markets In The Analysis?

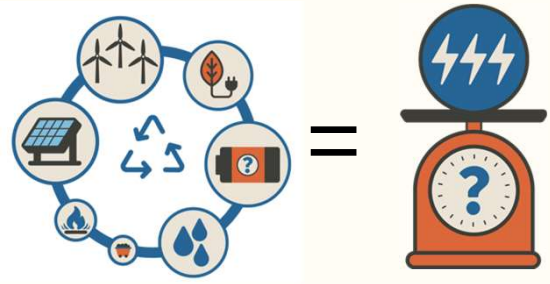
- The variable cost/value of a potential new regional resource is heavily influenced by the price and volume of wholesale market resources.
- Our region does not control how other entities in the western grid might choose to meet their loads.
- Having an understanding of future diversity of resources and loads throughout the western grid can facilitate allow a more nuanced approach to regional resource strategy analysis.

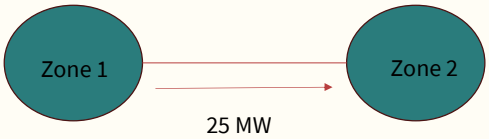


4

Wholesale Power Markets Review

- Utilities are **instantaneously** trying to match power generation to the customer demand for that power.
- Sometimes a neighboring utility/power producer will be able to offer power for a lower cost than the utility's generators can provide it. This can result in a market transaction.
- Why do wholesale electricity markets exist?
  - Primarily to exchange power to decrease overall power costs
- We simulate the net result of all these market transactions and supply/demand (fundamentals) in AURORA over the whole Western Interconnect for 20 years
- For adequacy studies we traditionally limit market reliance.
- For portfolio analysis, the market availability is limited by the physical limits of the system and market fundamentals.



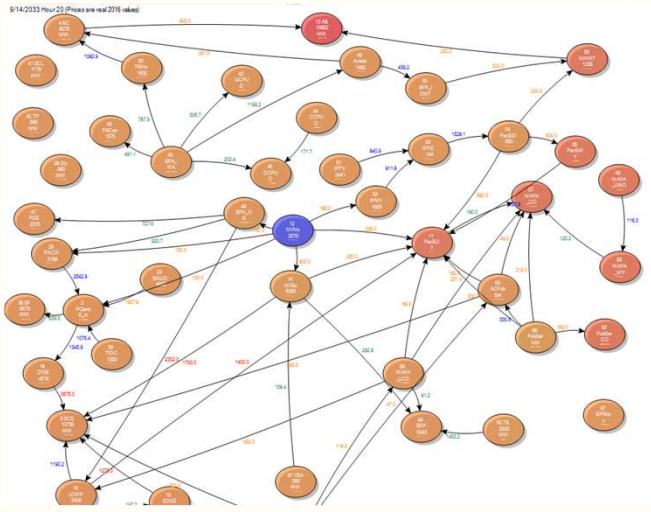


5

Council's AURORA Setup for Market Studies – What Does AURORA simulate?

Capital Expansion and Production Cost Modeling in AURORA

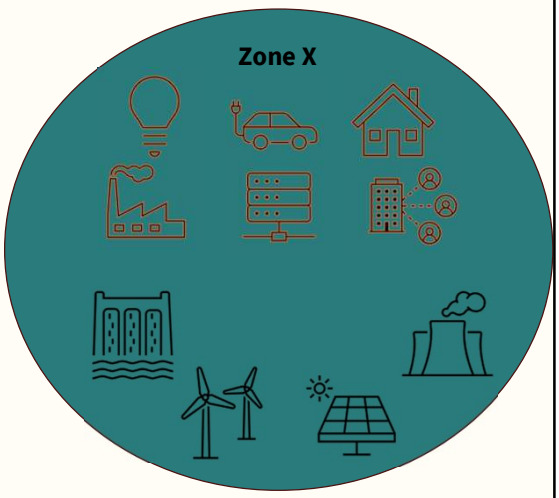
- Uses a simplified zonal (transport) representation of the wholesale power transactions on the western electric grid
- Each **zone** represents a **set of demands** and the **set of generation (supply)** that can meet that demand without incurring additional wheeling charges or transmission losses.



6

Wholesale Power Markets Players

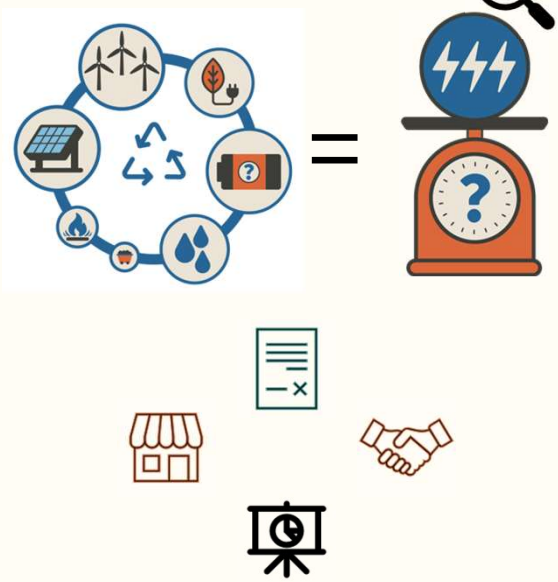
- **Demand**: Load Serving Entities
  - Entity granted authority by local or state law, regulation or franchise to serve electric retail load by generating or engaging in wholesale energy transactions.
- **Supply**: Wholesale Power Marketers
  - Independent Power Producers
  - Investor Owned Utilities
  - Public Utilities
  - Financial Institutions



7

Future Right to Generation

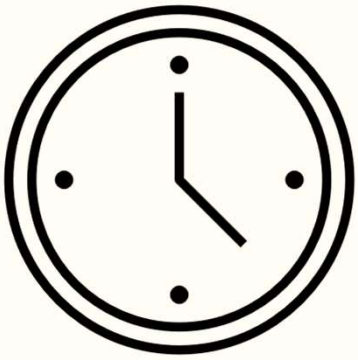
- Generation of power is instantaneous and meets load according to the laws of physics.
  - **Planning**
  - Purchase Additional Physical Assets/Long Term Contracts
  - **Purchase/Sell on Wholesale Market**
- Coordinating future power and transmission ahead of time facilitates enough power generation and transmission capability to meet forecasted demand.
  - Interchange scheduling
  - Balancing reserves



8

Interchange Scheduling

- Electronic Tagging (e-tag)
  1. All Control Areas involved
  2. MW amount of the schedule
  3. Starting and ending times of schedule
  4. Point of receipt/delivery
  5. Terms of interruption and reserve responsibility
  6. Ramp duration (usually 5 to 20 minutes)
  7. Effective Time (usually 15 minutes to an hour)
- Usually implemented at least before previous full hour



9

Transmission Path

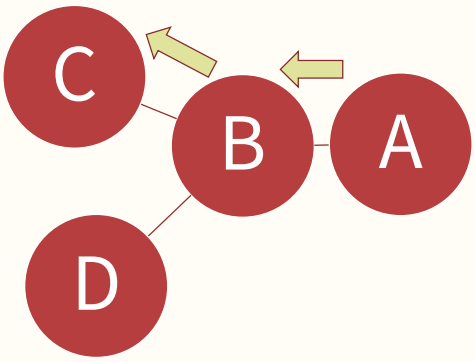
- A transmission path may consist of one or more parallel transmission elements.
- The transfer capability of the transmission path is the maximum amount of actual power that can flow over the path without violating reliability criteria.
- To schedule power from the Control Area (CA) containing the generation to the CA of delivery rights, transmission service on the path connecting the CAs must be obtained.

10

Scheduling Example

- E-tag for one hour ending 11 am (HE 1100)
  1. Some generator in A, B intermediary, some delivery point in C
  2. 25 MW scheduled
  3. Schedule time (10:00 am to 11:00 am)
  4. Delivered to Control Area C
  5. Terms of interruption and reserve responsibility
  6. Ramp 20 minutes from 9:50 am to 10:10 am
  7. Effective Time 10:00 am
- Transmission service for 25 MW is obtained from control areas A, B and C to the point of delivery.

25 MW **scheduled** to flow from A to C

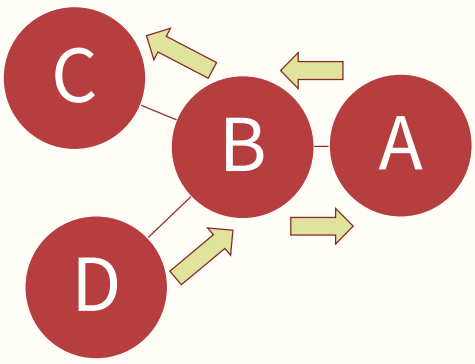


11

Another transaction

- E-tag for one hour ending 11 am (HE 1100)
  1. Some generator in D, B intermediary, some delivery point in A
  2. 50 MW scheduled
  3. Schedule time (10:00 am to 11:00 am)
  4. Delivered to Control Area A
  5. Terms of interruption and reserve responsibility
  6. Ramp 20 minutes from 9:50 am to 10:10 am
  7. Effective Time 10:00 am
- Transmission service for 50 MW is obtained from control areas D, B and A to the point of delivery.

25 MW **scheduled** to flow from A to C, and 50 MW **scheduled** to flow from D to A

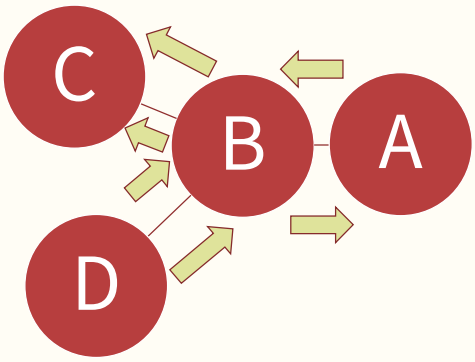


12

Yet another transaction

- E-tag for one hour ending 11 am (HE 1100)
  1. Some generator in D, B intermediary, some delivery point in C
  2. 25 MW scheduled
  3. Schedule time (10:00 am to 11:00 am)
  4. Delivered to Control Area C
  5. Terms of interruption and reserve responsibility
  6. Ramp 20 minutes from 9:50 am to 10:10 am
  7. Effective Time 10:00 am
- Transmission service for 25 MW is obtained from control areas D, B and C to the point of delivery.

25 MW **scheduled** to flow from A to C,
50 MW **scheduled** to flow from D to A,
25 MW **scheduled** to flow from D to C

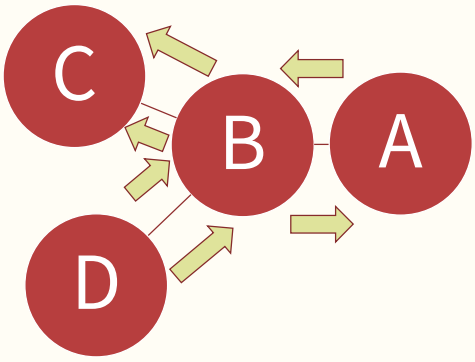


13

What happens HE 1100?

- Control area A is a net importer (25 MW)
- Control area B is an intermediary (for 25 to 100 MW depending on the path)
- Control area C is a net importer (50 MW)
- Control area D is a net exporter (75 MW)

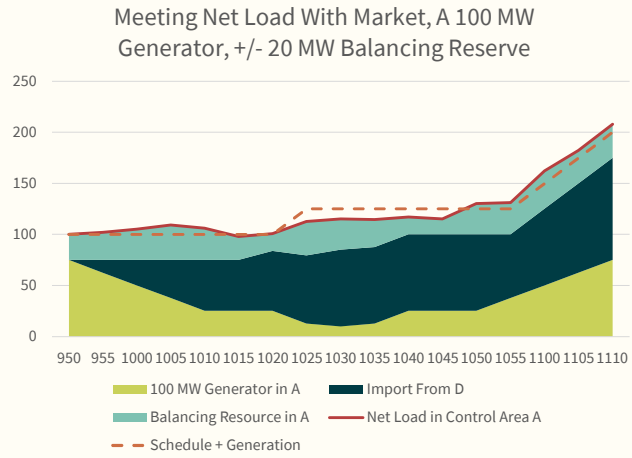
25 MW **scheduled** to flow from A to C,
50 MW **scheduled** to flow from D to A,
25 MW **scheduled** to flow from D to C



14

Balancing Reserves In a Portfolio (since Energy Imbalance Market)

- Inside the scheduling time period (15 minutes) the market is not available.
- LSE's and variable energy resource schedulers must often contract for balancing services and/or hold back reserve capacity to account for intra-schedule variability to alleviate any supply and demand differences.



15

Forward Power Contracts

Forward Contract Lengths

1. Long-Term:(5 to 20 years)
   - Power Purchase Agreements
   - Usually in Integrated Resource Plans
2. Term and/or Mid-Term (1 to 5 years)
   - Often for hedging financial risk*
3. Current Year
   - Seasonal
   - Balance of Month
   - Preschedule
   - Real-Time

*See extra slides for discussion on hedging

DA Bilateral Markets

By morning of the day-ahead…
- Block trades on long term transmission rights and incremental transmission

Day Ahead Market

By noon of the day-ahead…
- CAISO, EDAM, M+ clear
- Hourly trading on intertie and long-term transmission rights

Intra-Day Markets

Afternoon of day-ahead to hour-ahead…
- Bilateral trades on remaining transmission

Intra-hour and Real-Time

Within the hour to real-time…
- CAISO, WEIM, WEIS trading of economic energy
- Transmission released in WEIM and WEIS
- Real time balancing in balancing authority areas

16

Review of life on the trading floor

Scheduling transactions up to the hour…

- **Long-term, mid-term, term and balance of month trading**
- **Preschedule trading**
  - Trading for the next day
  - Mostly on-peak and off peak blocks of power
  - 25 MW increments
  - Change position per risk appetite
- **Real-time trading**
  - 24 hours to 30 minutes before scheduling time period
  - Less liquidity, more volatile pricing
- **Dispatch**
  - Scheduled generation and balancing reserves ensure power supply meets demand instantaneously.

volume

volume

AURORA mostly takes the perspective of the final net volume after preschedule/real-time transactions.

17

Summing Up

- Considering these market fundamentals in AURORA over the whole Western Interconnect for 20 years. In practice, new resource builds happen for the following reasons:
  1. Economics of supply and demand
  2. Adequacy
  3. Policy obligations
- We assume all builds outside the region are for outside the region loads and incorporate those out-of-region resources into the wholesale market availability

18

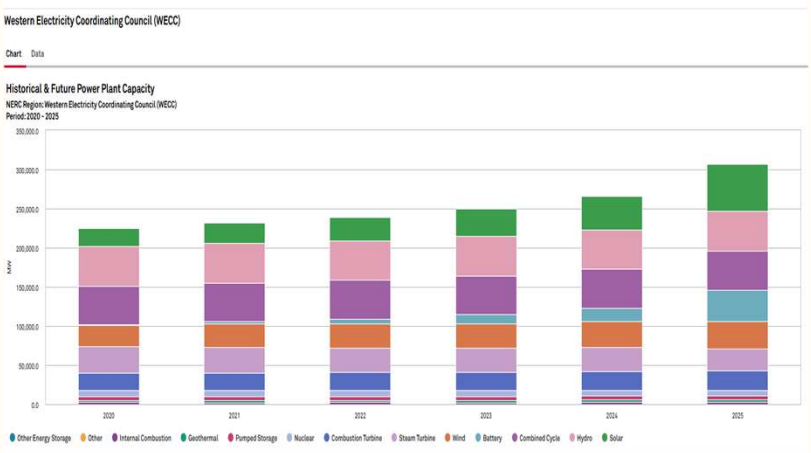
How is The Study Performed?
Data Updates

Update Existing System

- State, Municipal, Local and Utility Policies and Goals are met on a WECC-wide basis
- Hydro capability in NW limited by daily max and min and monthly energy limits informed by GENESYS
- Updates to loads, existing resources, fuel prices, transmission capabilities
- Update, if appropriate planning reserve margins for each operating pool

Update New Potential Resources

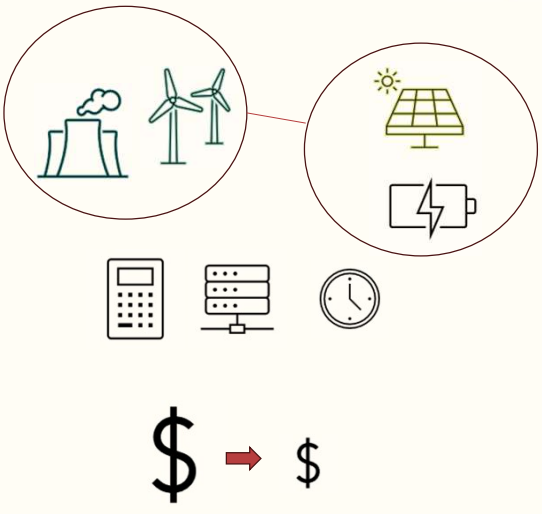
- Update costs, availabilities and parameters



19

How is The Study Performed?
Least Cost Buildout

1. Simulate a set of capital investment decisions (new resource acquisitions) throughout all parts of the WECC.
2. Calculate the total fixed and variable costs of those decisions. This involves simulating the all the net market transactions and operations of resources in the WECC over 20 years.
3. Iterate until finding the set of capital investment decisions throughout the WECC that have the least costs over the 20 years.



20

Discuss Buildouts with Advisory Committees

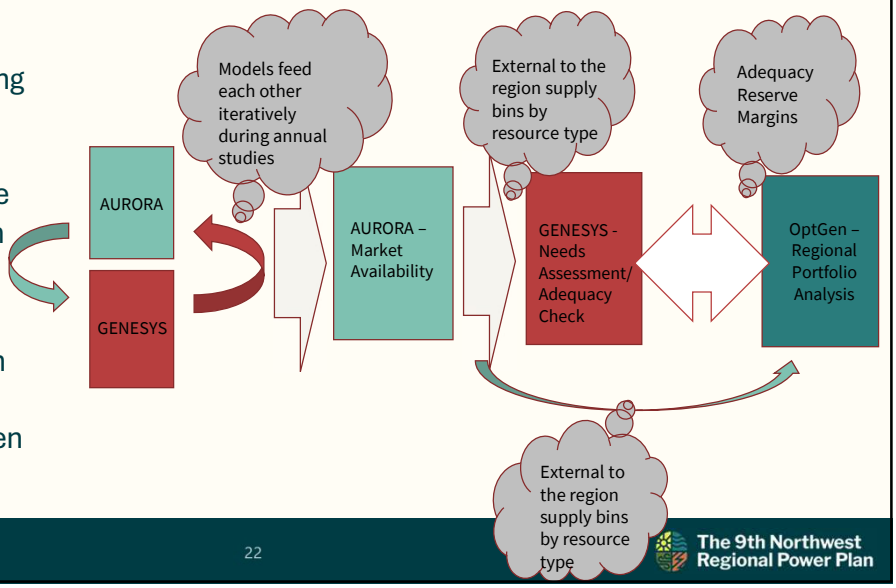
Main points of discussion since 2021 Power Plan:

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 of loads
4. Number of resource types available for builds later in study

21

How Will the Market Study Be Used in the Plan?

- Council staff modeling strategy for using an iterative approach to modeling to guide the analytics in the Ninth Power Plan
- This is similar but simplified in this plan due to different capabilities of OptGen



22

Review: Proposed Plan Scenarios and Analysis

Priority Scenarios		Other Analytical Interests	
New Resource and Transmission Risk Scenario	**Hydro Operations Flexibility Scenario**	**Extreme Weather Analysis**	**Load Growth Uncertainty Analysis**
Broad scenario to explore uncertainty around resource availability, resource costs, and transmission availability	Exploring the implication for resource needs with varying hydro operations impacting the flexibility of the hydro system	Include extreme weather futures across all scenarios and using the results for focused exploration of this risk area	Include high load futures across all scenarios to inform risks of this uncertainty (including data centers, decarbonization loads, etc.)

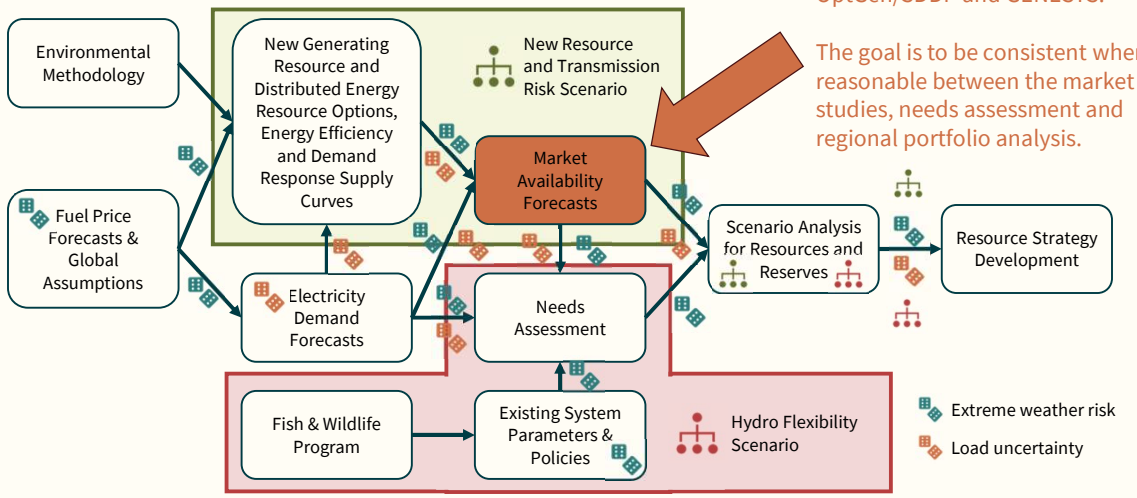
Note: After more staff discussion, our proposal is to ensure appropriate model tuning to reflect other elements of operational flexibility

23

How These Questions Flow in Our Analysis

Currently planning multiple WECC buildouts to inform different out of region market supplies for different sensitivities also tested in OptGen/SDDP and GENESYS.

The goal is to be consistent where reasonable between the market studies, needs assessment and regional portfolio analysis.



24

25

Power Price Hedging

- Many wholesale power market transactions are financial (more liquidity from banks).
- Fixed for floating swap
  - Trade a fixed price of the underlying for an index (floating) price.
  - Financial fixed contract matched with index/spot purchase of power gives purchaser a virtual forward contract on power (locks in power price).

26

Fixed for Floating Swap Example

Utility hedges for price risk

Buy 25 MW a few months ahead of time for hour ending 2100 on 3/14/17 hour 10 am to 11 am at $20 per MWh in early March, from Bank X

Utility buys physical power on spot market.

At 9:20 pm on 3/14/17, buy 25 MW of power at $23 per MWh from a power producer for the 10 pm to 11 pm hour.

Utility gets 25 MWh * 20 $ per MWh = $500 at and the bank gets 25 MWh * 23 $ per MWH = $575 which translates into a $75 loss for the bank.

This transaction is like if the utility made a physical power purchase a few months ahead for $20 per MWh.

Increases Liquidity of Financial Market

- Disaggregation of price and physical power delivery increases liquidity.
- Banks and financial institutions don't want physical power, but want to make financial bets on the price of power.
- Utilities want to hedge price volatility for customers.
- Financial liquidity concerns are exchanged for adequate physical supply concerns.