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

June 6, 2023

MEMORANDUM

TO: **Power Committee**

FROM: **Jennifer Light, Director of Power Planning**

SUBJECT: **Bonneville's 2024 Resource Program**

BACKGROUND:

Presenter: Ryan Egerdahl, Manager of Long Term Power Planning, Bonneville Power Administration

Summary: Bonneville recently started working on its upcoming Resource Program to be completed in fall of 2024. Bonneville's resource program is an analysis of potential system needs and resources available to meet those needs. Ryan Egerdahl will join the Power Committee to provide an overview on this effort, highlighting anticipated analysis and changes in the approach. Ryan will also speak to the timing of this effort as it connects to other efforts at Bonneville, namely the ongoing post-2028 contract negotiations with customers.

Relevance: The Resource Program is an analysis by Bonneville of its potential system needs and the resources available to meet those needs. The Resource Program is informational and not a decision-making process, nor a decision document, but the results do inform Bonneville's resource acquisition strategies.

The upcoming Resource Program is anticipated to be complete in the fall of 2024. This is expected to provide direct information into Bonneville's post-2028 contract negotiations. The post-2028 discussions to date have

highlighted significant load growth anticipated for many Bonneville customers. Bonneville will likely need to acquire additional resources to serve firm loads should customers place some or all the expected load on Bonneville under these future contracts. This upcoming Resource Program will provide insight into potential resource types that Bonneville might pursue if needed to serve long-term firm loads in the region.

Under the Act, Bonneville's resource acquisition decisions are to be consistent with the Council's power plan. Therefore, the ultimate interest of the Council is to ensure that any potential resource decisions by Bonneville are consistent with the Council's power plan. Staff is working closely with the Bonneville team throughout the development of this Resource Program, and Bonneville staff are prepared to provide updates to the Council as needed throughout this process.

Background: As noted above, Bonneville's resource acquisition is to be consistent with the Council's plan under the Northwest Power Act. The current plan, the Council's 2021 Power Plan, provides specific recommendations to Bonneville. The recommendations around resource acquisitions include:

- Acquire between 270 and 360 aMW of cost-effective energy efficiency by the end of 2027, of which at least 243 aMW must be from programmatic savings, and at least 865 aMW by 2041
- Work to enable and encourage its customer utilities to pursue low-cost and high value demand response, including time-of-use rates and demand voltage regulation
- Look to mid-term and long-term market resources for additional energy when needs are beyond those met by the recommended energy efficiency and demand response resources
- Compare market products, both in price and capacity, to renewable power purchase agreements to ensure that the lowest-cost product that suffices to meet any need is identified.

More Info: Bonneville's Resource Program webpage: https://www.bpa.gov/energy-and-services/power/resource-planning

BPA's 2024 Resource Program

Planning and Development Phase

NWPCC Power Committee Meeting

June 13, 2023

Power Planning at BPA

- Each year, BPA publishes the Pacific Northwest Loads and Resources Study – often referred to as the **White Book** - which analyzes BPA's projections of retail loads, contract obligations, contract purchases, and resource capabilities over a 10-year study horizon and describes expected energy and capacity deficits under varying water conditions.

- On a biennial basis, BPA conducts an IRP-like assessment collectively referred to as the **Resource Program** which examines uncertainty in loads, water supply, natural gas prices, and electricity market prices to develop least-cost portfolios of resources that meet BPA's obligations.

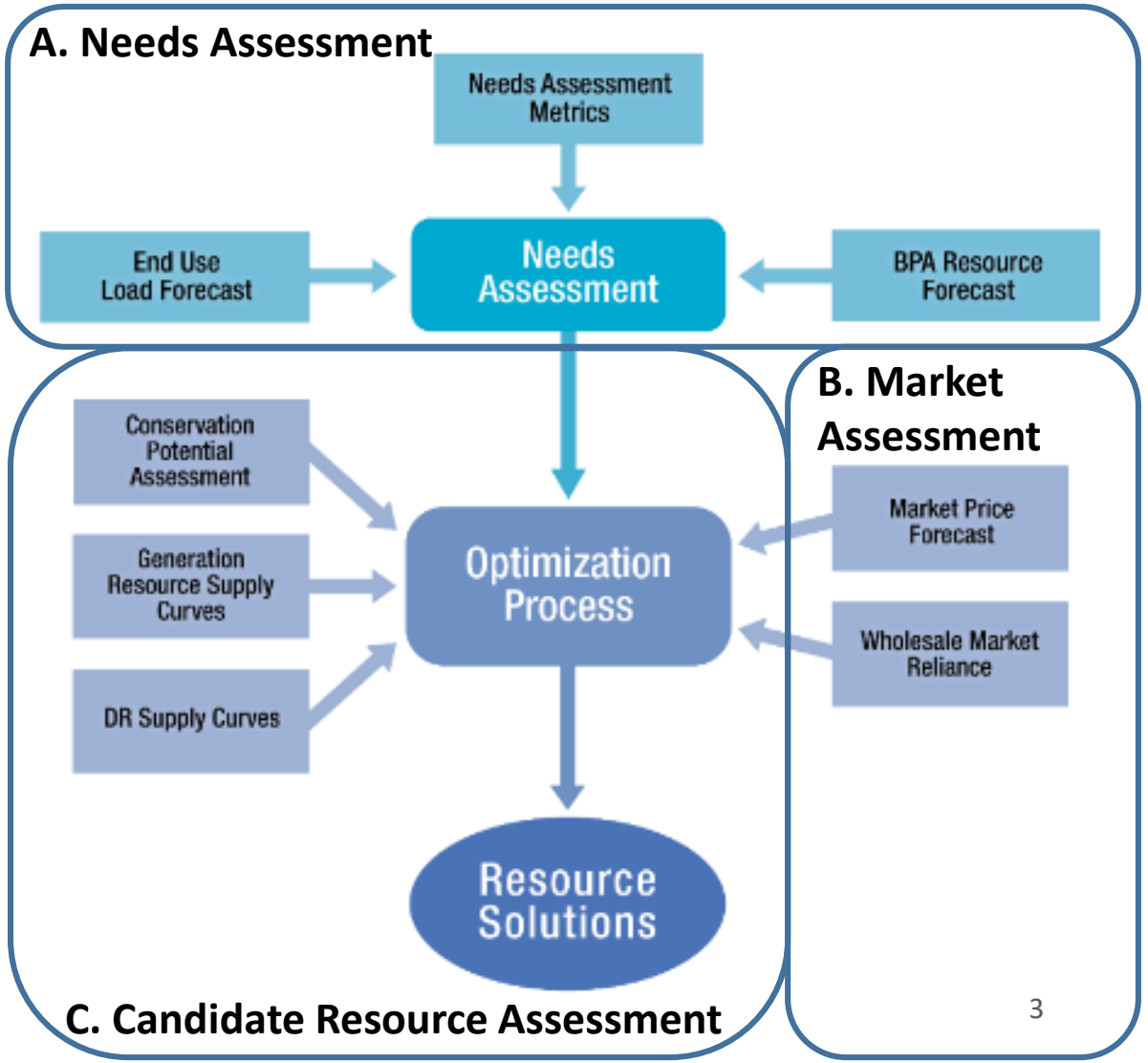
- These processes are voluntarily undertaken to inform acquisition strategies and provide valuable insight into how Bonneville can meet its obligations cost-effectively. They are neither decision documents nor a process required by any external entity.

BPA Resource Program Process Map

A. The **Needs Assessment** measures the federal system's expected generating resource capabilities to meet projected load obligations.

B. The **Market Assessment** simulates the evolution of power markets in the Western Interconnect to generate a long-term forecast of Mid-Columbia prices and market availability under a variety of generation, load, and economic conditions

C. The **Candidate Resource Assessment** explores how the varying costs, performance, and availability of candidate demand-and-supply-side resources (including conservation, demand response, market purchases, and generating resources) can be used to provide a least-cost resource strategy for meeting identified needs



Planning Approach to 2024 Resource Program

- Maintain emphasis on examining how various uncertainties influence least-cost resource solutions
- Expand analysis to include geographic considerations to further align BPA power planning with the Western Resource Adequacy Program (WRAP)
- Replace Aurora portfolio optimization methodology with new solver developed by BPA specifically for the Resource Program focused on delivering single least-cost resource portfolio for meeting identified needs in each scenario/sensitivity
- Two scenarios:
  - Base case
  - Accelerated clean energy transition (Fast Transition)
- Sensitivity Analyses, for example:
  - Stress system loads
  - Costs and availability of candidate resources
  - Prices and ability to rely on wholesale power market

Resource Program Connection to Provider of Choice

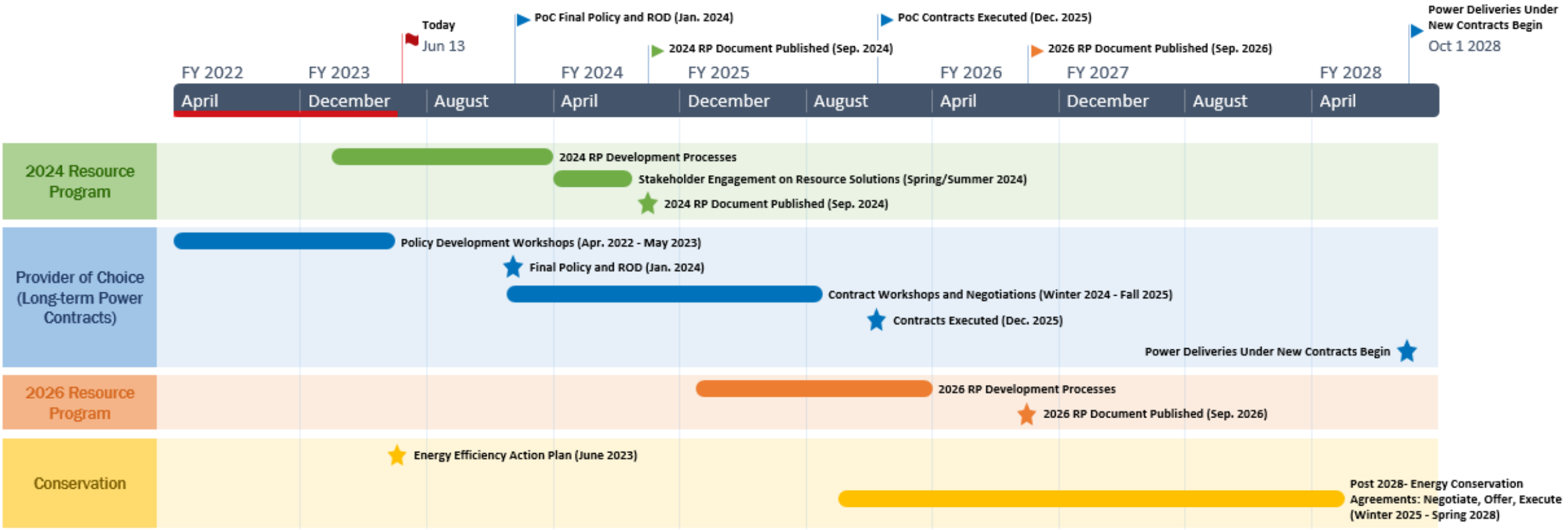
To help inform BPA customer contract elections:

- Provides valuable insight into potential BPA resource portfolio sizes, costs, and compositions;
- Evaluates the implied fuel mix and carbon content of BPA system;

Resource Program Connection to NWPCC Planning

- Consistency with Council's Power Plan
- Conservation and 6(b) of the 1980 Northwest Power Act (NWPA)
  - BPA Energy Efficiency Action Plan (EEAP)
- "Major resources" and 6(c) of the 1980 NWPA
  - Planned capability greater than 50 aMW acquired for period of more than 5 years

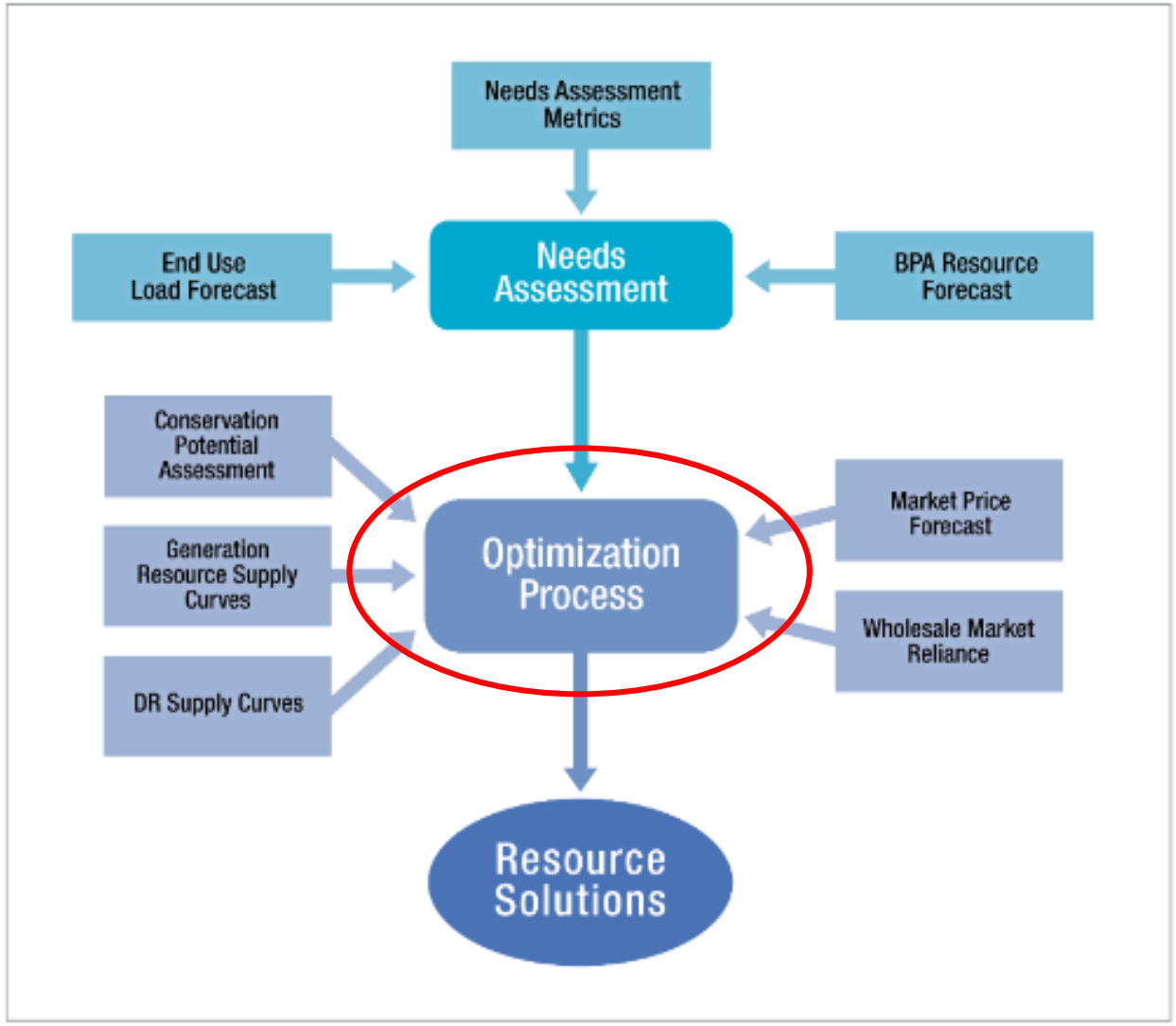
Timeline: Resource Program and Related Processes



*For illustrative purposes only. Dates tentative and subject to change

Resource Selection Methodology

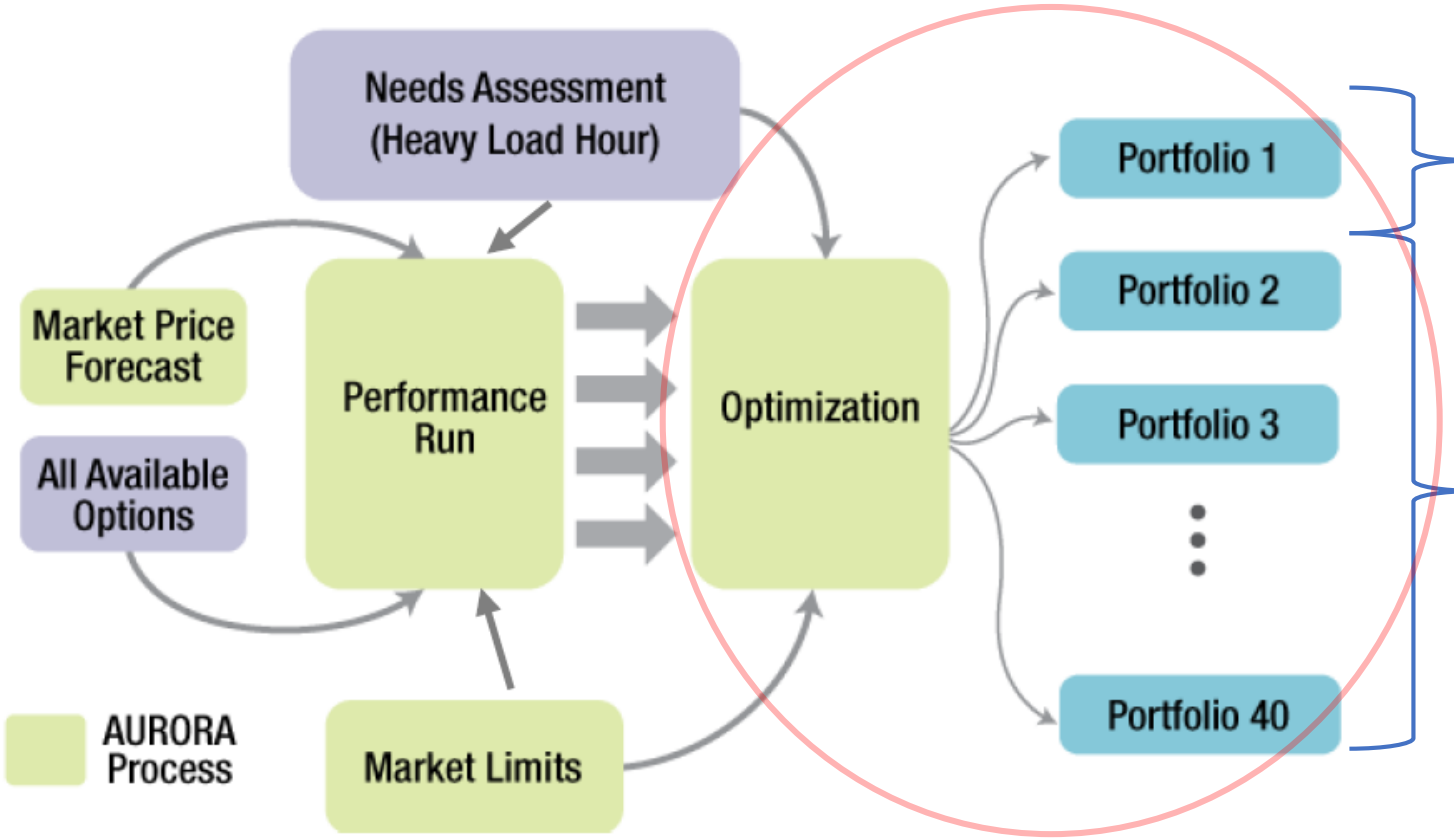
The Solver (Optimization Process)



Outline

- Aurora's Portfolio Optimization (old process)
  - Quick review
  - Issues and limitations
- New Solver
  - Main benefits
  - Focus on addressing uncertainty through scenarios + sensitivities

Aurora Portfolio Optimization Review



Aurora solves for:

1) The least-cost solution (portfolio)* that satisfies monthly p10 HLH energy needs over the planning horizon

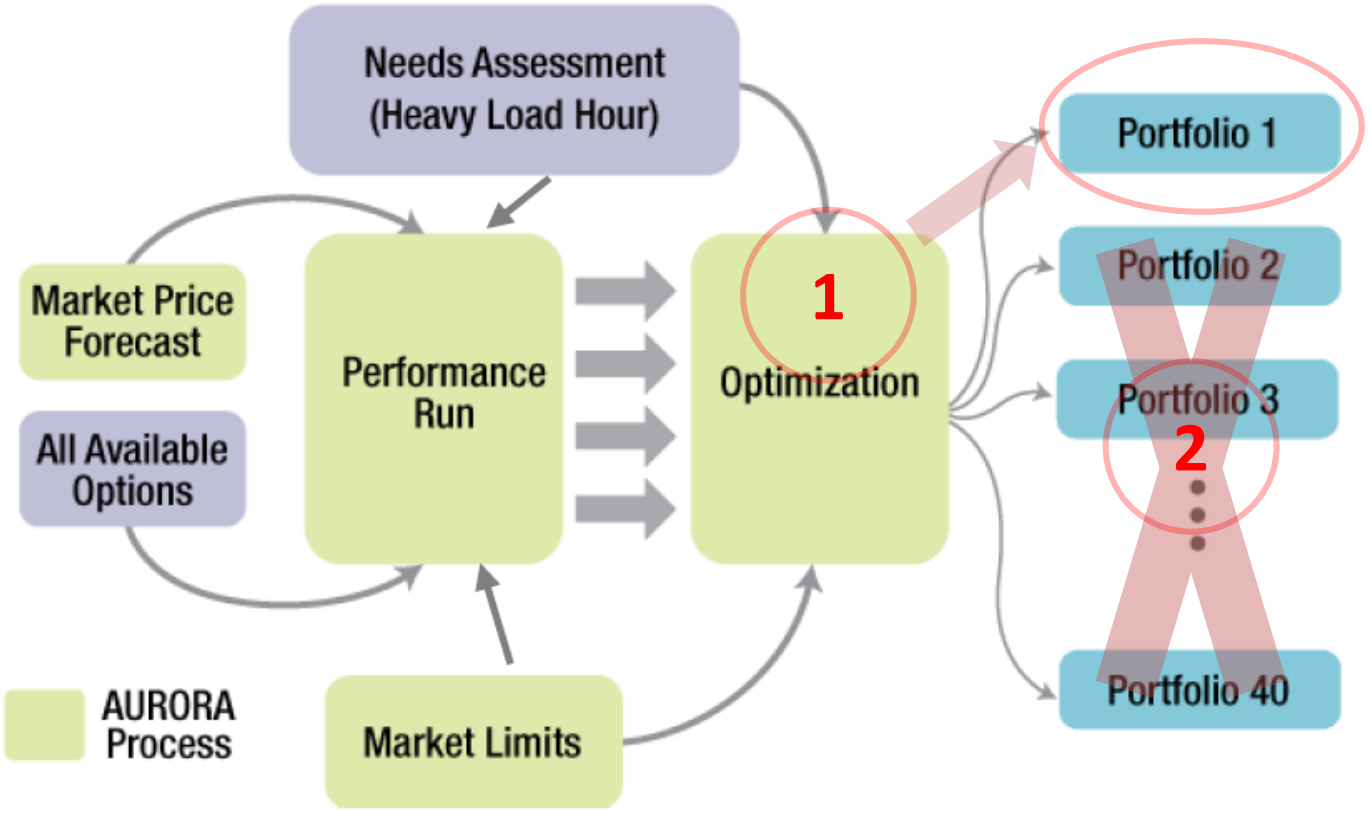
2) 39 additional portfolios that minimize *variation* of total costs—reducing the overall range of potential financial outcomes under different possible future conditions, given the selected resources and market reliance

*A solution, or portfolio, is a combination of selected resources and market reliance that meet needs over the planning horizon

Aurora Portfolio Optimization Issues and Limitations

- **Very poor fit for BPA needs**
  - The portfolio optimization is designed for more traditional utility planning (meet annual planning reserve margins and low variability energy needs)
  - Extensive modifications / customizations are required to capture BPA's stochastic energy needs and 18-hour capacity metric
  - Limited developer appetite to support changes that impact only one user of the model
- **~12-24 hours of runtime to solve for one case / scenario**
  - Vast majority related to inefficient data management
- **Highly time consuming to modify once working**
  - Evaluating key drivers of resource selection decisions required significant time and effort
  - Very limited ability to accommodate exploratory analysis
- **39 variance reducing portfolios have arbitrary budget limits, limited comparative value across cases, and often largely fail to reduce risk**
  - The model would increase spending by $50-100+ million to reduce risks by $10 million (roughly analogous to paying $50,000 to insure a $25,000 car)
  - Does not explicitly address tail risks (adverse outcomes were becoming more likely and had higher costs)

New Solver



1. Replaces Aurora, finds the least cost solution to all needs with optimization using well established algorithms and solvers widely available in statistical programming tools (R/Python)

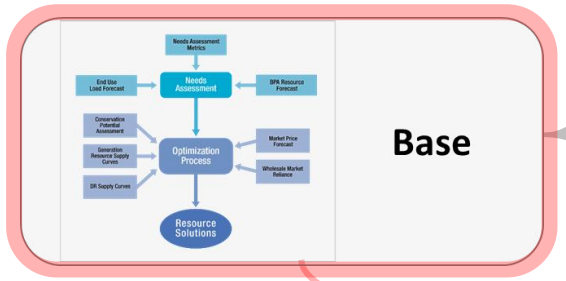
2. Eliminates variance reduction portfolios

3. Provides numerous additional benefits (next slide)

New Solver Benefits

- **Can model all existing BPA needs**
  - Separately or any combination of monthly p10 energy for HLH/LLH/super-peak/graveyard/flat
  - 18-hour summer and winter capacity metric
  - Readily accommodate WRAP metrics separately or in combination with other BPA needs
- **High flexibility enables us to focus on addressing risk and uncertainty through scenarios + sensitivities**
  - **Gives us the ability to tie different resource selections to specific risks**
  - Evaluate key drivers of resource selection decisions to better understand results
  - More readily accommodates evolving agency priorities and uncertain policy environment
- **Estimated 10 minute solve time per case**
  - For comparison, Aurora typically solves for about 150 **billion** variables when producing the rate case price forecast with ~ 1 week of solve time. For a single hour of a single iteration of that study, Aurora is solving for about 6,200 variables with tens of thousands of constraints in a fraction of a second. The new solver will only need to evaluate about 200 variables with 1,000-2,000 constraints.

Making Sense of Results

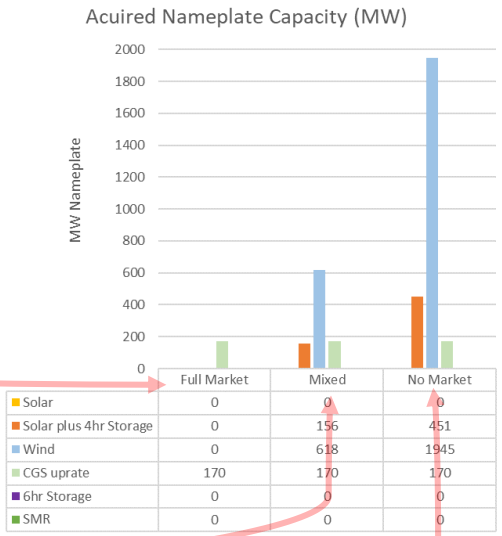


Base

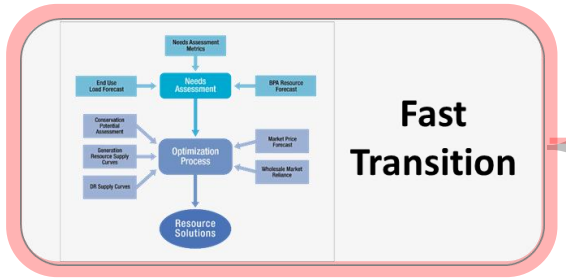
- Base Sensitivity 1
- Base Sensitivity 2
- •
- •
- •
- Base Sensitivity N

Select results shared externally in resource program document

Help inform internal evaluations / support customer requests



	Full Market	Mixed	No Market
Solar	0	0	0
Solar plus 4hr Storage	0	156	451
Wind	0	618	1945
CGS uprate	170	170	170
6hr Storage	0	0	0
SMR	0	0	0



Fast Transition

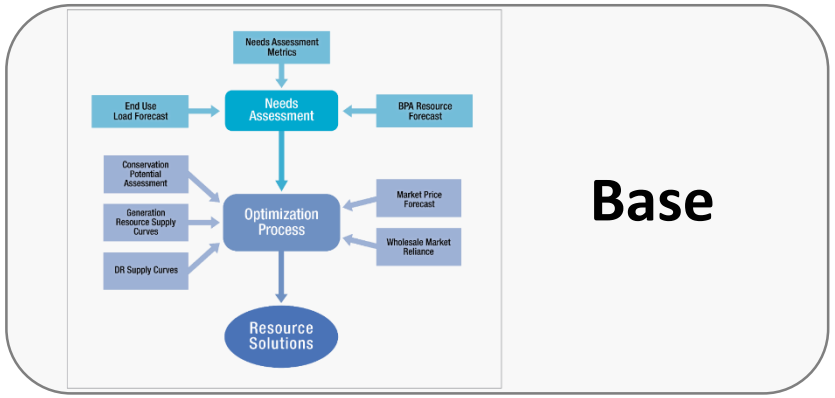
- FT Sensitivity 1
- FT Sensitivity 2
- •
- •
- •
- FT Sensitivity N

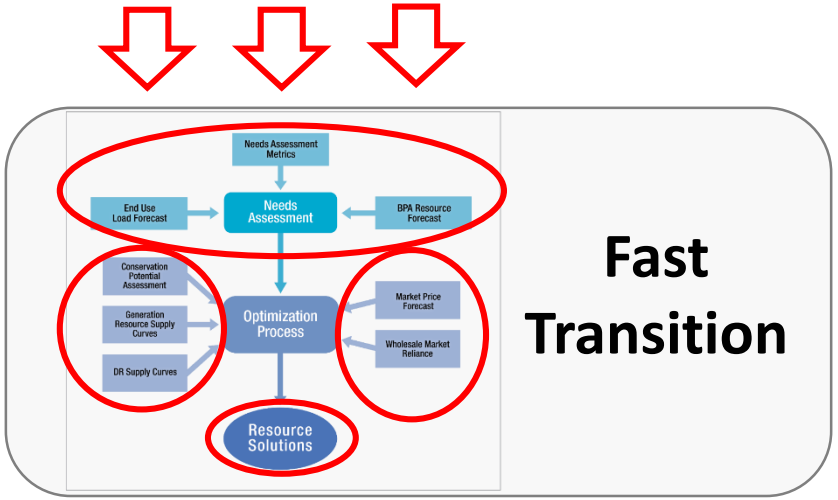
Scenarios and Sensitivities

RP24 Planning Framework

Scenarios

Scenarios are comprised of a set of inputs that are consistently developed for a future outlook.

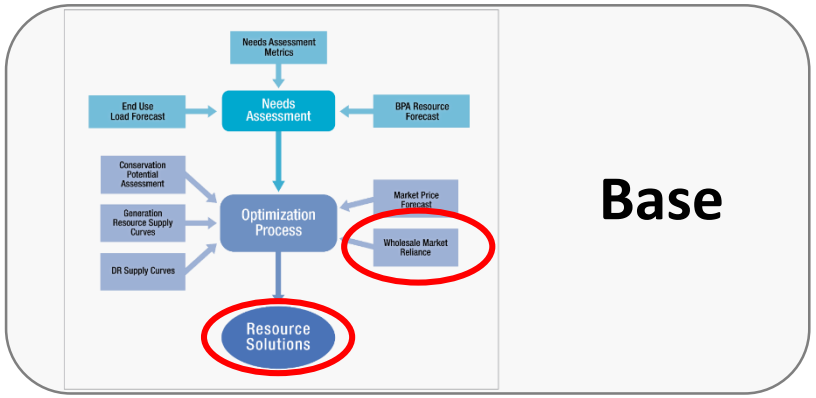




Sensitivities

Changes to individual input assumptions (or smaller subsets of input assumptions) within a given scenario.

- Provide BPA decision-makers with additional options to address key strategic interests (PoC / Carbon Vision, etc).
- Evaluate solution sensitivity to specific assumptions
- Assess solution robustness.



Two Scenarios: Base and Fast Transition (1 of 2)

Category	Base	Fast Transition (relative to base)
BPA Loads	• Expected, mid-range load growth with average economic activity • Electrification / behind-the-meter (BTM) solar PV consistent with current policy • Two zones (Mid C and BPA-SE) • Expected conservation removed (“Frozen efficiency”) • Current customer elections • Climate change impacts on technology saturation and temperature adjustments	• Moderately higher load growth, slightly elevated economic activity • Higher electrification/ BTM solar PV, and speculative loads
BPA Resources	• Federal hydro under 2020 EIS selected alternative & AOP24 treaty • Planned FCRPS upgrades (increased capacity at some plants during study period) • Current CGS (no uprate) • Climate change impacts on hydro generation from RMJOC-II, 2035 and beyond.	***Same as Base scenario***
Energy Efficiency and Demand Response	• Refresh Conservation Potential Assessment (CPA) based on new industry trends and updated study years • Include frequently deployable energy shifting products in the Demand Response Potential Assessment (DRPA) and update study years • Incorporate zonal considerations and updated climate change assumptions	• Adjust potential based on load

Two Scenarios: Base and Fast Transition (2 of 2)

Category	Base	Fast Transition (relative to base)
Market Landscape	• Mid-range values for all fundamental assumptions (expected case WECC-wide loads, gas prices, resource costs, carbon prices, etc.) • All current Federal/state policies • High likelihood resource additions/retirements over next rate period • Climate change not explicitly accounted for in WECC loads/resources	• Higher electrification and moderately higher load growth • WECC-wide carbon allowance pricing • Accelerated decarbonization targets and/or additional ZEM targets in areas currently lacking explicit policies
Candidate Generating Resources	• High likelihood emerging tech (SMRs), solar, wind, and storage. • Cost and performance characteristics developed from best available estimates using BPA specific assumptions	***Same as Base scenario***
Solver	• Twenty year study horizon (FY26-FY45) • Mixed-integer programming (MIP) approach solves for single portfolio which meets BPA needs at lowest total system cost (NPV)	***Same as Base scenario***

Sensitivities (1 of 2)

Sensitivity	Details
BPA Loads – Traditional Load Growth	• Higher Tier 2 elections of existing customer base (Above High Water Mark load growth is served by BPA) • Load characteristics set by scenarios (Base, Fast Transition) • Adjust EE/DR potential (if applicable)
BPA Loads – Block Adder	• Additional flat block obligations placed on BPA e.g. 5(b) contracts from IOUs or NLSL from existing customers
Transmission – B2H Delay	• Delay to energization of B2H and transfer service capability from Mid-C to BPA-SE

Sensitivities (2 of 2)

Sensitivity	Details
Market - Prices	• Positional shifts in price distribution reflecting sustained changes in energy prices • Changes to shape of price distribution to reflect increased tail risk from additional extreme events or significant renewables buildouts
Market – Availability	• Changes to BPA's ability to meet needs by relying on market purchases
Candidate Resources – Costs/Availability	• Costs and availability of candidate supply-side resources • Cost/benefits of EE/DR from UCT perspective
Evaluate Incremental Need Impacts	• Run solver with no needs, only HLH energy, and only capacity to better understand contributors to resource selection
Study Horizon	• Consider shorter time horizon (e.g. ten instead of twenty years) to see how near term resource selections are influenced by long term assumptions

Get in Touch

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