Washington State Department of Commerce

UTC Washington Utilities and Transportation Commission

JOINT WORKSHOP AND DISCUSSION

Modeling Greenhouse Gas Pollution Costs in Electric Integrated Resource Planning

January 16, 2020, at 9:30 a.m.

SCC in Integrated Resource Plan Models

Joint Washington Utilities and Transportation Commission & Washington Department of Commerce Workshop , Lacey WA

1/16/2020

Tacoma Power and Snohomish PUD

SCC provisions in Chapter 19 of the RCW

(3)(a) An electric utility **shall consider the social cost of greenhouse gas emissions**, as determined by ……the department for consumer-owned utilities, when developing integrated resource plans and clean energy action plans.

An electric utility **must incorporate the social cost of greenhouse gas emissions as a cost adder** when:

(i) **Evaluating and selecting** conservation policies, programs, and targets;

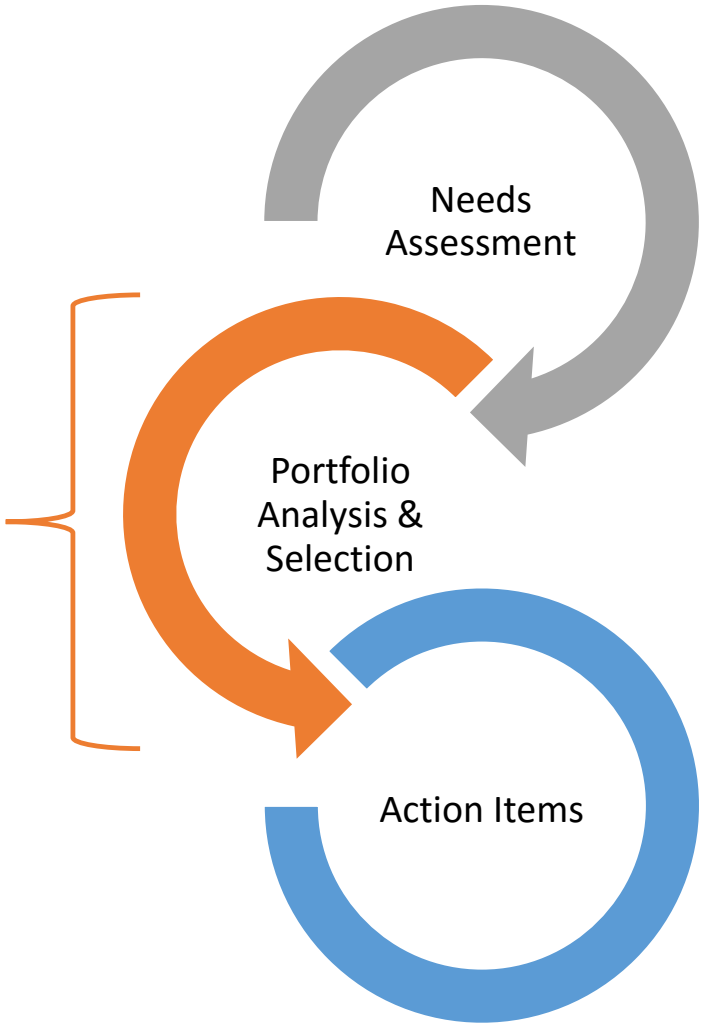
(ii) **Developing** integrated resource plans and clean energy action plans; and

(iii) **Evaluating and selecting** intermediate term and long-term resource options.

Resource Planning Process Overview

Question at hand:

How to incorporate SCC?



Do we have enough resources to meet our load under ***most*** conditions?

Which set of resources best meet our needs, risk tolerance and values?

What are our next steps?

Two public utilities, two different situations

Tacoma Power

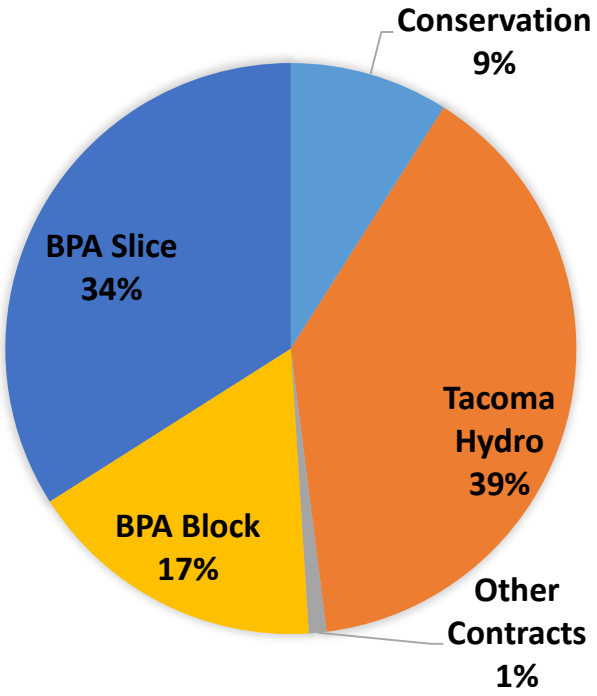
- Municipal Utility
- Balancing Authority
- Adequate resources with current portfolio
- Conservation as preferred resource

Snohomish PUD

- Public Utility District
- Projected seasonal deficit with current portfolio under some weather conditions
- Conservation as preferred resource

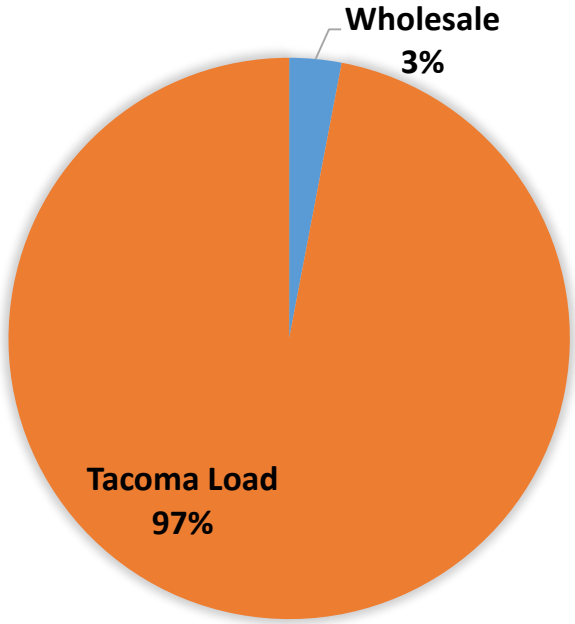
Tacoma's Resource Portfolio is Predominately Hydro and Long-Term Contracts

BPA contract/product selection is an important IRP component!



Resources

We plan for resource adequacy in a critical water year…



Sales to Customers

TACOMA POWER
TACOMA PUBLIC UTILITIES

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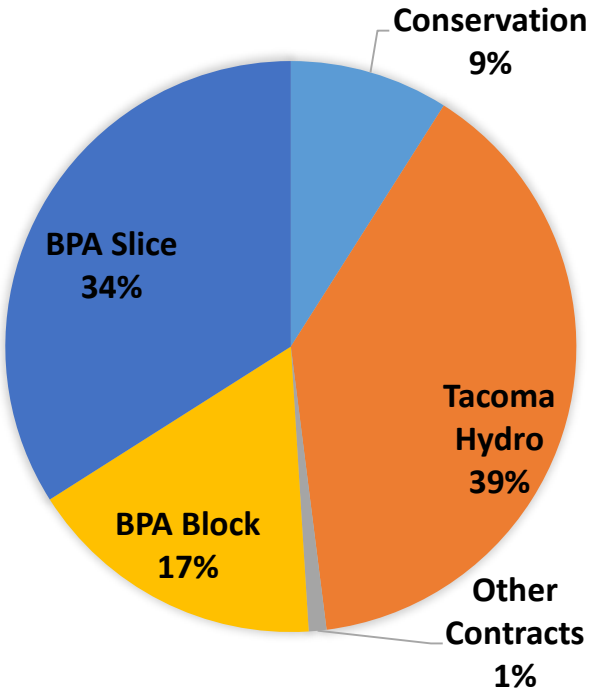
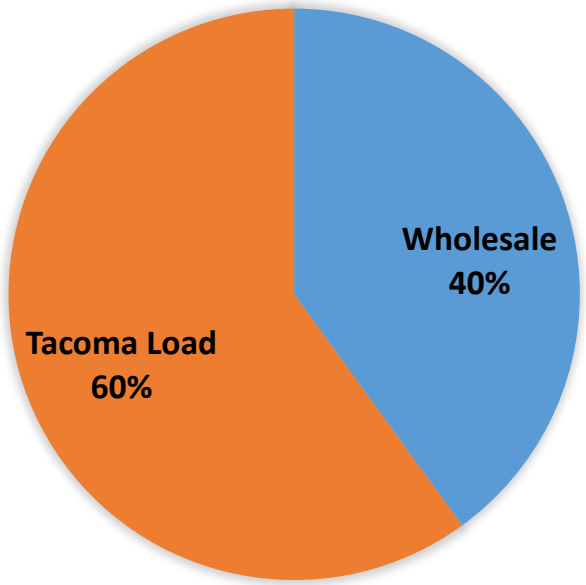


Resources

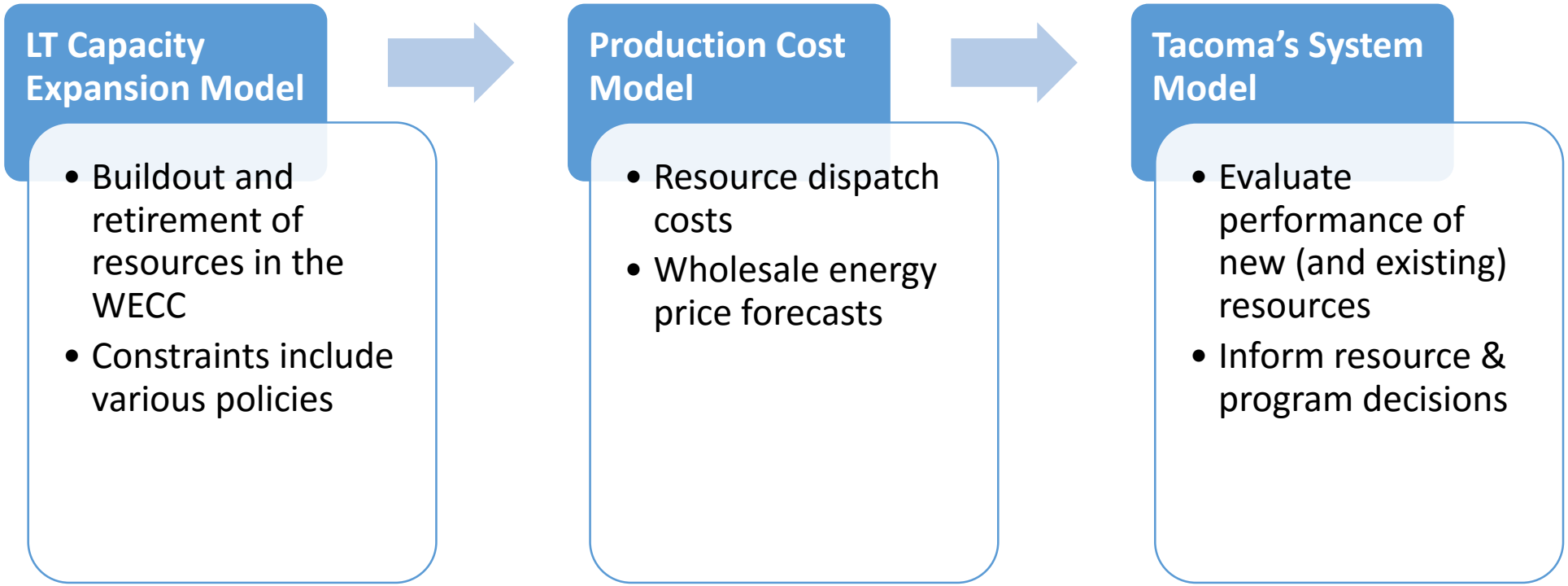
… we are surplus on <u>average</u> – Evaluation of surplus is important!



Sales to Customers

TACOMA POWER
TACOMA PUBLIC UTILITIES

Tacoma includes SCC and other state-specific policies in the LT capacity expansion model



TACOMA POWER
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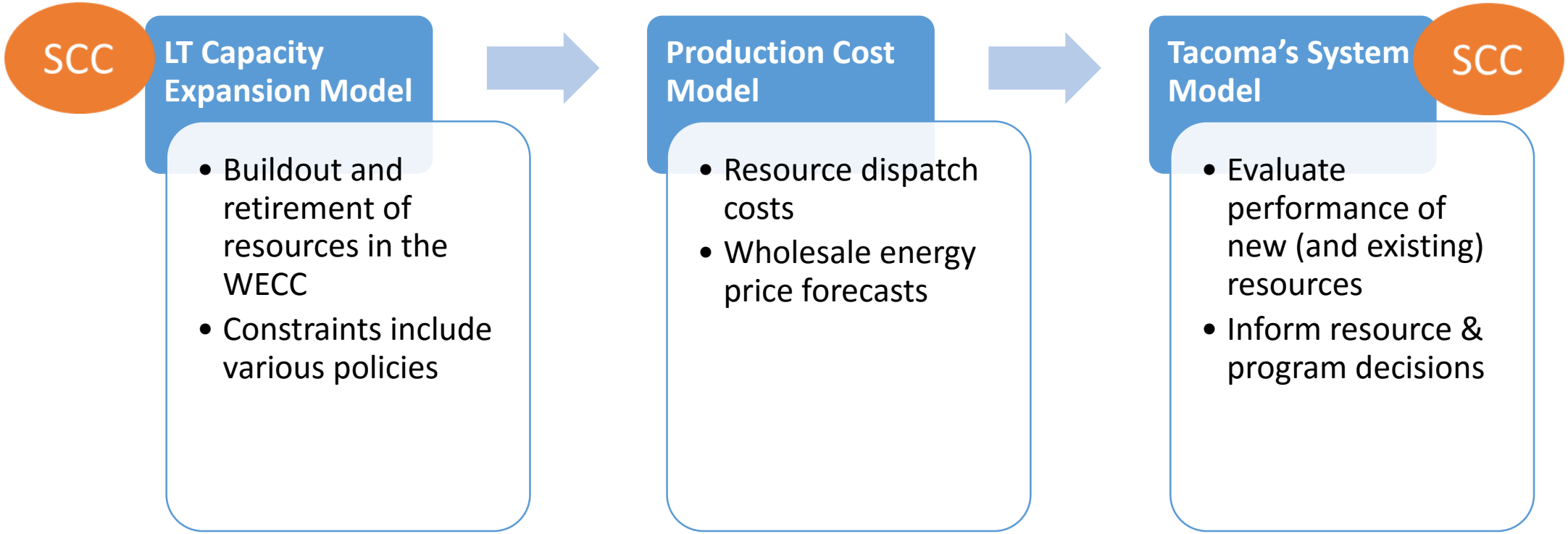


- SCC modeled to influence resource decisions in WA where SCC is required in planning; This is to avoid distorting or exaggerating the impact of State policies on WECC-wide outcomes.

TACOMA POWER
TACOMA PUBLIC UTILITIES

Tacoma's primary IRP decision is 2028 BPA product selection

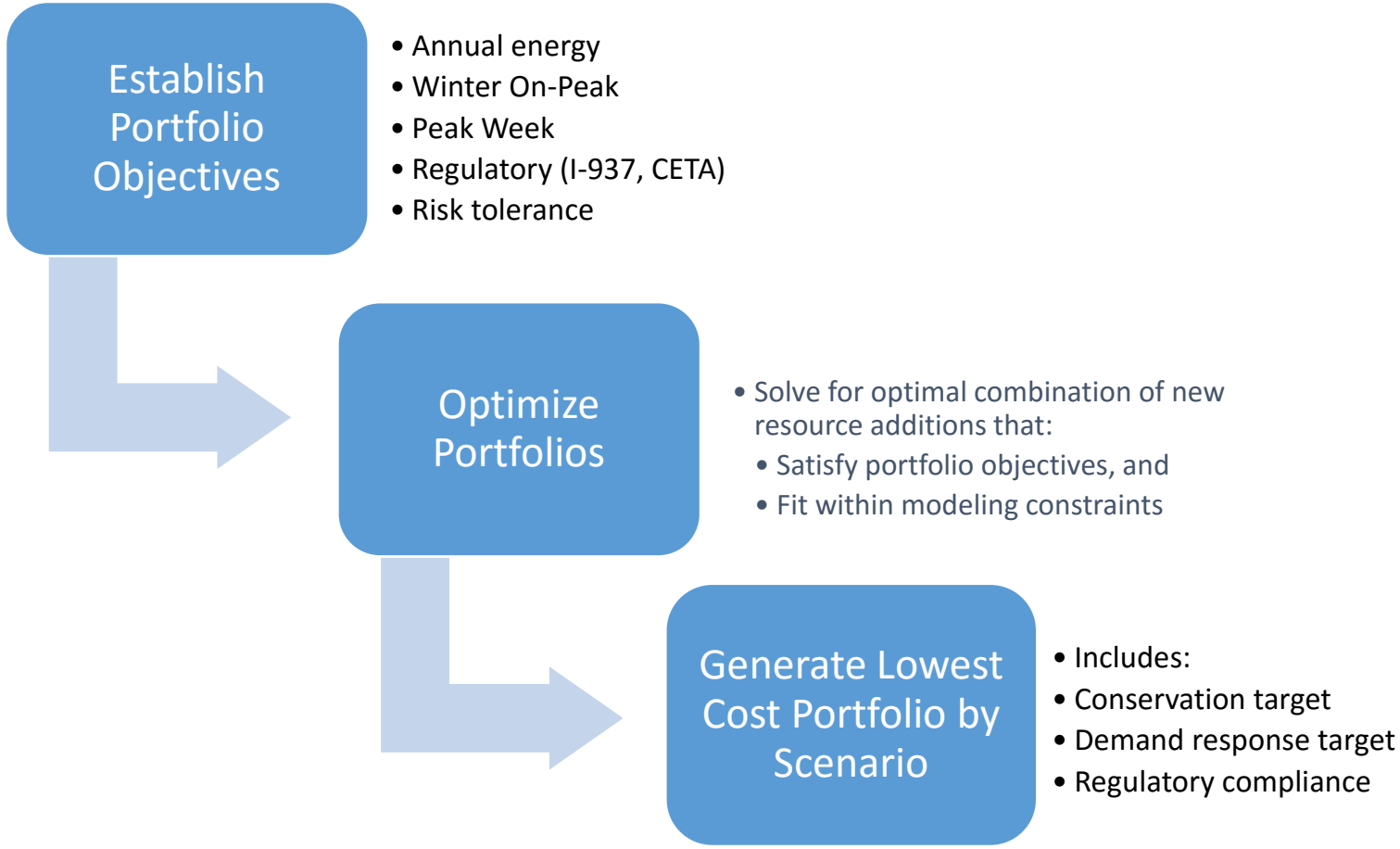
Tacoma's BPA product selection is influenced by projected value/risk of surplus hydro generation and capacity

Projected value/risk of surplus is a function of regional resource mix in the market

Methodology to incorporate SCC matters!

TACOMA POWER
TACOMA PUBLIC UTILITIES

Snohomish PUD Portfolio Modeling Sequence



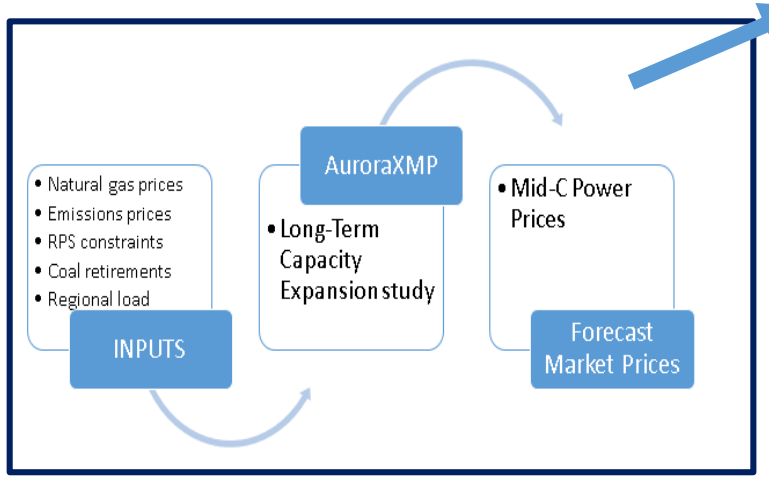
Snohomish PUD Portfolio Modeling Sequence

Establish Portfolio Objectives

- Annual energy
- Winter On-Peak
- Peak Week
- Regulatory (I-937, CETA)
- Risk tolerance

Optimize Portfolios

- Solve for optimal combination of new resource additions that:
  - Satisfy portfolio objectives, and
  - Fit within modeling constraints



Generate Lowest Cost Portfolio by Scenario

- Includes:
- Conservation target
- Demand response target
- Regulatory compliance

Societal Cost of Carbon (SCC) in the Portfolio Modeling Sequence

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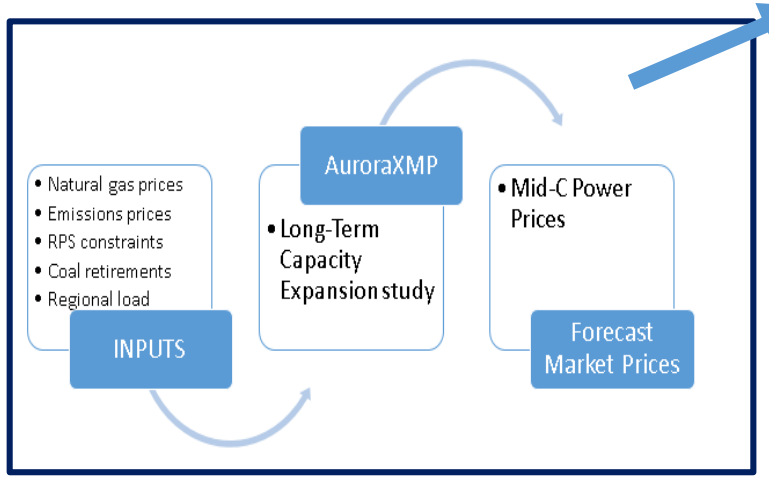

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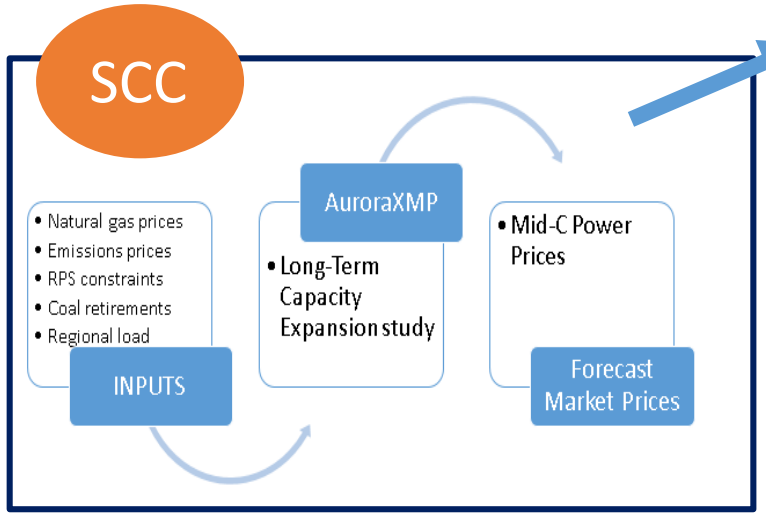
SCC



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Generate Lowest Cost Portfolio by Scenario

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Portfolio Modeling Steps are interdependent

Establish Portfolio Objectives

- Annual energy
- Winter On-Peak
- Peak Week
- Regulatory (I-937, CETA)
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Optimize Portfolios

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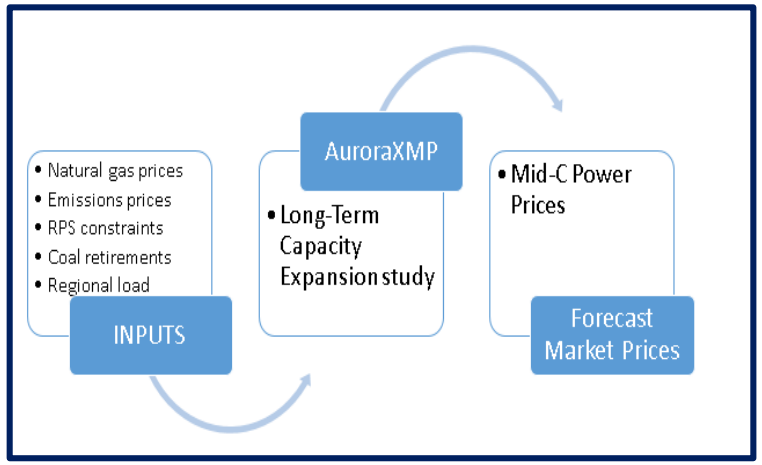


Generate Lowest Cost Portfolio by Scenario

- Includes:
- Conservation target
- Demand response target
- Regulatory compliance

Modeling the SCC accurately helps each utility evaluate different portfolio needs

- Modeling market constraints by reflecting actual carbon policies across the WECC provides useful insights into future market fundamentals
  - This approach informs Tacoma's ability to strategically address its potential surplus and BPA product choices
  - This approach helps Snohomish evaluate its potential portfolio deficit risks, and provides more clarity on the types of resources that can most cost-effectively address the risk
  - Inaccurate models can result in suboptimal or detrimental outcomes for utilities and ratepayers

Social Cost of Greenhouse Gases Workshop

climate solutions
accelerating the transition to our clean energy future

celebrating 20 YEARS

Social Cost of Greenhouse Gas Planning Adder

Intent

- Internalize the societal cost of carbon of various resource portfolios in making resource decisions
- This includes:
  - Evaluating and selecting conservation policies, programs and targets
  - Developing IRPs and Clean Energy Action Plans
  - Evaluating and selecting intermediate term and long term resource options

Consistency

- Consistent application across all utilities

Resource Application

Geography

- Apply to resources used in the entire WECC, but only insofar as these are dispatched to serve customers to avoid unintended consequences
  - Avoid applying to Washington-only facilities
  - Avoid applying entire WECC facilities that are dispatched to utilities outside of Washington

New & Existing Resources

- Should apply to both new and existing
- The social cost of any given portfolio will be significantly underestimated if the social cost of carbon is only applied to new resources
- Resource decisions are based on a utility's existing portfolio and its resource need to meet load
- Social cost of GHG should be considered cumulatively

Market Purchases

- Carbon content should reflect marginal resource

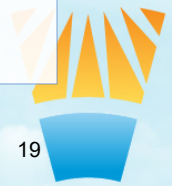
Timing of application

Pre-economic dispatch: SCC influences dispatch of resources in portfolios

- Similar to a carbon tax, assumes that the Social Cost of GHGs impacts real-time dispatch operations
- Risk is that it underestimates the GHGs coming from real-time dispatch
- Additional scenarios should reflect the potential for a future carbon pricing policy using this application, such as a $15/ton escalating carbon tax

Post-economic dispatch: SCC applied after economic dispatch to portfolios

- Since utilities operate facilities without a carbon price, adding the Social Cost of GHGs after economic dispatch may better reflect reality
- Planning adder should be added after the capacity factor and projected dispatch is established



Emissions Covered

Point of generation

- Should be applied at point of generation
- All resources coming into a utility's system

Leakage

- Should also cover upstream leakage emissions
- Leakage should be calculated using the best available science

Incremental Cost & PURPA

"Costs…must be directly attributable to actions necessary to comply with the requirements of Sections 4 and 5 of this act."

- Utilities need to run BAU scenarios without 100% requirements, but using the SCC and other components of the law outside of Sec. 4 and 5
  - For example, coal transition, public interest language, low-income assistance, etc.
- Incremental cost should be based on a portfolio of resources with Sections 4 and 5 compared
- Rules should clarify incremental cost calculation

PURPA

- Should be specified as an avoided cost in the avoided cost calculation

Thank you

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NW Energy Coalition

for a clean and affordable energy future

Modeling Greenhouse Gas Pollution Costs in Integrated Resource Planning
CETA Workshop
January 16, 2020

Wendy Gerlitz

Policy Director

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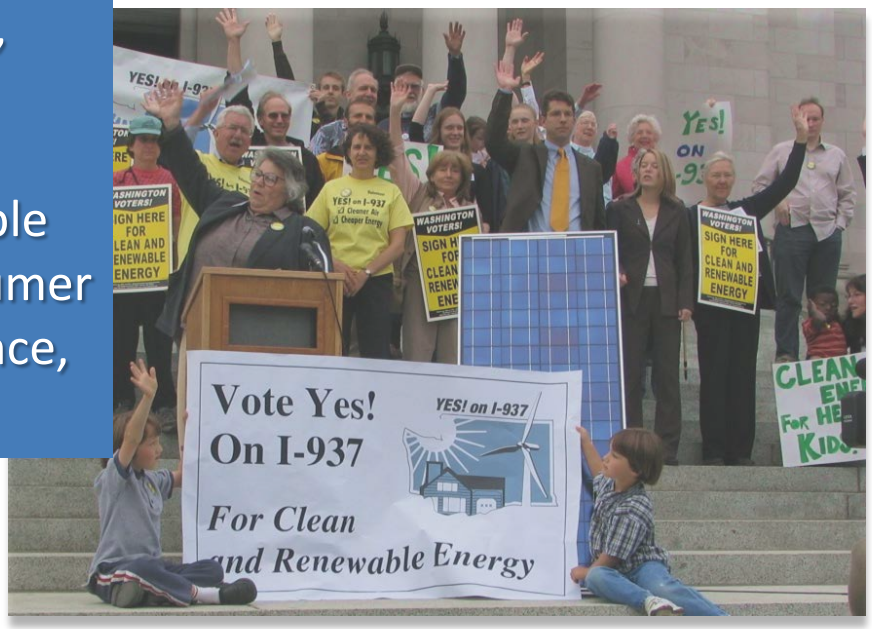
503-449-0009

About the NW Energy Coalition

- The NW Energy Coalition is an alliance of over 100 environmental, civic and human service organizations; progressive utilities; and businesses in Oregon, Washington, Idaho, Montana, and British Columbia.
- Promotes the development of renewable energy and energy conservation, consumer protection, low-income energy assistance, and fish and wildlife restoration.



Main office: (206) 621 - 0094

Website: www.nwenergy.org

NW Energy Coalition

CETA Requirements

Washington's Clean Energy Transformation Act (CETA) requires the consideration and use of the social cost of carbon (SCC) in utility resource planning.

Section 14 (1) (l) (3) (a), beginning at line 32 states:

An electric utility must incorporate the social cost of greenhouse gas emissions as a cost adder when:

i. Evaluating and selecting conservation policies, programs, and targets;

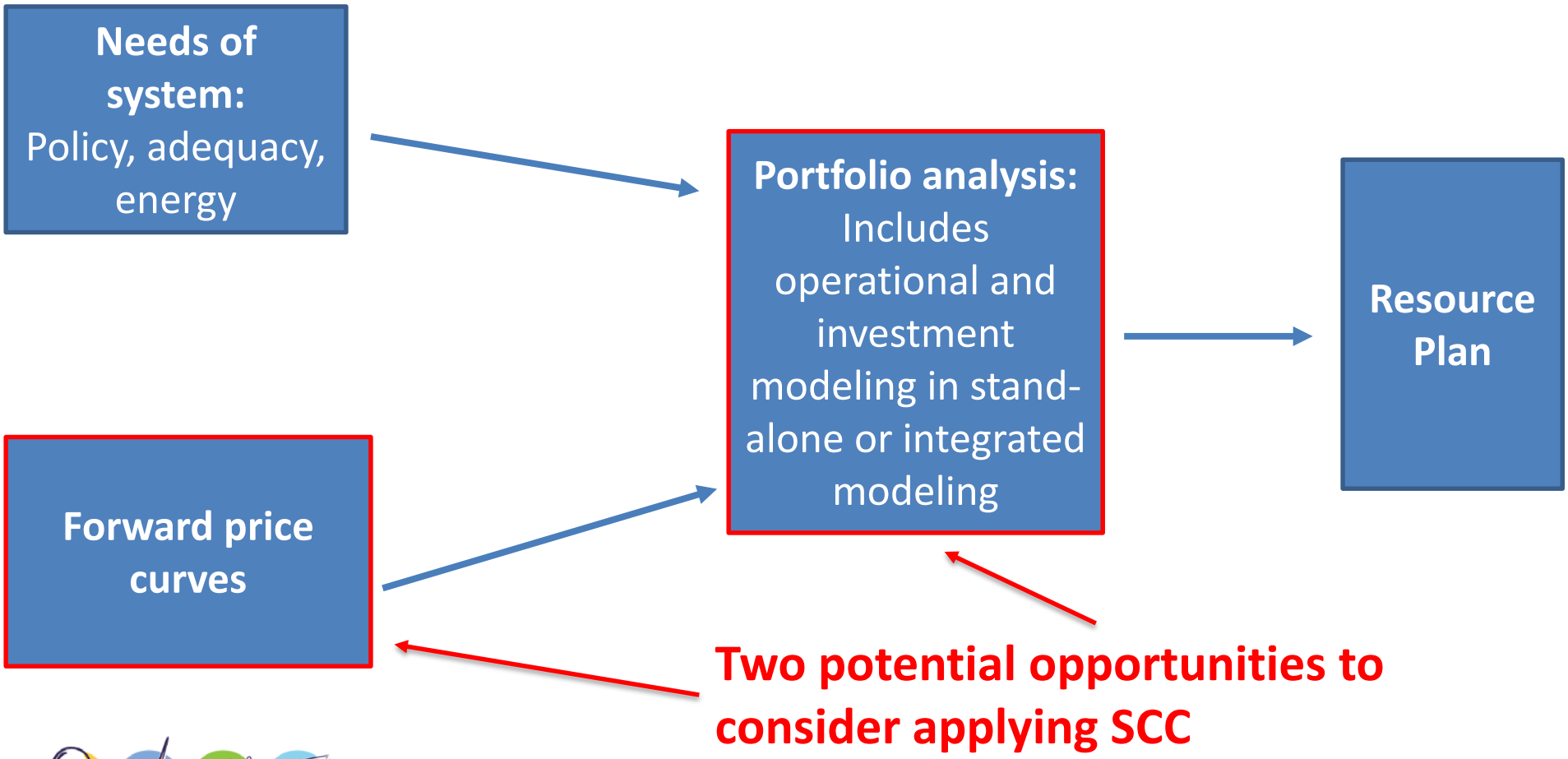
ii. Developing integrated resource plans and clean energy action plans; and

iii. Evaluating and selecting intermediate term and long-term resource options.

CETA Requirements

- The purpose of WA SCC planning price is to internalize the external cost of emitting greenhouse gases into planning decisions
- All known sources of GHG emissions, including upstream natural gas emissions, must be included.

This work assumes the following "default" IRP modeling framework



Working Principles for SCC Analysis Forward Price Curve Development

- Utilities often develop forward price curves to forecast the cost of potential market purchases (as an input to portfolio analyses)
  - For example, PSE runs Aurora™, a capacity expansion model, to develop Mid-C power price forecasts
  - Model adds resources, over time, and simulates system operations to estimate power costs
- As a matter of principle, the goal of forward price curve development is to, as accurately as possible, forecast the price of spot power purchases at a given location
  - Generally, NW utilities try to forecast Mid-C pricing

- The CETA SCC planning requirements will not impact day-to-day operations of the system – it is a planning cost that is intended to impact investment decisions
- Therefore, the SCC should, generally, not be included in the operational costs of existing and new resources in price forecasting models – this helps ensure accurate power pricing
- One exception: in resource build SCC applied to new thermal resources in Washington
  - Since SCC impacts the *planning* economics of these resources, not including a SCC for new thermals in WA could distort pricing at key trading hubs as the system may build an un-realistic amount of thermal resources in WA

Working Principles for SCC Analysis Forward Price Curve Development

1. Assuming forward price curves are generated separately from the portfolio analysis, the SCC should only be applied to new thermal resources (in WA), as doing so helps forward pricing capture the effects of the CETA SCC planning requirement.

SCC planning price only added to new thermal resources in Washington

Resource build in forward curve modeling will "see" environmental cost of building new thermal resources in WA, while operating the rest of the fleet "status quo"

Forward curves for key trading hubs (e.g., Mid-C) **only** reflect reasonably anticipated investment effects of CETA SCC requirements

Working Principles for SCC Analysis Portfolio Analysis

2. **During the portfolio analysis phase, assuming dispatch modeling informs investment analysis, the SCC must be included in <u>both</u> thermal generation resource options and conservation operations or else the analysis and resulting resource portfolio may become distorted.**

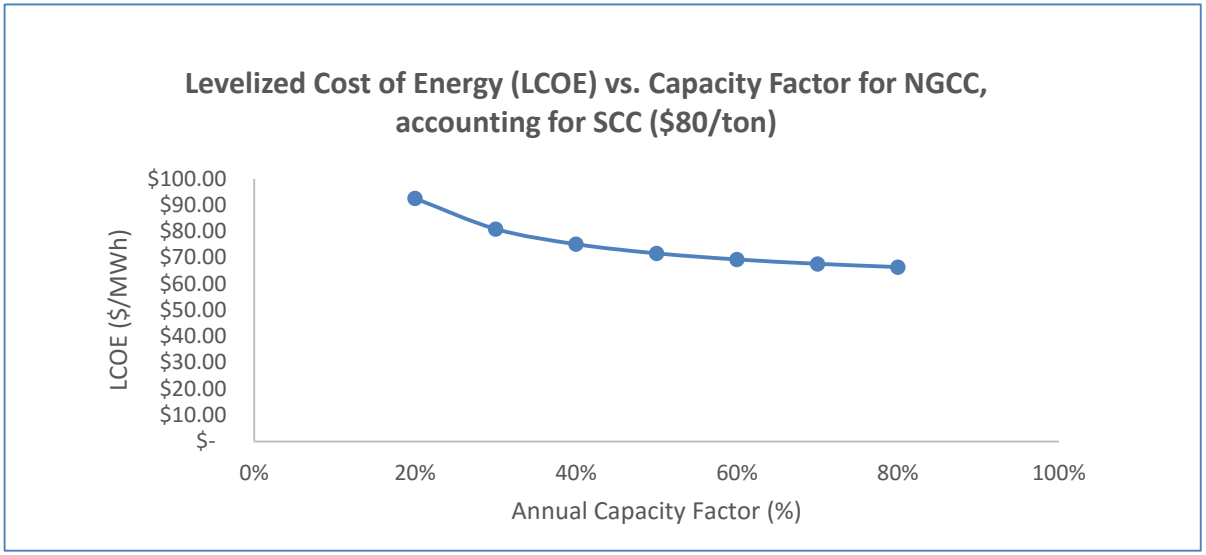
- SCC impacts how much a resource runs, and how much a resource runs (and what it avoids) *matters* in investment analysis
- This distortion shows up in calculating LCOE for resource options, and could impact the "value" of conservation measures that might avoided existing or new thermal generation (that otherwise would have produced CO_2 emissions, which by law have a cost in the planning environment)

Working Principles for SCC Analysis Portfolio Analysis

- The primary issues with including the SCC only in the investment analysis are:
  - By excluding SCC from dispatch modeling, it is more likely that certain new and existing thermal resources will *run more* than if the SCC was accounted for in their dispatch costs
  - After accounting for the SCC *ex post,* certain thermal resources will have lower levelized costs (a per MWh measure) simply because of this modeling decision – see chart on next slide
  - Model's economic "incentive" is to add thermals and run them more because they become more economic the more they run as their upfront fixed cost is spread of more and more MWhs
  - Including the SCC in the dispatch ensure consistent signals are provided to model

Working Principles for SCC Analysis Portfolio Analysis

- Accounting for SCC in dispatch modeling will reduce a NGCC's capacity factor (all else being equal), which will increase overall cost on a levelized basis



Working Principles for SCC Analysis Market Purchases

3. **In addition to applying a SCC to new and existing in-state thermal resources, portfolio analysis should apply a SCC to known imports or contracts based on their emission rate, and an unspecified rate should be assigned to market purchases.**

- When portfolio analysis has the option to purchase energy or capacity from the market, an implied carbon "import" price may need to be added to these market purchases.

- If such an adder is not included, a type of "leakage" can occur as IRP models will be incented to add "brown" market purchases to the portfolio as it will appear to be lower cost than alternative options that account for the SCC.

- Specified purchases, such as those from a specific merchant gas generator or contract, should be applied based on that generator's emission rate (in order to internalize its environmental cost).

Thank you!

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NW Energy Coalition
for a clean and affordable energy future

Social Cost of Carbon Modeling in Avista's 2020 IRP

James Gall, IRP Manager

January 16, 2020

Topics of Discussion

- Pricing in electric market forecast (Aurora)
- Pricing in resource selection (PRiSM)
  - Demand-side resources
  - Supply-side resources
  - Market transactions
- Portfolio optimization

CETA Requirements for Social Cost of Carbon (SCC)

(3)(a) An electric utility shall consider the social cost of greenhouse gas emissions, as determined by the commission for investor-owned utilities pursuant to section 15 of this act and the department for consumer-owned utilities, when developing integrated resource plans and clean energy action plans. An electric utility must incorporate the social cost of greenhouse gas emissions as a cost adder when:

i. Evaluating and selecting conservation policies, programs, and targets;
ii. Developing integrated resource plans and clean energy action plans; and
iii. Evaluating and selecting intermediate term and long-term resource options.

Electric Market Price Forecast

- Avista's electric market price forecast's (Aurora) objective is to estimate actual operating conditions for each resource options (both supply & demand) to understand its economic value to customers.

- Avista forecasts regional resources to be constructed:
  - SCC is used for each "new" resource option to serve Washington load. This process is to simulate each utility's acquisition process.

- No direct SCC is used to simulate future plant operations for the electric price forecast.

- Avista conducted a SCC scenario which included pricing in the dispatch - but for all regions in the west to simulate a national SCC policy.

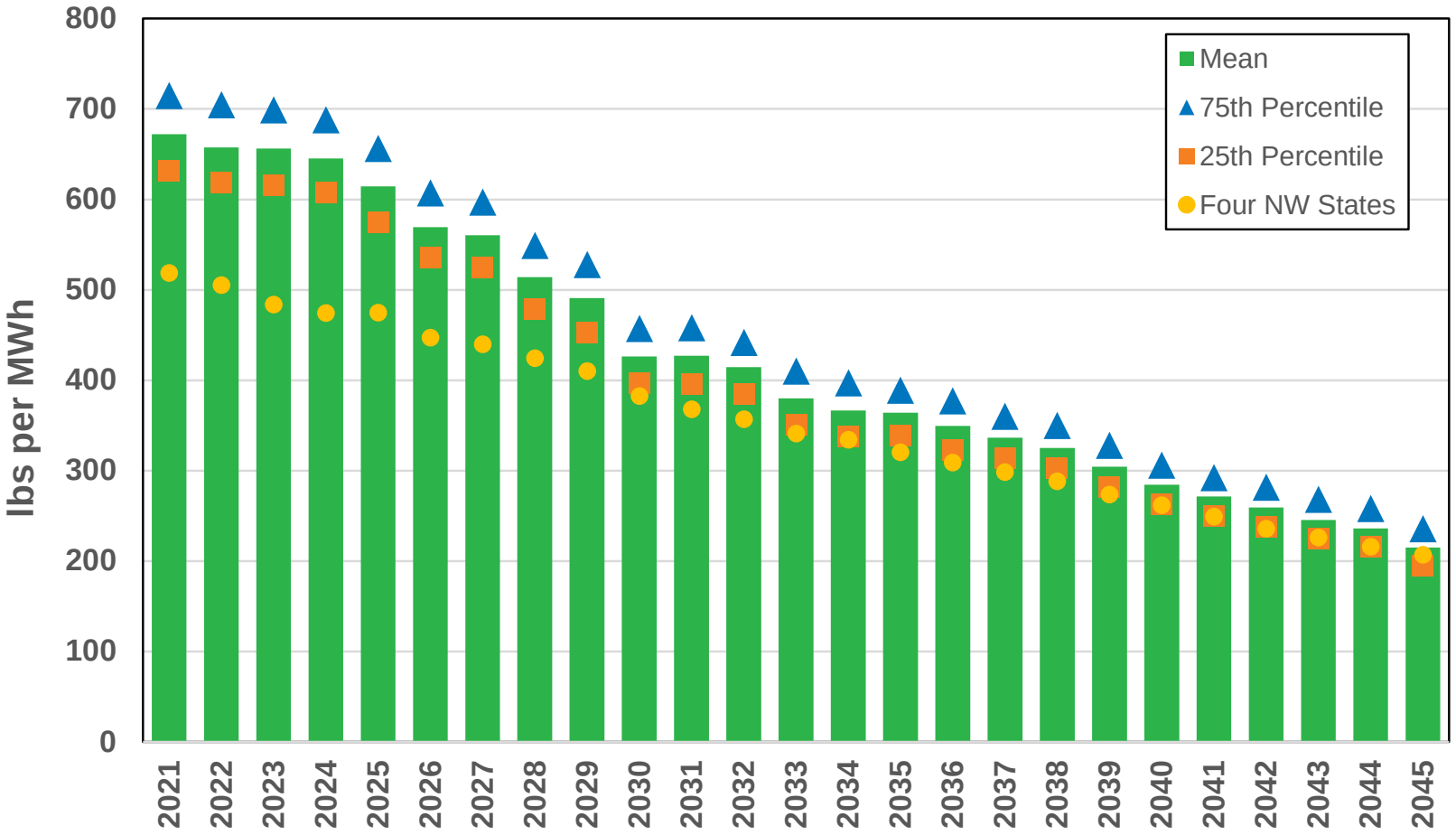
Regional Carbon Emissions

- Portfolio modeling - Avista needs an estimate for emissions associated with market transactions.
  - Avista chose a regional annual average for the 2020 IRP.
  - An hourly regional emissions intensity is likely needed for future modeling.

- Avista included emissions from WA, OR, ID, MT, UT, and WY for this metric - but also compared this result to just the four NW states.

- This is a larger footprint than Avista has market access to, but chose to be consistent with other WA state calculations.

Regional Emissions Intensity



Note: Market purchases associated with storage resources use a lower emissions intensity from their likely charging pattern. Region includes WA, OR, ID, MT, UT, and WY.

Demand-Side Resources

- Avista's modeling premise: any reduction in our load will be a regional electric market response and have little to minor impacts on Avista's generation dispatch decisions.
  - Why: Avista dispatches its generation primarily to regional market prices - not Avista loads!
- Therefore:
  - Energy efficiency (EE) reduces GHG emissions based on the regional change in emissions rather than Avista's mix.
  - Avista chose to use the annual regional emission intensity rate for EE.
  - For future modeling: a regional study with and without EE in the NW could estimate the actual incremental emissions benefit from EE.

- For each Washington kWh of EE savings, the PRiSM model credits EE programs by the SCC price and the market intensity rate.

- By 2040, emissions are lower by 171,000 metric tons due to EE.

Supply-Side Resources

- Avista does not include the SCC in dispatch decisions of its resources in the IRP.

- Although the IRP includes the SCC price from resulting operation projections.
  - If the SCC price is included in dispatch decisions, plants would operate in less then expected, therefore the model would underestimate future emissions and SCC.

- Avista includes the SCC for WA's share of each thermal resource's emissions.

- Other considerations:
  - Avista included emissions associated with upstream natural gas emissions
  - Future IRPs will include emissions from operations and construction of new resources and ancillary emissions from operations.

Market Transactions

- Avista uses the regional market annual average intensity rates for all market purchase and sales.
  - When Avista is short on an annual basis - emissions are added to the portfolio to account for emissions associated with market purchases.
  - For storage resources, Avista uses an adjusted market emissions intensity rate (from slide 6). This is to account for a lower emissions profile.
  - When Avista is long on an annual basis - emissions are reduced from the portfolio total by the market rate rather than the Avista rate. This simulates the overall regional emissions impact by Avista's wholesale sales.
    - *For example, if Avista sells excess wind - this will reduce greenhouse gas emissions at the incremental regional rate - not Avista's!*

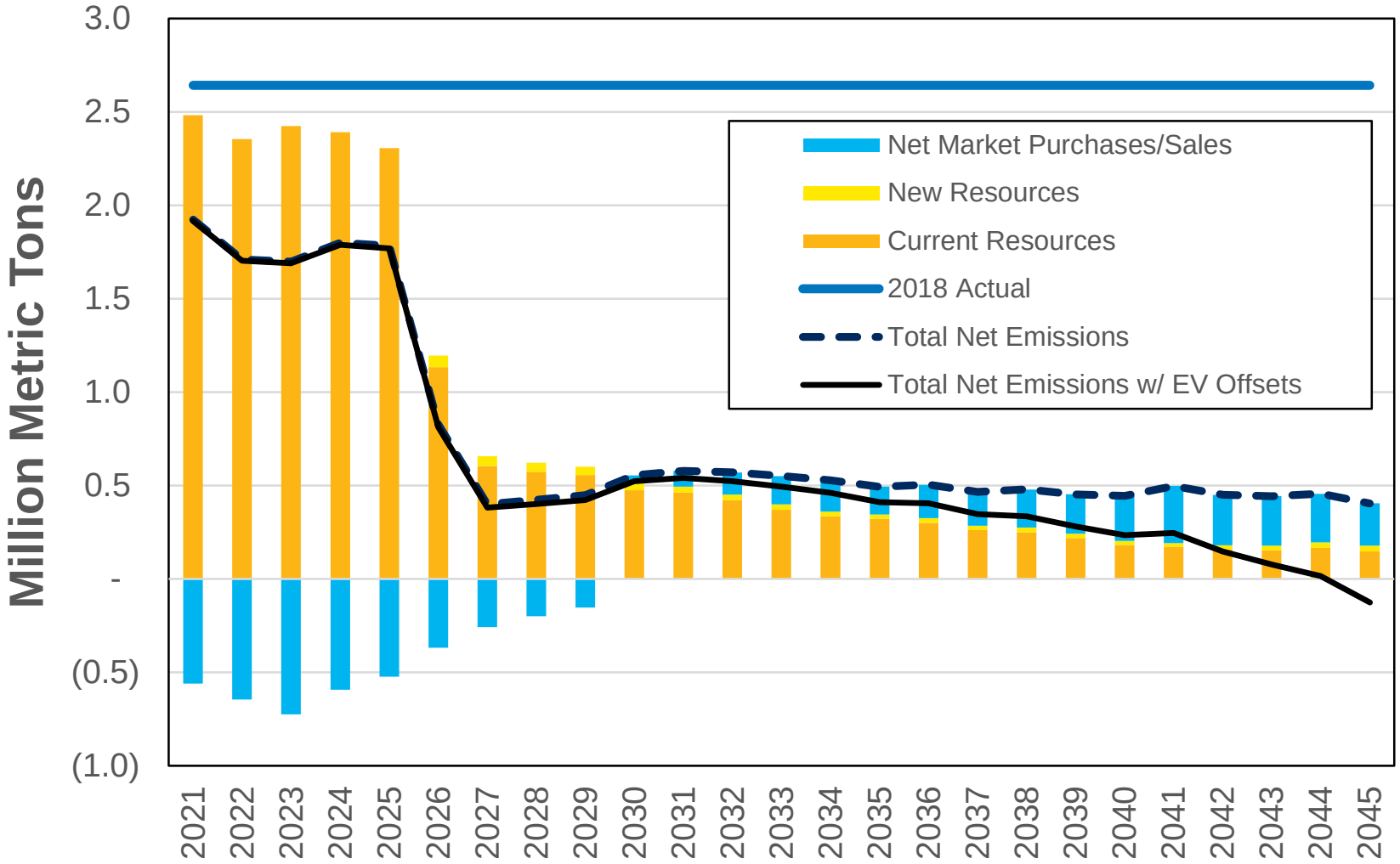
Portfolio Optimization

- When optimizing the resource portfolio - Avista includes social costs in the objective function.
  - This includes SCC for GHG emissions projections and Total Resource Cost (TRC) for EE programs.
  - Avista may include other items in this calculation to account for vulnerable populations and other emissions - depending on rule making requirements.

- Avista removes societal costs from its PVRR calculations to show rate impacts and portfolio cost comparisons.
  - Although it shows risk comparisons of portfolios with and without societal costs.

- Implied carbon pricing can be calculated by comparing portfolios with and with CETA - for Avista the levelized implied cost of carbon is $55 per metric ton.

Avista's GHG Emission Forecast (System)



Draft Approach on GHG Emissions Cost Treatment in the 2021 Power Plan

JOINT WORKSHOP AND DISCUSSION:
WUTC and Washington Department of Commerce
1/16/2020
John Ollis – Manager of Planning and Analysis

THE 2021 NORTHWEST POWER PLAN
FOR A SECURE & AFFORDABLE ENERGY FUTURE

Outline

1. Staff's Draft Proposal
2. Interpretation of Power Act language
3. Greenhouse Gas (GHG) emissions costs associated with resource strategies and scenarios

Staff's Draft Proposal

- Staff's current proposal process has only been partially vetted by advisory committees

AND

- Is not yet approved by the Council.

- Thus, the following methodology is **draft** at this point.

Power Act – Cost Effective, Directly Attributable and Quantifiable

The plan shall, as provided in this paragraph, give priority to resources which the Council determines to be cost-effective. Priority shall be given: first, to conservation; second, to renewable resources; third, to generating resources utilizing waste heat or generating resources of high fuel conversion efficiency; and fourth, to all other resources.

- The definition of *cost-effective* requires the Council to estimate and compare the *incremental system cost* of different resources.
- *System cost* is defined as: *an estimate of all direct costs of a measure or resource over its effective life, including, if applicable, the cost of distribution and transmission to the consumer and, among other factors, waste disposal costs, end-of-cycle costs, and fuel costs (including projected increases), and such quantifiable environmental costs and benefits as the Administrator determines, on the basis of a methodology developed by the Council as part of the plan, or in the absence of the plan by the Administrator, are directly attributable to such measure or resource.*

Northwest Power Act - https://www.nwcouncil.org/sites/default/files/poweract.pdf

Power Act – Environmental Methodology

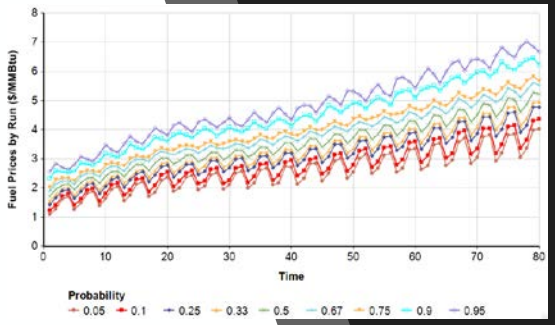
The plan shall set forth a general scheme for implementing conservation measures and developing resources pursuant to section 839d of this title to reduce or meet the Administrator's obligations with due consideration by the Council for (A) environmental quality, (B) compatibility with the existing regional power system…

To accomplish the priorities established by this subsection, the plan shall include the following elements which shall be set forth in such detail as the Council determines to be appropriate:

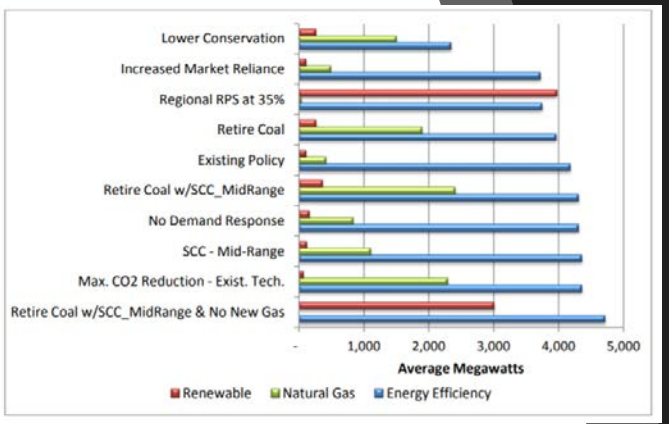
a methodology for determining quantifiable environmental costs and benefits under section 839a(4) of this title

- Northwest Power Act - https://www.nwcouncil.org/sites/default/files/poweract.pdf

Review of Resource Strategy Development (Part 1)



What If????



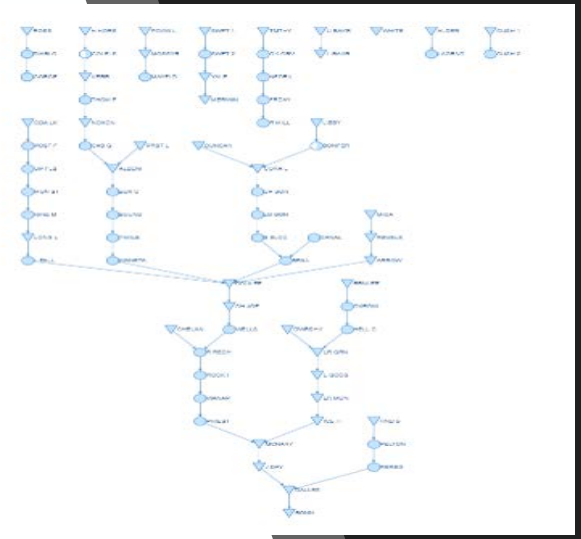
- Define a list of futures

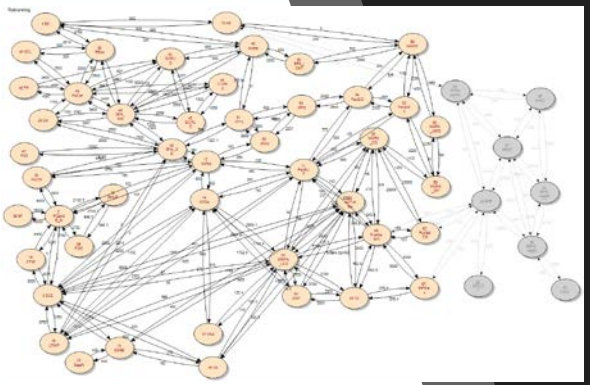
  - Elements of risk over which we have no or little control, like fuel prices, regional demand, wholesale market electricity price, and hydro conditions.

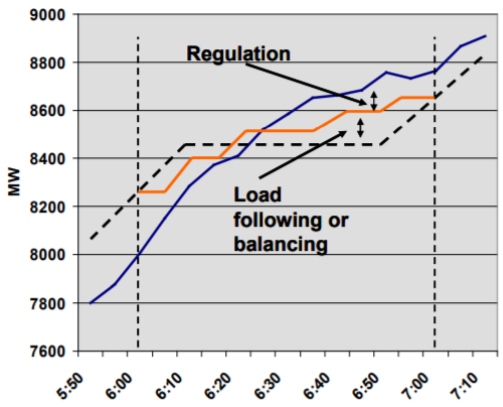
- Define a list of scenarios

  - Policies or outcomes over which we may have some control

- Use the Regional Portfolio Model (RPM) to test regional resource strategies from 2021 to 2040.
  - A resource strategy could include investments in new generating and demand-side resources.
  - Each resource strategy is tested over all the futures for every scenario, and the RPM is used to seek the least cost/risk strategy for each scenario.







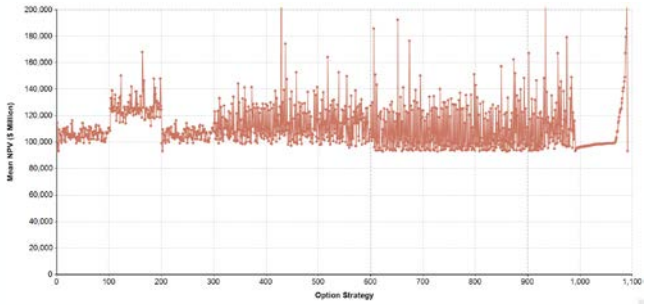
Review of Resource Strategy Analysis and Adequacy Check

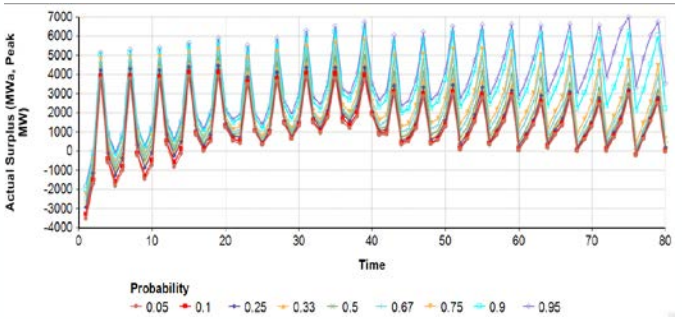
- To perform a regional resource expansion from 2021 to 2040 considered implicitly in RPM but not in detail.
  - Plant retirements and additions (out of the region)
  - Reliance on planning reserve margins for outside the region WECC planning areas for excess market availability
  - Existing state and regional policies (i.e. RPS, clean policies, carbon cap and trade policies, etc.)
  - Operational feasibility of a resource strategy
- Use AURORA to examine the repercussions of resource strategies on a WECC-wide basis
- Use GENESYS to check whether a regional resource strategy of interest meets the Council's adequacy standard.
  - This will include a consideration of whether balancing reserves and operational constraints of the system are maintained.

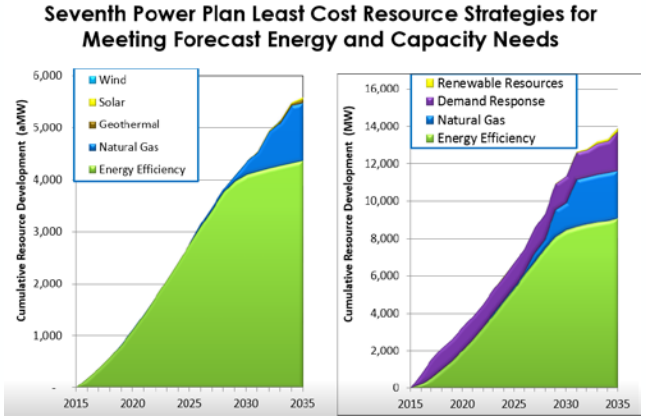
Regional Strategy Analysis – What We Do?

Assess the cost and risk associated with different regional investment strategies in RPM, and check strategies of interest in AURORA and GENESYS.

- Test optioning and building generic new resources at different times during the 20 year time horizon to determine the least cost investment strategy.
- Consider market reliance and adequacy but do not model hourly and topological detail in the RPM.
  - Focus on capital investment decision making to meet adequacy and policy constraints in the most economic way
  - Economic signals external to the region are reflected to some extent in external market electricity price and emissions forecast
  - Regional adequacy standard is reflected via the adequacy reserve margin, associated system capacity contribution and hydro available under critical conditions.







Resource Strategy Development: GHG Emissions Damage Cost

Table 2: Social Cost of CO_2, 2010 – 2050 (in 2007 dollars per metric ton of CO_2)

Year	5% Average	**3% Average**	2.5% Average	High Impact (95th Pct at 3%)
2010	10	**31**	50	86
2015	11	**36**	56	105
2020	12	**42**	62	123
2025	14	**46**	68	138
2030	16	**50**	73	152
2035	18	**55**	78	168
2040	21	**60**	84	183
2045	23	**64**	89	197
2050	26	**69**	95	212

- Council has estimated emissions rates for regional plant emissions of carbon dioxide, methane, and nitrous oxide.
- Council can calculate emissions rates for the market: i.e. use extra-regional WECC plant emissions of carbon dioxide, methane, and nitrous oxide.
- CO2e calculations include
  - Carbon dioxide, Methane, Nitrous oxide, Water vapour, Tropospheric ozone, Chlorofluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Perfluorocarbons, Sulphur hexafluoride
- Use a Societal Cost of CO2e as a proxy damage cost

Resource Strategy Development: GHG Emissions Damage Cost

Accounting for cost of GHG emissions damages in the objective function

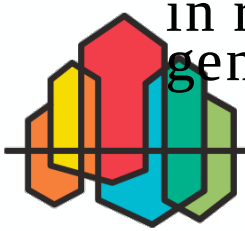
- The total emissions implied by the dispatch market and regional portfolio resources will be multiplied by the selected social cost of GHG emissions and considered by the RPM when determining a least cost plan in ALL scenarios.

Accounting for cost of GHG emissions in dispatch decisions

- In some scenarios, the GHG emissions cost may be included in the dispatch decision to test the effect of policies.

Accounting for cost of GHG emissions in rates/reported costs.

- In some scenarios, the GHG emissions cost may be included in rates depending on policy tested (say a tax), but, in general, any carbon damages will be backed out.



Objective Function Accounting

- An objective function in a least cost planning exercise requires an attempt to minimize total system cost while maintaining constraints on the system (reliability, state federal policies, fish and wildlife constraints, etc.)

$$Total\ System\ Cost = Fixed\ Cost + Variable\ Cost$$

Minimize this number

Account for emissions by multiplying damage cost by number of emissions in a candidate resource strategy

Include Change in Dispatch

$$Total\ System\ Cost = Fixed\ Cost + Variable\ Cost$$

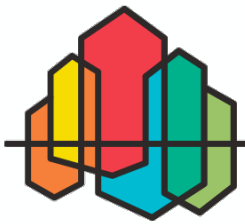
Minimize this number

Account for emissions by multiplying damage cost by number of emissions in a candidate resource strategy

AND…

Account for change in dispatch by inputting damage cost in plant dispatch decision.

- This will likely make coal plants and inefficient gas plants dispatch less

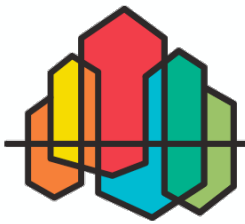


Rates Accounting

- The rate is calculated by taking the
  1. Annual revenue requirement, which is total system cost for the year minus the *CO2e damage cost for the year**
  2. And dividing by the annual sales, which is regional frozen efficiency load net of energy efficiency acquisitions.

$$Rate = \frac{Annual\ Revenue\ Requirement}{Annual\ Sales}$$

*If there is a carbon tax then the customer explicitly pays for the damages and CO2e damages are not netted out.



Questions?

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Washington State Department of Commerce

UTC Washington Utilities and Transportation Commission

Opportunity to Comment

Modeling Greenhouse Gas Pollution Costs in Electric Integrated Resource Planning

Washington State Department of Commerce

UTC Washington Utilities and Transportation Commission

Next Steps

a. **Update on rulemaking(s), comments, and information gathering**
b. **Additional workshops**