# IRP Stakeholder Meeting

## 2023 Electric Progress Report

March 22, 2022

PUGET SOUND ENERGY

*This session is being recorded by Puget Sound Energy.*
*Third-party recording is not permitted.*

# Safety moment

Handling Work Stress

- Ask for help
- Communicate problems early
- Take breaks throughout the day
- Take mental health days off if needed
- Remember to not take work stress home



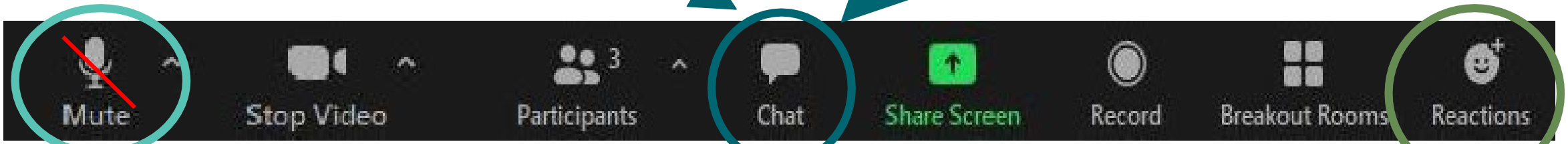


PUGET SOUND ENERGY

# Welcome to the webinar and thank you for participating!

If you **want to type a question regarding the presentation,** insert **"Slide X followed by your question"** in the chat box!

If you **have a technical issue or a general question**, please type it in the chat box.




Please **keep yourself on mute** unless you are speaking.

If you want to **ask a question verbally,** click the 'Reaction' button and click on the **'Raise Hand'** option and we will call on you.

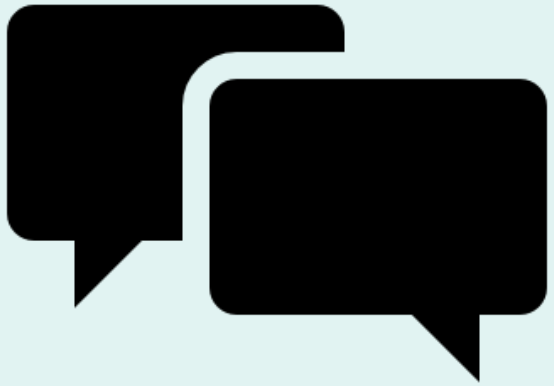




PUGET SOUND ENERGY

# Facilitator Requests

- Engage constructively and courteously towards all participants
- Respect the role of the facilitator to guide the group process
- “Take space and make space”
- Avoid use of acronyms and explain technical questions







PUGET SOUND ENERGY

# Agenda

| Time | Agenda Item | Presenter |
|---|---|---|
| 9:00 – 9:10 a.m. (*10 min.)* | **Introduction** | **Sophie Glass** |
| 9:10 – 9:20 a.m. (*10 min.)* | **Overview** | **Kara Durbin** |
| 9:20 – 10:30 a.m. *(70 min.)* | **Informational overview on Climate Commitment Act**<br><br>**Carbon Prices and Social Cost of Greenhouse Gas Emissions** | **Lorna Luebbe**<br>**Phillip Popoff**<br>**Elizabeth Hossner** |
| 10:30 – 10:40 a.m. (*10 min.)* | **Break** | |
| 10:40 – 11:25 a.m. (45 min.) | **Electric Supply Side Resource Alternatives** | **Elizabeth Hossner**<br>**Tyler Tobin** |
| 11:25 – 11:55 a.m. *(30 min.)* | **Regional Assumptions for Electric Price Forecast** | **Tyler Tobin** |
| 11:55 a.m. – 12:00p.m. | **Next steps** | **Sophie Glass** |
| 12:00 p.m. | **Adjourn** | **Sophie Glass** |





PUGET SOUND ENERGY

# Today's Speakers

**Lorna Luebbe**
Vice President of Sustainability and Deputy General Counsel, PSE

**Phillip Popoff**
Director, Resource Planning Analytics, PSE

**Kara Durbin**
Director, Clean Energy Strategy, PSE

**Elizabeth Hossner**
Manager, Resource Planning and Analysis, PSE

**Tyler Tobin**

Senior Analyst, Resource Planning Analytics, PSE

**Sophie Glass**
Facilitator, Triangle Associates





PUGET SOUND ENERGY

# Overview

Kara Durbin, Director, Clean Energy Strategy, PSE

PUGET SOUND ENERGY

# 2022 energy planning process focus areas

## Clean Energy Implementation Plan

We will continue to engage on CEIP elements and prepare for implementation

## Today's focus

## 2023 Electric Progress Report

- *New* Clean Energy Transformation Act (CETA) requirement
- Provides two-year progress report on 2021 IRP
- Results will inform 2023 Biennial CEIP Update

## March 31 focus

## 2023 Gas Utility IRP

- Separate IRP focused on needs of natural gas sales customers





PUGET SOUND ENERGY

# How input from Jan. 20 meeting is shaping our work

| Themes heard at Jan. 20 meeting | What we did with it |
|---|---|
| **Climate change in load forecasting**:<br>• General support for approach | Incorporating climate change assumptions into our load forecasting for 2023 reports |
| • Suggestions to meet with climate scientists at University of Washington (UW) | • PSE has met with UW climate scientists, given the time will use the NWPCC data for the 2023 Progress Report<br>• Continuing to research available climate data models by working with regional climate experts, such as the UW |
| • Suggestions to model PSE's specific service territory beyond SeaTac weather station | We're taking feedback on using other weather stations under advisement for future IRPs |
| • Interest in 2023 Electric Progress Report including forecasted changes in vehicle and building electrification | The F22 load forecast incorporates an EV forecast, the load forecasting team plans to share this forecast at a future stakeholder meeting. An electrification analysis will be included within the Gas Utility IRP |
| **Conservation Potential Assessment (CPA)**<br>• Interest in considering time-varying rates and electric vehicles in the Conservation Potential Assessment | Impacts will be included – see feedback report for details |
| • Suggestions that energy efficiency programs improve customer awareness, encourage using PSE incentives, and expand assistance for low-income programs | Shared feedback with Energy Efficiency team for consideration in their programming. |

# How input from Jan. 20 meeting is shaping our work

| Themes heard at Jan. 20 meeting | What we did with it |
|---|---|
| **IRP process feedback:**<br>• Additional topics suggested: legislative session highlights | • PSE will provide a summary |
| • Suggestions for discussing resource adequacy modeling and plans for distributed energy resources and vehicle to grid.<br>• Questions on schedule for the IRP processes. | • We're working to incorporate space for these discussions<br>• We're continuing to work on the schedule for 2022-2023 and included a draft schedule in this presentation |
| • Suggestion to use different modeling tool | • To learn more, PSE researched the suggested tool, which is a production cost and capacity expansion model, similar to AURORA. There are several new tools on the market that PSE will continue to research. For the 2023 reports, PSE will continue to use the AURORA model, and work on building more granularity into the model |

Unanswered questions from Jan. 20 meeting and feedback form addressed in Feedback Report



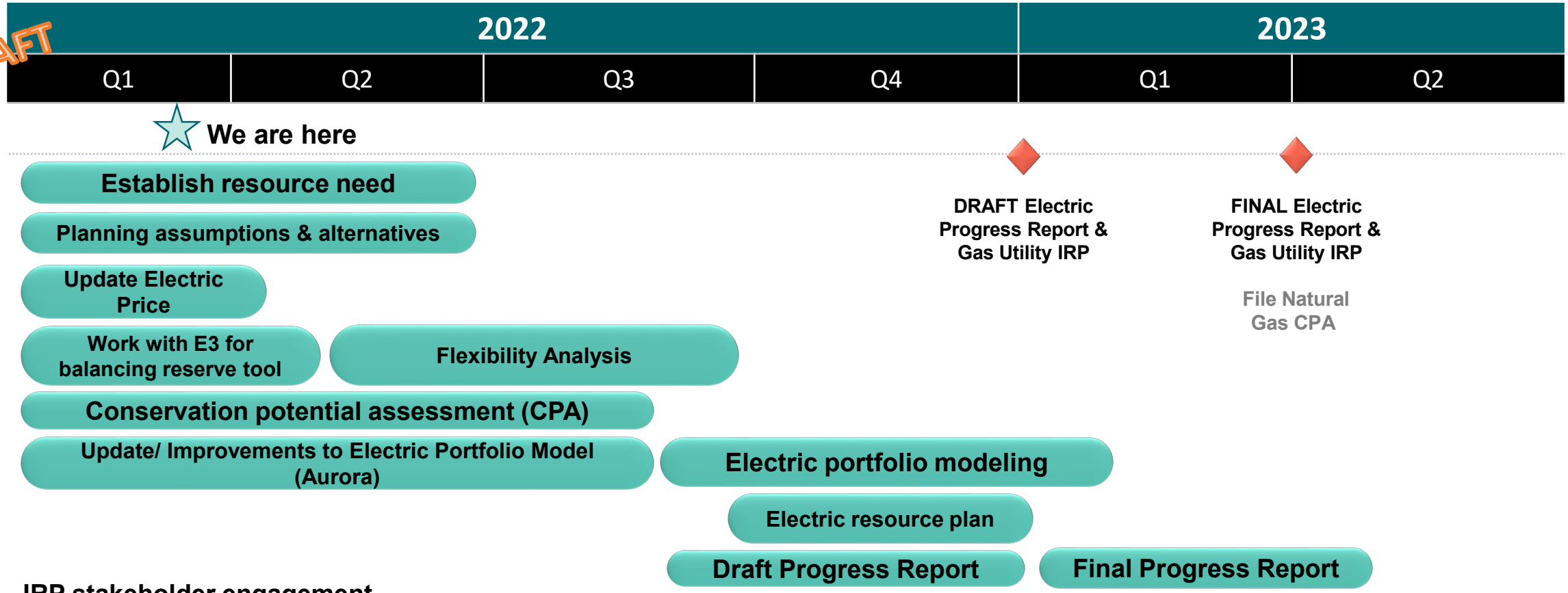


PUGET SOUND ENERGY

*Updated:* 3/21/22

# 2023 Electric Progress Report timeline

DRAFT




## IRP stakeholder engagement

- **Meeting #1: Jan. 20** Energy planning update
- **Meeting #2: Mar. 22** Assumptions for Electric Progress Report
- **Meeting #3: March 31** Assumptions for Gas Utility IRP
- **Meeting #4: June 2022** Electric & Gas Delivery System Planning
- **Resource Adequacy Info Session: July 2022**
- **Meeting #5: Sept. 2022** Electric: Final resource need, final CPA results
- **Meeting #6: Sept. 2022** Gas Utility: Feedback on gas resource alts
- **Meeting #7: Nov. 2022** Updates and feedback on draft results of electric & gas portfolio
- **Meeting #8: March 2023** Updates and feedback on draft results of electric progress report & gas utility IRP

DRAFT



PUGET SOUND ENERGY

# Informational overview of Climate Commitment Act

**Lorna Luebbe,** Vice President of Sustainability and Deputy General Counsel

PSE PUGET SOUND ENERGY

# Snapshot: Climate Commitment Act overview

| Key points to be aware of... | Key questions for stakeholders |
|---|---|
| 1. The Climate Commitment Act (CCA) is a new state law and rules are being written now to implement.<br><br>2. The law creates a cap-and-invest program that sets an overall limit on greenhouse gas (GHG) emissions in the state that declines over time. Utilities must comply by covering their emissions under the cap – either through emissions allowances and/or emissions reductions.<br><br>3. Washington Department of Ecology is responsible for drafting the rules and compliance. Rules will be final this fall and program will start on Jan. 1, 2023.<br><br>4. As a market-based program, the CCA will put a price on carbon that will affect IRP price forecasting. | None.<br><br>This is an informational session to inform:<br>• Today's discussion on electric price forecasts.<br>• The Mar. 31 discussion on natural gas price forecast. |

Additional resource: [Climate Commitment Act - Washington State Department of Ecology]

# Climate Commitment Act overview

WA Legislature passed law in 2021 to reduce carbon pollution statewide

**Purpose: Creates a "cap-and-invest" program**

- Establish a carbon pricing mechanism to reduce carbon pollution
- Meet state's greenhouse gas (GHG) emissions limits
- State invests revenues in carbon reduction activities prioritizing overburdened communities

WA Dept. of Ecology (Ecology) is responsible for rule development and program implementation

- Rule development ongoing and final rules expected in Fall 2022
- Program begins January 1, 2023
- Rulemaking will establish a structure for the program:
    - Methods and procedures for allocating allowances
    - Auction mechanics and auction prices (floor and ceiling)
    - Compliance and enforcement provisions
    - Among other features





PUGET SOUND ENERGY


# Climate Commitment Act program overview

- Statewide program to reduce carbon pollution - **begins January 1, 2023.**
- **Emissions cap** will be set for all GHG emissions under the CCA and will be reduced incrementally – tied to state GHG emissions limits targets for the years 2030, 2040, & 2050.
- Covered entities are required to obtain '**emissions allowances'** equal to their GHG emissions for four-year compliance periods.
- With cap reduction, allowances will become more scarce and more valuable over time (supply & demand) which is expected to incentivize decarbonization.
- The market is a **system for trading credits and allowances** that can link with other trading regimes like California & Quebec.
- Revenue generated by the allowance auctions will be invested by the state in programs that reduce carbon pollution, with specific percentages dedicated to projects that ensure benefits to overburdened communities and tribes.
- Expands air monitoring and reduces air pollution in overburdened communities.



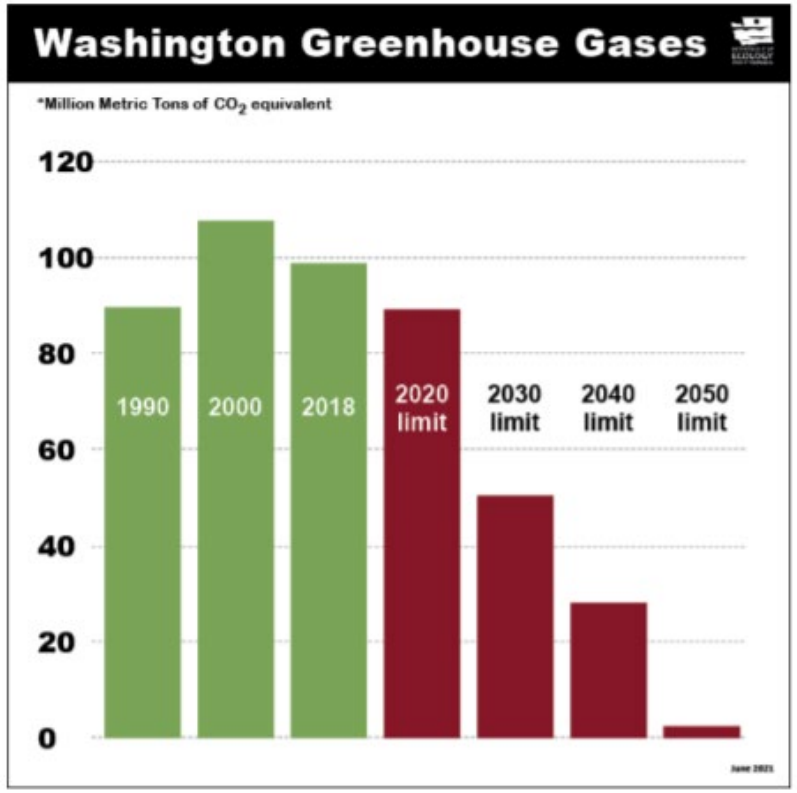


PUGET SOUND ENERGY

# Background: Statutory GHG limits

DEPARTMENT OF ECOLOGY
State of Washington

## Taking action on greenhouse gases




In 2020, the Washington Legislature set new greenhouse gas emission limits in order to combat climate change. Under the law, the state is required to reduce emissions levels:

- 2020 - reduce to 1990 level of 95.5 million metric tons.
- 2030 - **45%** below 1990 level to 50 million tons.
- 2040 - **70%** below 1990 levels to 27 million tons.
- 2050 - **95%** below 1990 levels to 5 million tons – and achieve net zero emissions.





PSE PUGET SOUND ENERGY

# Background: Coverage

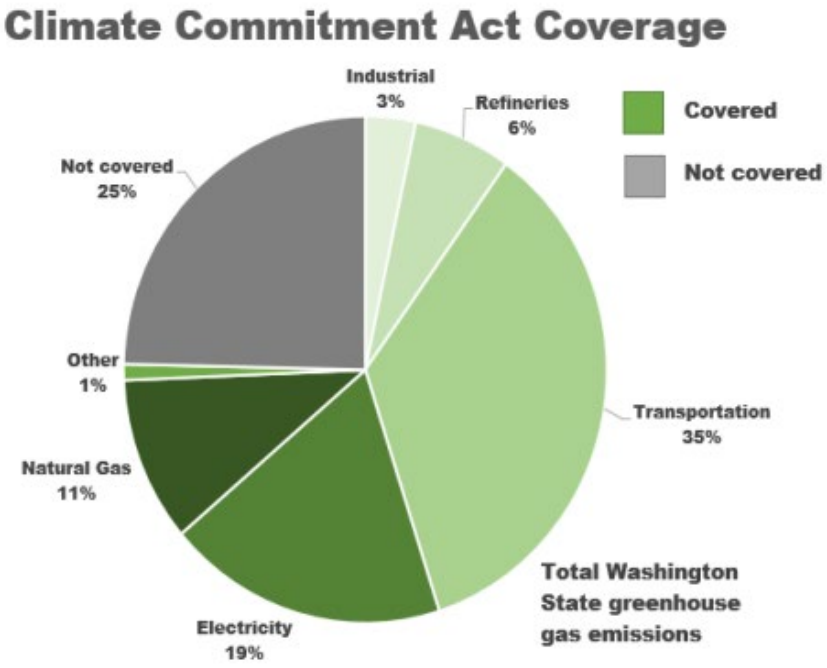
## Covered emissions in the Climate Commitment Act

**What's covered – 75%**

- Gasoline and on-road diesel
- Electricity consumed in WA state
- Facilities generating more than 25,000 metric tons a year or more of greenhouse gas emissions
- Natural gas distributed to homes and commercial businesses
- 2027 - waste to energy facilities
- 2031 - railroads & certain landfills

**What's not covered – 25%**

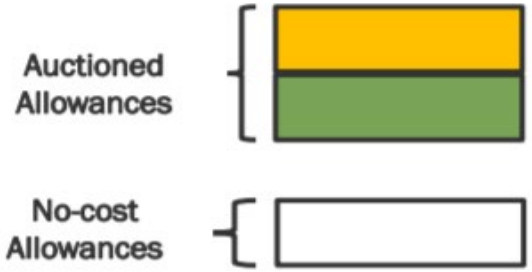
- Agricultural operations
- Forestry operations
- Small businesses with under 25,000 metric tons/year of greenhouse gas emissions
- Aviation fuels
- Most marine fuels

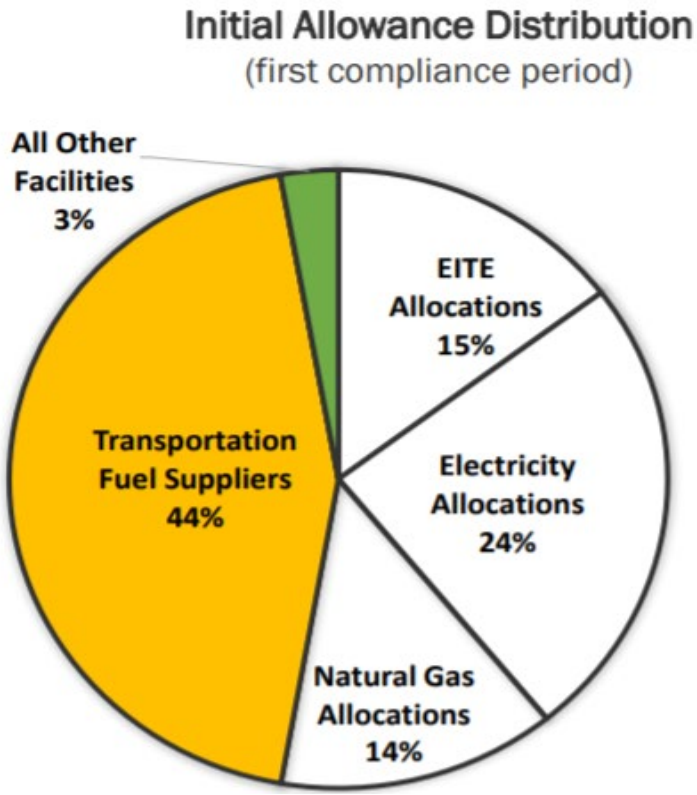


# First Compliance Period: Allowance allocation by industry

## Emissions allowances in the Climate Commitment Act

- Covered entities must obtain allowances to cover their emissions.
- The total number of allowances decrease over time to meet statutory GHG emissions limits.
- Some covered entities will be issued no-cost allowances; other allowances will be auctioned for revenue.



# Allowance Distribution: Electric Utilities

- CCA is designed to work with CETA - electric utilities are already working to comply with CETA's ambitious decarbonization targets.
- Therefore, electric utilities subject to CETA are allocated free allowances to mitigate the cost burden of the CCA program on electric customers until 2045.
- Allowance allocation for four-year compliance periods will be adopted in Ecology rulemaking, in consultation with Commerce and WUTC, no later than:
    - October 1, 2022 for the 2023-2026 compliance period.
    - October 1, 2026 for the 2027-2030 compliance period.
    - October 1, 2028 for the 2031-2045 compliance periods.
    - No free allowances for electric utilities past 2045.
- Allocations must be consistent with a forecast  of supply and demand and the cost burden in each compliance period as approved by WUTC (for IOUs).
- Allowances can be consigned to auction for the benefit of ratepayers, deposited for compliance, banked for future compliance, or combination. All proceeds from the consignment of allowances must benefit ratepayers with first priority to mitigating rate impacts to low-income customers.
- Rules for allocation must consider the impact of electrification of buildings, transportation and industry on the electricity sector.

# Allowance Distribution: Natural Gas Utilities

- PSE will receive direct allocation of allowances to protect ratepayers from price increases and allowances will decline proportionally with the statewide cap.
- Ecology to set allocation schedules by rule, in consultation with WUTC, by:
  - October 1, 2022 for the 2023-2030 compliance periods.
  - October 1, 2028 for the 2031-2040 compliance periods.
- Starting in 2023, 65% of the no cost allowances, increasing at 5% annually, must be consigned to auction for the benefit of customers, prioritizing the elimination of the burden on low-income customers.
- Remaining revenues from allowances sold at auction must be returned by providing:
  - Non-volumetric credits on ratepayer bills, prioritizing low-income customers, or
  - Weatherization, decarbonization, conservation and efficiency services, and bill assistance to minimize cost impact on low-income, residential, and small business customers (any customer benefits provided with revenues must be in addition to existing legal requirements).
- Customer bill credits are only available for customers whose location was connected to a natural gas utility's system on the June 2021, except for low-income customers.

# Carbon Pricing and Social Cost Greenhouse Gas Emissions

**Phillip Popoff,** Director of Resource Planning Analytics, PSE

**Elizabeth Hossner,** Manager, Resource Planning and Analysis, PSE

PUGET SOUND ENERGY

# Snapshot: CCA carbon pricing and social cost of greenhouse gas emissions

| Key points to be aware of... | Key questions for stakeholders |
|---|---|
| 1. PSE's approach is to apply CCA as a carbon cost on the electric portfolio. Given that we're ahead of the final CCA rules and don't have information on allowances, we're not modeling allowances on electric side and instead focusing on it as a carbon cost.<br><br>2. PSE plans to apply CCA as a direct cost in dispatch.<br><br>3. PSE plans to apply social cost of greenhouse gas emissions (SCGHG) as an externality cost after dispatch cost.<br><br>4. PSE will use California pricing as carbon cost (to be discussed in a different section of today's meeting). | None. This section is intended to be informational to help inform subsequent discussions in the meeting. |

# Overview of social cost of greenhouse gas emissions

- CETA requires utilities to apply social cost of greenhouse gas emissions (SCGHG) as a cost in energy planning analyses
- UTC determines the costs, which are available on UTC's website
- Upstream emissions included on natural gas plants which relies on data published by the Puget Sound Clean Air Agency (PSCAA)

| Year | Social Cost of Carbon Dioxide* (in 2007 dollars per metric ton) | ** GDP Index (2007 dollars) | ** GDP Index (2020 dollars) | Adjusted Social Cost of Carbon Dioxide* (in 2020 dollars per metric ton) |
|---|---|---|---|---|
| 2010 | $50 | 92.498 | 113.623 | *$61* |
| 2015 | $56 | 92.498 | 113.623 | *$69* |
| 2020 | $62 | 92.498 | 113.623 | *$76* |
| 2025 | $68 | 92.498 | 113.623 | *$84* |
| 2030 | $73 | 92.498 | 113.623 | *$90* |
| 2035 | $78 | 92.498 | 113.623 | *$96* |
| 2040 | $84 | 92.498 | 113.623 | *$103* |
| 2045 | $89 | 92.498 | 113.623 | *$109* |
| 2050 | $95 | 92.498 | 113.623 | *$117* |

*"Adjusted cost of greenhouse gas emissions" table - excerpt from UTC website*





PUGET SOUND ENERGY

# Applying SCGHG and CCA carbon pricing to energy planning

**Total Cost = Direct Costs + Externality Costs**





PUGET SOUND ENERGY

# Applying SCGHG and carbon pricing to Total Costs

**Direct Costs** + **Externality Costs** = **Total Costs**

**Drives Operations**
- Plant costs
- Operations & maintenance
- Fuel
- Variable costs
- New! **CCA Price x combustion tons**

**Resulting pollution**

**Costs paid by PSE and reflected in customers' bills**

**Calculation that doesn't affect Operations**

*Calculation* of:
Tons of pollution include upstream emissions
X
**SCGHG**
($/ton from UTC)

**Costs to Society as a Whole**

**Costs NOT directly billed to customers**

**Total cost for making intermediate and long-term resource decisions**





PUGET SOUND ENERGY

# Double counting?

**Is including CCA carbon prices in Direct Costs with SCGHG in Externalities double counting?**

- No…by definition

| Direct Costs | + | Externality Costs | = | Total Costs |
|---|---|---|---|---|
| Direct costs include a CCA Price times the quantity of emissions from operations | | Externality costs are specifically intended to reflect the cost of pollution that resulted from operations | | Total Costs must include both Direct and Externality Costs; otherwise planning decisions will be biased in favor of fossil fuel generation |





PUGET SOUND ENERGY

# **Break**

Please return in 10 minutes

*"Monet Wind" by Eric Jensen of Roslyn, WA*





PUGET SOUND ENERGY

# Electric Supply Side Resource Alternatives

Elizabeth Hossner, Manager, Resource Planning and Analysis, PSE

Tyler Tobin, Senior Analyst, Resource Planning Analytics, PSE

PUGET SOUND ENERGY

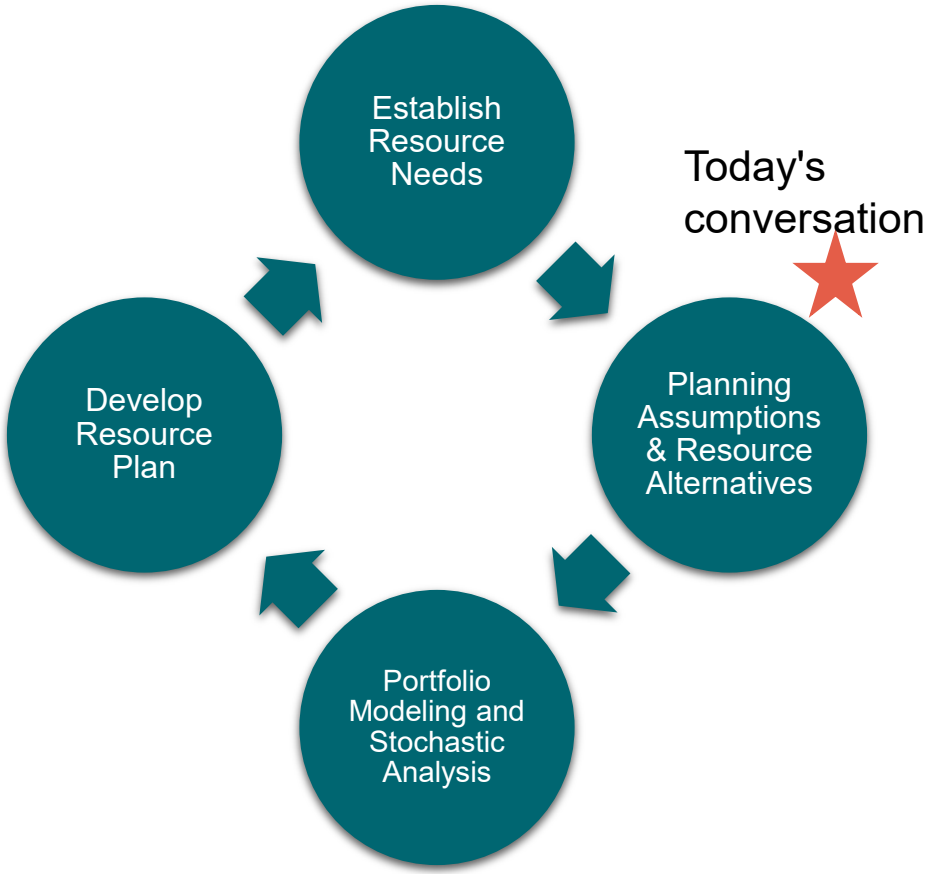
# Snapshot: Electric supply side resource alternatives

| Key points to be aware of... | Key questions for stakeholders |
|---|---|
| 1. PSE is concurrently working to establish resource need, determine planning assumptions, and identify resource alternatives.<br><br>2. PSE has updated assumptions for:<br>• Costs: Using 2021 National Renewable Energy Lab (NREL) Annual Technology Baseline (ATB) costs.<br>• Updated resource assumptions: battery storage, pumped storage, and hybrid resource assumptions.<br><br>3. PSE is considering a variety of generic resources, including wind and solar, battery storage, hybrid renewables + storage, thermal facilities, and emerging technologies. | • Should PSE use the 2021 NREL ATB capital costs and cost curves or should PSE consider other alternatives?<br>• What sources would you recommend besides the ATB costs?<br>• How should PSE approach resource costs where ATB costs are not available (e.g., reciprocating peaker, pumped hydro electric storage, hydrogen, nuclear)? |

# 2023 Electric Progress Report modeling process

The 2023 Electric Progress Report will follow a 4-step process for analysis:

1. Analyze and establish resource need
    - Energy Need
    - Capacity Need
    - Renewable Need
2. Determine planning assumptions and identify resource alternatives
3. Portfolio Modeling and Stochastic Analysis
4. Develop resource plan








PUGET SOUND ENERGY

# Changes from 2021 IRP for 2023 Electric Progress Report

**Costs: Using 2021 National Renewable Energy Lab (NREL) Annual Technology Baseline (ATB)**

- Consistent with approach taken in the CEIP in response to stakeholder feedback
- Unlike past IRPs, PSE will not average across several resources
- NREL ATB source data excel files available on IRP website (see Electric Progress Report's Generic Resource Cost Adjustments and Generic Resource Cost Breakdown files)

**Configuration of hybrid resources**

- Added: Wind + Solar + Battery option
- Increased: Generation to storage ratio from 100MW:25MW to 100MW:50MW

**Pumped storage**:

- Updated operation for full discharge; minimum charge of 0 up to 100% discharge based on newer technology





PUGET SOUND ENERGY

# Changes from the 2021 IRP

**Battery storage**

- Updated operating considerations based on stakeholder feedback
- Model minimum state of charge of 0 by overbuilding battery capacity to account for operating parameters
- Add cycling limit of 1/day or 365/year
- Change battery options modeled based on info available from NREL ATB
- Nameplate changed to 100 MW for utility scale
- Add separate distributed energy resources (DER) battery of 10 MW or less

**Other**

- Consultant studying updated wind and solar shapes





PUGET SOUND ENERGY

# What's not changing?

- **Variable and Fixed Operations and Maintenance** (VOM and FOM, respectively)
  - NREL ATB does not have enough documentation behind their variable and fixed costs to align them with operating assumptions
  - PSE will continue to use the assumptions from the 2021 IRP which are based on a report from the consultant HDR

- **Operating characteristics of thermal resources**, including:
  - Heat rate and ramp rate
  - Minimum uptime/downtime
  - Force outage rate and mean time to repair

# Generic resources act as resource place holders in PSE's models

## Generic resources

- ✓ Best guess representation or **proxy for different resource types**
- ✓ Use **general locations** to show an indicative shape of a wind or solar resource and represent large areas
- ✓ **Assumes** generic resources are to be **PSE built, owned and operated facilities**

- ✗ **Not an actual resource** (e.g., XYZ project) or specific technology or generator
- ✗ Not an actual resource down to community level (e.g., XYZ project in City G)
- ✗ PSE doesn't always build, own or operate the facility. **New resources are acquired through Request for Proposals** (RFPs)

**Example: Why don't we model power purchase agreements (PPAs)?**

- PPAs are developed by individuals for RFPs based on each builder's own financial structure and assumed rate of return. ***We can't assume*** individual PPA costs 5, 10 or 20 years in the future
- ***We can assume*** the current cost to build, an assumed cost curve from the NREL ATB, and PSE's financial structure and rate of return





PUGET SOUND ENERGY

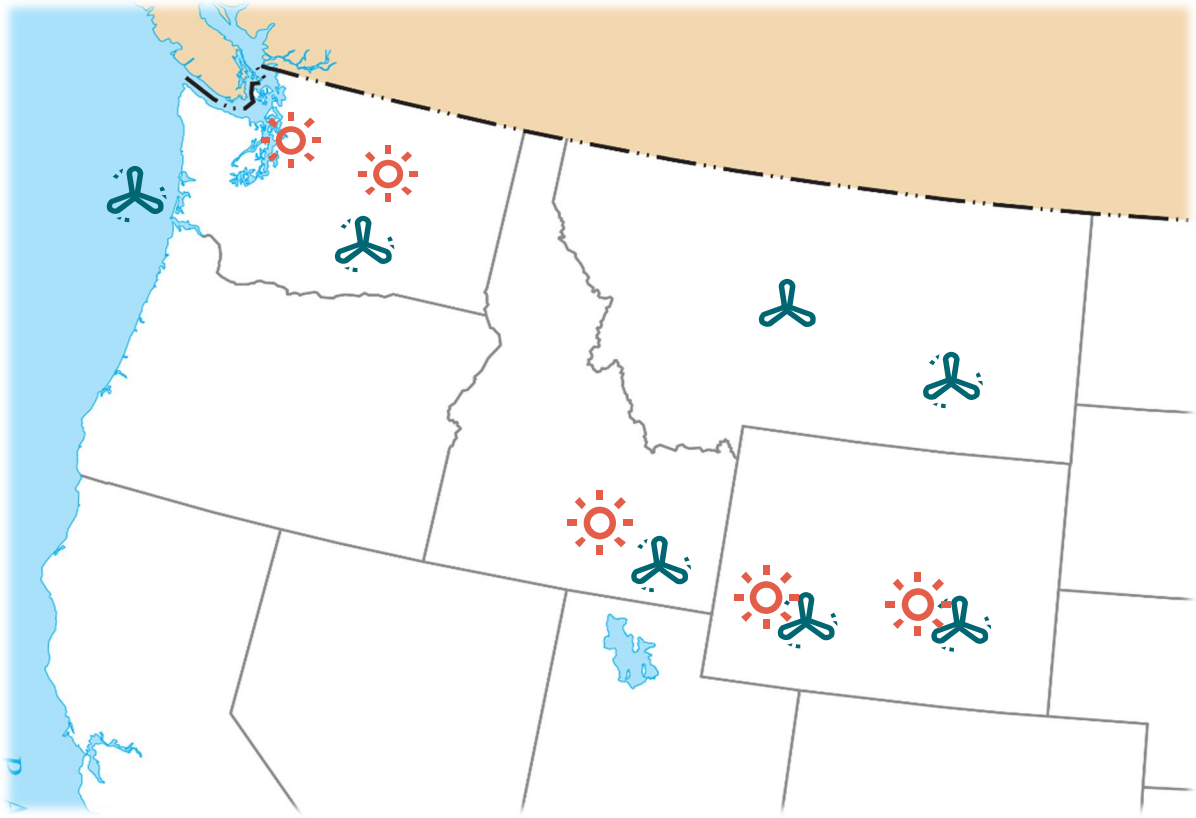
# Wind and solar resources

**Possibly add:**

- Add British Columbia or Oregon wind or solar
- Reviewing Oregon wind shapes to see if statistically different than WA wind

**Possibly drop:**

- Wyoming and Idaho solar were never selected in 2021 IRP process, considering dropping in the 2023 Electric Progress Report



*Western Washington includes utility solar and distributed solar*



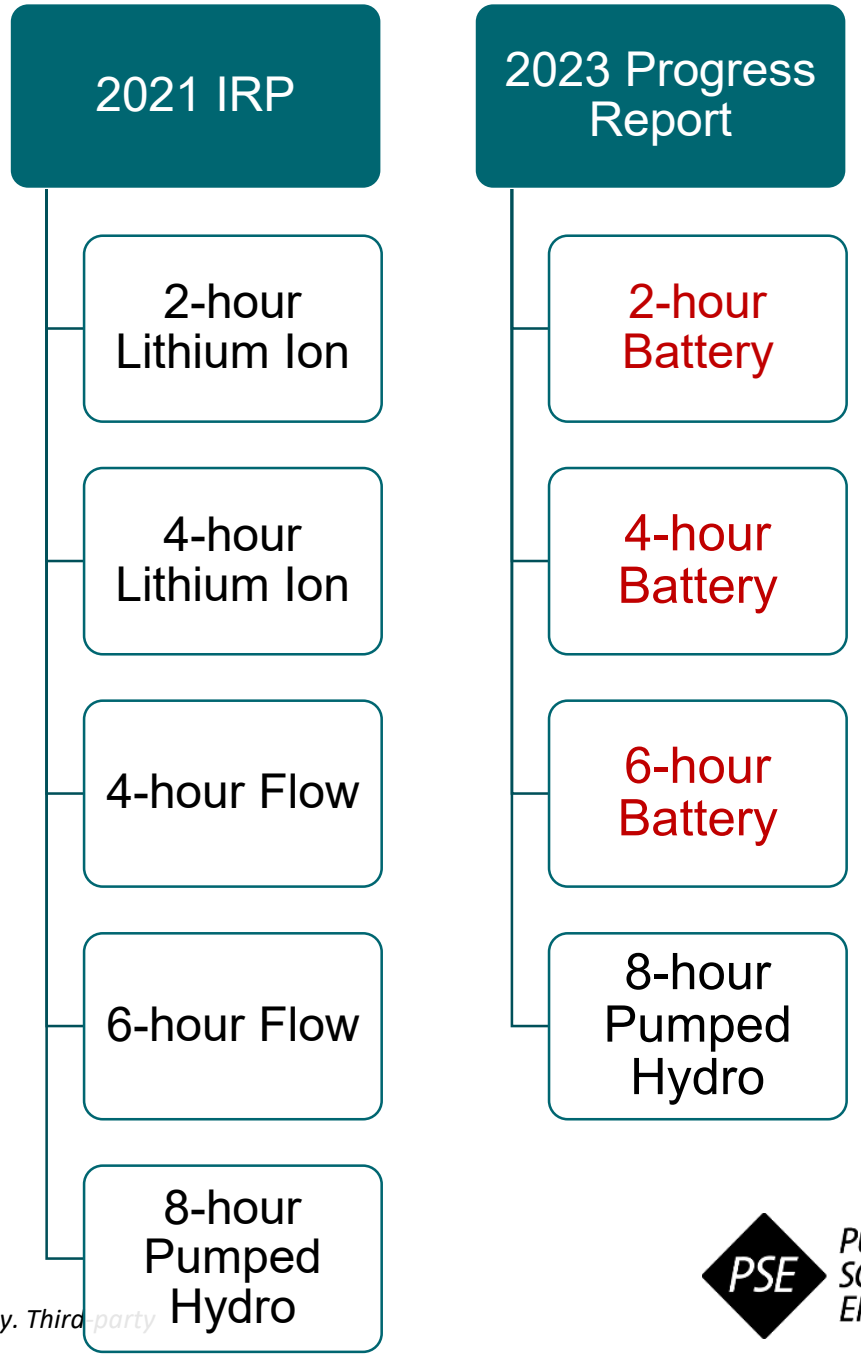


PUGET SOUND ENERGY

# Energy storage resources

**Proposed changes:**
- Consolidate battery technologies to align with NREL ATB cost information.
- Assume “over build” of battery capacity and model complete discharge in models

**Challenge:**
- No NREL ATB cost information for flow batteries








PUGET SOUND ENERGY

# Hybrid renewable + storage resources

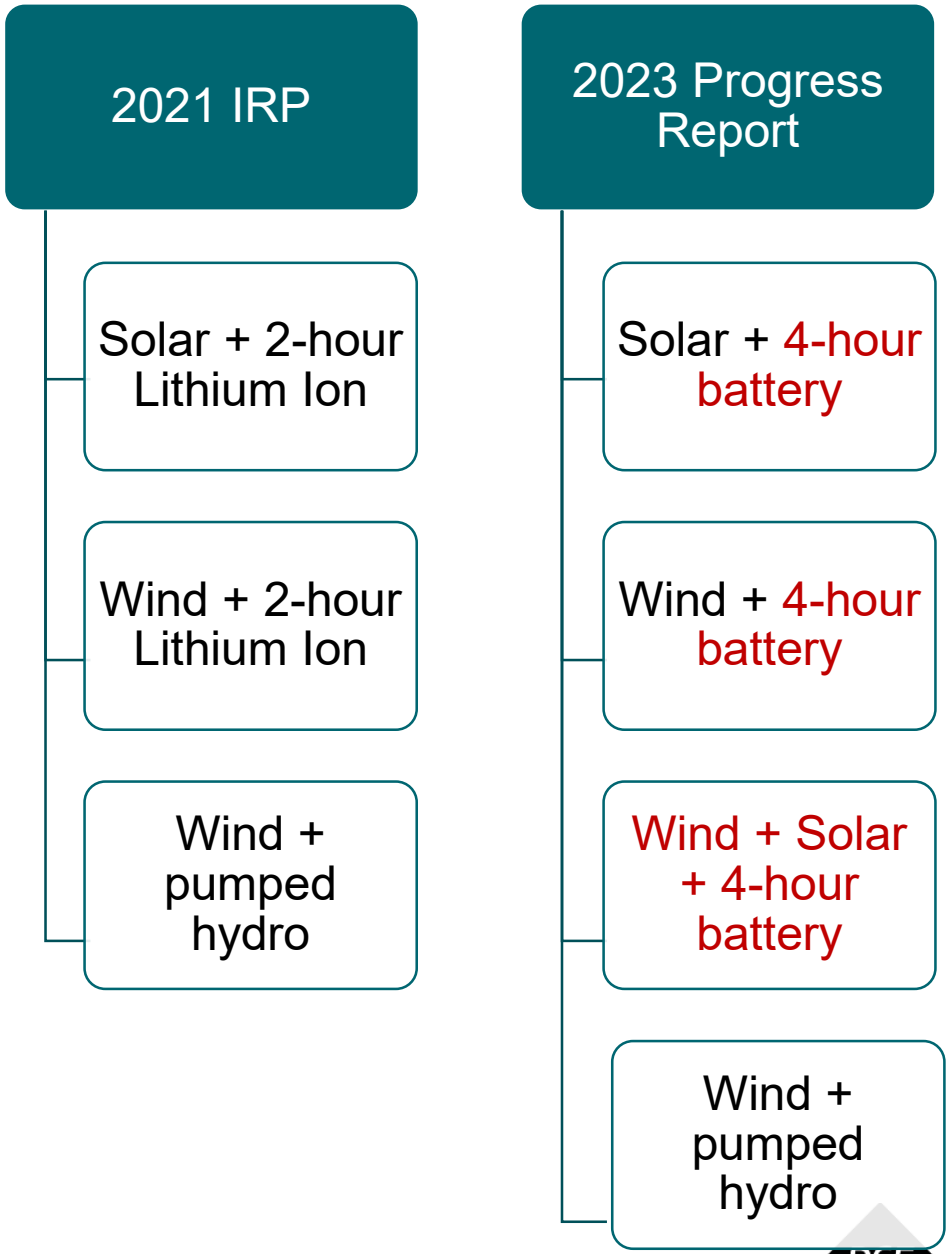
**Other Updates**:

- Improved modeling methodology to better allocate costs

- Increased generation to storage ratio:

100MW:25MW

100MW:50MW








PUGET SOUND ENERGY

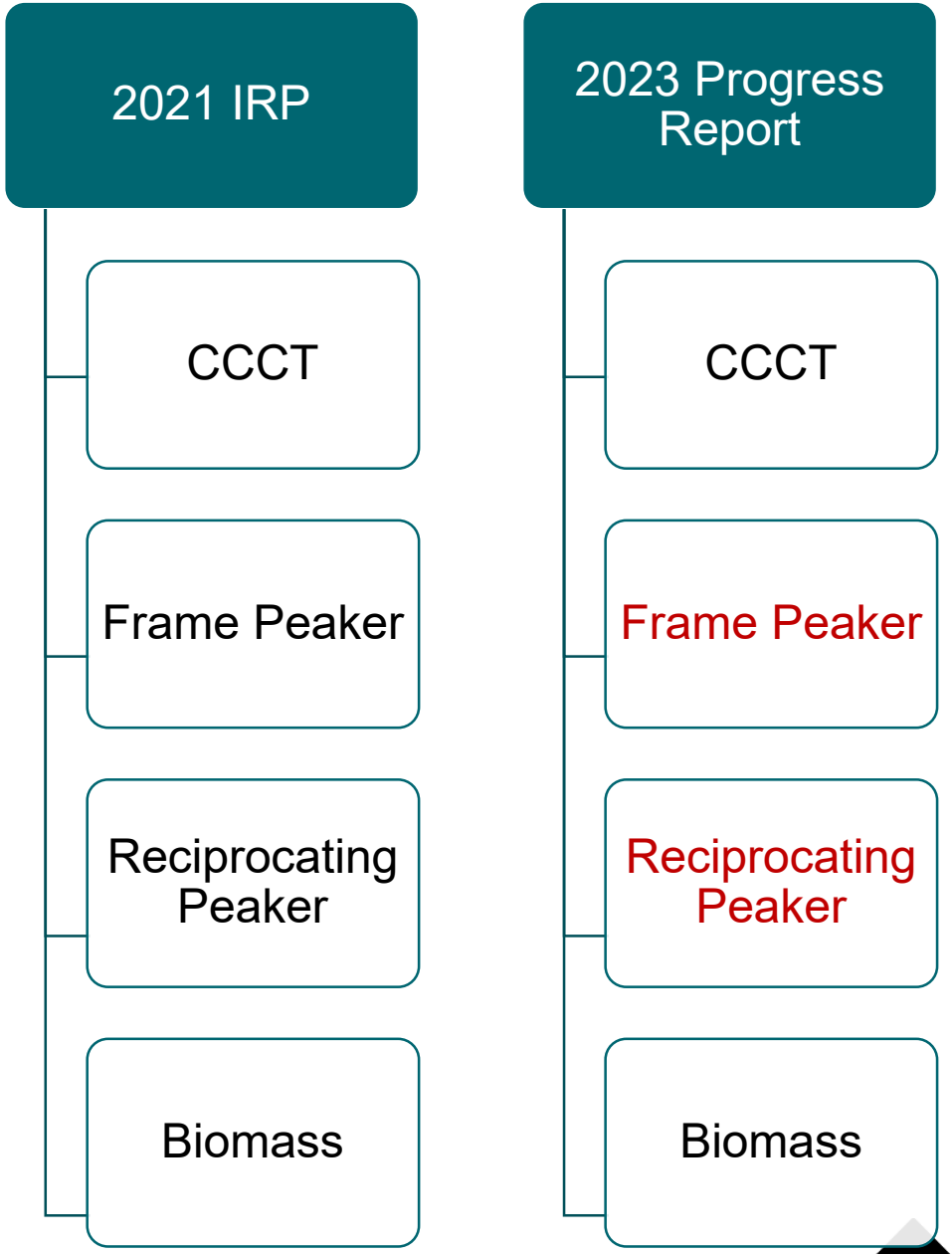
# Thermal technologies

**Proposed change:**

- Frame Peaker:
  - Modeling different fuel options
  - Requires different assumptions on fuel costs, transportation of fuel and storage for biodiesel and hydrogen

**Challenges:**

- No NREL ATB cost information for Reciprocating Peaker
- Question: How should PSE approach modeling the resource cost?

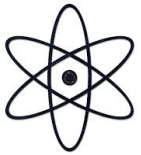







PUGET SOUND ENERGY

# Emerging technologies we're studying



## Small Modular Nuclear

- 12 Module design for 600 MW, one possible configuration
- Modules may range in size from 10 to 100 MW
- Modules are similar in design to reactors used in submarines
- Passively cooled for improved safety
- Some data available through Energy Information Administration (EIA)

## Hydrogen

- Considerations:
  - Fuel can be purchased or
  - stored onsite
- Hydrogen is a fuel can that can be used in a combustion turbine or fuel cells
- What's missing:
  - Pipeline development costs
  - Fuel costs
  - Onsite electrolyzers
- Resources:
  - PSE-Mitsubishi partnership
  - Mitsubishi green hydrogen package





PUGET SOUND ENERGY

# Generic Resource Capital cost changes

- Costs for 2023 Progress Report are modeled after the 2021 NREL ATB plus an additional $2.5MM for a 5-mile interconnection spur line.
- Resource costs for resources with no cost provided are still under development.

**Frame Peaker costs include $15 million for storage tank and infrastructure*

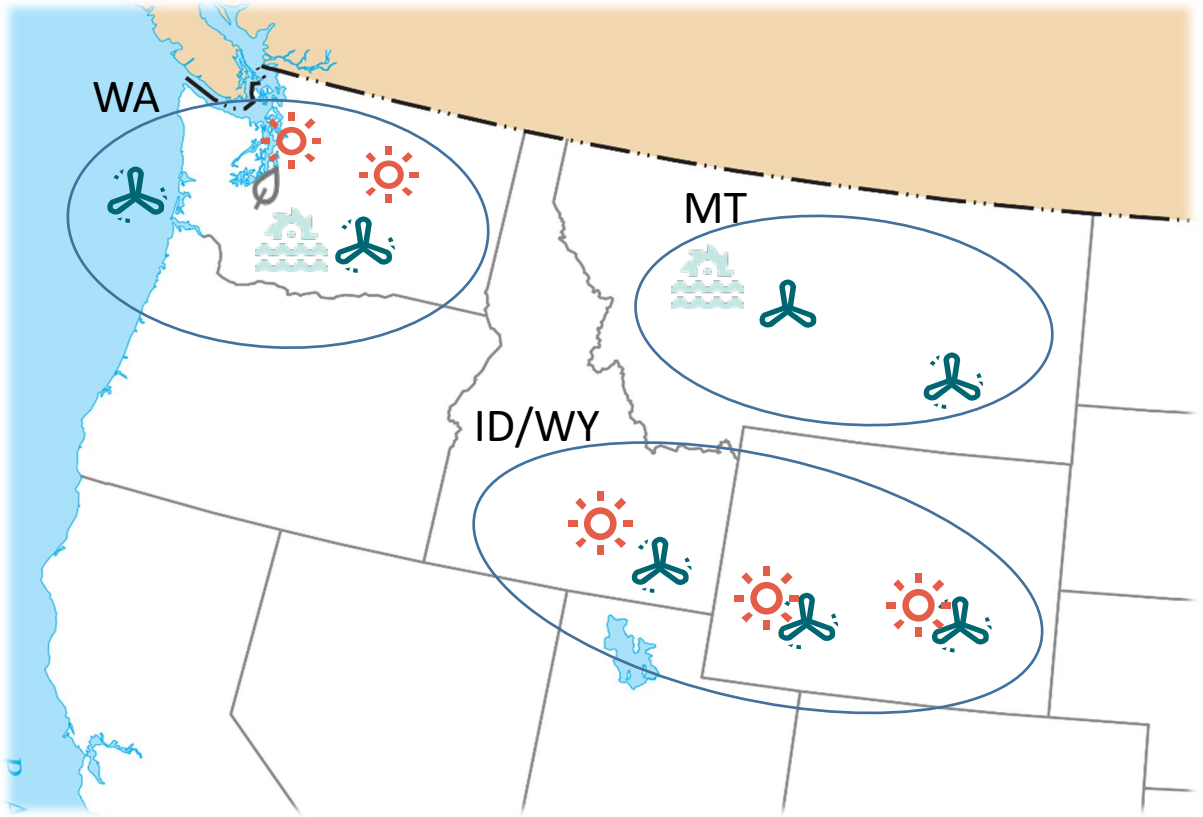
| (2021 Vintage, | Capital Cost ($/kW) | | |
|---|---|---|---|
| 2020 U.S. Dollars) | 2021 IRP | Draft 2023 Progress Report | Change |
| CCCT | 1,246 | 1,074 | -172 |
| Frame Peaker | 954 | 1,016* | 62 |
| Recip Peaker | 1,683 | TBD | TBD |
| Solar Utility | 1,644 | 1,353 | -291 |
| Solar Residential | 3,590 | 2,603 | -987 |
| Onshore Wind | 1,778 | 1,393 | -385 |
| Offshore Wind | 5,385 | 4,716 | -669 |
| Pumped Storage | 2,656 | TBD | TBD |
| Battery (2hr, Li-Ion) | 1,093 | 882 | -211 |
| Battery (4hr, Li-Ion) | 1,934 | 1,460 | -474 |
| Battery (6hr, Li-Ion) | NEW | 2,042 | NEW |
| Battery (4hr, Flow) | 2,553 | REMOVED | REMOVED |
| Battery (6hr, Flow) | 3,535 | REMOVED | REMOVED |
| DER Battery | NEW | 4,083 | NEW |
| Solar + Battery | 2,464 | 1,255 | -1,209 |
| Wind + Battery | 2,585 | 1,299 | -1,285 |
| Wind + Solar + Battery | NEW | 1,576 | NEW |
| Wind + Pumped Storage | 3,988 | TBD | TBD |
| Biomass | 7,040 | 4,477 | -2,563 |
| Hydrogen Electrolyzer | NEW | TBD | NEW |
| Modular Nuclear | NEW | TBD | NEW |

*Updated:* **3/21/22**

# Transmission Tariff Costs

| Location | Resource | $/kW-Year |
|---|---|---|
| WA | Wind | $32.60 |
| WA | Solar | $29.04 |
| WA | Other resources | $23.59 |
| ID/WY | Wind | $68.51* |
| MT | Wind | $64.63* |
| MT | Pumped Storage Hydro | $55.60* |
| PSE | Solar (Balancing Only) | $5.47 |
| PSE | Thermal, Battery | TBD |

*Interconnection costs included in capital cost estimate*
**Does not include upgrade costs*




**Example: WA Wind** (BPA tariff rates)

| | |
|---|---|
| Point-To-Point (PTP) + Scheduling (SCD) [1] | 23.57 |
| + Balancing Services[2] | + 9.04 |
| | $32.60/kW-yr |

*1 Scheduling, System Control and Dispatch*
*2 EIM DERBS Incremental + Decremental Reserves (in kW max hourly deviation)*





PUGET SOUND ENERGY

# Discussion questions

- Should PSE use the 2021 NREL ATB capital costs and cost curves or should PSE continue to average across different sources?
- What sources would you recommend besides the ATB costs?
- How should PSE approach resource costs where ATB costs are not available (e.g. reciprocating peaker, pumped hydro electric storage, hydrogen, nuclear)?





PUGET SOUND ENERGY

# Regional Assumptions for Electric Price Forecasts

Tyler Tobin, Senior Analyst, Resource Planning Analytics, PSE

PSE PUGET SOUND ENERGY

# Snapshot of electric price forecasts

| Key points to be aware of... | Key questions for stakeholders |
|---|---|
| 1. Timing for carbon price in the energy planning process and the final CCA rules don't align, so we need to estimate carbon pricing for our analysis.<br><br>2. PSE looking at expected forecast, ceiling, and floor based on California Clean Air Resources Board (CARB).<br><br>3. PSE incorporating climate change assumptions consistent with Northwest Planning and Conservation Council into regional demand and hydro condition assumptions. | • Do you have other data sources for the California / Washington Cap & Trade prices?<br><br>• Is there information missing that should be incorporated into the electric price forecast? |





PUGET SOUND ENERGY

# What is the Electric Price Forecast?

- The electric price forecast can also be referred to as “power prices”
  - In this context “**power price**” does not mean the rate charged to customers; it **means the price to PSE of purchasing (or selling) one megawatt (MW) of power on the wholesale market**

- The electric price forecast is:
  - **Developed based on regional assumptions** spanning the entire Western Electricity Coordinating Council (WECC) area
  - An **important input to** the **IRP analysis**, **since market purchases make up a substantial portion of PSE’s existing electric resource portfolio**
  - An essential input to other models used in the IRP and across PSE

- The electric price forecast is used for the avoided cost of energy as part of
  - PSE’s tariff filings (Schedule 91 & 92)*
  - Energy Efficiency avoided cost calculation

*PSE offers Schedule 91, a Power Purchase Agreement for Qualified Facilities up to 5 megawatts, and Schedule 92, Purchases from Qualifying Facilities of Greater Than Five Megawatts. Qualifying facilities under Public Utility Regulatory Policy Act (PURPA)

# Changes since 2021 IRP

**Incorporating Climate change**

- **Incorporating climate change temperature assumptions into demand forecast and hydro generation**
- Using three climate change models from Northwest Power and Conservation Council's Draft 2021 Power Plan. Models cover a range of likely climate scenarios
- Discussed in Jan. 2022 IRP Stakeholder meeting

**Natural gas prices**

- Based on an ensemble of data from forward marks and Wood Mackenzie
- From 2022 to 2028, the 3-month average of forward marks describes the natural gas price forecast
- From 2029 onward, Fall 2021 Wood Mackenzie long-run fundamentals-based describes gas price forecast
- Levelized cost increase from 2021 IRP $3.32/mmBtu to $4.13/mmBtu in 2023 electric progress report

**Resource retirements and new builds**

- **Update scheduled retirements for coal and natural gas plants**: 68 resources retired for 23,000 MW of nameplate capacity through 2045. Majority coal with some natural gas.
- **Recently constructed and advanced-development projects** will be incorporated into the WECC Zonal database - 55 resources for over 13,800 MW nameplate capacity added across the WECC, This includes solar, solar + storage, and wind
- File posted at pse-irp.participate.online/get-involved (see Regional New Builds & Retirements file)





PSE PUGET SOUND ENERGY

# Changes since 2021 IRP

**Clean energy targets**

- 100% non-emitting energy sales in Washington state by 2045
- All other State legislation, policies and goals with the western region
- Consistent with the Northwest Power and Conservation Council 2021 Power Plan methodology

**Climate Commitment Act**

- Carbon price applied to Washington State
- Note: The CCA carbon legislation was included in the 2021 IRP and PSE will continue to model it in the 2023 electric progress report.

**Aurora model updates**

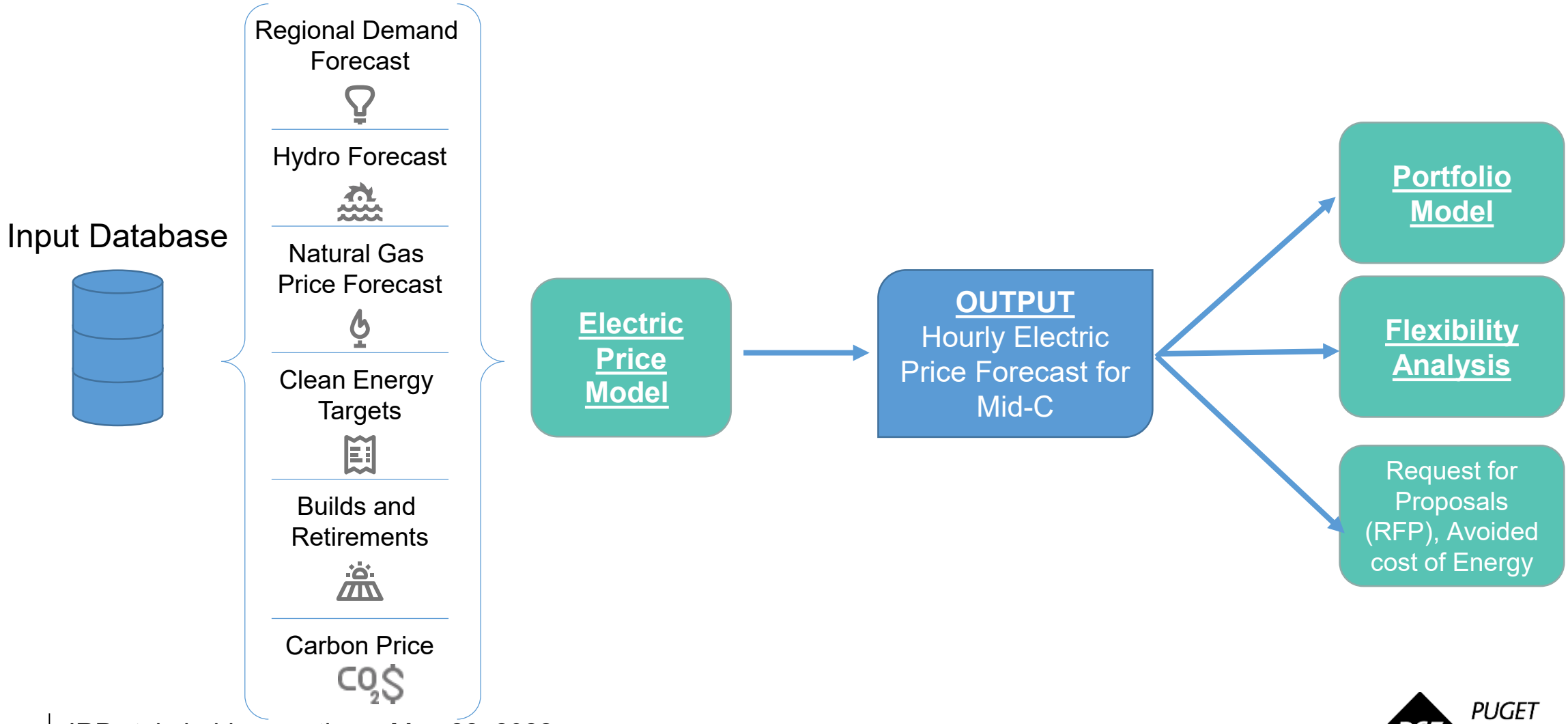
- Latest version: 14.1
- Latest database: WECC zonal database 2020 v1.0.1





PUGET SOUND ENERGY

# Electric Price Forecast Modeling Framework

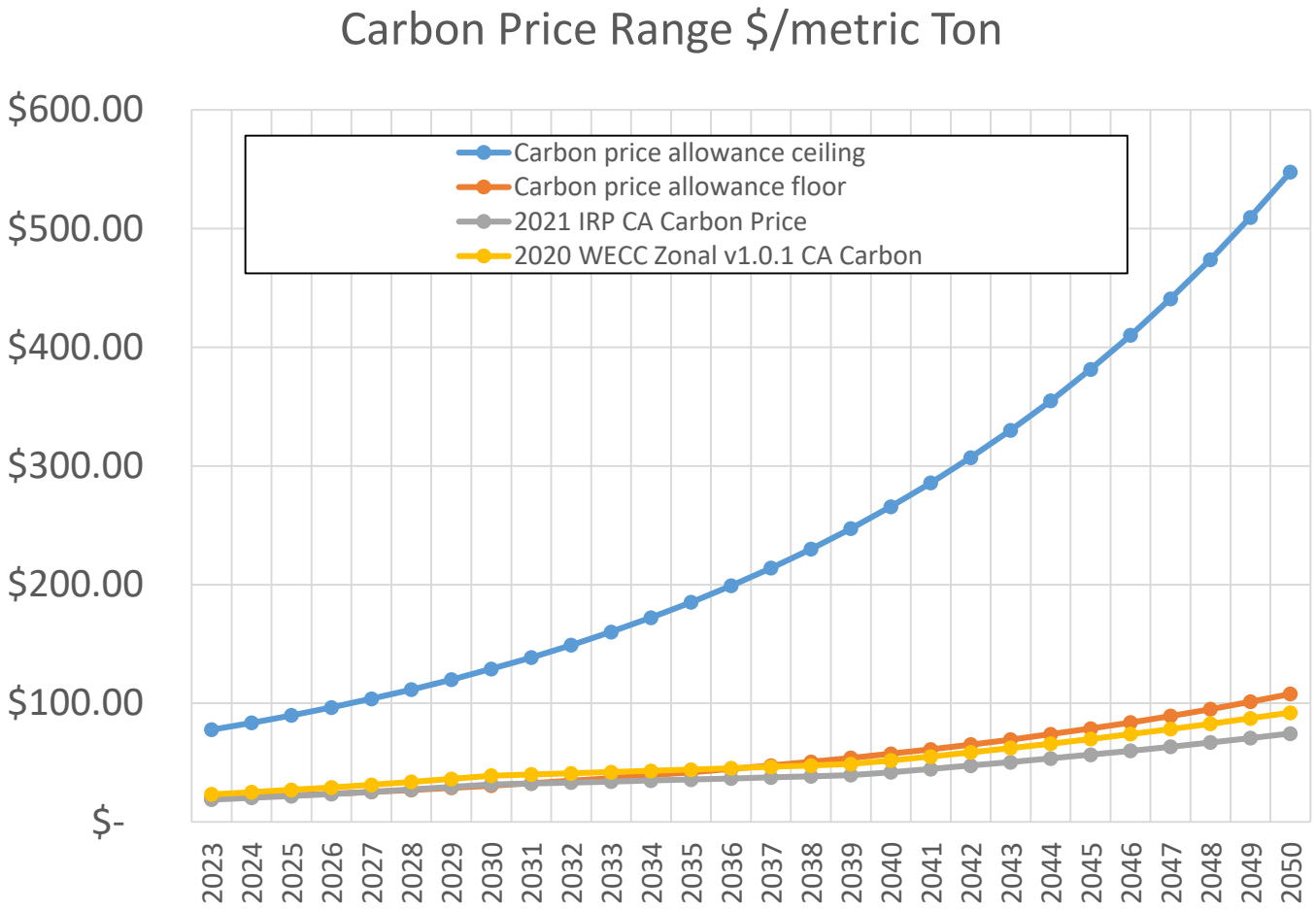







PUGET SOUND ENERGY

# California carbon price: ceiling and floor








PUGET SOUND ENERGY

# Discussion questions

- Do you have other data sources for the California / Washington Cap & Trade prices?
- Is there information missing that should be incorporated into the electric price forecast?





PUGET SOUND ENERGY

# Next steps

PUGET SOUND ENERGY

# IRP stakeholder feedback process

**Feedback form:** pse-irp.participate.online/feedback-form

| | |
|---|---|
| **Mar. 24** | A recording of the webinar and the transcript of the chat will be posted to the IRP website so those who were unable to attend can review |
| **Mar. 31** | Feedback forms are due. Feedback should focus on:<br>• Assumptions for 2023 Electric Progress Report |
| **Apr. 22** | A feedback report of comments collected from the feedback form, along with PSE's responses, and a meeting summary will be shared with stakeholders and posted to pse.com/irp |





PUGET SOUND ENERGY

# Next steps and stay in touch

## Next meetings with IRP stakeholders

- We'll review feedback from this meeting to shape the 2023 Electric Progress Report
- Stay tuned for updates on IRP stakeholder meeting dates!

## Stay in touch

irp@pse.com

pse.com/irp






PUGET SOUND ENERGY

# Appendix

PUGET SOUND ENERGY

# Common acronyms

| Acronym | Meaning |
|---|---|
| BCP | Biennial Conservation Program |
| CBI | Customer benefit indicator |
| CCA | Climate Commitment Act |
| CDD | Cooling Degree Day |
| CEAP | Clean Energy Action Plan – 10-year strategy |
| CEIP | Clean Energy Implementation Plan – 4-year roadmap |
| CETA | Clean Energy Transformation Act, which set clean electricity standards for Washington |
| CPA | Conservation Potential Assessment |
| DER | Distributed energy resource, e.g., rooftop solar & small-scale battery storage |
| DR | Demand response, e.g., incentive programs for customers to reduce their energy use at peak periods |
| GHG | Greenhouse gas emission |
| HDD | Heating Degree Day |
| IRP | Integrated Resource Plan – 20 year resource plan |
| Mid-C | Mid-Columbia |
| Named Communities | Refers to “Highly Impacted Community” and “Vulnerable Populations” (defined by CETA) |
| PPA | Power purchase agreement |
| RA | Resource Adequacy |
| RFP | Request for proposal |
| SCGHG | Social cost of greenhouse gas emissions |
| UTC | Washington Utilities and Transportation Commission, which regulates PSE |
| WAC | Washington Administrative Code |