IRP stakeholder meeting

2023 Gas Utility Integrated Resource Plan

March 31, 2022

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Safety moment

March is National Nutrition month!

- Brings awareness to the importance of making informed food choices and developing sound eating & physical activity habits
- Only buy what you will eat to avoid food waste
- Donate to local food pantry and/or shelter

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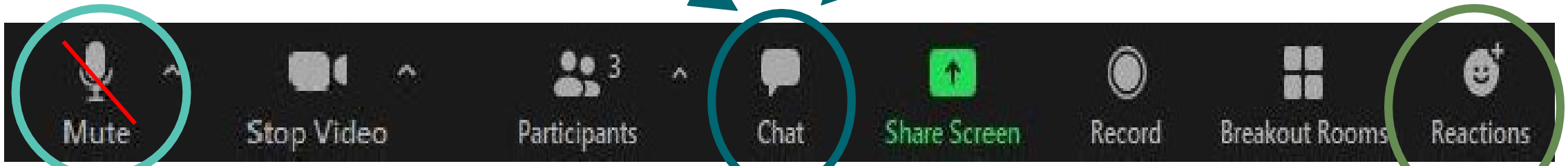
Welcome to the webinar and thank you for participating!

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.

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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

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Agenda

Time	Agenda Item	Presenter
1:00 – 1:10 p.m. *(10 min)*	**Opening**	**Sophie Glass**
1:10 – 1:20 p.m. *(10 min)*	**Process Overview**	**Kara Durbin**
1:20– 1:50 p.m. *(30 min)*	**Carbon Prices & Social Cost of Greenhouse Gas Emissions**	**Phillip Popoff**
1:50 – 2:25 p.m. *(35 min)*	**Gas Utility Resource Alternatives**	**Gurvinder Singh**
2:25 – 2:35 p.m. *(10 min)*	**Break**	
2:35 – 3:05 p.m. *(30 min)*	**Gas Utility IRP Scenarios**	**Jennifer Coulson**
3:05 – 3:45 p.m. *(40 min)*	**Break out room discussion**	
3:45 – 4:00 p.m. *(10 min)*	**Next steps**	**Sophie Glass**
4:00 p.m.	**Adjourn**	**Sophie Glass**

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Today's Speakers

Phillip Popoff
Director, Resource Planning Analytics, PSE

Kara Durbin
Director, Clean Energy Strategy, PSE

Jennifer Coulson
Manager, Resource Planning and Analytics, PSE

Gurvinder Singh
Consulting Analyst, Resource Planning Analytics, PSE

Sophie Glass
Co-facilitator, Triangle Associates

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Overview

Kara Durbin, Director, Clean Energy Strategy, PSE

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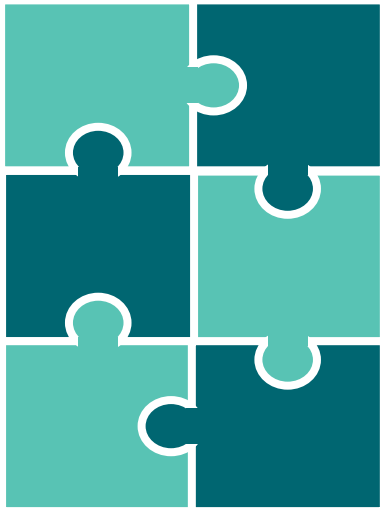
Integrated Resource Planning

What is integrated resource planning?

Process evaluating customer energy needs over the next 20 years and ways for PSE to meet those needs to provide clean, safe and reliable energy

Analyses consider regulatory policies, costs, economic conditions, weather conditions, physical energy systems, etc.

An Integrated Resource Plan (IRP) serves as the starting point for making decisions about resources that may be procured in the future



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2022 energy planning process focus areas

Clean Energy Implementation Plan

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

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

Today's focus

2023 Gas Utility IRP

- Separate IRP focused on needs of natural gas sales customers

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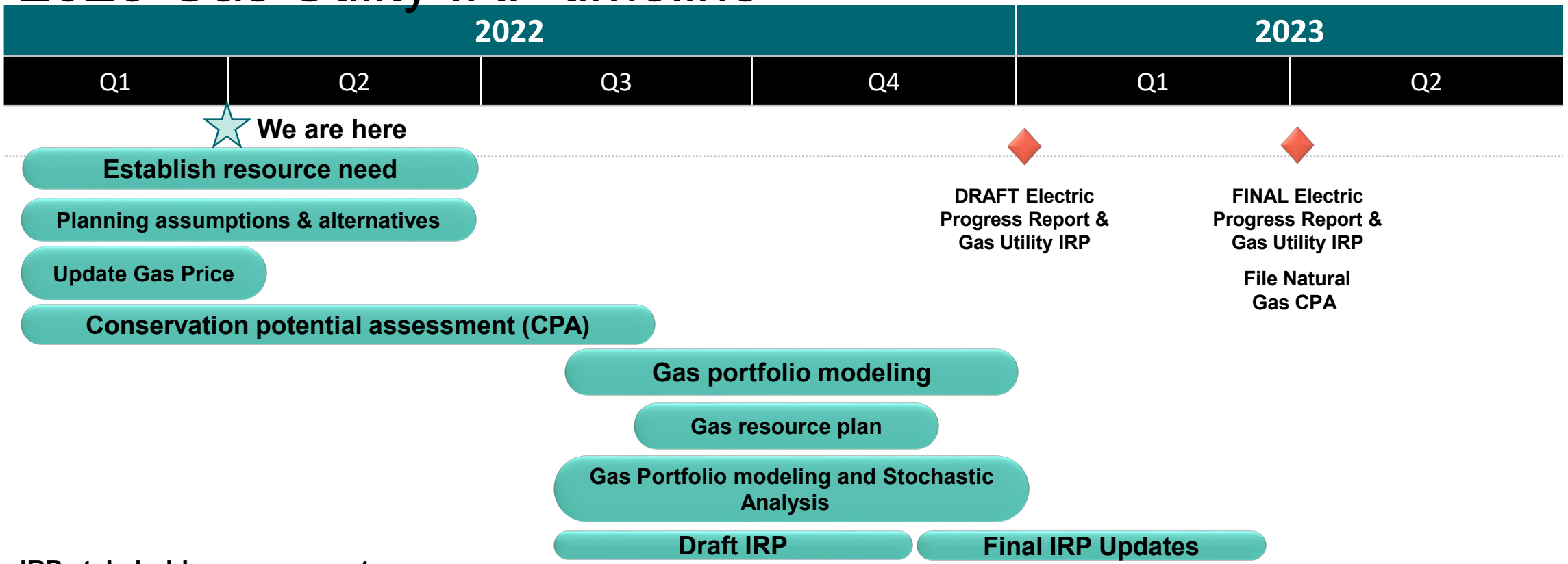
2023 Gas Utility IRP timeline



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
- **Meeting #5: July 2022** Electric & Gas demand forecast
- **Meeting #6: Sept. 2022** Electric: Final resource need, final CPA results
- **Meeting #7: Sept. 2022** Gas Utility: Final scenarios, gas alternatives, gas CPA results
- **Meeting #8: Nov. 2022** Updates and feedback on draft results of electric & gas portfolio
- **Meeting #9: March 2023** Updates and feedback on draft results of electric progress report & gas utility IRP
- **Resource Adequacy Info Session – July. 2022**

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Carbon Price and Social Cost of Greenhouse Gas Emissions

Phillip Popoff, Director of Resource Planning Analytics, PSE

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Snapshot: Carbon price and social cost of greenhouse gases

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.
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.
3. Washington Department of Ecology is responsible for drafting the rules and compliance. Rules will be final Oct. 2022 and program will start on Jan. 1, 2023.
4. As a market-based program, the CCA will put a price on carbon that will affect IRP price forecasting. PSE will use California pricing as carbon cost.
5. In addition, gas utilities are now required to apply social cost of greenhouse gas emissions to conservation planning. However, there's uncertainty as to what "conservation" may include beyond conservation and hybrid heat pumps.
	• Are there policy uncertainties that are not represented in our material you think we should consider?
	• CCA Carbon Price: Do you have a data source for CCA prices?
	  • California expected price forecast
	  • Washington-only floor, ceiling, and expected price?
	
	Additional resources:
	• Climate Commitment Act - Washington State Department of Ecology
	• PSE overview on CCA at Mar. 22, 2022 meeting with IRP stakeholders

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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

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Climate Commitment Act (CCA) 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.

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Applying social cost of greenhouse gas (SCGHG) emissions and CCA carbon pricing to gas utility planning

Total Cost = Direct Costs + Externality Costs

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Applying SCGHG and carbon pricing to Total Costs

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

Drives Operations
- Fixed costs
- Variable/Fuel costs
- New! **CCA Price x combustion tons**

Resulting pollution

Calculation that doesn't affect Operations

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

Appropriate for making intermediate and long-term resource decisions for electric utilities…

…but what about gas utilities?

Costs paid by PSE and reflected in customers' bills

Costs to Society as a Whole

Costs NOT directly billed to customers

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On social cost of greenhouse gas emissions (SCGHG)

- House Bill 1257 requires gas utilities to apply social cost of greenhouse gas emissions (SCGHG) to conservation planning
- 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

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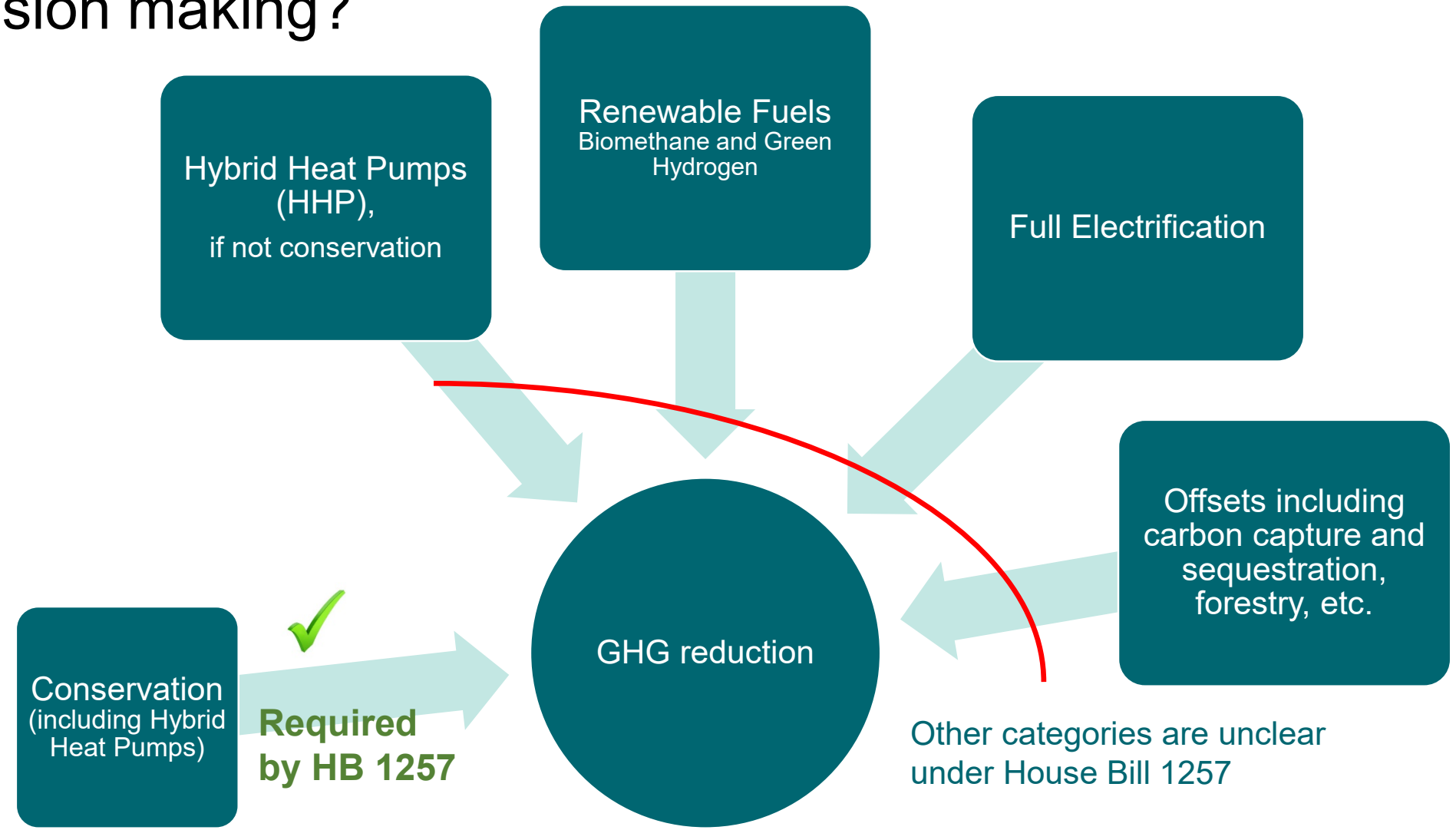
Does the law allow gas utilities to internalize Externalities in decision making?



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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

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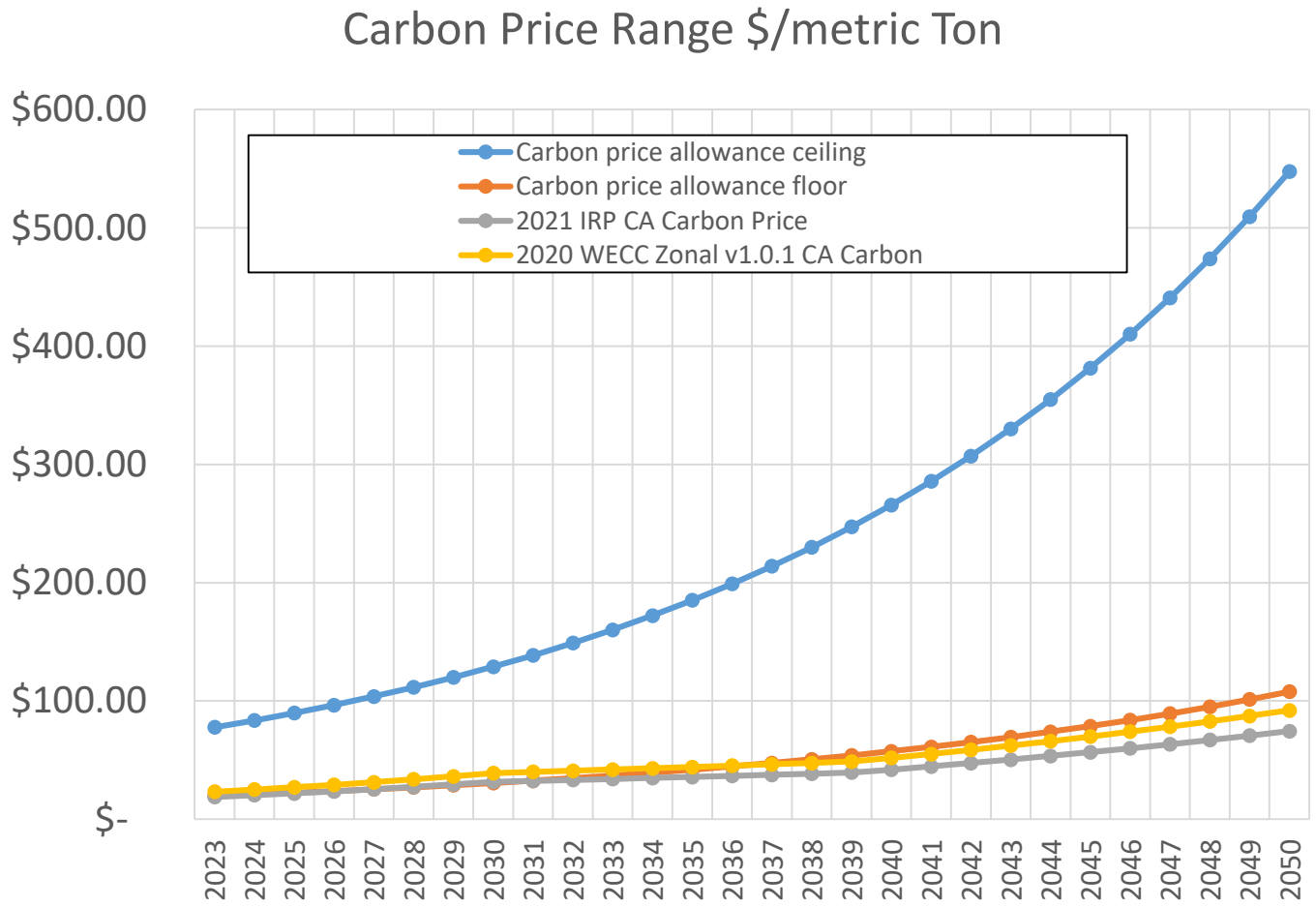
Carbon pricing: ceiling and floor



- California carbon pricing ceiling and floor gives us a starting place for pricing

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Discussion questions

- Are there policy uncertainties that are not represented in our material you think we should consider?
- CCA Carbon Price: Do you have a data source for CCA prices?
    - California expected price forecast
    - Washington-only floor, ceiling, and expected price?

Gas Utility IRP Resource Alternatives

Gurvinder Singh, Consulting Analyst, Resource Planning Analytics, PSE

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Snapshot: Gas Utility resource alternatives

Key points to be aware of...	Key questions for stakeholders
• As one of the first steps in the energy planning process, PSE is considering different resource alternatives for the gas utility. PSE is considering alternatives that help with decarbonization. • Gas utility supply-side resource alternatives include natural gas, pipeline and storage contract options, and renewable fuel options. • The demand-side resources alternatives include energy efficiency and electrification (e.g., hybrid heat pumps).	Alternative resources: • Are there other additional renewable fuel sources we should consider? • Are there other publicly-available data sources for biomethane (RNG) supply curve data we should consider? • Electrification: What types of heat pumps should we model in the electrification scenario?

2023 Gas Utility IRP modeling process

The 2023 Gas Utility IRP will follow a 5-step process for analysis:

1. **Establish Resource Needs**
2. **Determine planning assumptions and identify resource alternatives**
3. Portfolio Modeling and Stochastic Analysis
4. Analyze Results
5. Develop resource plan

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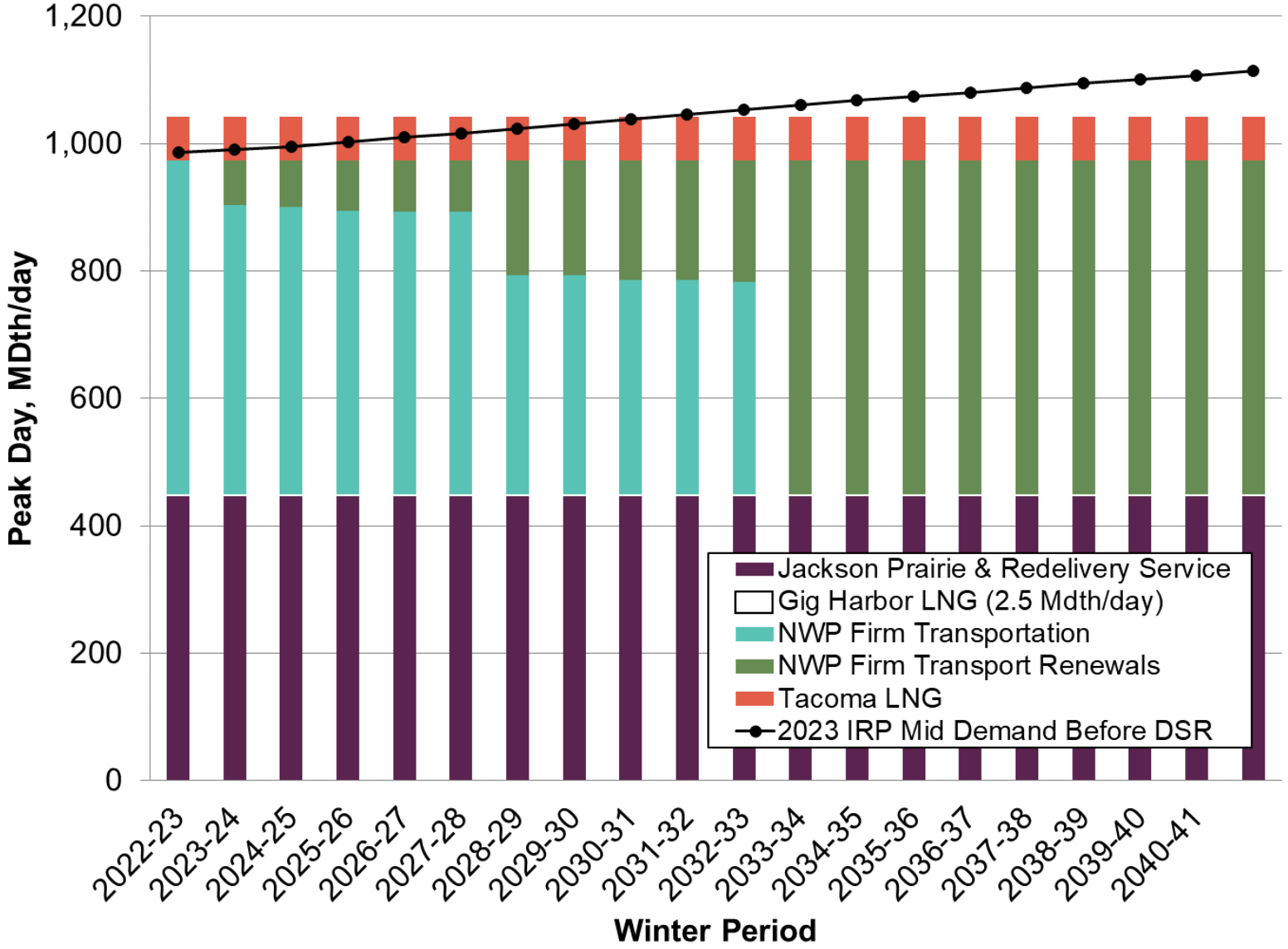
Load resource balance – resource need



- The **demand line** is the 2023 IRP Mid demand (detailed presentation of the 2023 IRP demand will be provided in future meeting)
- Firm transport, or gas supplied via Northwest Pipeline (NWP), is based on contracts. The **green bars** show contracts that could be renewed or allowed to expire

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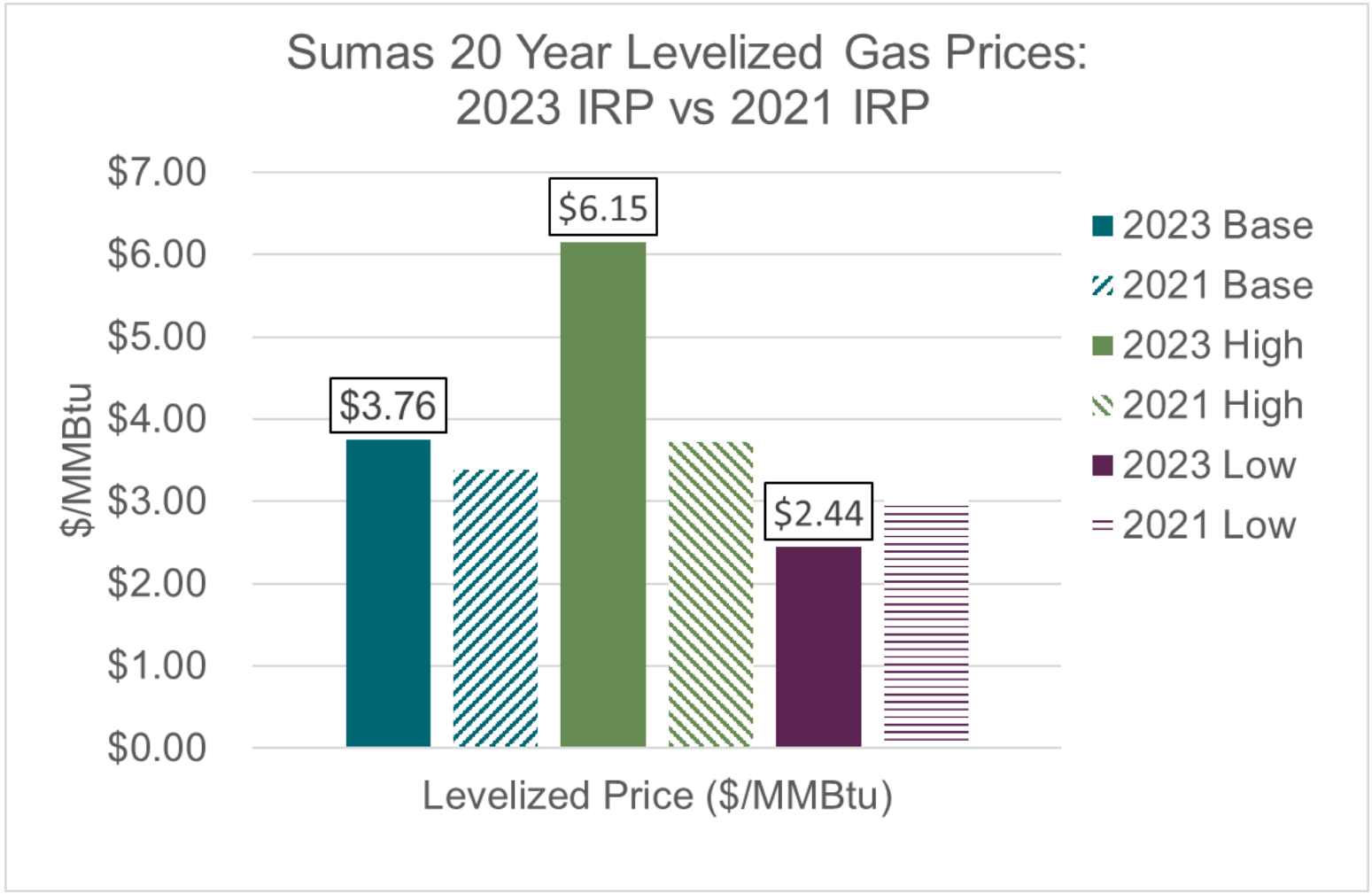
Natural gas prices in the 2023 IRP



- The 2023 IRP High/Low range is derived from the Northwest Power and Conservation Council's 2021 Plan

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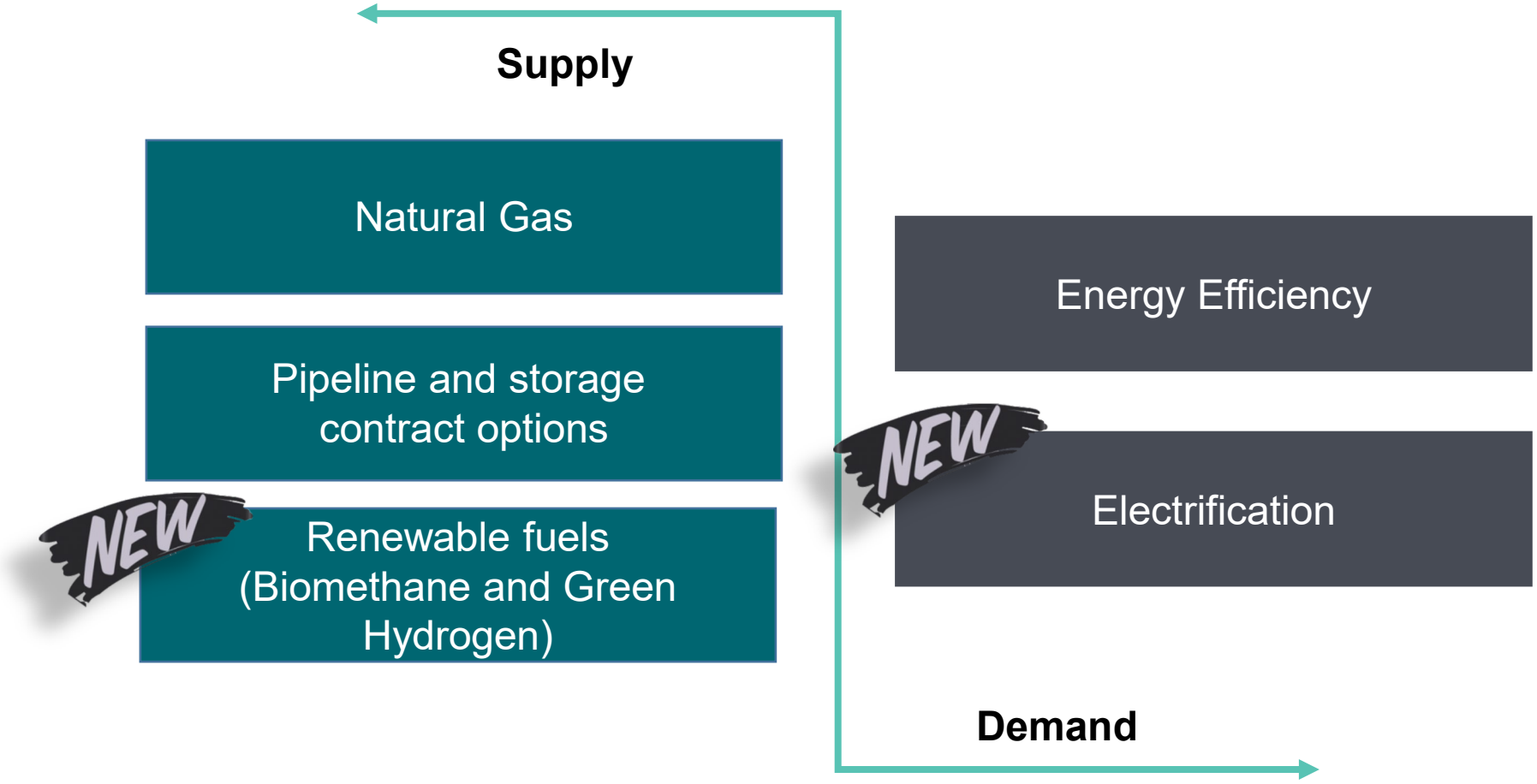
2023 Gas IRP: Resource alternatives



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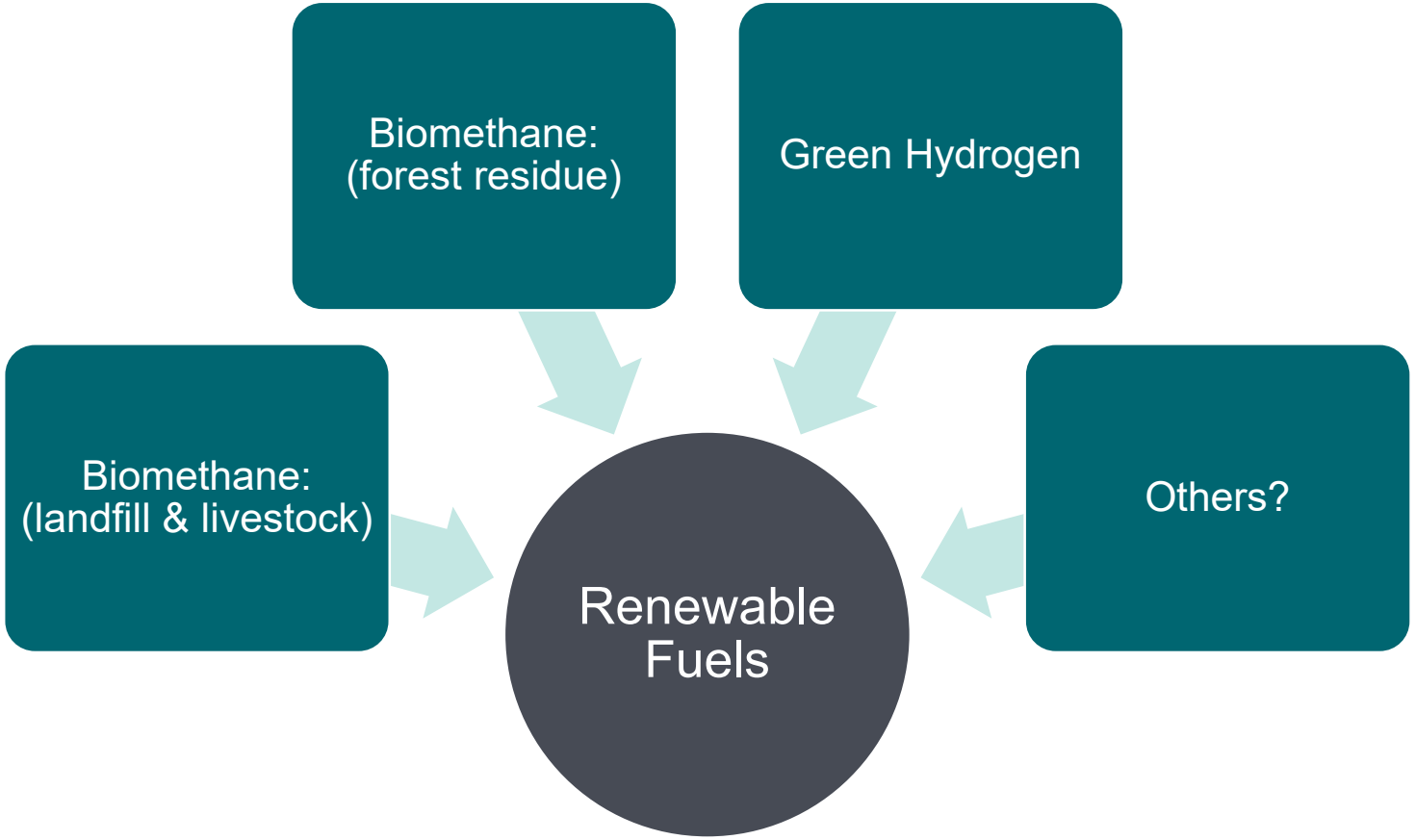
Emerging renewable fuel options



- We have some data for biomethane from American Gas Foundation study
- We are researching sources for green hydrogen
- Are there other **publicly available data sources** for these or other renewable fuel options?

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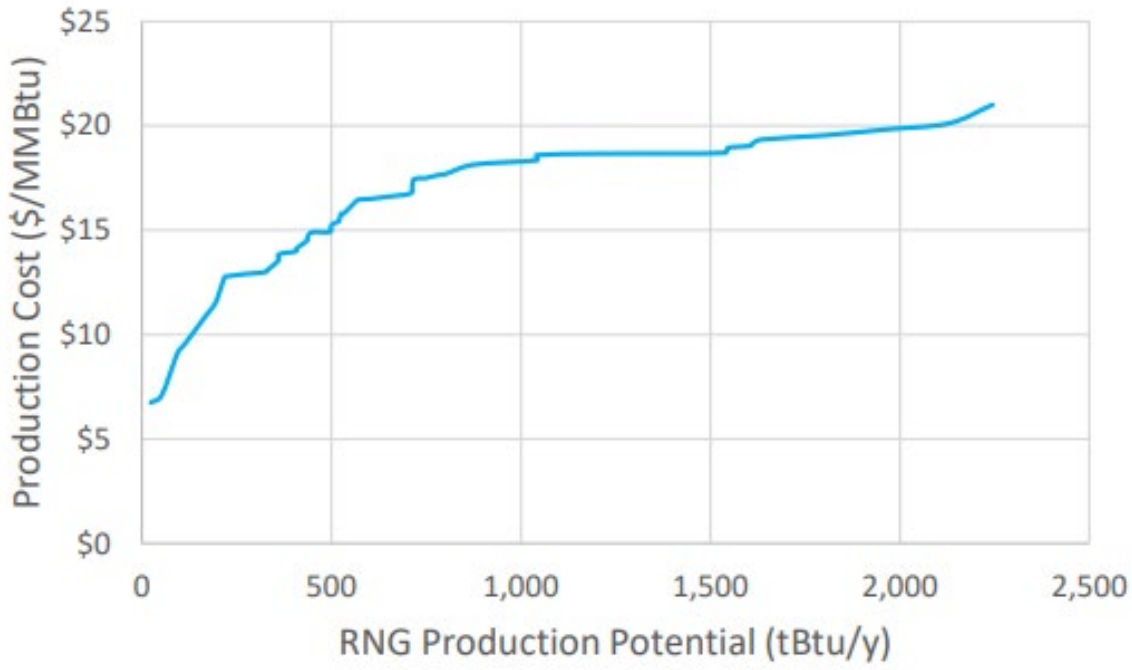
Biomethane: Landfill gas (LFG) and livestock

RNG Production Potential tBtu/year by 2040

	LFG	Animal Manure	Total, tBtu/y	MDth/y	% of US
WA High	14.745	6.069	20.814	20,814	1.6%
US High	865.6	462.3	1327.9	1,327,900	
WA Low	9.052	3.034	12.086	12,086	1.6%
US Low	528.4	231.2	759.6	759,600	

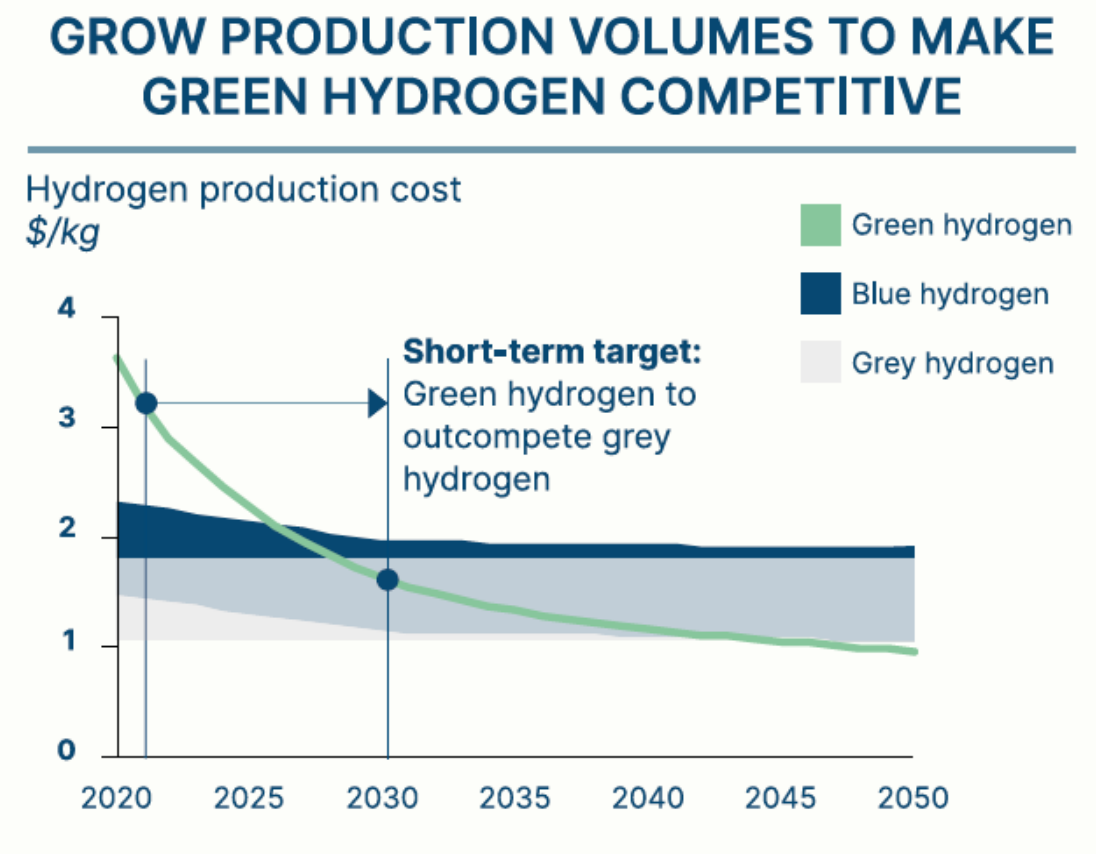
WA State Range: 12,000 to 20,000 MDth/Year

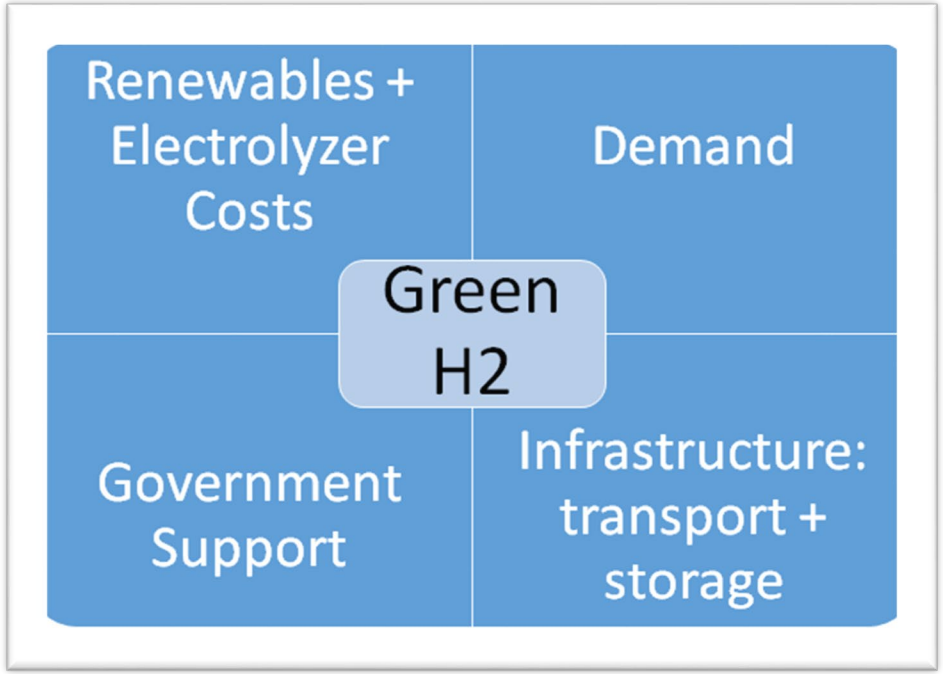
Figure 34. Combined RNG Supply-Cost Curve, less than $20/MMBtu in 2040



Source: https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

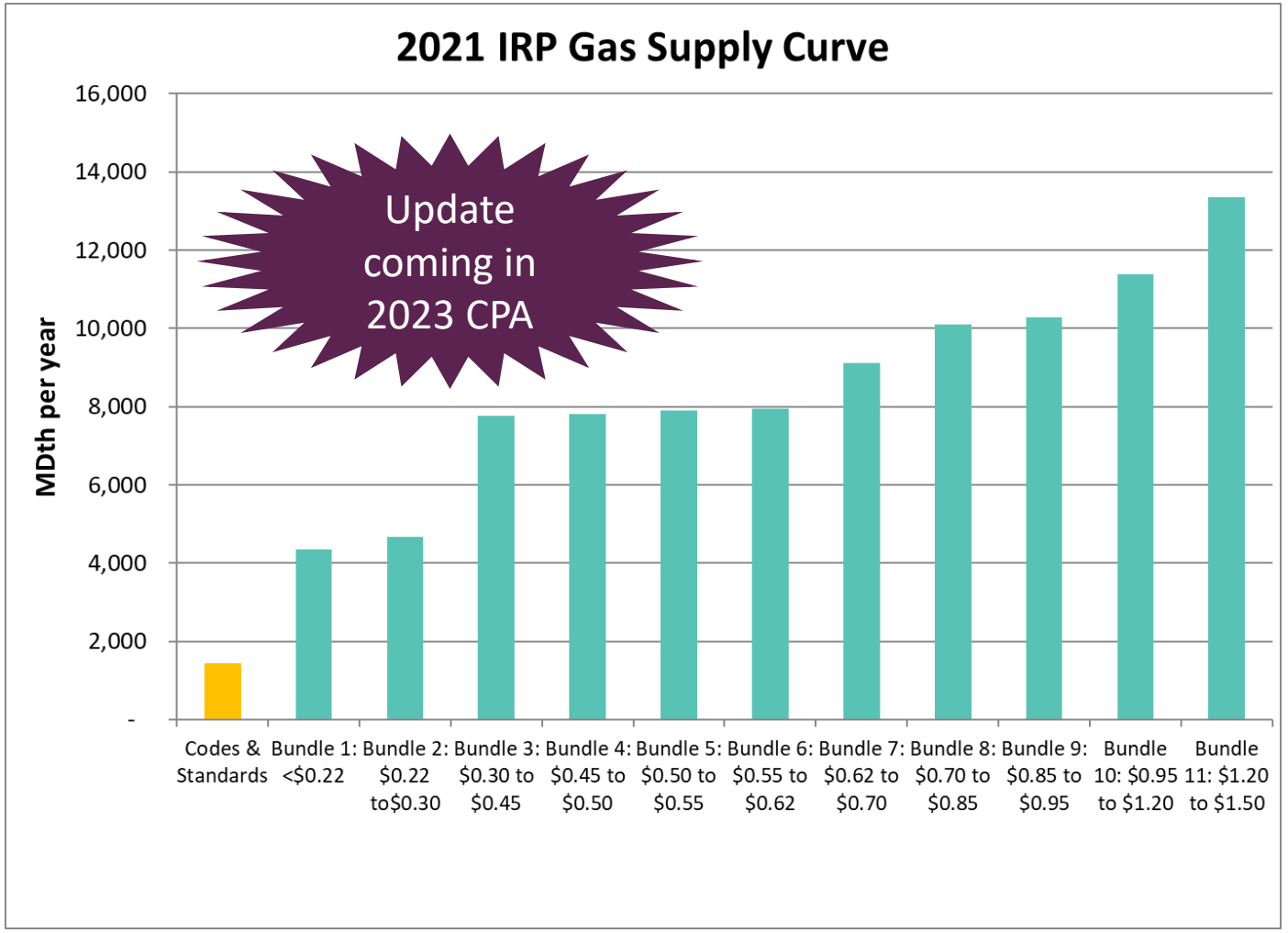
Green Hydrogen overview





Source: https://energy-transitions.org/wp-content/uploads/2021/04/ETC-Global-Hydrogen-Report.pdf

Energy Efficiency as resource alternative



Supply curve for:

- Utility program energy efficiency
- Codes and Standards
- Updated for costs and savings
- Updated to reflect climate change consistent with the Northwest Power and Conservation Council (NWPCC)
- Include Non-Energy Impacts

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Electrification alternatives

Electrification supply curve based on three configurations:

- *Traditional Heat Pumps*: Electric grid peak impacts
- *Hybrid Heat Pumps* (gas peak back-up): No impact on electric grid
- *Cold Weather Heat Pumps*: Mitigated impact on electric grid

In analyzing these alternatives, we must also consider:

- Implementation ramp rate
- Interaction with Energy Efficiency savings – both gas and electric
- Total cost will include impacts on electric system

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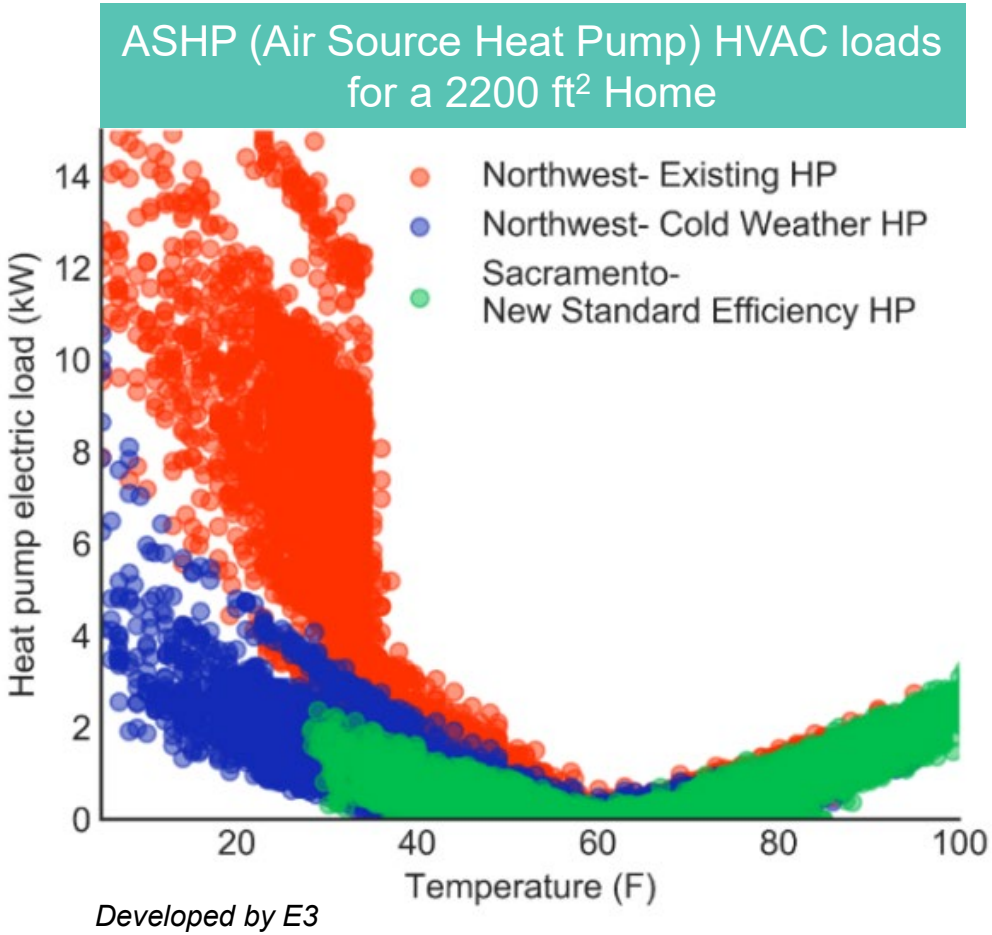
Full electrification would add large new electric loads, particularly on cold winter days when demand peaks



Developed by E3

- Air-source heat pumps are very efficient on an annual basis, with coefficients of performance (COPs) of 3 or higher possible in Washington today
- However, heat pump **efficiencies drop as the outdoor temperature falls.** This can lead to large impacts on peak demands
- The magnitude of peak demands depends on what type of heat pump is installed
  - Traditional heat pumps **(Existing HP) require large amounts of electric resistance backup heat** and have **large peak impacts**
  - Cold-climate heat pumps **(Cold Weather HP) reduce, but do not eliminate peak impacts**, and come at a **cost-premium**

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Discussion and questions

- Alternative resources:
  - Are there other renewable fuel sources we should consider?
  - Are there other publicly-available data sources for renewable fuel costs we should consider?
- Electrification:
  - What types of heat pumps should we model in the electrification scenario?

Gas Utility IRP Scenarios

Jennifer Coulson, Manager, Resource Planning Analytics, PSE

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Snapshot: IRP scenarios

Key points to be aware of...	Key questions for stakeholders
1. PSE uses scenarios to create a 20-year portfolio. The scenarios test a specific picture of the future using economic factors. PSE also applies sensitivities to scenarios to test different assumptions related to changes in resources, environmental regulations or other conditions. 2. The Gas Utility IRP is going to incorporate decarbonization factors, which have not been included in the past. These factors will be used to develop scenarios. 3. The rules for the Climate Commitment Act (CCA) will not be developed in time for this analysis; therefore, we are proposing several scenarios that we believe encompass the range of potential outcomes.	• Are we considering the right input components? Are we missing anything? • Are there other scenarios and sensitivities we should be considering? • Would you change anything?

How does PSE model different conditions to get a portfolio?

- IRP builds a 20-year portfolio – a mix of resources to meet customer gas needs – based on demand, price and applicable laws
- IRP analysis looks forward 20 years, yet the exact combination of conditions and risks are unknown
- PSE uses scenarios and sensitivities to help us model and understand potential outcomes based on various conditions

What are scenarios?

- Scenarios **test how different sets of economic and policy conditions affect portfolio costs and risks**, followed by the inputs used to create those scenarios

What are sensitivities?

- Sensitivities start with the optimized, least cost Reference Scenario portfolio produced in the scenario analysis and **change a resource, environmental regulation or other condition to examine the effect of that change on the portfolio**

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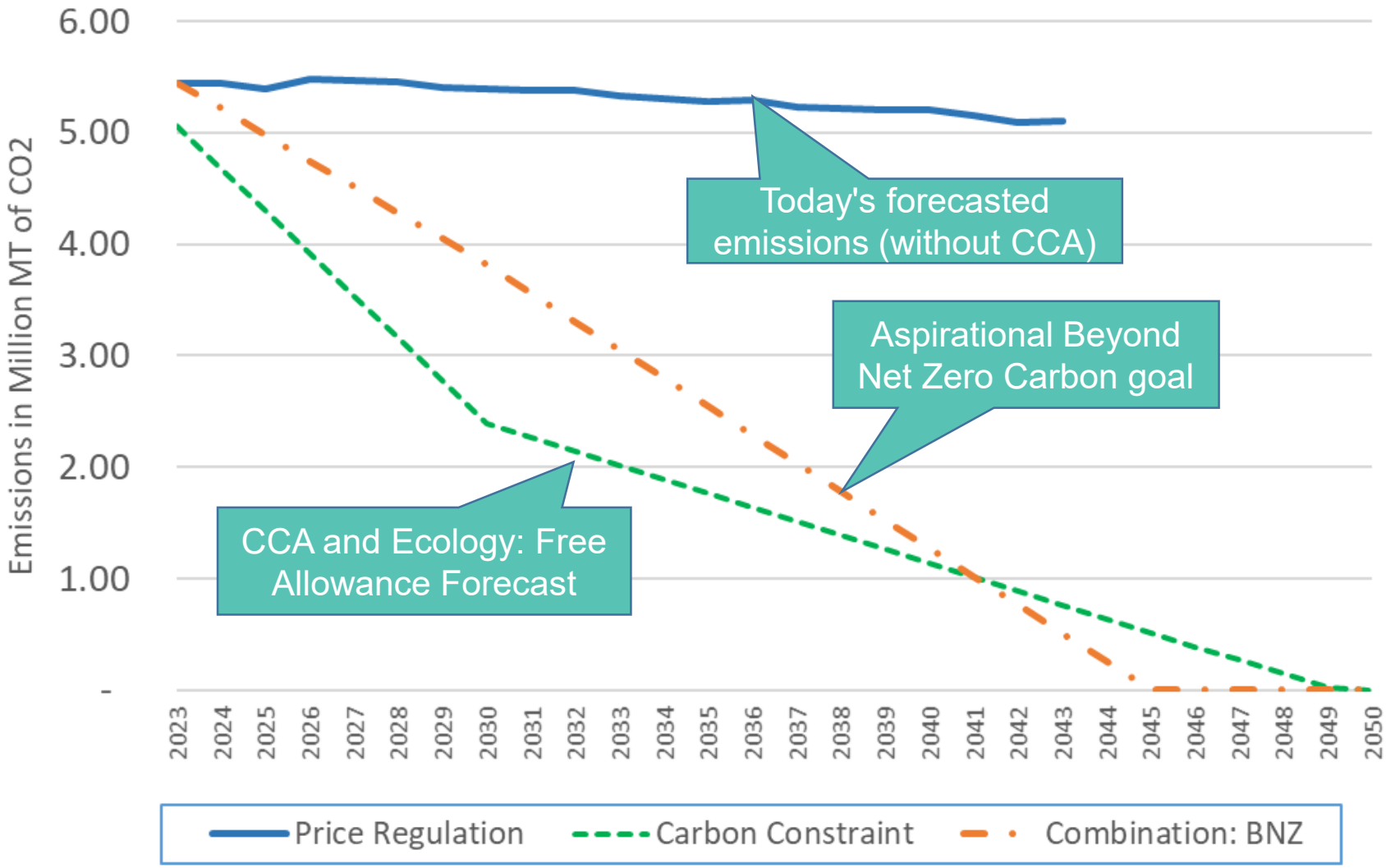
Decarbonizing PSE's emissions



- We're analyzing ways to decrease forecasted emissions

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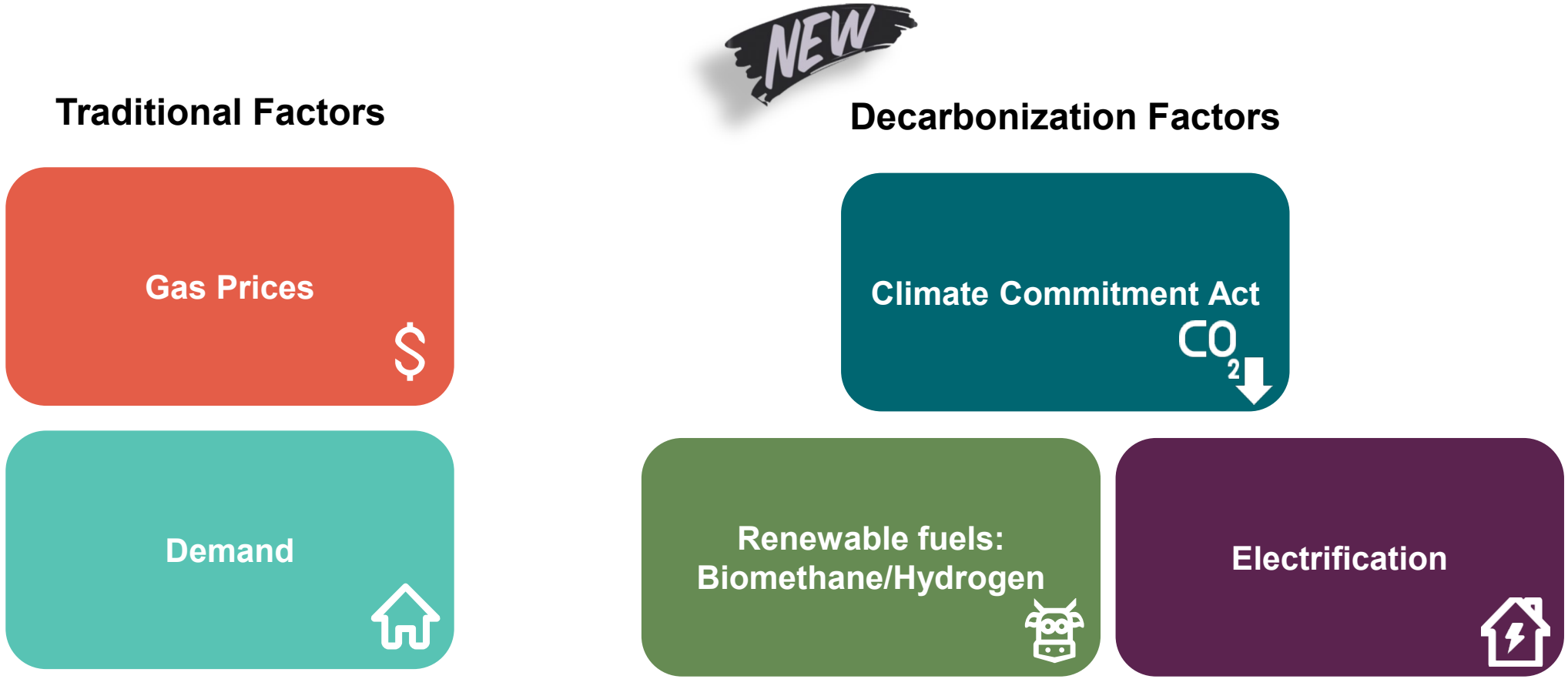
Input components that were considered in the development of the scenarios



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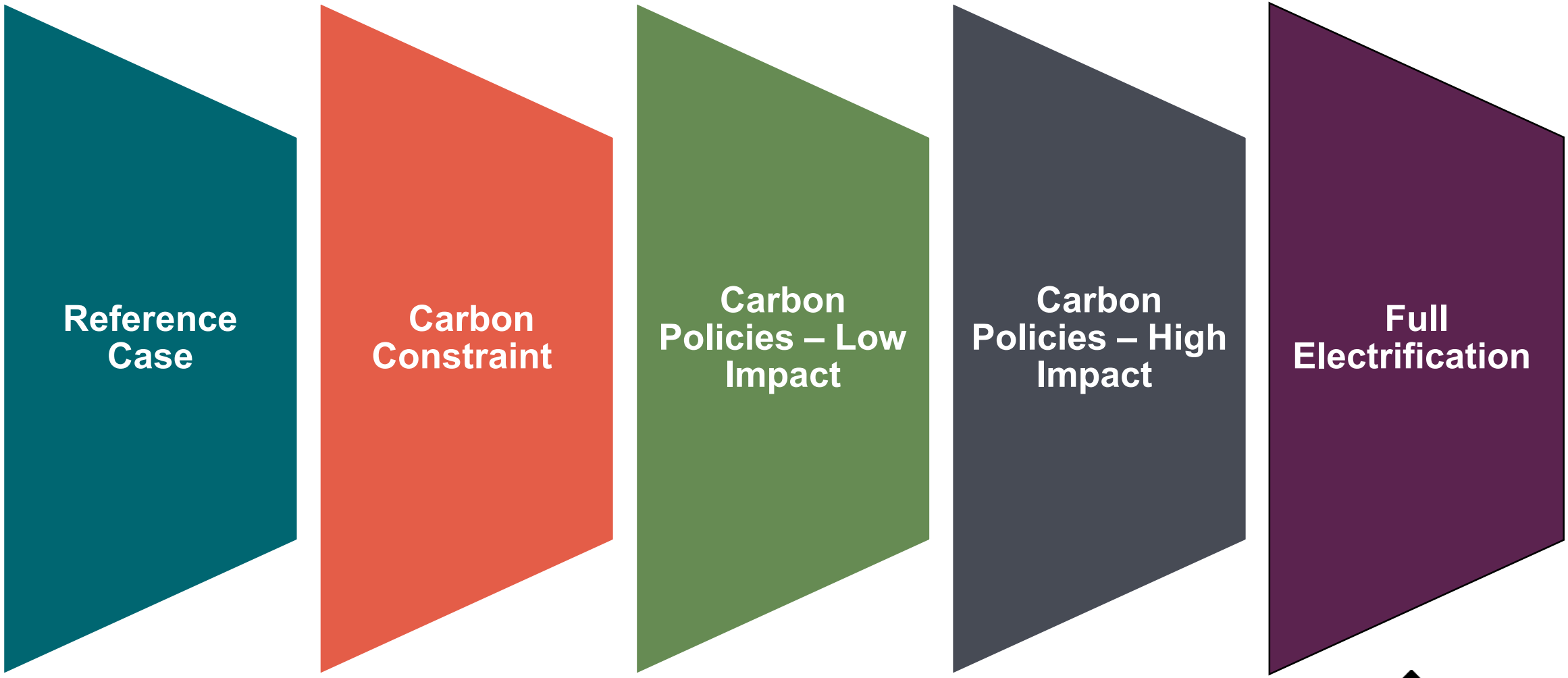
2023 Gas IRP: Draft Scenarios definitions



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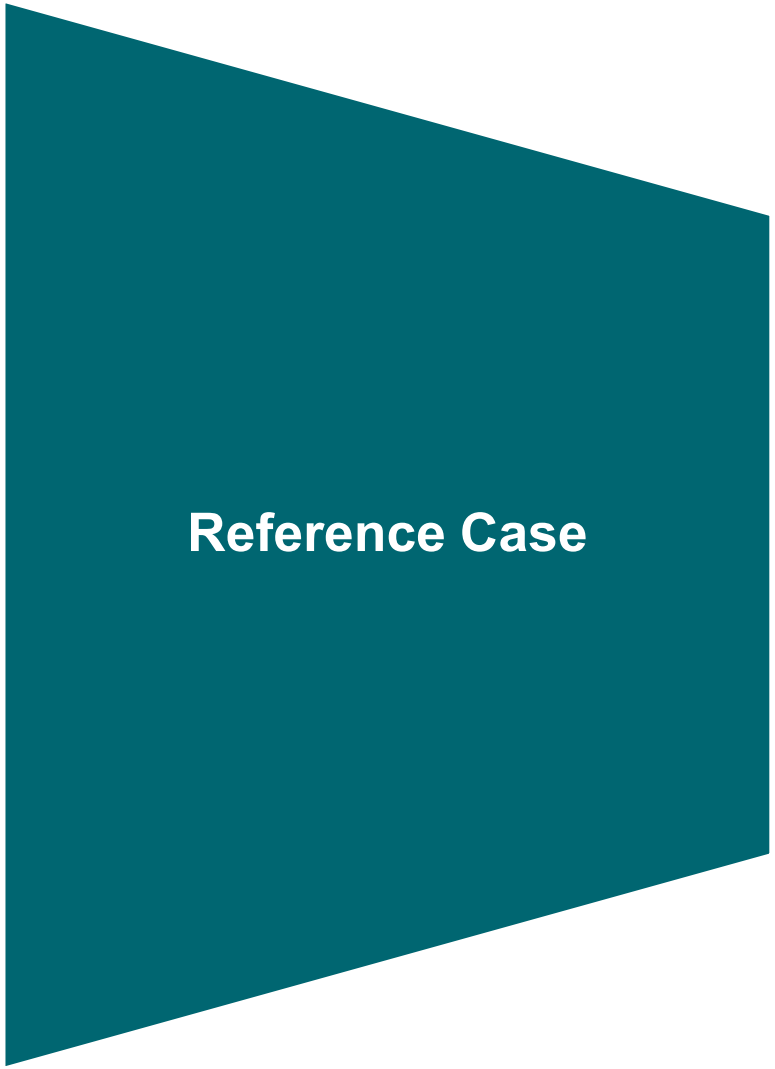
2023 Gas IRP: Draft Scenarios definitions



- Carbon reduction influenced by CCA price signal
- Incorporates renewable fuel sources across North America (similar to a Renewable Energy Credit on the electric system) with the SCGHG adder
- Hybrid heat pumps are considered a conservation measure allowing Energy Efficiency to provide incentives to customers to move to hybrid systems

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2023 Gas IRP: Draft Scenarios definitions

Carbon Constraint

- Carbon emissions decrease, following free allowance line from the CCA
- Incorporates renewable fuel sources across North America (similar to a Renewable Energy Credit on the electric system) with the SCGHG adder
- Hybrid heat pumps are considered a conservation measure allowing customers to be incentivized to move to hybrid systems

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2023 Gas IRP: Draft Scenarios definitions

Carbon Policies – Low Impact

- CCA does not reduce emissions as initially intended; entities are paying the difference between the free allowance line and their emissions
- Carbon reduction does not move fast enough because hybrid heat pumps are not considered a conservation measure and therefore not incentivized
- Renewable fuels must be sourced in Washington state

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2023 Gas IRP: Draft Scenarios definitions

Carbon Policies – High Impact

- The CCA reduces emissions as intended
- Entities are bringing down their emissions to the free allowance line and gas demand is reducing over time
- To support the transition:
  - Renewable fuels are sourced across North America with the SCGHG adder
  - Hybrid heat pumps are considered a conservation measure and incentivized
  - Gas demand is low

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2023 Gas IRP: Draft Scenarios definitions

Full Electrification

- Move away from gas infrastructure all together
- The CCA enforces the allowance emission line
- Cannot leverage renewable fuels to decarbonize the contents of the pipeline, and therefore must fuel switch
- Renewable fuels must be sourced in Washington state
- Hybrid heat pumps are not included
- Gas demand falls to zero by 2045

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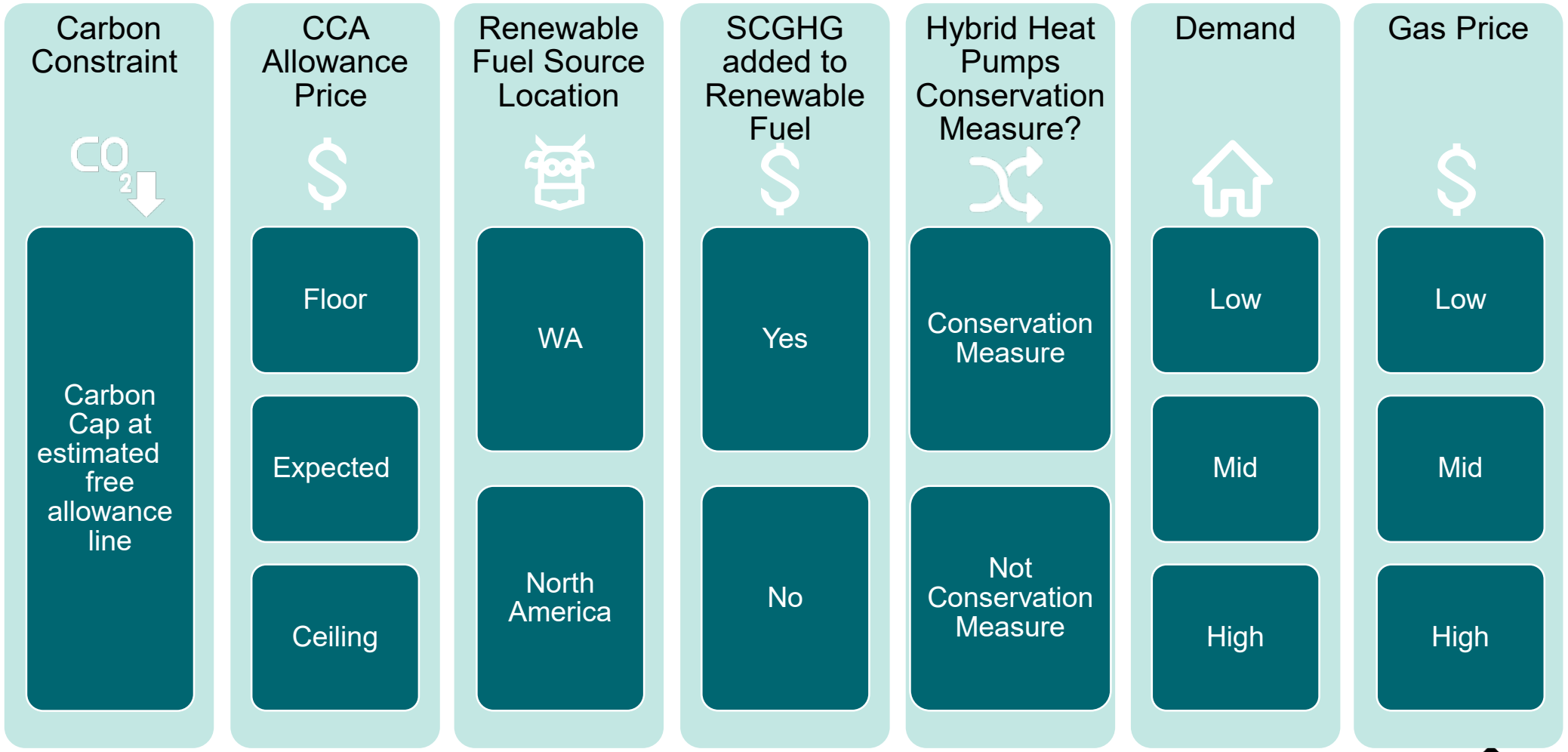
Scenario set-up: Various components produce different outcomes, these are reflected in the different scenarios



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2023 Gas IRP: Draft Scenarios

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Scenario #	Scenario Name	CCA		Renewable Fuel		New Energy Efficiency	Typical Gas IRP Parameters	
		Carbon Constraint Parameter	Allowance Price	Renewable fuel source location	SCGHG added to Renewable Fuel?	Hybrid Heat Pump (HHP): Conservation or Not?	Demand	Gas Price
1	Reference Case	Price	Expected	North America	Yes	Conservation	Mid (F22)	Mid
2	Carbon Constraint	Free Allowance Line	Expected	North America	Yes	Conservation	Low	Mid
3	Carbon Policies - low impact	Price	Ceiling	WA	No	Not Conservation	Mid (F22)	Mid
4	Carbon Policies - high impact	Free Allowance Line	Floor	North America	Yes	Conservation	Low	Low
5	Full Electrification	Free Allowance Line	Floor	WA	No	N/A	Zero	Mid

2023 Gas IRP: Draft Sensitivities

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Sensitivity #	Sensitivity Name	CCA		Renewable Fuel		New Energy Efficiency	Typical Gas IRP Parameters	
		Carbon Constraint Parameter	Allowance Price	Renewable fuel source location	SCGHG added to Renewable Fuel?	Hybrid Heat Pump (HHP): Conservation or Not?	Demand	Gas Price
1	Reference Case	Price	Expected	North America	Yes	Conservation	Mid (F22)	Mid
A	Allowance Price High	Price	Ceiling	North America	Yes	Conservation	Mid (F22)	Mid
B	Allowance Price Low	Price	Floor	North America	Yes	Conservation	Mid (F22)	Mid
C	Alternative Fuel Location WA	Price	Expected	WA	Yes	Conservation	Mid (F22)	Mid
D	Alternative Fuel without SCGHG	Price	Expected	North America	No	Conservation	Mid (F22)	Mid
E	HHP - No Conservation	Price	Expected	North America	Yes	Not Conservation	Mid (F22)	Mid

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Breakout rooms

Discuss scenarios

- Are we considering the right input components? Are we missing anything?
- Are there other scenarios and sensitivities we should be considering?
- Would you change anything?

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Next Steps

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IRP stakeholder feedback process

Feedback form: PSE IRP - Feedback Form (participate.online)

Apr. 5	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
Apr. 8	Feedback forms are due. Feedback should focus on: • CCA price application • Gas resource alternatives • Gas scenarios & sensitivities
Apr. 29	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

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Next steps and stay in touch

Next meetings with IRP stakeholders

- We'll review feedback from this meeting to shape the 2023 Gas Utility Integrated Resource Plan
- Stay tuned for updates on IRP stakeholder meeting dates!

Stay in touch

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Appendix

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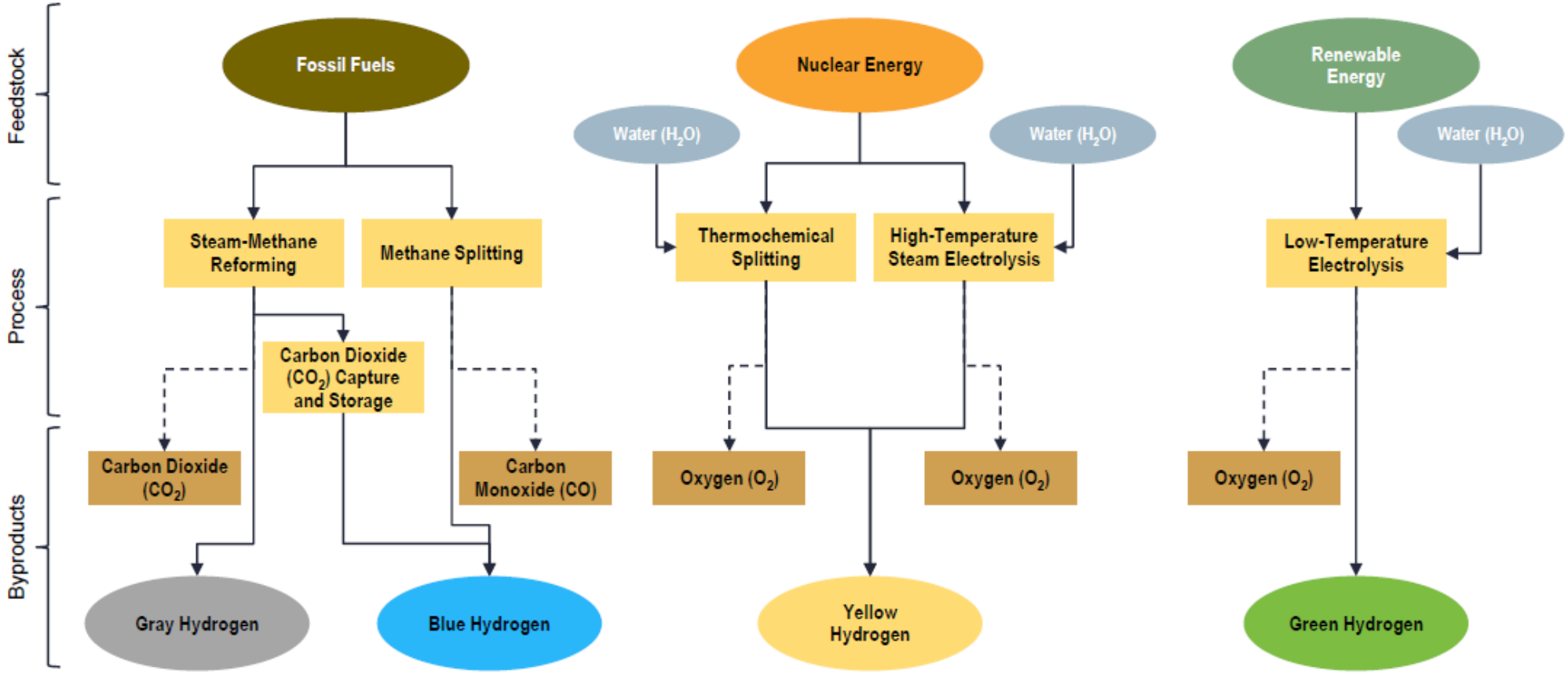
Common Acronyms

Acronym	Meaning
BCP	Biennial Conservation Program
BNZ	Beyond Net Zero
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
COPs	Coefficients of Performance
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
HHP	Hybrid Heat Pump
IRP	Integrated Resource Plan – 20 year resource plan
LFG	Landfill Gas
NWP	Northwest Pipeline
NWPCC	Northwest Power and Conservation Council
PGCAA	Puget Sound Clean Air Agency
PPA	Power purchase agreement
REC	Renewable energy credit
RNG	Renewable natural gas
SCGHG	Social cost of greenhouse gas emissions
UTC	Washington Utilities and Transportation Commission, which regulates PSE
WAC	Washington Administrative Code

Hydrogen Overview

Leading Processes for Hydrogen Production

Hydrogen has historically been produced primarily through the use of fossil fuels; however, improvements in the cost effectiveness of renewable energy and electrolyzer technology create a path for economically viable green hydrogen



Source: https://www.lazard.com/media/451779/lazards-levelized-cost-of-hydrogen-analysis-vf.pdf

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