NW Natural 2025 IRP Technical Working Group: *IRP Scenarios*

TWG #1 Part 2
November 1, 2024

NW Natural®

Forward Looking Statement

This and other presentations made by NW Natural from time to time, may contain forward-looking statements within the meaning of the U.S. Private Securities Litigation Reform Act of 1995. Forward-looking statements can be identified by words such as “anticipates,” “intends,” “plans,” “seeks,” “believes,” “estimates,” “expects” and similar references to future periods. Examples of forward-looking statements include, but are not limited to, statements regarding the following: including regional third-party projects, storage, pipeline and other infrastructure investments, commodity costs, competitive advantage, customer service, customer and business growth, conversion potential, multifamily development, business risk, efficiency of business operations, regulatory recovery, business development and new business initiatives, environmental remediation recoveries, gas storage markets and business opportunities, gas storage development, costs, timing or returns related thereto, financial positions and performance, economic and housing market trends and performance shareholder return and value, capital expenditures, liquidity, strategic goals, greenhouse gas emissions, carbon savings, renewable natural gas, hydrogen, gas reserves and investments and regulatory recoveries related thereto, hedge efficacy, cash flows and adequacy thereof, return on equity, capital structure, return on invested capital, revenues and earnings and timing thereof, margins, operations and maintenance expense, dividends, credit ratings and profile, the regulatory environment, effects of regulatory disallowance, timing or effects of future regulatory proceedings or future regulatory approvals, regulatory prudence reviews, effects of regulatory mechanisms, including, but not limited to, SRRM and the Company’s infrastructure investments, effects of legislation, including but not limited to bonus depreciation and PHMSA regulations, and other statements that are other than statements of historical facts.

Forward-looking statements are based on our current expectations and assumptions regarding our business, the economy and other future conditions. Because forward-looking statements relate to the future, they are subject to inherent uncertainties, risks and changes in circumstances that are difficult to predict. Our actual results may differ materially from those contemplated by the forward-looking statements, so we caution you against relying on any of these forward-looking statements. They are neither statements of historical fact nor guarantees or assurances of future performance. Important factors that could cause actual results to differ materially from those in the forward-looking statements are discussed by reference to the factors described in Part I, Item 1A “Risk Factors,” and Part II, Item 7 and Item 7A “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” and “Quantitative and Qualitative Disclosure about Market Risk” in the Company’s most recent Annual Report on Form 10-K, and in Part I, Items 2 and 3 “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and “Quantitative and Qualitative Disclosures About Market Risk”, and Part II, Item 1A, “Risk Factors”, in the Company’s quarterly reports filed thereafter.

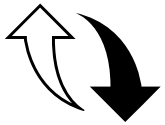
All forward-looking statements made in this presentation and all subsequent forward-looking statements, whether written or oral and whether made by or on behalf of the Company, are expressly qualified by these cautionary statements. Any forward-looking statement speaks only as of the date on which such statement is made, and we undertake no obligation to publicly update any forward-looking statement, whether as a result of new information, future developments or otherwise, except as may be required by law.

Today's Agenda

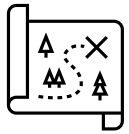
- Logistics
- Recap of TWG 1, Part 1
- Scenarios Overview
- Scenarios Deeper Dive

Facilitator Requests

Engage constructively and courteously towards all participants



Take space and make space



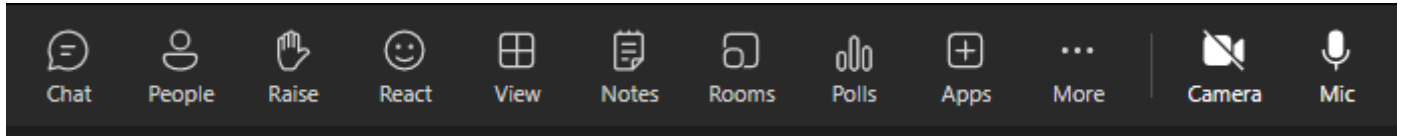
Respect the role of the facilitator to guide the group process

Avoid use of acronyms and help each other understand

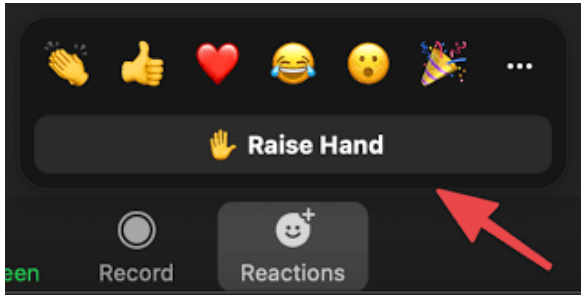
Aim to focus on the meeting topic

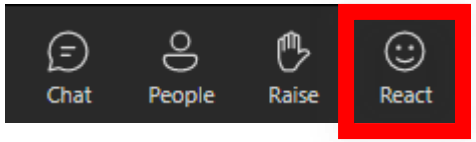
How to Interact in a Teams Meeting

- Participant Controls are at the top or bottom of your screen

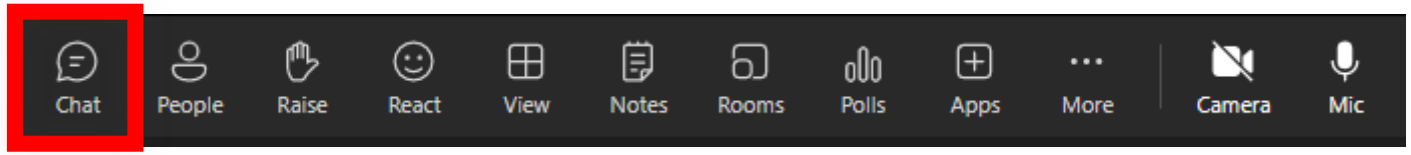


- Ask a question or comment at any time using the “raised hand”





- You may also use the chat box



A member of the IRP team will monitor the chat, and participant list for raised hands during the meeting.

Meeting Best Practices – virtual spaces

To maintain an engaged and productive space, please:

Mute your mic unless asking a question and/or providing comment

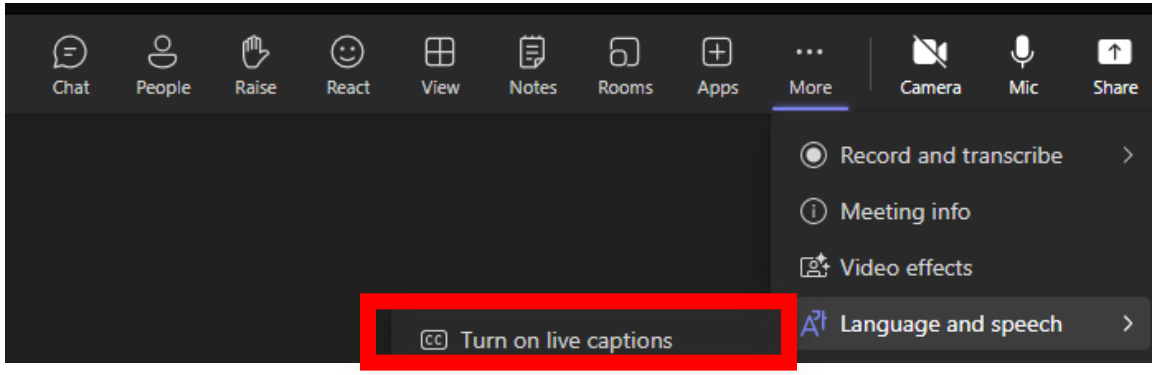
Turn your camera on when speaking (if you are comfortable and your bandwidth allows)

Limit side conversations in the chat

Make efforts to adhere to the meeting schedule

Teams Meeting – Accessibility Functions

- Live Captions - real-time auto-generated text of what is said in a meeting. They appear a few lines at a time for a user who has turned them on, and aren't saved



- Reducing Distractions and Customizing Views:
  - Microsoft Teams has a variety of features to support different learning styles, please find reference material for:
    - Turn on live captions during meetings
    - Customize your meeting view
    - Change background effects in Teams meetings
    - Reduce background noise in Teams meetings
    - 5 tips for using Teams when you're deaf or hard of hearing

- Meeting Recordings:
  - NW Natural will record IRP virtual meetings and will post them to the NW Natural website on the resource planning webpage

Take 2 Minutes for Safety: Distracted While Walking

To avoid distracted walking, the National Safety Council recommends the following:

- Do not walk, talk, and text.
- If you must talk or text, move out of the way of others and to the side of the walkway.
- Do not cross or walk in the street while using an electronic device.
- Do not walk with headphones in your ears.
- Be aware of your surroundings, especially in congested areas.

Distracted walking can lead to injuries such as walking into fixed objects, being struck by moving vehicles or equipment, walking over an edge or into an open hole, and tripping over an object.

Recap Oct. 22 TWG

- Gained a shared understanding of the planning environment shaping the Integrated Resource Plan (IRP)
- Identified areas of uncertainty that may affect the IRP
- Addressed clarifying questions about customer profiles, cost and risk analysis of renewable fuels, procedural equity and public participation

▷ ▶ Today's objectives

- Understand the role of scenarios in the IRP process and the constraints of scenario analysis
- Introduce scenarios for the modeling process
- Answer clarifying questions about scenarios

Scenarios

Goal of these Scenarios

- Be able to represent a set of realistic outcomes and how NW Natural would plan its resources accordingly under each scenario
- The IRP does not advocate for one scenario over another, but may have discussions about how likely or unlikely certain scenarios are to occur
- Scenarios can help establish bookend results, knowing that what future ultimately unfolds will likely be somewhere in-between
- Every scenario plans resources to reliably serve our customers and comply with Oregon and Washington carbon compliance policies

Metrics for Scenario Comparison

NW Natural®

Demand

- Total demand
- Total customers
- Use-per customer
- Residential / Commercial demand

Supply

- Capacity additions / Capacity retirements
- Compliance Resources acquisition and timing

Costs

- Fixed, variable, energy, compliance costs
- Weighted average cost of gas (WACOG)
- Weighted average cost of carbon compliance
- Bill impacts
- Cost of emissions reductions

Emissions

- Total emissions

Scenarios for this IRP

		Scenario	
		Reference Case	Includes all known codes, policies and energy efficiency expectations.
Policy Variations	1	CPP/CCA Compliance	Eligible resources are acquired to meet CPP and CCA compliance.
	2	SB 98 Targets	SB 98 eligible resources are acquired to meet voluntary SB 98 targets. Required by Oregon Administrative Rule 860-150-0100 to be studied in an IRP; Applies to WA for voluntary RNG under HB 1257.
	3	No GHG Compliance Policies	Scenario considers current building codes but is absent CPP/CCA or RNG procurement policies; customers are served with the lowest cost resources.
Demand Variations	4	Growth Recovery	Population and housing trends experience higher growth patterns than the reference case.
	5	Modest Customer Electrification	Aims to aligns with trends from NEEA-RBSA, projections from electric utilities of existing buildings electrifying, and limitations on natural gas in new construction buildings.
	6	Hybrid System Electrification	Hybrid systems [electric heat pump with gas furnace as back up] are installed in existing buildings and new construction based on stock turn-over.
	7	All-Electric Buildings	Significant levels of building electrification of existing buildings and new construction based on stock turn-over.

Electrification in the Last IRP

- Examined low, moderate, high, and extreme levels of electrification
- The 2022 IRP analysis did NOT attempt to quantify the total costs impacts to the electric system under these different level of electrification
- More information of the full impacts to both the electric system and gas system is needed to understand costs and risks shifting winter space heating requirements to the electric system
- NW Natural does not have the internal expertise to adequately model electric system planning
    - For this IRP, NW Natural is working with ICF to model the impacts of building electrification to electric system planning under each of the electrification scenarios

Scenario	Level Of Electrification
Dual Fuel Heating Systems	Low
New Direct Use Gas Customer Moratorium in 2025	Moderate
Aggressive Building Electrification	High
Full Building Electrification	Extreme

Electrification Scenarios

ICF to help measure the impact for a reference case and building electrification scenarios (highlighted)

		Scenario	
		Reference Case	Includes all known codes, policies and energy efficiency expectations.
Policy Variations	1	CPP/CCA Compliance	Eligible resources are acquired to meet CPP and CCA compliance.
	2	SB 98 Voluntary Targets	SB 98 eligible resources are acquired to meet voluntary SB 98 targets. Required by Oregon Administrative Rule 860-150-0100 to be studied in an IRP; Applies to WA for voluntary RNG under HB 1257.
	3	No GHG Compliance Policies	Scenario considers current building codes but is absent CPP/CCA or RNG procurement policies; customers are served with the lowest cost resources.
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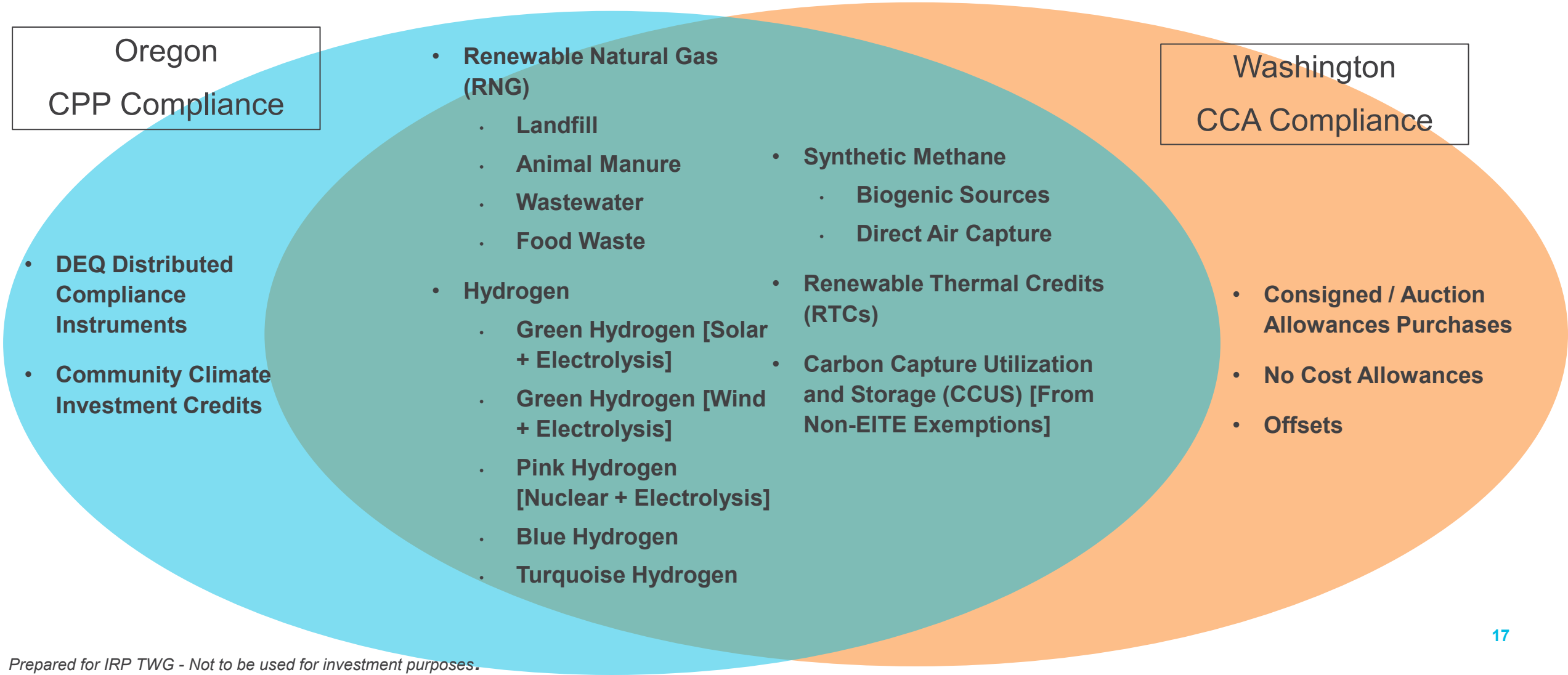
Policy Variations

	Policy Variations		
	1	2	3
Scenario Name	CPP/CCA Compliance	SB 98 Voluntary Targets	No GHG Compliance Policies
Level of Natural Gas Demand	Reference Case		
Description	The model to achieves compliance with the CPP and the CCA using eligible resources CPP rules to be finalized later this month Carve out EITE exemptions from compliance requirements For CCA purchased allowance costs, the model will use the maximum of the social cost of carbon and the allowance price for resource selection Will use forecasted allowance price for discussing total costs to WA customers	Oregon Administrative Rule 860-150-0100 requires SB 98 be examined in NW Natural's IRP Set the model to achieve SB 98 targets using eligible resources Use the same percentage targets to be achieved in Washington under potential provisions in HB 1257 regarding RNG purchases Cost caps OR: 5% of revenue requirement WA: 5% of the amount charged to retail customers Cannot model cost caps within the resource selection model, but can use outputs to see when/if this would become a binding constraint	Scenario considers current building codes but is absent CPP/CCA or RNG procurement policies Customers are served with the lowest cost resources. Existing RNG contracts remains on our system until current contracts expire
Research Questions	• What types and forecasted timing of resources are procured to meet state GHG compliance for CCP/CCA? • What is the cost to complying with state GHG compliance? • What are the future bill impacts to customers? • What are the total emissions reductions by 2050?	• What types and forecasted timing of resources are procured that would achieve voluntary targets outlined by SB 98? • What are the costs to achieving these targets? Are the cost caps reached? If so, when? • What are the future bill impacts to customers? • What are the total emissions reductions by 2050?	• What is the baseline emissions level to serving customers with the lowest cost resources? • What is the baseline cost to serving customers with the lowest cost resource? • What is the baseline bill expectation to serving customers with the lowest cost energy resources?

CPP and CCA Compliance Resources



SB 98 and HB 1257

Oregon - SB 98

SECTION 5. (1) A large natural gas utility that participates in the large renewable natural gas program adopted by rule by the Public Utility Commission under section 4 (1) of this 2019 Act may make qualified investments and procure renewable natural gas from third parties to meet the following portfolio targets for the percentage of gas purchased by the large natural gas utility for distribution to retail natural gas customers in Oregon that is renewable natural gas:

(a) In each of the calendar years 2020 through 2024, five percent may be renewable natural gas;

(b) In each of the calendar years 2025 through 2029, 10 percent may be renewable natural gas;

(c) In each of the calendar years 2030 through 2034, 15 percent may be renewable natural gas;

(d) In each of the calendar years 2035 through 2039, 20 percent may be renewable natural gas;

(e) In each of the calendar years 2040 through 2044, 25 percent may be renewable natural gas; and

(f) In each of the calendar years 2045 through 2050, 30 percent may be renewable natural gas.

.....

(5) If the large natural gas utility's total incremental annual cost to meet the targets of the large renewable natural gas program exceeds five percent of the large natural gas utility's total revenue requirement for an individual year, the large natural gas utility may no longer be authorized to make additional qualified investments under the large renewable natural gas program for that year without approval from the commission.

Washington – HB 1257

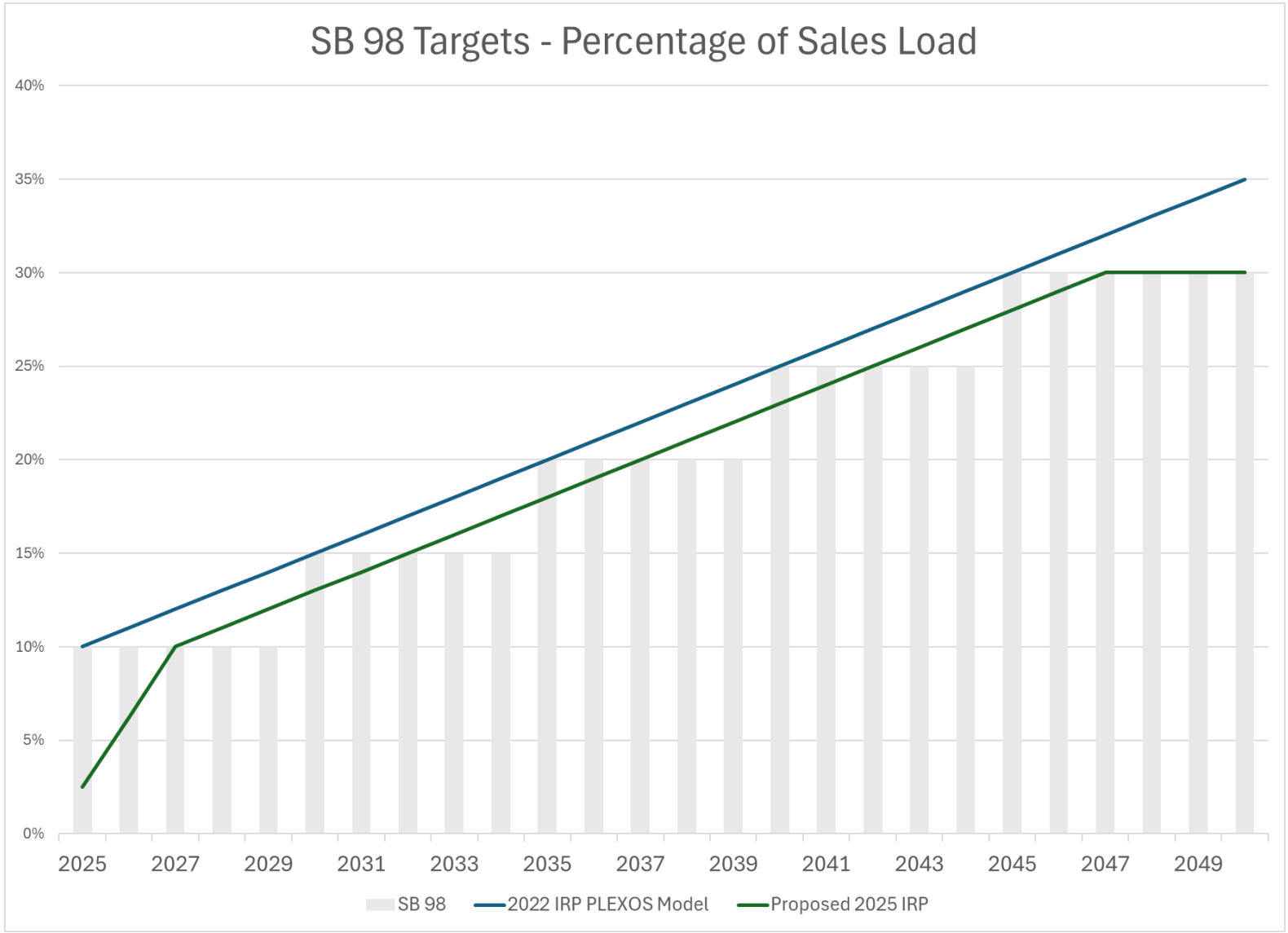
NEW SECTION. **Sec. 13.** A new section is added to chapter 80.28 RCW to read as follows:

(1) A natural gas company may propose a renewable natural gas program under which the company would supply renewable natural gas for a portion of the natural gas sold or delivered to its retail customers. The renewable natural gas program is subject to review and approval by the commission. The customer charge for a renewable natural gas program may not exceed five percent of the amount charged to retail customers for natural gas.

(2) The environmental attributes of renewable natural gas provided under this section must be retired using procedures established by the commission and may not be used for any other purpose. The commission must approve procedures for banking and transfer of environmental attributes.

(3) As used in this section, "renewable natural gas" includes renewable natural gas as defined in RCW 54.04.190. The commission may approve inclusion of other sources of gas if those sources are produced without consumption of fossil fuels.

SB 98 Target Scenario



- SB 98 targets are voluntary targets that are set as percentage of total sales load
- As written in the law, SB 98 targets are *stairstep* targets which are not a realistic method to procure RNG
- In the last IRP we modeled a linear approach into the PLEXOS model (Blue line)
- NW Natural is anticipating achieving around 2.5% in 2025
- Proposed green line for modeling this scenario in the 2025 IRP

SB 98 Qualified Resources

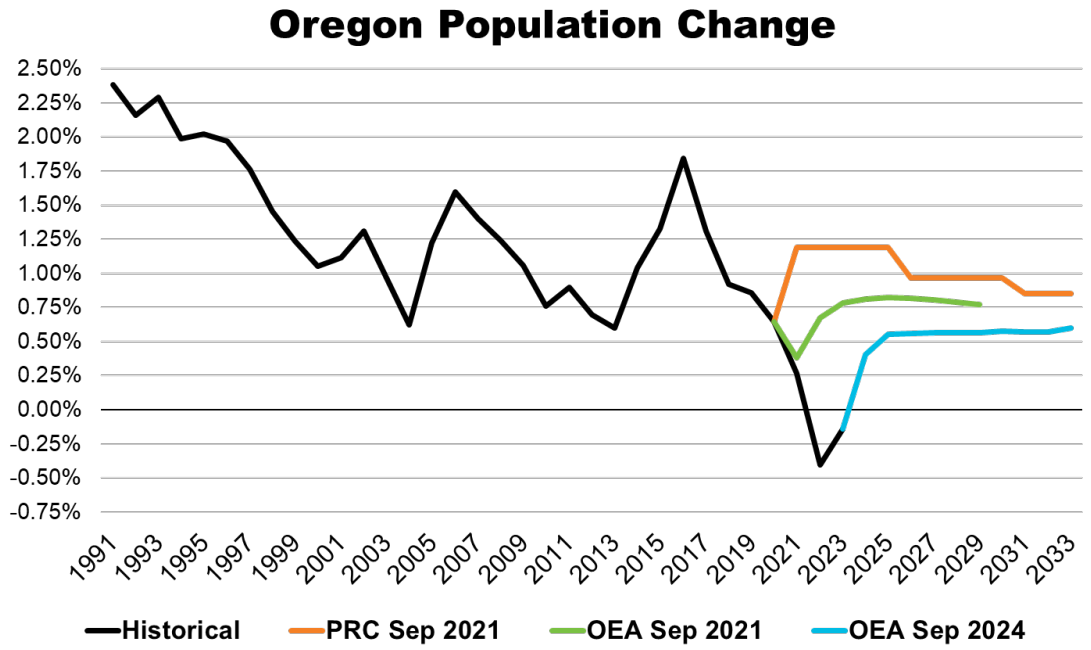
- **Renewable Natural Gas (RNG)**
  - Landfill
  - Animal Manure
  - Wastewater
  - Food Waste
- **Hydrogen**
  - Green Hydrogen [Solar + Electrolysis]
  - Green Hydrogen [Wind + Electrolysis]
- **Synthetic Methane**
  - Biogenic Sources
  - Direct Air Capture
- **Qualified Renewable Thermal Credits (RTCs)**

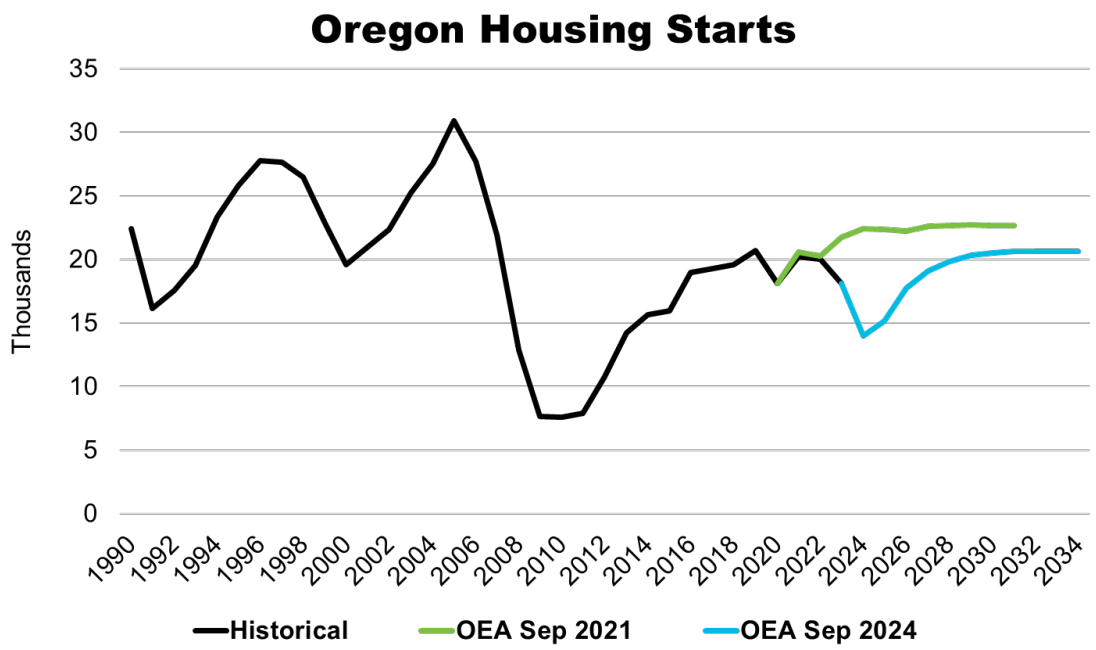
Demand Variation Scenarios

	4		5	6	7
Scenario Name	**Growth Recovery**		**Modest Customer Electrification**	**Hybrid System Electrification**	**All-Electric Buildings**
Level of Natural Gas Demand	Higher than Reference		Medium Gas Load	Low Gas Load Scenario	Lowest Gas Load Scenario
NW Natural Policy Scenario	CPP/CCA Compliant		CPP/CCA Compliant	CPP/CCA Compliant	CPP/CCA Compliant
Description	Higher than reference case customer growth due to changes in macro-economic trends. Rebound in population growth and housing starts	**Reference Case – TBD**	Aims to aligns with trends from NEEA-RBSA, projections from electric utilities of existing buildings electrifying, and limitations on natural gas in new construction buildings.	Significant levels of electrification through hybrid-heating retrofits and hybrids for new construction. Hybrid system adoption curve mirrors heat pump adoption curve in scenario 7 but uses hybrid systems.	Significant levels of building electrification through a mix of cold climate, standard air source heat pumps, water heat electrification, etc. Heat pump for space heating adoption curve mirrors hybrid system adoption curve in scenario 6 but installs only heat pumps.
Research Question	• What should NW Natural prepare for in terms of energy capacity, annual deliveries and total compliance costs if demand for natural gas is higher than expected?		• What levels of electrification are electric utilities currently planning to meet? • What is the impact the winter peak capacity requirements needed on the electric grid? • What is the level of demand reduction on the gas system?	• What are the benefits and costs of deploying hybrid systems relative to the all-electric building adoption scenario? • What are the total societal costs? • What are emissions costs ($/MTCO2e)?	• What are the challenges to the electric system to meeting winter peak space heating requirements? • What are the total societal costs? • What are the risks of relying on a single energy delivery system? • What are the emissions costs ($/MTCO2e) for building electrification in the Pacific Northwest?

ICF is helping quantify the range of full electric system costs for a reference case, and scenarios 5, 6, & 7

Growth Recovery Scenario





- Oregon has seen significant changes in growth since the last IRP that have an impact on the company's ability to add new customers.
- Population growth expectations have changed from 1.03% at the time of the 2022 IRP to 0.55% for the 2025 IRP – a nearly 50% reduction in expected population growth.
- Housing starts, which we also use for customer count forecast models, are also expected to be lower over the planning horizon, as population change is the primary variable used in the housing starts model.
- Reference case will use current OEA forecasts (blue line), and the growth recovery scenario will rely on previous September 2021 forecasts (green line)

Demand Variation Scenarios

	4	5	6	7
Scenario Name	**Growth Recovery**	**Modest Customer Electrification**	**Hybrid System Electrification**	**All-Electric Buildings**
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Reference Case – TBD

ICF is helping quantify the range of full electric system costs for a reference case, and scenarios 5, 6, & 7

5 Minute Break

ICF Presentation

NW Natural Electrification Study

NW Natural 2025 IRP Technical Working Group Meeting

Overview of Scenarios

11/01/2024

ICF's energy + climate footprint

ICF is a leading provider of professional services and technology-based solutions to governments, utilities, and companies.

ICF is headquartered in Reston, Virginia, with more than 9,000 employees in over 50 offices worldwide.

50+
years of energy work

1K+
energy experts

Top 50
utilities in North America

200+
energy efficiency programs

All major
federal agencies

All major
energy NGOs

40+
years of climate science, impacts, and adaptation

2K+
climate, energy, and environment experts

Agenda

1. Overview of Study
2. Discussion of Key Scenario Assumptions
3. Next Steps

Overview of the Study

Overview of NW Natural Electrification Study

Key Objectives:

- Provide input on gas demand impacts to NW Natural's IRP on potential electrification scenarios
- Consider the electric supply requirements for these electrification scenarios – to give context and characterize costs
- Assess the overall impacts and costs associated with electrifying NW Natural customers
- Assess how hybrid heating (ASHP with gas back-up) would change the impacts and costs of electrification
- Focus is on building electrification – but analysis also considers load growth in other sectors

Demand-Side Analysis

- Assess electric load growth and gas demand impacts from different levels of electrification and types electric equipment
- Focus is on buildings but also considers other sources of load growth (industrial, transportation, data centers)

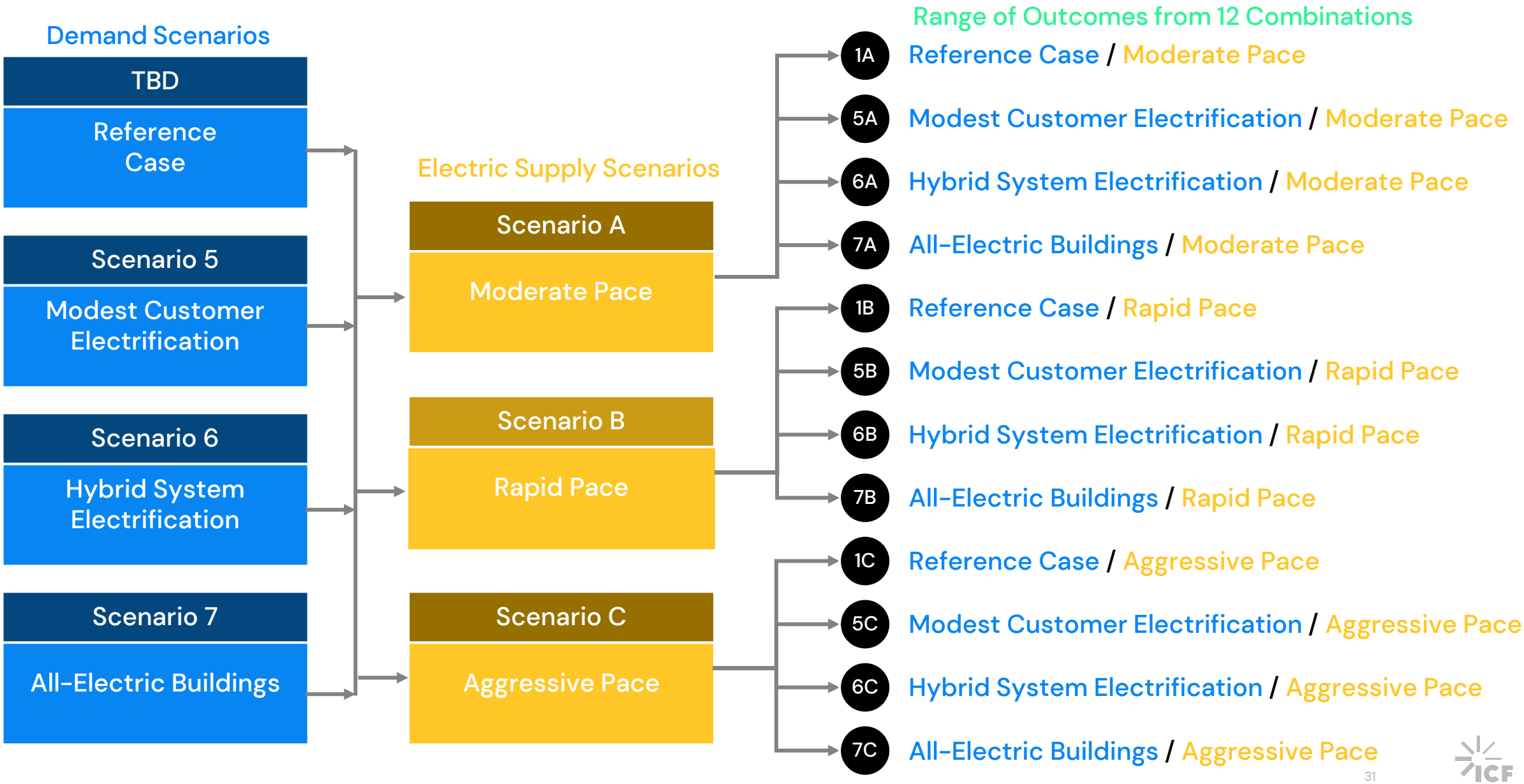
Electric Supply Analysis

- Capacity expansion modelling to assess the infrastructure requirements resulting from increased electric loads
- Consider different sets of constraints on supply resources
- Includes generation, transmission, and distribution

Sector Integration & Results

- Combine demand and electric sector results to understand overall cost and GHG emissions impacts of different scenarios
- Including customer equipment conversion costs and incremental infrastructure costs for generation, transmission, and distribution

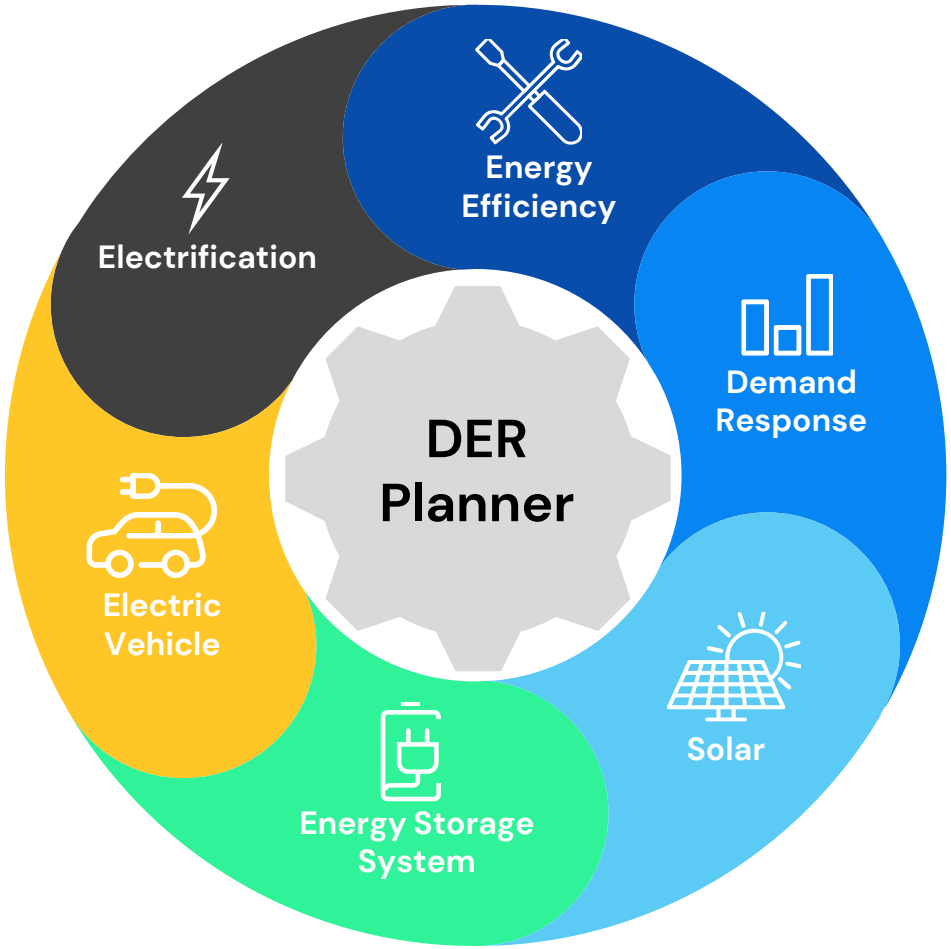
Demand & Electric Supply Scenarios Combine for Distinct Sets of Capacity Expansion Modelling Results



Demand Side Scenarios

Overview of the Demand Side Analysis

- **ResStock and ComStock are being used to characterize the building electrification measures.**
  - ResStock and ComStock are tools developed by the National Renewable Energy Laboratory (NREL) for large-scale building energy analysis. It leverages the U.S. Department of Energy's (DOE) open-source building energy modeling ecosystem, including OpenStudio and EnergyPlus, to provide detailed information on building electrification.
- **ICF's DER Planner model to be used to assess the overall building electrification impacts**.
  - This model will analyze the stock turnover, based on assumed measure adoption levels for each scenario, and calculate the impacts on electric and gas consumption, as well as customer conversion costs.
- **Other electric loads to be considered at a higher level.**
  - The main focus of the analysis is comparison of different scenarios in terms of the impacts from electrification of buildings. However, a simpler approach to quantify other sources of electric load growth (electric vehicles, industry, data centers) will also be considered so that the electric supply modelling is not missing other expected load growth.



Overview of the Differences between the Demand Side Scenarios

	Demand Variance Scenarios included in the Electrification Analysis		
IRP Scenario	**5**	**6**	**7**
Scenario Name	**Modest Customer Electrification**	**Hybrid System Electrification**	**All-Electric Buildings**
Description	•Aims to align with PGE and Pacific Corp assumptions about IRP customer adoption of building electrification (modest level of building electrification) •Resulting loads calculated independently	•High levels of electrification through hybrid-heating retrofits •Hybrid-heating for new construction starting in 2035 •Mirrors Oregon Department of Energy (ODOE) study customer adoption assumptions (e.g., heat pumps capture 90% of sales by 2040), but uses only hybrid gas-electric systems instead of all-electric	•High levels of whole building electrification (mix of cold climate and standard air source heat pumps) •Mirrors ODOE study customer adoption assumptions (e.g., heat pumps capture 90% of sales by 2040) •Resulting loads calculated independently

Measures for Building Electrification Assessment (Residential & Commercial)

NREL ResStock Upgrade Measures

- R1 - Heat Pump Water Heater
- R2 - Electric Conventional Range/Oven
- R3 - Electric Induction Range/Oven
- R4 - Energy Star air-to-air heat pump, Electric Backup
- R5 - Energy Star air-to-air heat pump with existing system as backup (select NG as backup/baseline)
- R6 - Energy Star air-to-air heat pump with electric backup + light touch envelope improvements
- R7 - Energy Star air-to-air heat pump with existing system as backup + light touch envelope improvements
- R8 - High efficiency cold-climate air-to-air heat pump, Electric Backup
- R9 - High efficiency cold-climate air-to-air heat pump with electric backup + light touch envelope improvements
- R10 - Basic enclosure
- R11 - Enhanced enclosure

NREL ComStock Upgrade Measures

- C1 - Variable Speed HP RTU, Electric Backup
- C2 - Variable Speed HP RTU, Original Heating Fuel Backup
- C3 - VRF with DOAS
- C4 - HP Boiler, Electric Backup
- C5 - HP Boiler, Gas Backup
- C6 - Demand Control Ventilation
- C7 - Energy Recovery for AHUs
- C8 - Wall Insulation
- C9 - Roof Insulation
- C10 - New Windows
- C11 - Electric Kitchen Equipment
- *C12 - Heat Pump Water Heater*
- *C13 - Electric resistance boiler*

Assumed Residential Electrification Levels

		Demand Variance Scenarios		
Customer Type	End Use	Modest Customer Electrification	Hybrid System Electrification	All-Electric Buildings
Existing Gas Customers	Space Heating	•15% heat pump sales by 2030 •Evenly split between heat pumps with electric backup and with gas backup	•Align with ODOE 65% heat pump sales by 2030 & 90% by 2040 •Energy Star AHSP with existing system as backup	•65% heat pump sales by 2030 & 90% by 2040 •Mix of Energy Star and High efficiency cold-climate heat pumps, with electric backup
	Water Heating	•15% heat pump sales by 2030	•50% heat pump sales by 2030 & 95% by 2045	•50% heat pump sales by 2030 & 95% by 2045
	Cooking	15% sales of new appliances are electric by 2030	95% sales of new appliances are electric by 2035	95% sales of new appliances are electric by 2035
	Building shells	An incremental 0.5% of all residential buildings weatherize each year (vs. reference case)		
New Construction	Space Heating	50% of reference case gas new construction uses electric as of 2035	100% Hybrid Heating as of 2035	100% ASHP as of 2035
	Water Heating	50% Electric HPWH as of 2035	100% Electric HPWH as of 2035	100% Electric HPWH as of 2035
	Cooking	50% All-electric as of 2035	100% All-electric as of 2035	100% All-electric as of 2035

Assumed Commercial Electrification Levels

		Demand Variance Scenarios		
Customer Type	End Use	Modest Customer Electrification	Hybrid System Electrification	All-Electric Buildings
Existing Gas Customers	Space Heating	•5% heat pump sales by 2030 •Evenly split between heat pumps with electric backup and with gas backup	•Small commercial: follows residential •Large commercial: 25% of all new sales are electric with gas back-up by 2035 and 90% by 2045	•Small commercial: follows residential •Large commercial: 25% of all new sales are all-electric (ASHP or boiler) by 2035 and 90% by 2045
	Water Heating	•5% incremental electric sales by 2030	•Small commercial: follows residential •Large commercial: 25% of all new sales are electric (ASHP or resistance) by 2035 and 90% by 2045	•Small commercial: follows residential •Large commercial: 25% of all new sales are electric (ASHP or resistance) by 2035 and 90% by 2045
	Cooking	5% sales of new appliances are electric by 2035	95% sales of new appliances are electric by 2035	95% sales of new appliances are electric by 2035
	Building shells	An incremental 0.5% of all commercial building make building shell improvements each year (vs. reference case)		
New Construction	Space Heating	25% of reference case gas new construction uses electric as of 2035	100% Hybrid Heating as of 2035	100% ASHP as of 2035
	Water Heating	25% Electric HPWH as of 2035	100% electric as of 2035	100% electric as of 2035
	Cooking	25% All-electric as of 2035	100% electric as of 2035	100% electric as of 2035

Building Electrification Impacts – Key Data Sources

- **Simulation tools**:
  - ResStock and Comstock are highly granular modeling of the U.S. housing and commercial building stock which use a combination of sampling techniques from diverse public and private data sources, OpenStudio® building simulations, and advanced supercomputing capabilities.
  - They have granular building equipment saturation data by states and climate zones which helps determine baseline usage and impacts of DER and electrification measures to a lower level of granularity.
  - Electrification Measures modeled will be useful in determining the hourly 8760 kWh impacts at the building level and territory level.

- **Caveats**:
  - ResStock – In ResStock, multiple unit residential buildings are modeled for individual units – our method uses simple aggregation to building level.
  - ComStock does not cover all building types, ICF will make assumptions for missing building types on lines of similar building types.

Other Electric Load Growth

The main focus of the study is the comparison of different scenarios in terms of the impacts from electrification of buildings. However, there are other electric load impacts that may not be fully captured in electric utility Integrated Resource Plans (IRPs) at this time. These other electric loads are not necessarily NW Natural customers, but assumptions are needed here to avoid underestimating the electric sector infrastructure requirements. For the following sectors, we plan to include the same load impacts across all scenarios (so that the differences between scenarios can be clearly contrasted):

- **Transportation**
  - Electric IRPs do include significant transportation electrification, but the scope of electrification and assumptions unclear
  - ICF to model load impacts from existing transportation electrification policies (see next slide) to establish whether incremental loads beyond IRP forecasts are merited

- **Industrial & data centers**
  - Electric IRPs include expectations for data center load growth, but forecasts in this area have been rapidly increasing
  - Electric IRPs include some industrial load growth from industrial expansion, but minimal loads for electrification of industry
  - These categories of loads are also sometimes grouped together, and specific assumptions unclear
  - ICF to consider some third-party additional sources to establish whether the annual electric growth rates from electric IRPs should be increased for this study:
    - Northwest Power and Conservation Council Pacific Northwest Power Supply Adequacy Assessment for 2029 and PNUCC Northwest Regional Forecast of Power Loads and Resources for data center loads
    - NREL Electrification Futures study and Princeton Net Zero America study for industrial electrification

Transportation Electrification Load Impacts

- Oregon adopted the Advanced **Clean Cars** II (ACC 2) regulation on December 19, 2022.
  - The regulation shoots for 100% zero-emission vehicle (ZEV) sales by 2035
  - Automakers must meet increasing ZEV sales percentages, starting with 35% in 2026 and rising incrementally each year.
  - ZEV sales requirements cover battery electric vehicles (BEVs), hydrogen fuel cell vehicles (FCVs), and plug-in hybrid electric vehicles (which phase out by 2035).

Model Year	Minimum ZEV Sales Requirement
2026	35%
2027	43%
2028	51%
2029	59%
2030	68%
2031	76%
2032	82%
2033	88%
2034	94%
2035	100%

- Oregon adopted the **Clean Truck** Rule on Nov. 17, 2021, aligning with California's Advanced Clean Trucks rule.
  - Starting in 2025, manufacturers must ensure a percentage of medium- and heavy-duty trucks sold in Oregon are zero-emission vehicles (ZEVs).
  - The rule includes reporting requirements for manufacturers and a credit-trading system similar to passenger vehicle ZEV mandates.
  - By 2035, 50-75% of trucks sold in these classes must be zero-emission, depending on the vehicle type.

Model Year	Class 2b-3 Vehicles	Class 4-8 Trucks	Class 7-8 Tractors
2025	5%	9%	5%
2026	7%	11%	7%
2027	10%	13%	9%
2028	15%	20%	11%
2029	20%	30%	13%
2030	25%	40%	20%
2031	30%	50%	30%
2032	35%	55%	35%
2033	40%	60%	40%
2034	45%	65%	45%
2035	50%	75%	50%

Approach to Demand Side Electrification Costs

- ICF will conduct a literature review to develop the customer cost assumptions for the demand side analysis.
- The analysis will consider equipment and installation costs as well as other costs associated with electrification, including electrical panel upgrades and weatherization measures.
- Sources for the literature review include:
  - Program data tracking on actual costs
  - State and regional Technical Reference Manuals
  - Results from recent ICF studies on electrification costs and databases compiled from decarbonization studies conducted by ICF
  - Data from previous survey/interviews conducted by ICF with various market actors such as HVAC, electrical, and retrofit contractors from other studies
  - Independent research on publicly available information including electrification and panel upgrade reports by national labs and ESource

Equipment costs

- Space heating
- Water heating
- Cooking equipment
- Ductwork

Electrical panel upgrades

- Material costs
- Labor costs
- Permitting fees

Building Shell and Weatherization

- Whole home weatherization
- Air sealing and duct insulation

Electric Supply Analysis

Electric Sector Modeling

- About **IPM®**, ICF's capacity expansion and production-costing model of the electric sector.
  - Multi-Region, dynamic linear programming model of North America, of which we will model the western-interconnection, with specific attention paid to the electric utilities overlapping NW Natural's natural gas service territories in Washington and Oregon.
  - **Provides:**
    - Generation and transmission capacity expansion plans,
    - Unit dispatch decisions, and
    - Emission forecasts.
  - **Considers:**
    - Resource potential and operational availability,
    - Environmental requirements and policy targets,
    - Demand requirements,
    - Transmission constraints, and
    - Investment, fuel, and operational costs.

State and Regional Policies

- **All** scenarios will be modeled to comply with existing regulations, which will require significant additions of capacity in a short period of time while facing load growth on the system.

Regulation	Oregon	Washington
Clean Energy Standard (CES)	HB 2021 - Large electric utilities serving more than 25k customers (i.e., PGE & PacifiCorp) required to reduce GHG emissions by 80% by 2030, 90% by 2035, and 100% by 2040 from 2010-2012 levels.	Reduce emissions 45% below 1990 levels by 2030, 70% by 2040, and 95% by 2050.
Renewable Portfolio Standard (RPS)	Utilities serving at least 3% of state load • 25% by 2025 • 35% by 2030, • 45% by 2035, • 50% by 2040 Utilities serving 1.5-3% of state load: 10% by 2025 Smaller Utilities: 5% by 2025	15% by 2030 and 100% by 2045
Coal	No Coal supplying state electricity by 2030, inclusive of imports	No Coal supplying state electricity by 2025
Natural Gas	Prohibition on new or expanded natural gas-fired power plants	
Nuclear	In-state moratorium for new Nuclear plants	

Overview of Electric Supply Scenarios

Scenario A	Scenario B	Scenario C
Moderate Pace of Change	Rapid Pace of Change	Aggressive Pace of Change
Examines impacts of electrification on electric system that evolves at a moderate pace. Utilities rely on supply resources that moderately improve in cost and performance to meet growing energy need to source from primarily in-state/utility supply.	Examines impacts of electrification on an electric system with technologies that more rapidly become available at lower cost. Rapid pace of change enables transmission expansion more quickly and expands the role of demand-side resources such as energy efficient and demand response.	Examines impacts of electrification on an electric system that aggressively develops through optimistic technology cost declines and resource availability. Cost reductions of technologies, accelerated transmission development timelines and expanded deployment of demand-side resources lead to a diverse and lower-cost resource mix.

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Summary of Electric Supply Options

- Select electric supply assumptions that differ across scenarios are listed below.
- Technology resources such as solar, onshore wind and battery storage are offered as options across all scenarios

Supply Option	Assumption	Moderate	Rapid	Aggressive
Low Carbon Fuels (RNG, H_2, SNG)	Cost	↑	→	↓
	Availability	↓	→	↑
Offshore Wind	Cost	↑	→	↓
	Availability	Current Procurements	EPA Build Limits	EPA Build Limits
Natural Gas with or without CCS/Nuclear		Not permitted in Oregon. Permitted only as option to build outside of Oregon		
Planned Transmission Capacity		Delay for early-stage planned projects	Delay for early-stage planned projects	All projects proceed as planned
Economic Transmission Expansion	Timeline of Deployment	Current timelines	Shortened Timelines	Short Timelines
Demand Response/EE	Assumed Deployment	Low	Medium Low	High Medium Low

Overview of Scenario Assumptions

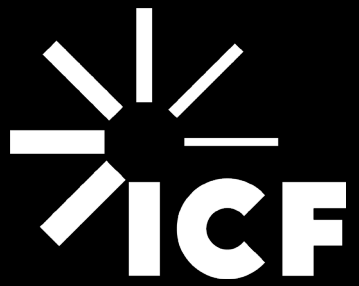
- The electric supply scenarios will draw from public industry sources to define the input assumptions:
  - NREL's Annual Technology Baseline
  - EPA's Power Sector Modeling
  - EIA's Annual Energy Outlook

- The assumptions for electric supply scenarios are informed by the latest data from electric utility proceedings and regional planning studies, such as:
  - Utility IRP and CEP data and supporting studies
  - Utility distribution system plans
  - Northwest Power and Conservation Council Pacific Northwest Power Supply Adequacy Assessment for 2029 and PNUCC Northwest Regional Forecast of Power Loads and Resources
  - NREL Electrification Futures study and Princeton Net Zero America study for industrial electrification

Next Steps

Next Steps

- Aiming to discuss additional assumptions on November 13th TWG meeting
- Modelling Q4 2024 / Q1 2025
- Share draft results in a TWG meeting Q2 2025



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About ICF

ICF (NASDAQ:ICFI) is a global consulting services company with approximately 8,000 full-time and part-time employees, but we are not your typical consultants. At ICF, business analysts and policy specialists work together with digital strategists, data scientists and creatives. We combine unmatched industry expertise with cutting-edge engagement capabilities to help organizations solve their most complex challenges. Since 1969, public and private sector clients have worked with ICF to navigate change and shape the future.

Current Technical Working Group Schedule

TWG No.	Date	Type & Purpose of Engagement
TWG#1: Part 1	Oct 22, 2024	Planning Environment
TWG#1: Part 2	Nov 1, 2024	Scenarios
TWG#2: Part 1	*Nov 13, 2024*	*Scenario Cont. and Climate*
TWG#2: Part 2	Nov 21, 2024	Load Forecast
TWG#3: Part 1	Dec 10, 2024	Avoided Costs & Demand- Side Resources
TWG#3: Part 2	Dec 17, 2024	Avoided Costs & Demand- Side Resource
TWG#4: Part 1	Jan 21, 2025	Supply-Side & Compliance Resources
TWG#4: Part 2	Jan 28, 2025	Supply-Side & Compliance Resources
TWG#5: Part 1	Apr 1, 2025	Distribution System Planning
TWG#5: Part 2	April 8, 2025	Distribution System Planning
TWG#6: Part 1	Apr 29, 2025	Resource Optimization Planning Model
TWG#6: Part 2	May 6, 2025	Portfolio Results and Action Plan
File Draft	Jun 13, 2025	Comments due by July 7th
File 2025 IRP	**Aug 2, 2025**	**Beginning of formal process**

- All TWGs will be facilitated and virtual
- Part Two will provide an opportunity at the beginning to follow up questions from Part 1
- Feedback forms found on website:

  IRP Website; Feedback Form

Or email us at:

IRP@nwnatural.com

Other Public Engagement Opportunities

Public Engagement Opportunity & Topic	Date	Type & Purpose of Engagement
Energy Resource (IRP) Fair #1:	November 16, 2024	**In-Person Only. Opportunity to learn and engage on IRPs and Energy Services & Programs. Event to be held in collaboration with community partners.** ***Parkrose High School from 11:00am to 2:00pm***
Public Engagement Webinar #1:	February 4, 2025	**Opportunity to learn and engage on an IRP and key topics previously presented and related to resource planning and utility energy services.**
Energy Resource (IRP) Fair #2:	May 10, 2025	**In-Person Only. Opportunity to learn about IRPs and Energy Services & Programs & Proposed Action Plan and engage. Event to be held in collaboration with community partners.**
Public Engagement Webinar #2:	May 12, 2025	**Opportunity to learn and engage on an IRP and key topics previously presented and related to resource planning and utility energy services.**

- Please check our dedicated IRP website (Link below) for the most current information:

IRP Website

Opportunities for Scenario Feedback:

- TWG 2 -Part 1, Nov. 13th

Time to be allotted for further scenario discussion

- Feedback Form

Feedback preferred by Nov. 15th

https://www.surveymonkey.com/r/NWNaturalIRP

Thank you!

We value your feedback.

IRP@nwnatural.com

IRP Website

IRP Feedback Form