Meeting for the Public for the 2022 Integrated Resource Planning (IRP)

Meeting for the Public (2022 IRP)
July 18, 2022

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

- Procedures and Introductions
- Introduction to NW Natural
- What is an IRP?
- Participating in NW Natural's IRP
- Draft Action Plan
- Public Comment
- Potential IRP Details:
  - Planning Environment
  - Planning Needs
  - Resource Options
  - Portfolio Optimization and Risk Analysis
  - Distribution System Planning

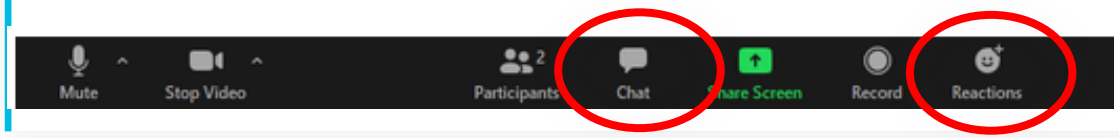
Procedures for Participation

- Please mute your microphones during the presentation, except when commenting and or asking a question
- All participants are muted upon entry into the meeting
- Phone Control- *6 for mute/unmute

- Cameras are optional and up to each participant to use
- All participant cameras are set to off upon entry into the meeting

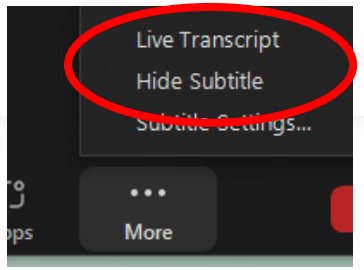
- Add a comment or question at any time using the “raised hand” or the chat box
- Phone Control- *9 for raise/lower hand

The raised hand function can be found in the reactions tab



Accessibility- Closed Captions (CC)/Live Transcript:

- To turn on CC, choose “Live Transcript” in the More section
- To turn on/off subtitles, choose “Hide/Show Subtitle” in the More section

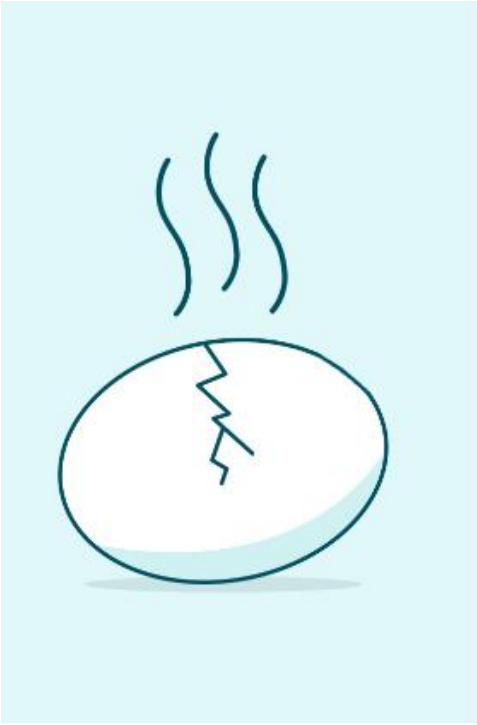


Take 2 Minutes for Safety:

Call before you dig.

- Call 811. It's free. It's the law.
- Utility lines in the ground can be at various depths
- Call 811 for locating utility lines **before** starting any project that involves digging on your property
- Respect the marks & dig with care

Smell. Go. Let us know.



- Natural gas leaks are rare, but can occur
- For easy detection, an odorant is added to the gas – scent resembles rotten eggs/sulfur
- Even the smallest leaks can be detected by smell
- If you **smell** gas, **leave** the area (if outside leave entire area immediately). Then, **let us know**.
  - 800-882-3377 (24hr emergency line)

Introduction to NW Natural

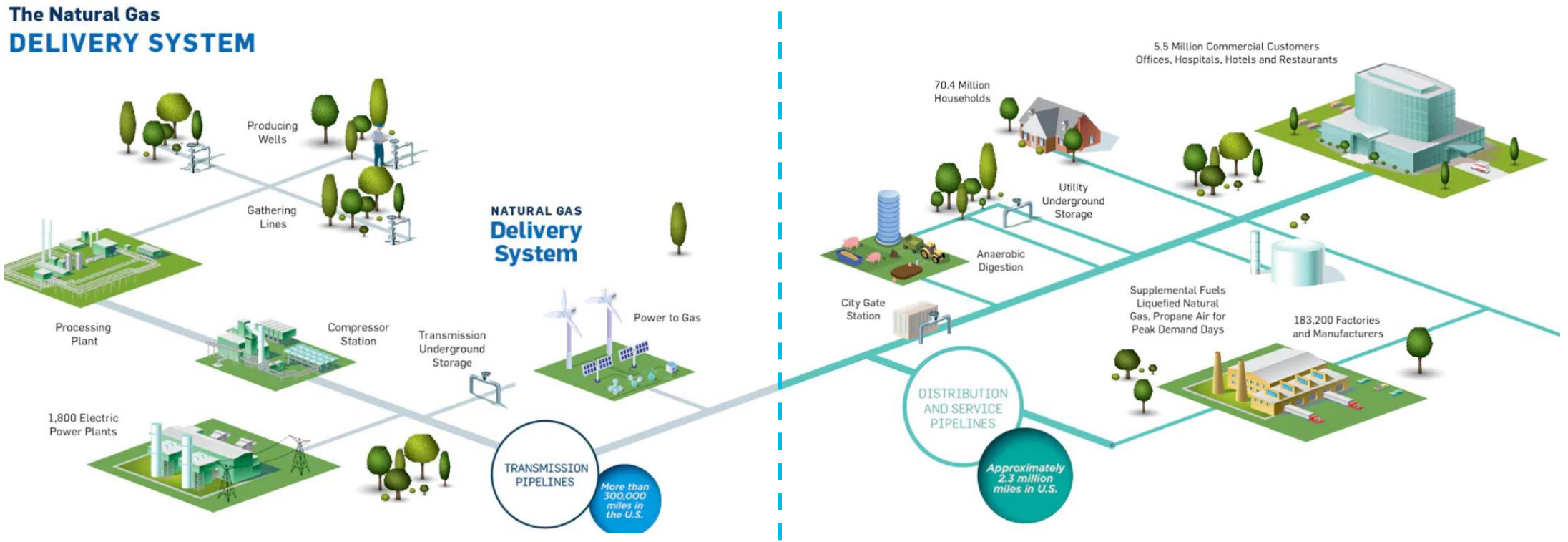
Who is NW Natural?

Quick Stats

- 163-year-old Oregon company
- Over 780,000 customers (meters)
  - 88% Oregon
  - 12% Washington
- Across 2 states, 18 counties, 140 different communities
- Serving over 2.5 million people
- More than 1200 employees

Supply Chain

Local Distribution Company (LDC)



Source: Adapted from American Gas Association

Our System

Quick Stats

- Approximately 14,600 miles of transmission and distribution pipelines
- 54 gate stations and farm taps from NWPL
- 2 RNG injection sites
- 2 LNG facilities
- Mist Underground Storage
- Approximately 1,030 district regulators

What is an IRP?

IRP Process, Objectives, and Evolution

The IRP process is a public process, and we welcome your feedback and participation!

- IRP participants come to the process with varying backgrounds and familiarity with IRP planning, and that is ok! Our IRP benefits from diverse perspectives
- We strive to strike the right balance in terms of the technical material presented, but are always evaluating the appropriate level of detail and might not always get it right

NW Natural's views on scope and role of the IRP:

- Rules and guidelines from the legislature and our regulatory commissions define the scope and purpose of IRPs and are grounded in a least cost-least risk approach to utility resource planning
- IRP rules and guidelines require robust planning that is highly complex and requires advanced modeling techniques and tools that are critical to serving our customers' needs as best we can
- IRPs assess the implications of the policy and market environment and how changes to that environment would impact meeting customer needs
- The IRP process is not a policy making process nor the best forum to discuss what policies should (or should not) be adopted

NW Natural acknowledges that IRPs are evolving and the active discussions about the role of IRPs and ways to make the process more inclusive and transparent as well as coordinate work across utilities

- We are proactively looking at ways to improve our IRP process and outreach and are excited to be able to lean on the experience and expertise of the Community and Equity Advisory Group NW Natural is forming moving forward

We value open and constructive discussion and IRP workshops are *LONG* meetings; we are bound to misspeak from time to time and we apologize in advance!

What is an IRP?

- Every few years, Integrated Resource Planning (IRP) develops a resource plan that meets our customers' long-term energy requirements with the dual objective of minimizing costs and risks for NW Natural customers. This robust planning process evaluates many factors including but not limited to the following:
  - Environmental policy
  - Customer growth
  - Consumption trends
  - Demand-side resources such as energy efficiency and demand response
  - Supply-side resources such as renewable natural gas and gas storage options
  - Uncertainty in all-of-the above
- The IRP is developed through a process open to the public and informed by feedback and a formal review by a diverse set of interested parties, including:
  - The Oregon and Washington utility commission staffs
  - Ratepayer, environmental and industry advocates
  - Energy Trust of Oregon
  - Other utilities and consultants
  - Other interested participants

IRP Guidelines and Dockets

Oregon:

- Secretary of State:
  - Rules: Chapter 860, Division 27 (860-027-0400)
- Oregon Public Utility Commission:
  - IRP Guidelines: Order No. 07-047; Order No. 08-339
  - General Utility Regulation
  - Formal Proceedings & Participating in a Docket
  - NW Natural IRP Dockets
    - LC 71 – 2018 IRP and 2018 IRP Update
    - Docket # TBD – 2022 IRP

Washington:

- State Legislature:
  - Administrative Code: Chapter 480-90 (480-90-238)
- Washington Utilities & Transportation Commission:
  - General Utility Regulation
  - Documents & Proceedings *(includes info on Hearings and how to participate in an Open Meeting)*
  - NW Natural IRP Dockets
    - UG 170911 – 2018 IRP and 2018 IRP Update
    - UG 190711 – 2022 IRP (petition- filing dates)
    - UG 210094 – 2022 IRP

Please note, Commission & IRP processes differ in each state.

2022 IRP Filing Timeline & How to Provide Feedback

- Draft 2022 IRP – July 29, 2022
  - Draft will be posted to the NW Natural website soon after filing
  - Informal Comment Period – August 1, 2022 – August 31, 2022
- Final 2022 IRP – September 23, 2022
  - Formal Comment Period – TBD per OPUC/WUTC prehearing conference
  - How to participate in a docket (OPUC)
  - How to participate in an open meeting (WUTC)

Feedback and comments on the Draft 2022 IRP can be submitted to the IRP team via:

- Email: IRP@nwnatural.com
- Mail To:

  NW Natural

  Attn: IRP Team

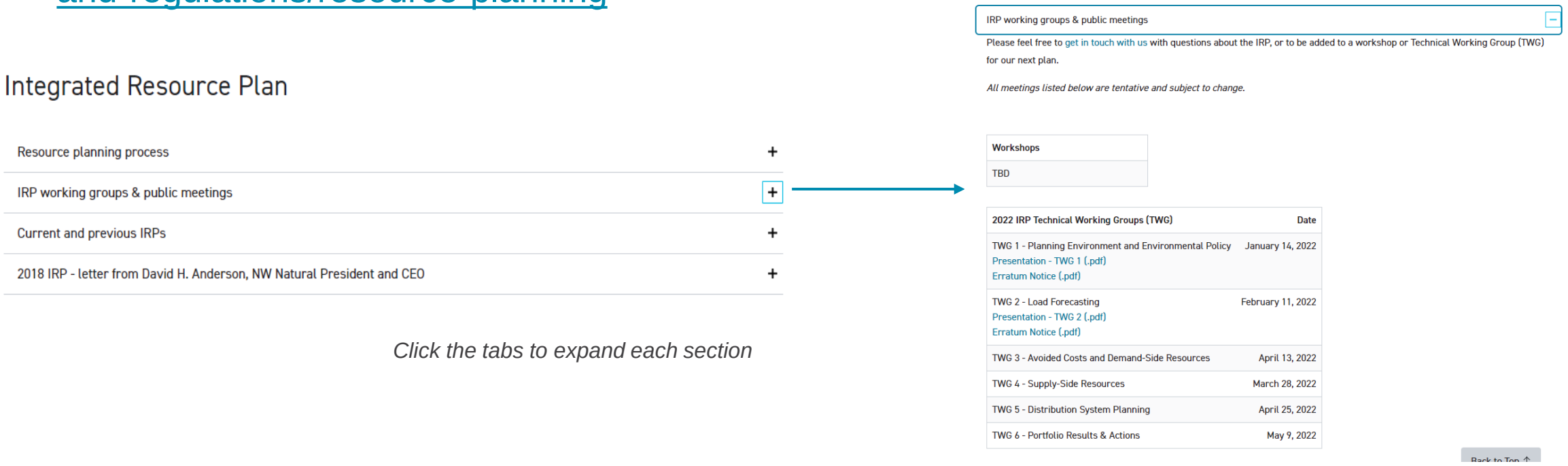
  250 SW Taylor St.

  Portland, OR 97214

IRP on the NW Natural website

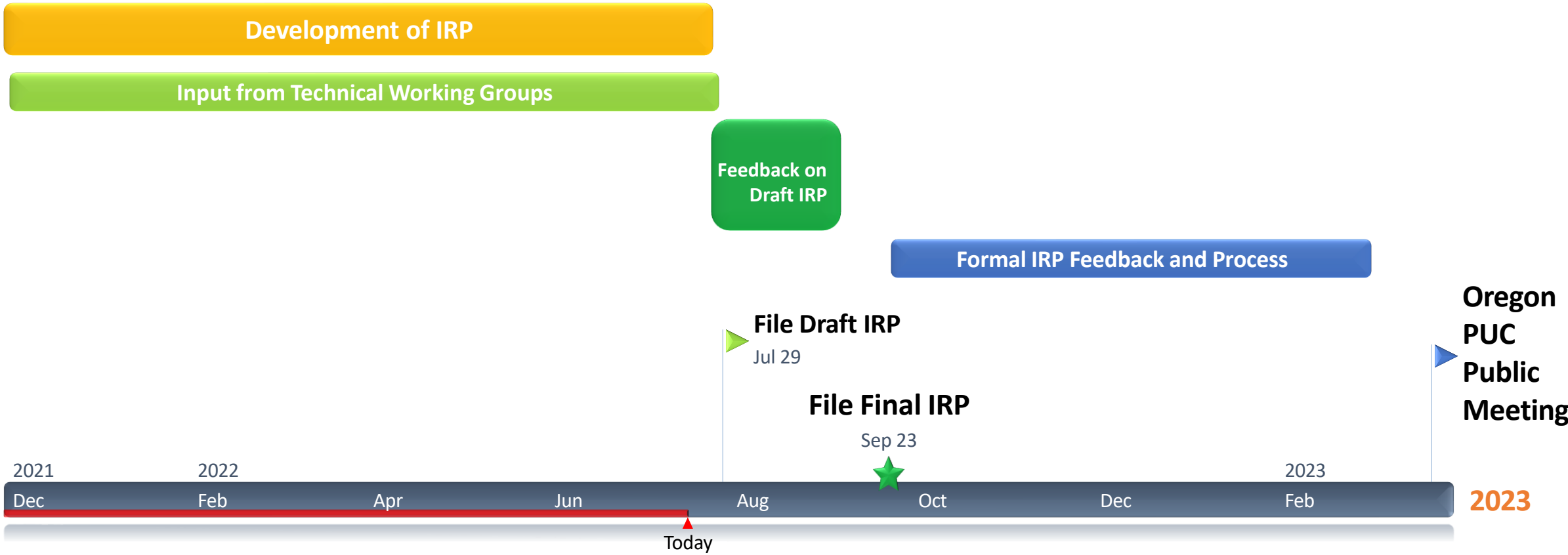
Find information about NW Natural's IRP on our website

- Integrated Resource Plan page: https://www.nwnatural.com/about-us/rates-and-regulations/resource-planning



Click the tabs to expand each section

Indicative Timeline



Prepared for IRP Meeting for the Public - Not to be used for investment purposes.

IRP Guidelines

Oregon : ORDER NO. 07-047 (link); ORDER NO. 08-339 (link)

Washington: WAC 480-90-238 (link)

IRP Guidelines outline the requirements of an IRP which govern the IRP process. There are 13 primary guidelines, but several have multiple sections and subsections. These guidelines are written for both Electric and Natural Gas Utilities, but not all guidelines apply to both.

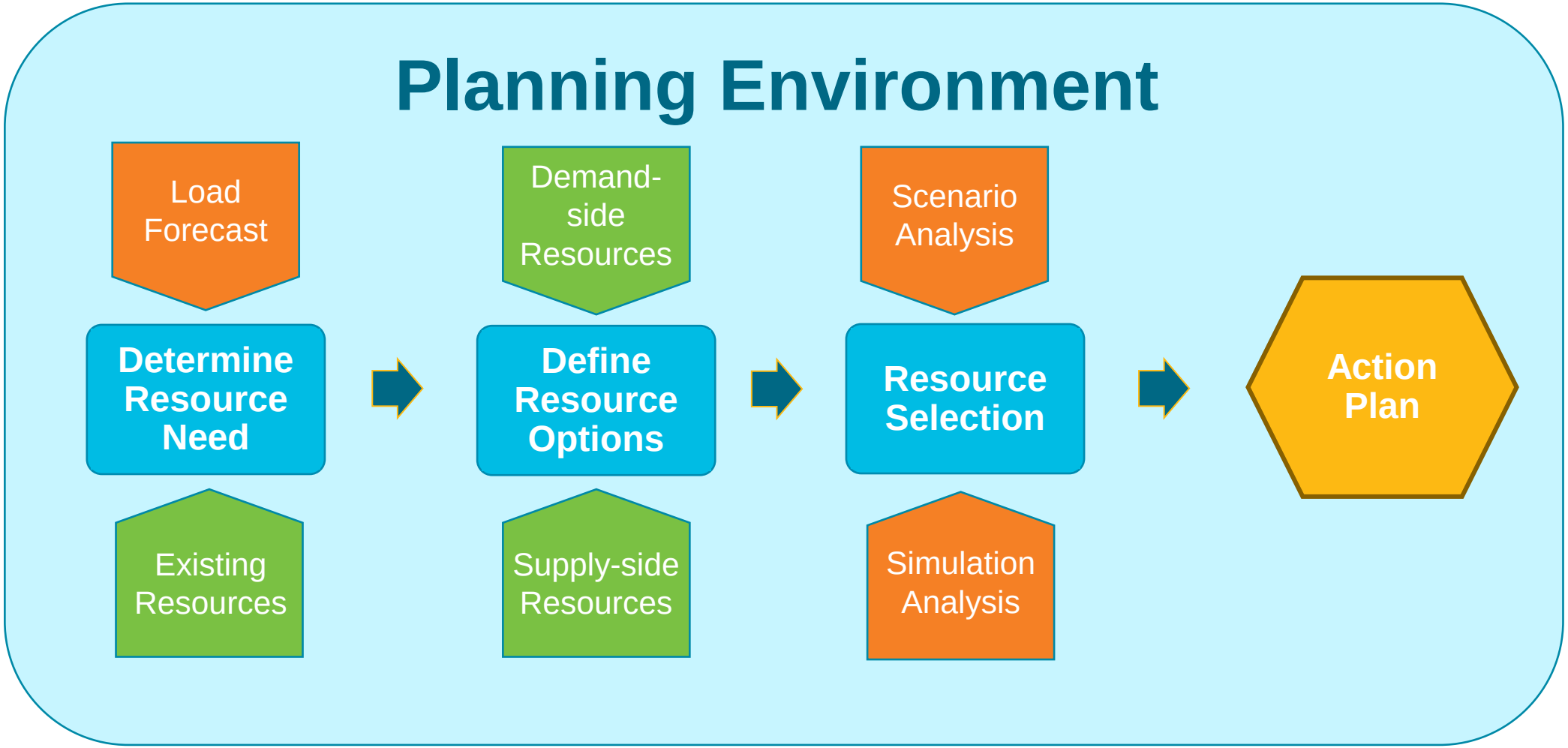
Guideline #1 (ORDER NO. 07-047)

(a) All resources (demand-side and supply-side) must be evaluated on a consistent and comparable basis

(b) Risk and uncertainty must be considered

(c) The primary goal must be the selection of a portfolio of resources with the best combination of expected costs and associated risks and uncertainties for the utility and its customers

Overview of IRP Process



Green = Resources Orange = Tools

Draft Scenarios for Evaluation in 2022 IRP

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		1	2	3	4	5	6	7	8
		Base Case - Compliance with OR-CPP and SB 98 and WA-CCA	**Carbon Neutral by 2050**	**New Direct Use Gas Customer Moratorium in 2025**	**Building Electrification**	**RNG and H2 Production Tax Credit**	**Limited RNG Availability**	**Supply-Focused Decarbonization**	**No CCIs Available**
Demand-Side	**Customer Growth**	Current Expectations		No New Customers After 2025		Current Expectations			
	Space and Water Heating Equipment	Moderate gas powered heat pump and hybrid heating adoption		High electrification of existing residential and small commercial load	Full electrification of existing residential and small commercial load by 2050	Moderate gas heat pump and hybrid heating adoption		No gas powered heat pumps and low levels of hybrid heating	Moderate gas heat pump and hybrid heating adoption
	Industrial Load Efficiency	Moderate increase	High increase	Moderate increase				Limited increase	Moderate increase
	Building Shell Improvement	Energy Trust projection	Energy Trust high sensitivity projection	Ajusted Energy Trust projection		Energy Trust projection			
Supply-Side	**Renewable Natural Gas**	Moderate availability and cost assumption	Moderately-high availability and moderate cost assumption	Moderate availability and cost		Moderate availability and low cost to customers	Low availability and moderately high cost	Moderate availability and cost assumption	Moderate availability and cost assumption
	Hydrogen	Moderate blending and dedicated system deployment; moderate cost assumption							
OR- Community Climate Investements		Costs and limits defined in CPP rule							No CCIs Available
WA- Allowances & Offsets		TBD- Pending Rule Development							

Draft 2022 IRP Action Plan

Covers activities over the next 2 to 4 years:

- Recall/Add Mist Storage Facility Service as Necessary to Retain Reliable Service
- Energy Trust of Oregon to Acquire Energy Efficiency at Targets Specified in IRP
- Acquire Renewable Natural Gas in Oregon in accordance with SB 98 Legislation (up to 5% in 2024)
- Purchase Community Climate Investments (CCIs) in Oregon as Necessary to Comply with the Oregon Department of Environmental Quality's (ODEQ's) Climate Protection Program (CPP)
- Purchase Emissions Allowances as Necessary to Comply with Washington's Climate Commitment Act (CCA)
- Replace Cold Box at Portland LNG Storage Facility
- Uprate Distribution System in Forest Grove Area to Maintain System Reliability

Questions/Feedback

Strategic Planning | Integrated Resource Planning Team
irp@nwnatural.com

We value your feedback!

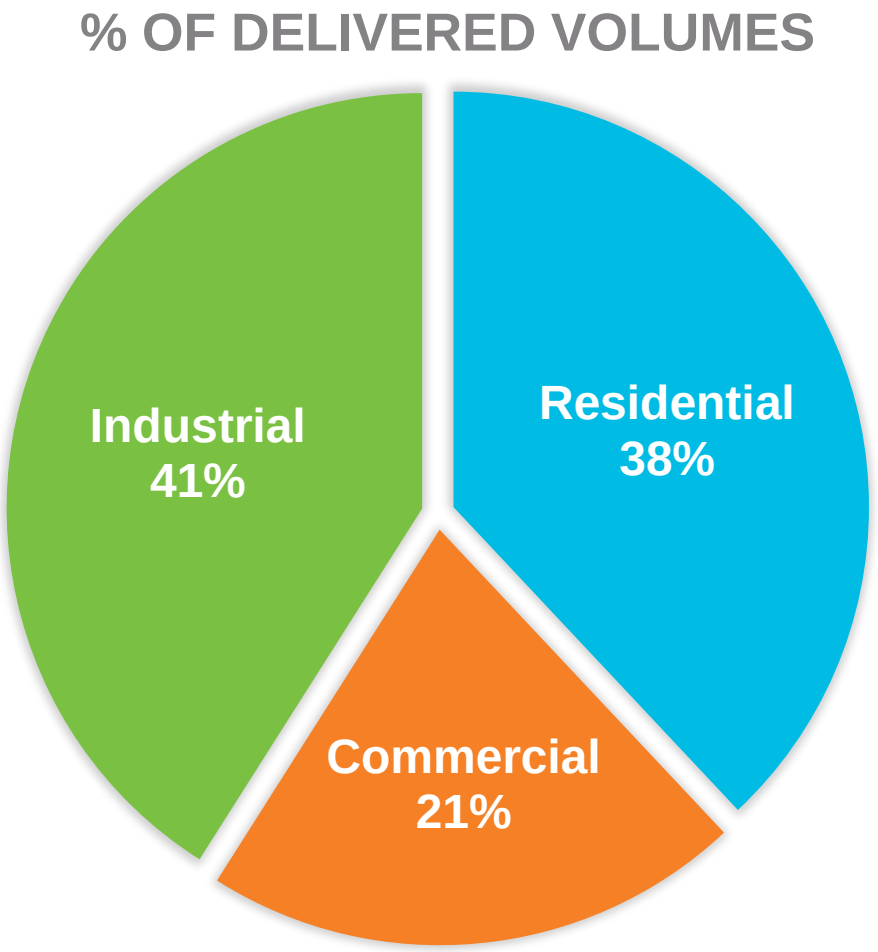
Background Information

Types of Customers

Approx. Customer Counts (meters)

Residential	705,000	91%
Commercial	69,000	9%
Industrial	900	<1%

Source: NW Natural 2020 10-K



Source: NW Natural 2020 10-K

Four Categories of Customers with Different Rate Schedules

Services Offered by NW Natural

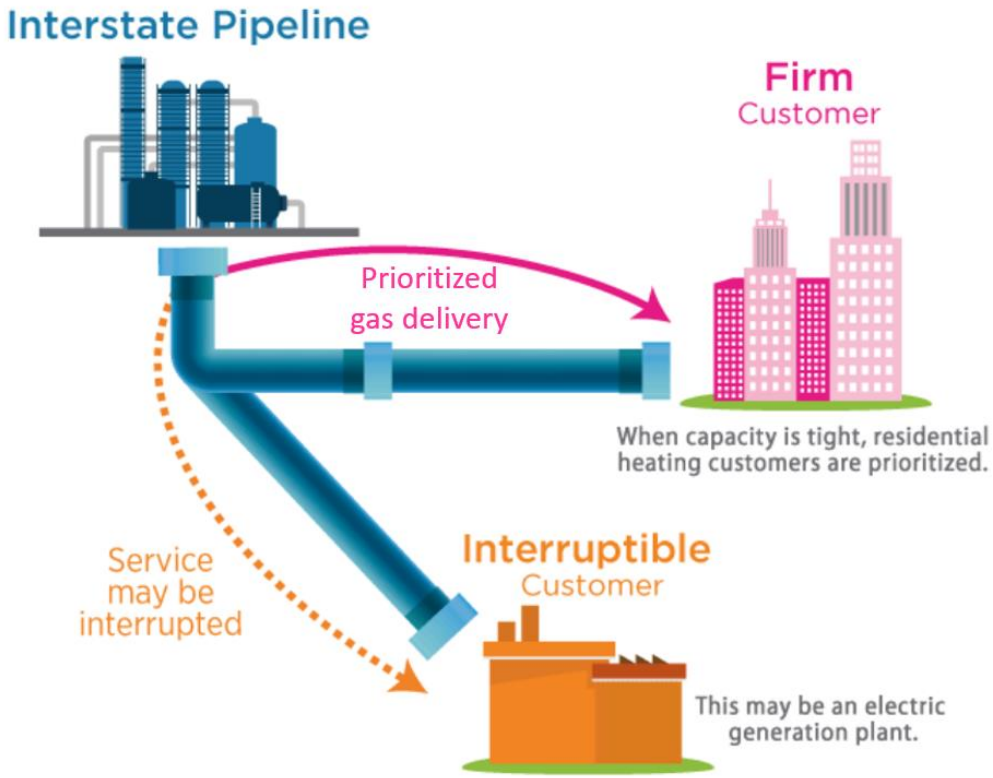
1) Firm Sales
- All Residential, most Commercial, very small amount of Industrial
- NW Natural purchases and delivers the gas
- Firm customers receive priority for delivery of gas

2) Interruptible Sales
- Large Commercial or Industrial
- NW Natural purchases and delivers the gas, but the customer may be interrupted if necessary to deliver gas to firm customers

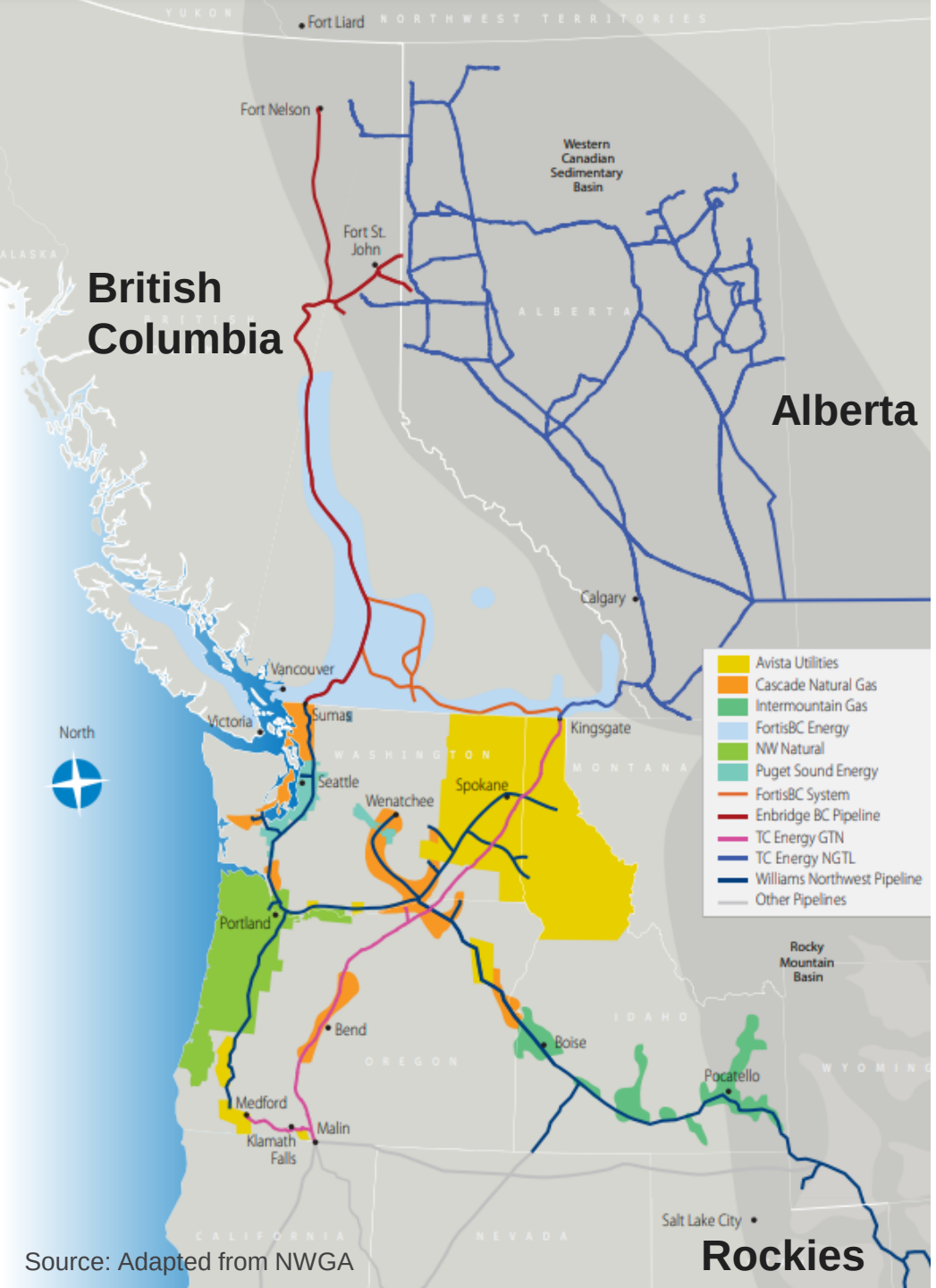
3) Firm Transportation
- Large Commercial or Industrial
- Customers under this tariff typically use a third-party gas marketer to acquire gas an bring it onto NW Natural's system
- NW Natural provides the distribution services to *transport* the gas from the interstate pipeline to the customer's site location
- Firm customers receive priority for delivery of gas on the distribution system

4) Interruptible Transportation
- Large Commercial or Industrial
- Customers under this tariff typically use a third-party gas marketer to acquire gas an bring it onto NW Natural's system
- NW Natural provides the distribution services to *transport* the gas from the interstate pipeline to the customer's site location
- Delivery of gas may be interrupted if necessary to deliver gas to firm customers

Firm vs. Interruptible



NW Natural Gas Purchases



Source: Adapted from NWGA

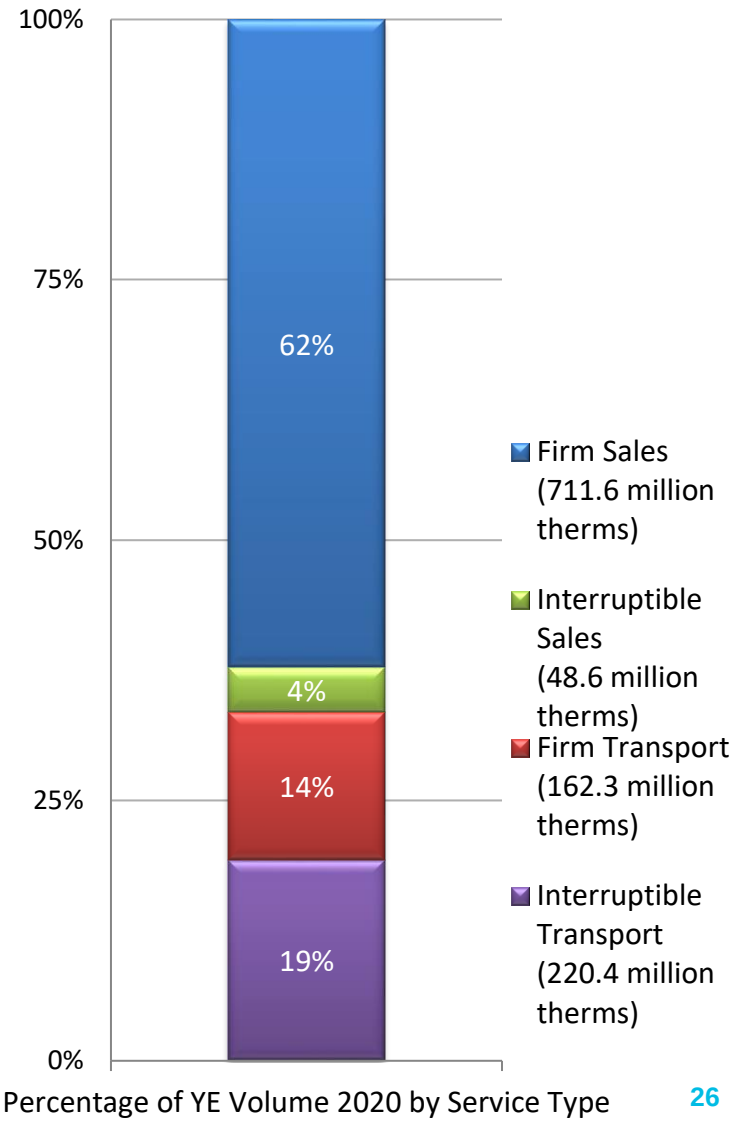
All off-system gas purchases ultimately travel through Williams Northwest Pipeline to our service territory

- 1/3 from Alberta
- 1/3 from British Columbia
- 1/3 from U.S. Rockies

Currently NW Natural is procuring small amounts of RNG, and will be delivering increasing RNG volumes into the future

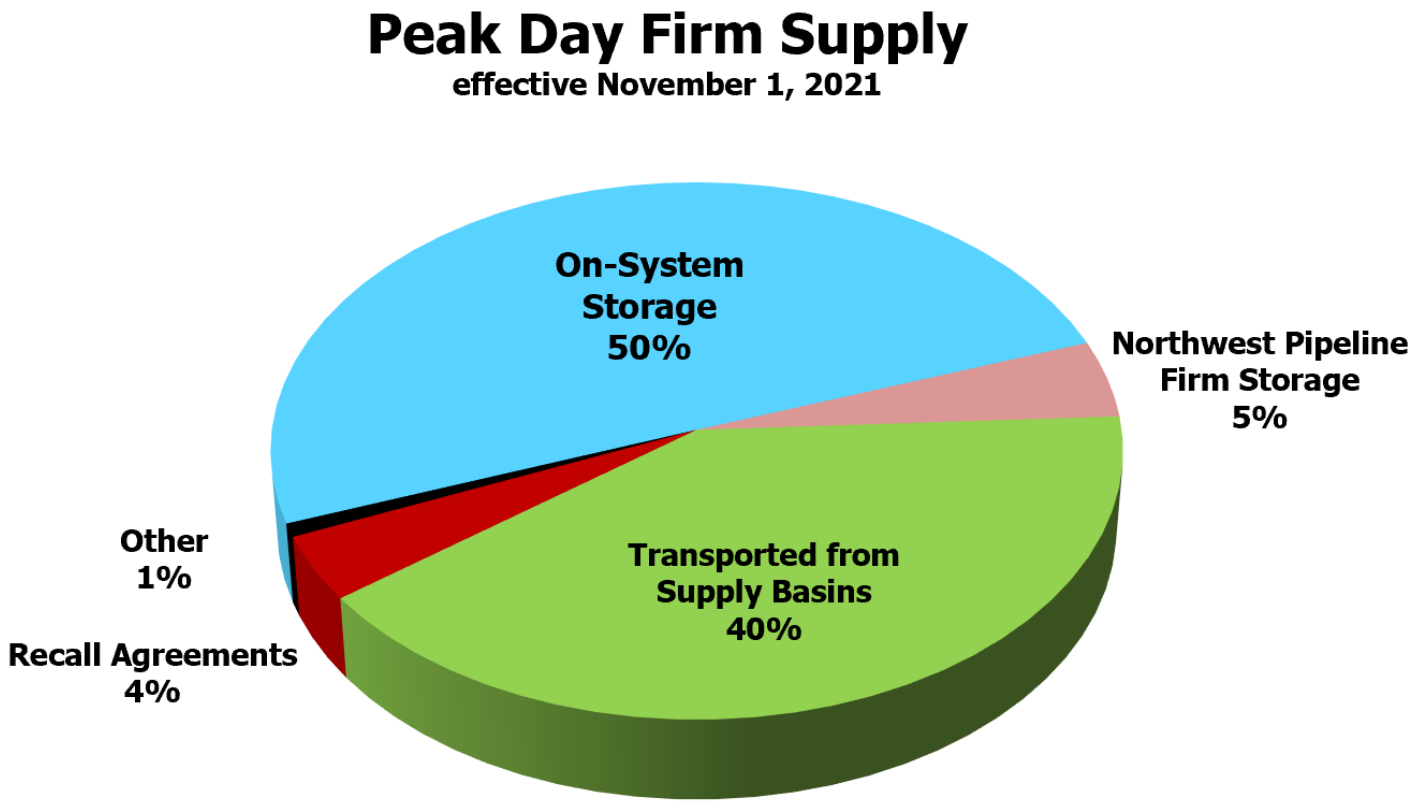
Customer Types and Resource Planning

Customer Category	System Capacity Resource Planning			Distribution System Planning
	Design Winter Weather Energy Requirements	Peak Day Capacity Requirements	Emission Compliance	Peak Hour Capacity Requirements
Firm Sales	✓	✓	✓	✓
Interruptible Sales	✓		✓	
Firm Transport			✓	✓
Interruptible Transport			✓	



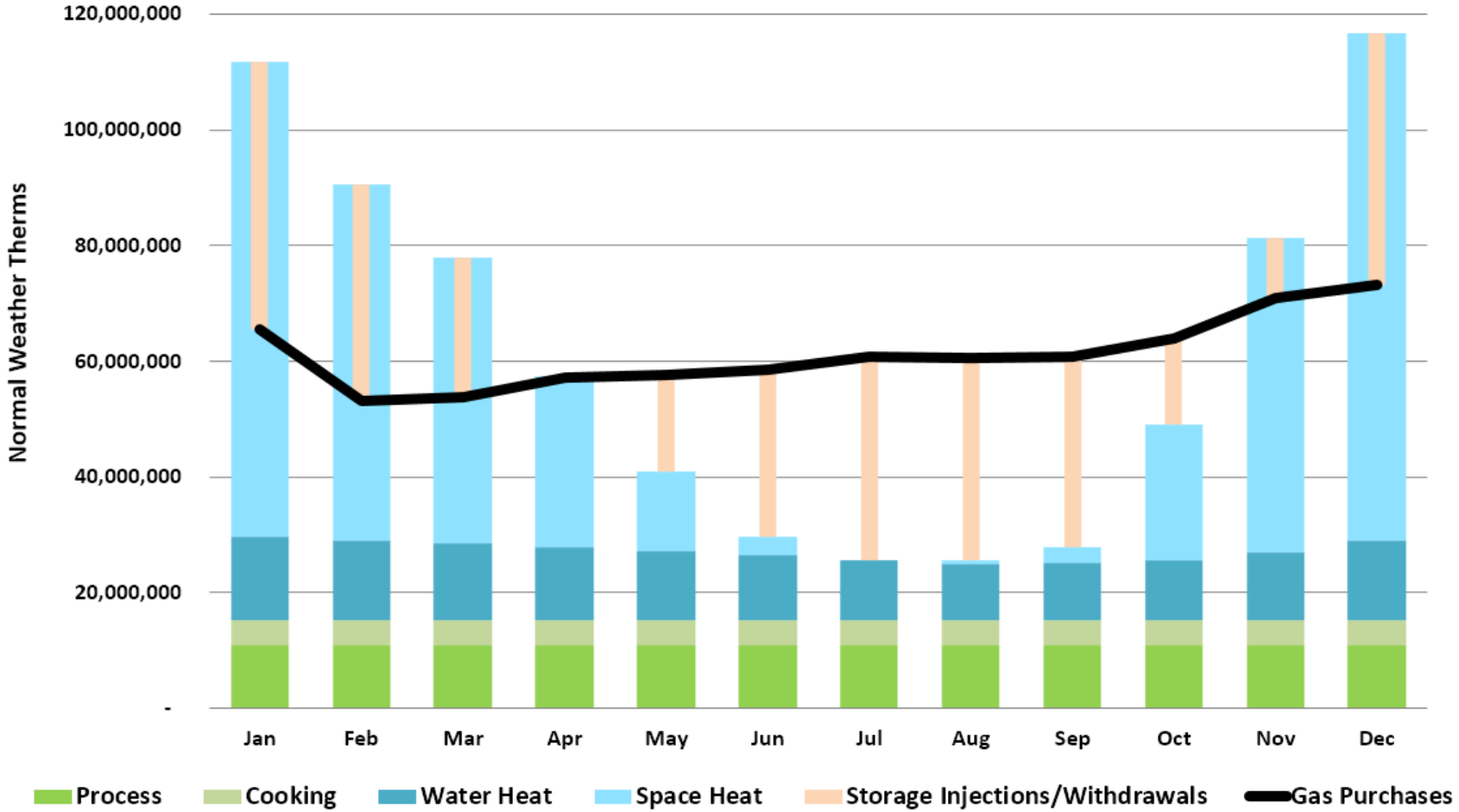
Percentage of YE Volume 2020 by Service Type

Existing Gas Supply Resource Capacity for Peak Day Demand



Total = 9.97 Million Therms
(includes Segmented Capacity)

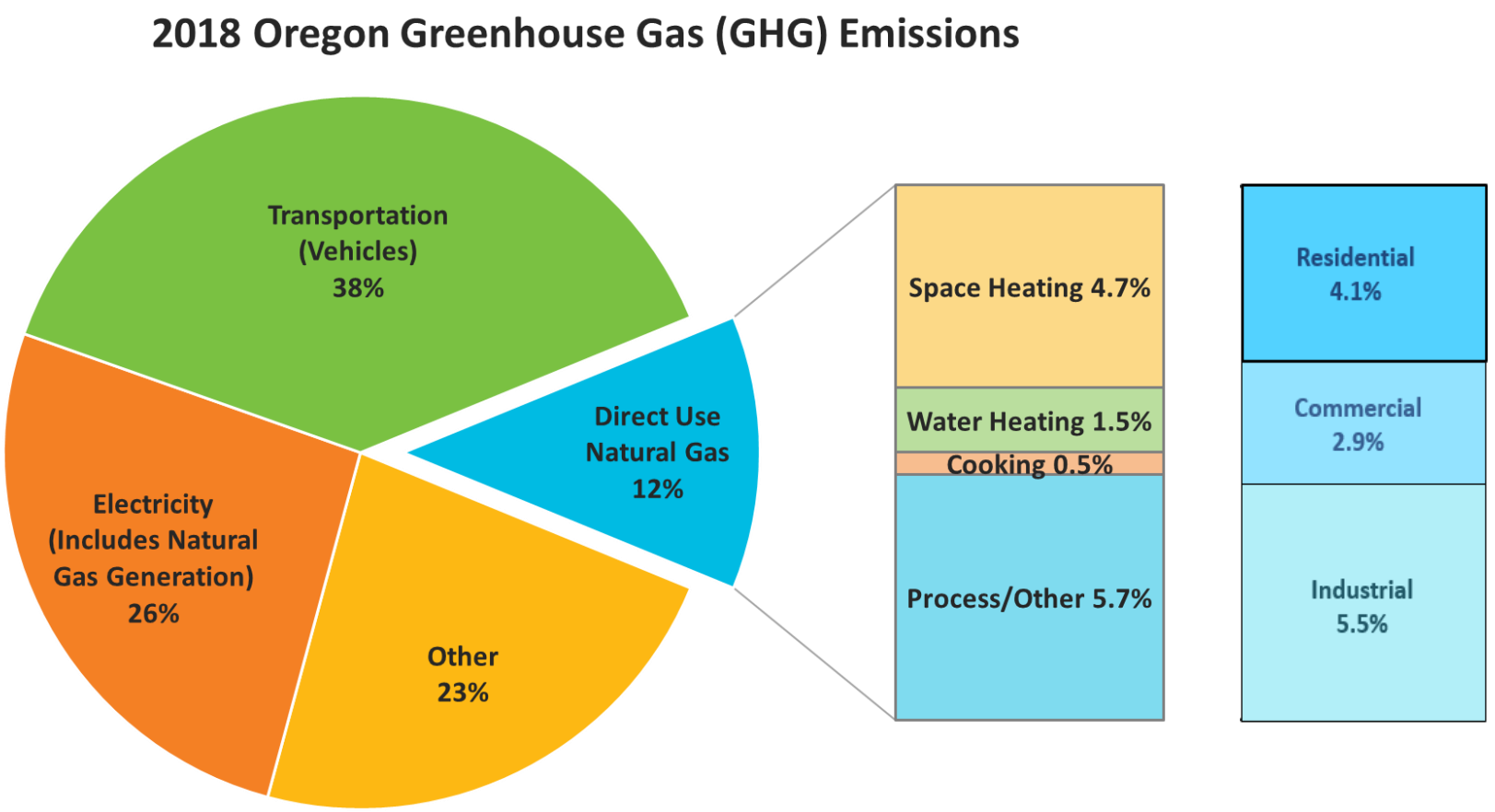
Energy storage is critical to meeting seasonal demand



Source: NW Natural 2018 IRP, Figure 1.8: NW Natural Monthly Sales Load by End Use. Includes both firm and interruptible customers

Planning Environment

Emissions Context



- Roughly 70% of Oregon's space heating needs are served by direct-use natural gas
- Roughly 1/3 of direct use natural gas used in Oregon is on transportation schedules (this does not mean cars and trucks in this context)
- Roughly ½ of the natural gas associated with Oregon's energy use is used in electric generation
- Direct use gas' share of emissions have remained relatively constant over the last decade
- NW Natural represents roughly 80% of gas utility emissions covered by the CPP

Source: (1) Oregon Department of Environmental Quality, Oregon Greenhouse Gas Sector-Based Inventory Data, and (2) NW Natural.

New State Policies for GHG Emissions

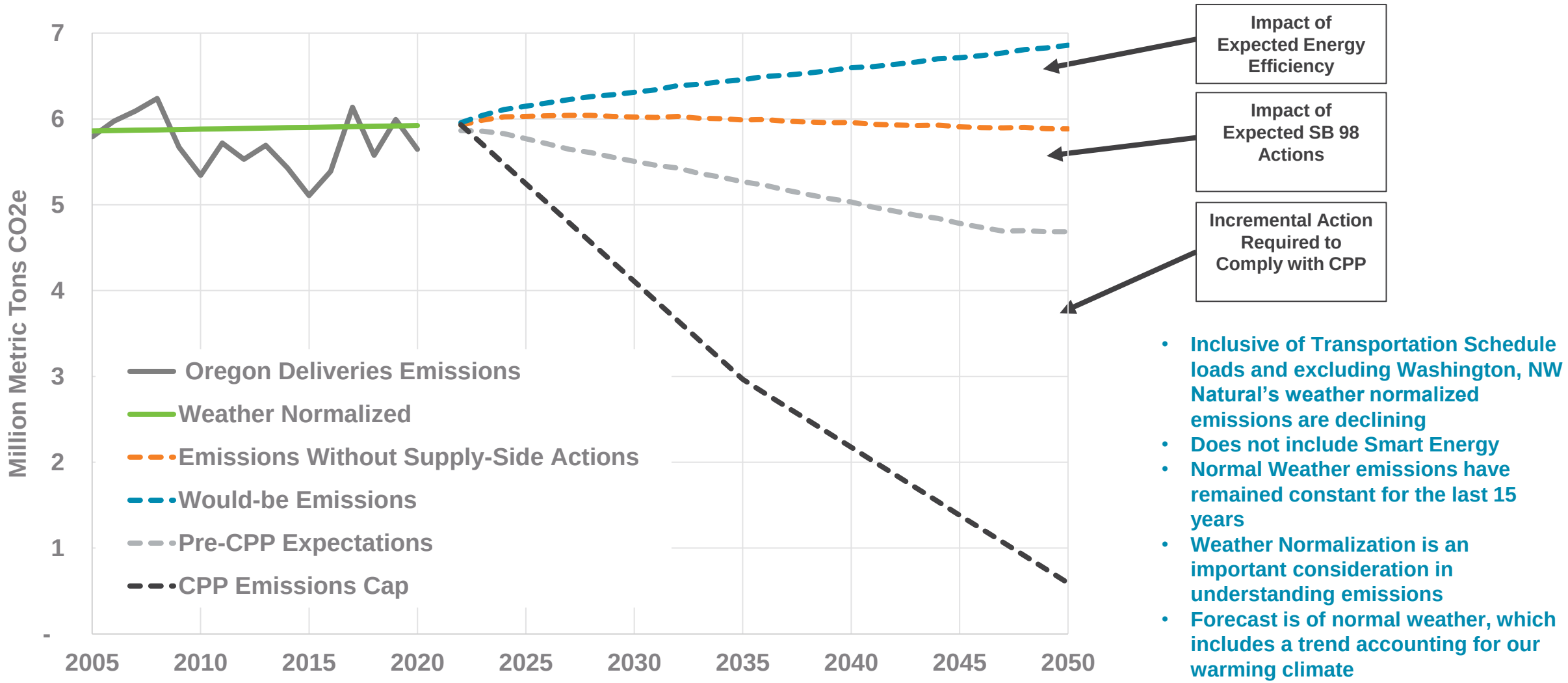
Oregon

- SB 98 – Established voluntary portfolio standard targets for renewable natural gas (RNG)
- On March 10, 2020, Governor Kate Brown signed Executive Order 20-04, which directed Oregon's Department of Environmental Quality (ODEQ) to take actions to reduce Oregon's GHG emissions and develop a cap and reduce program.
- On December 16, 2021, ODEQ finalized rules for the Climate Protection Program (CPP).

Washington

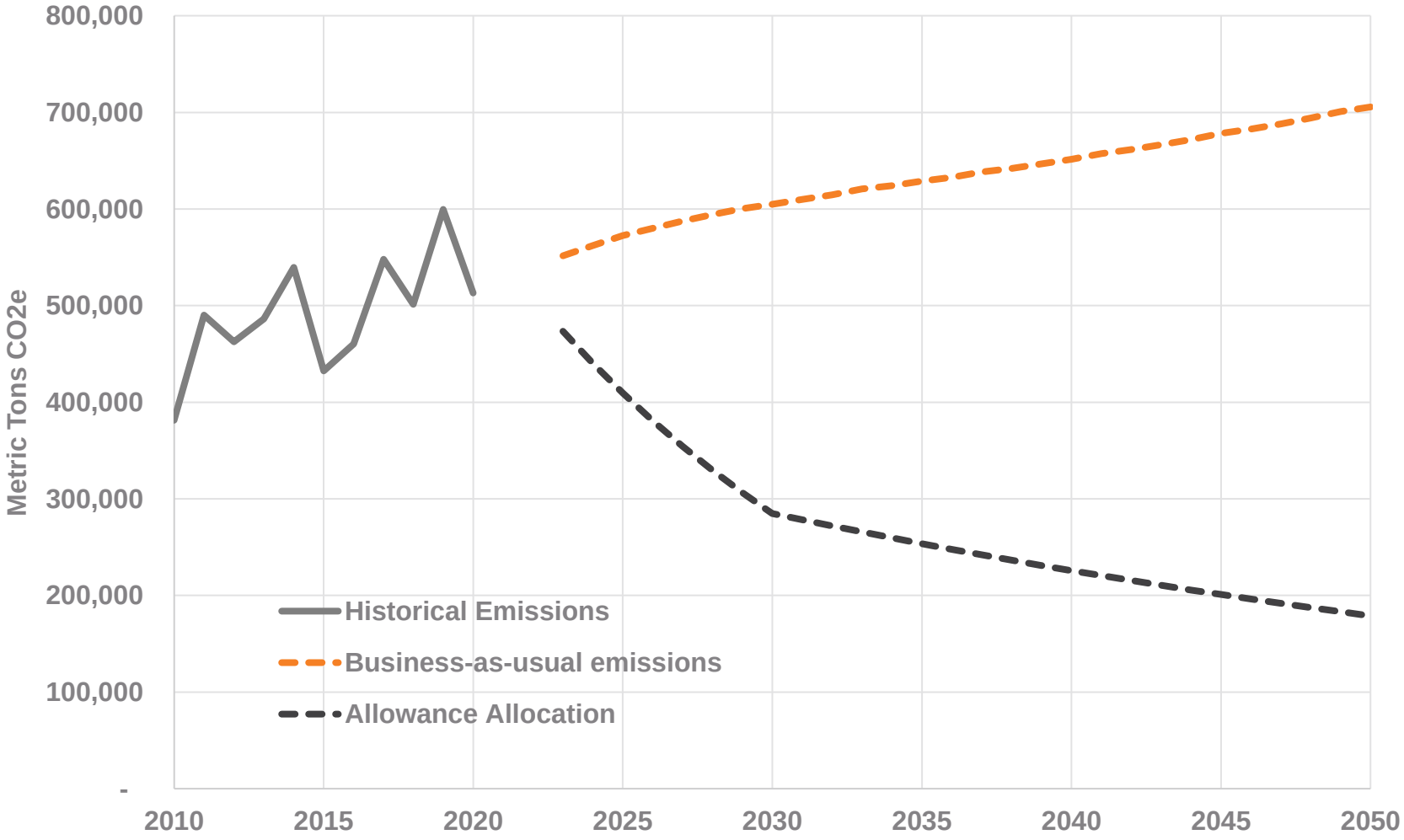
- 2018 Amendments to the WA residential codes went into effect on February 1, 2021.
- SB 5126 – Climate Commitment Act (Cap-and-Invest).
- HB 1257 – Clean Buildings bill.
  - Voluntary renewable natural gas tariff.
  - Conservation potential assessment (CPA) and two-year energy efficiency plan.

NW Natural's Oregon Compliance Outlook



- Inclusive of Transportation Schedule loads and excluding Washington, NW Natural's weather normalized emissions are declining
- Does not include Smart Energy
- Normal Weather emissions have remained constant for the last 15 years
- Weather Normalization is an important consideration in understanding emissions
- Forecast is of normal weather, which includes a trend accounting for our warming climate

NW Natural's Washington CCA Compliance Outlook



- Represents NW Natural's understanding of draft CCA rules as of 1/10/2022
- Inclusive of Transportation Schedule loads and excluding NW Natural's Oregon Service Territory
- Weather Normalization is an important consideration in understanding emissions
- Forecast is of normal weather, which includes a trend accounting for our warming climate

Changes in the Policy Landscape – County and Local Governments

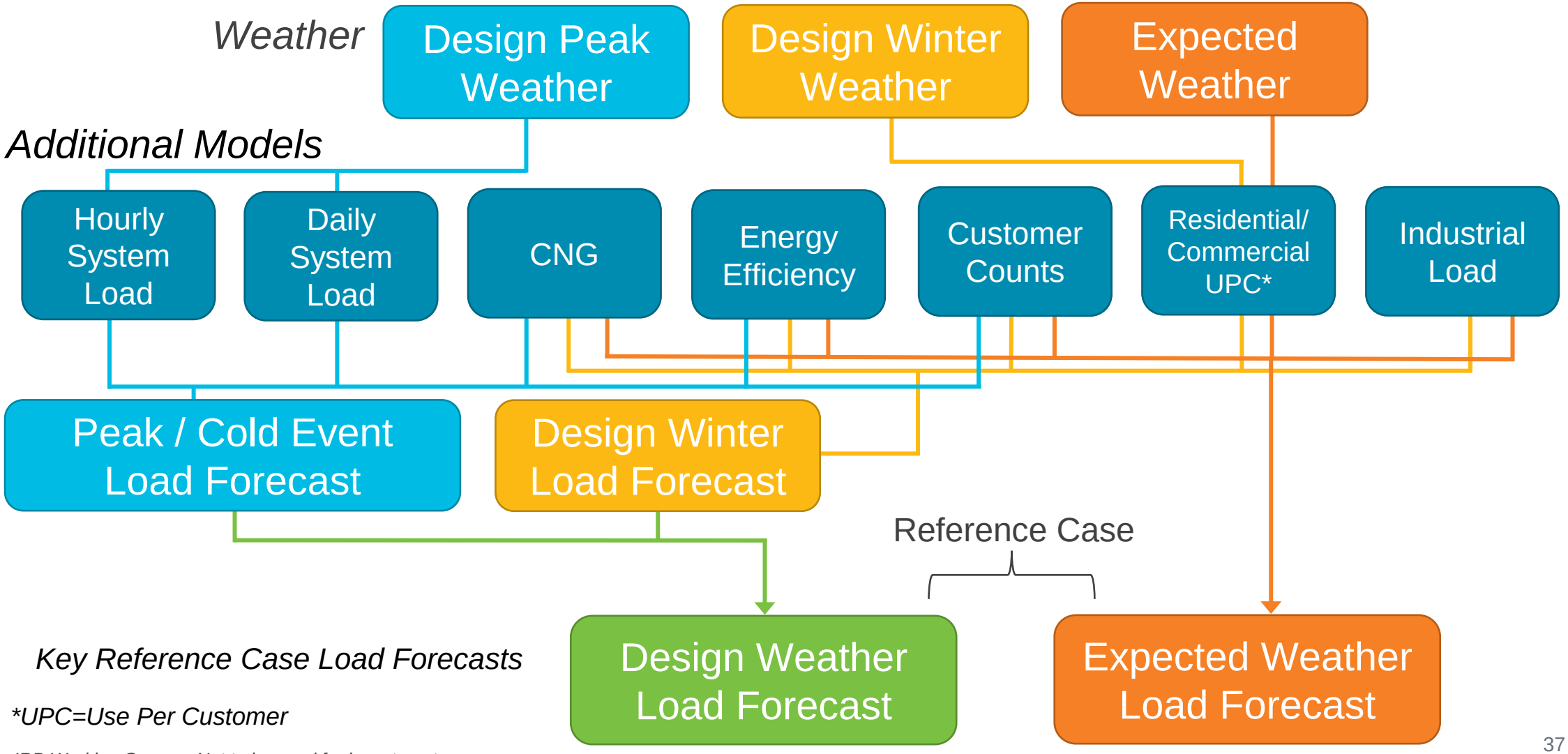
- Several local jurisdictions and local governments in the Pacific Northwest are developing climate action plans
- Some are considering placing a moratoria on new natural gas hook-ups
- At the same time, some jurisdictions are implementing an anti-moratoria of new natural gas hook-ups
- Local surcharges and carbon taxes are also being considered

Planning Needs – Load Forecast

Goals and Purpose of Load Forecasting

- The goal of load forecasting is to obtain a reasonable prediction of customer demand for energy services
  - Energy services can be met by both demand-side and supply-side resources
- The purpose is to determine the resource requirement based on the forecasted demand
- Resource requirements will need to satisfy three criteria
  - Annual/seasonal demand (energy requirement)
  - Peak demand (capacity requirement)
  - Emissions savings demand (compliance requirement)

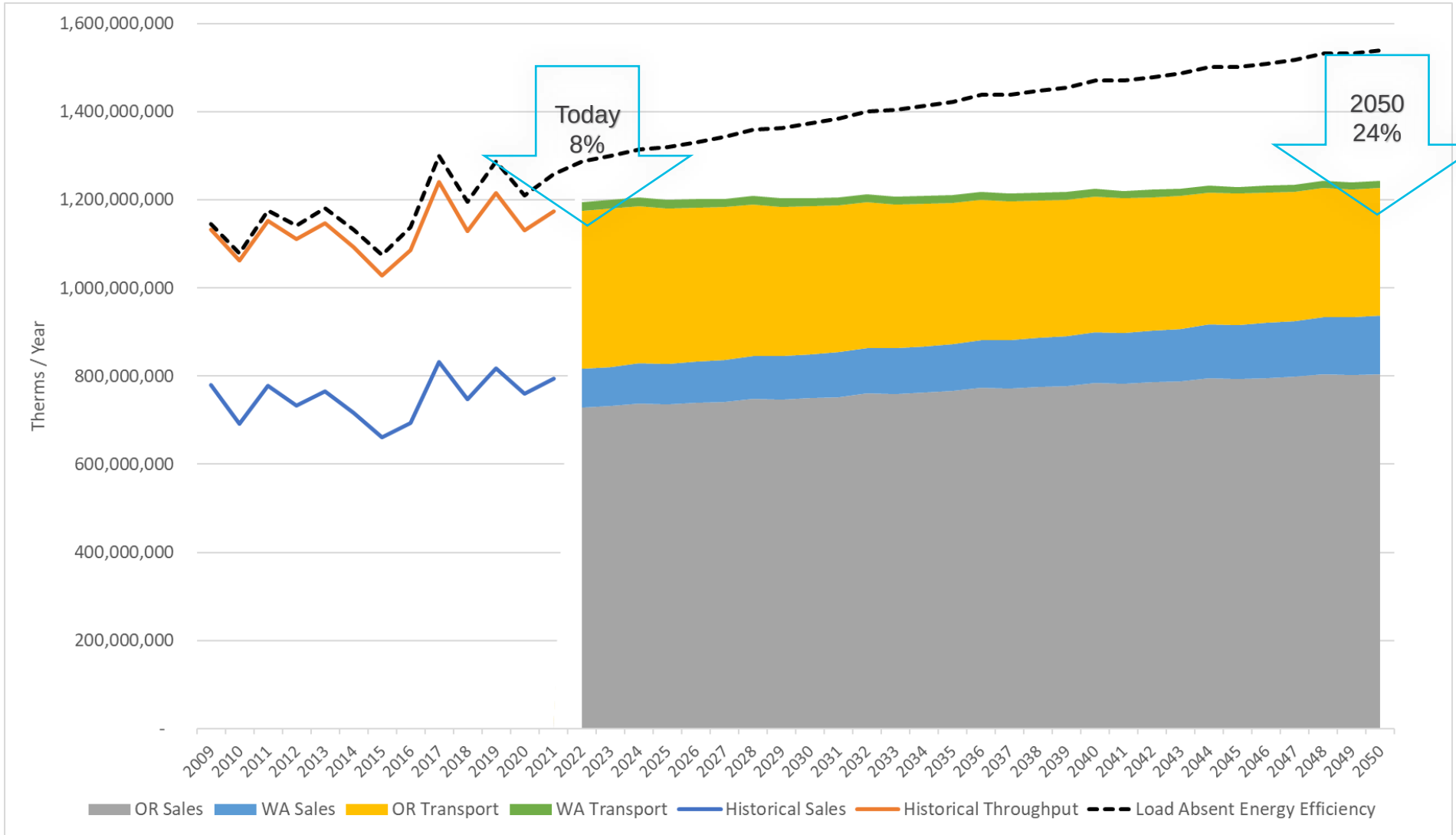
Load Forecast Model Flow Chart



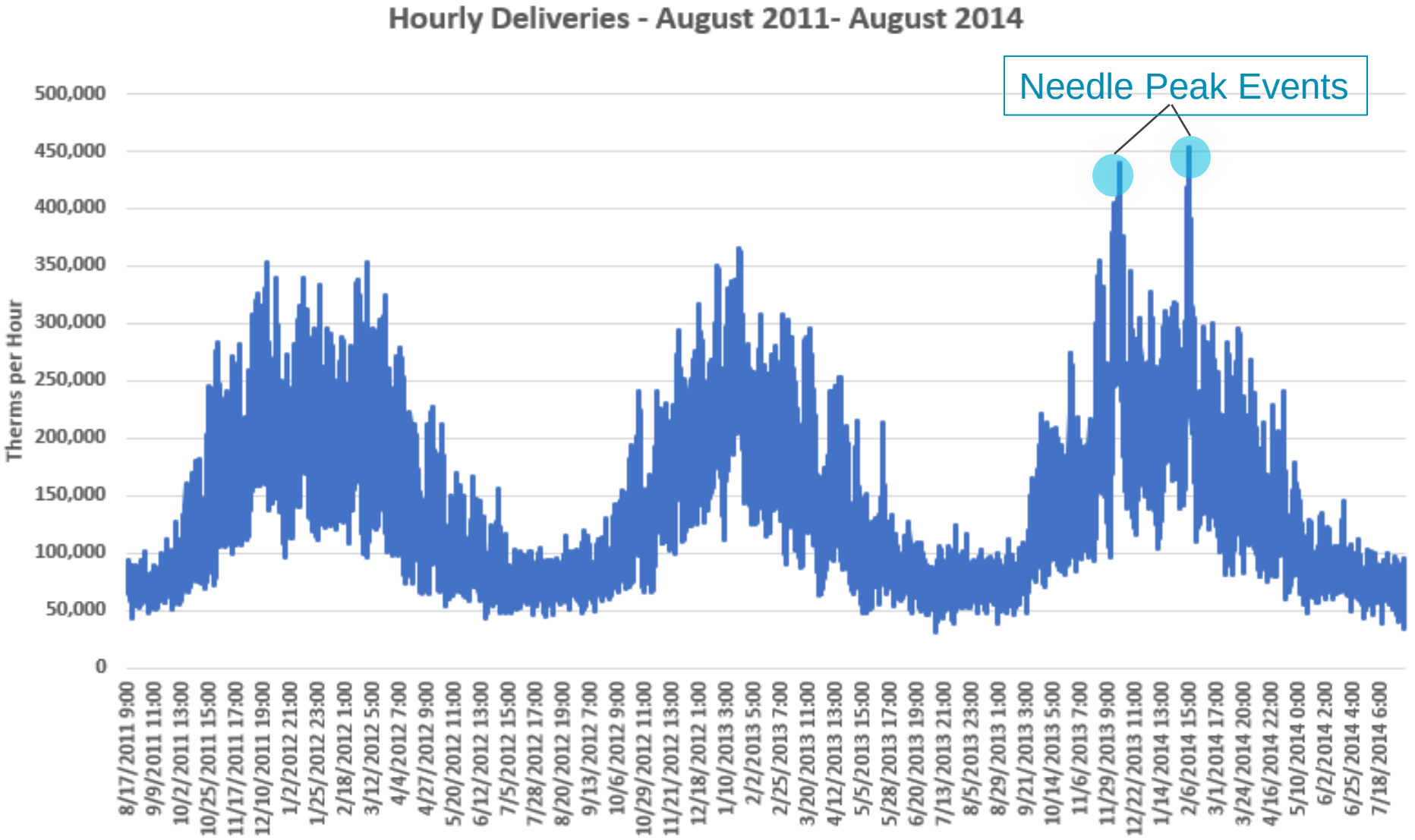
Key Reference Case Load Forecasts

**UPC=Use Per Customer*

Annual Load Forecast



What is a “Needle Peak”?

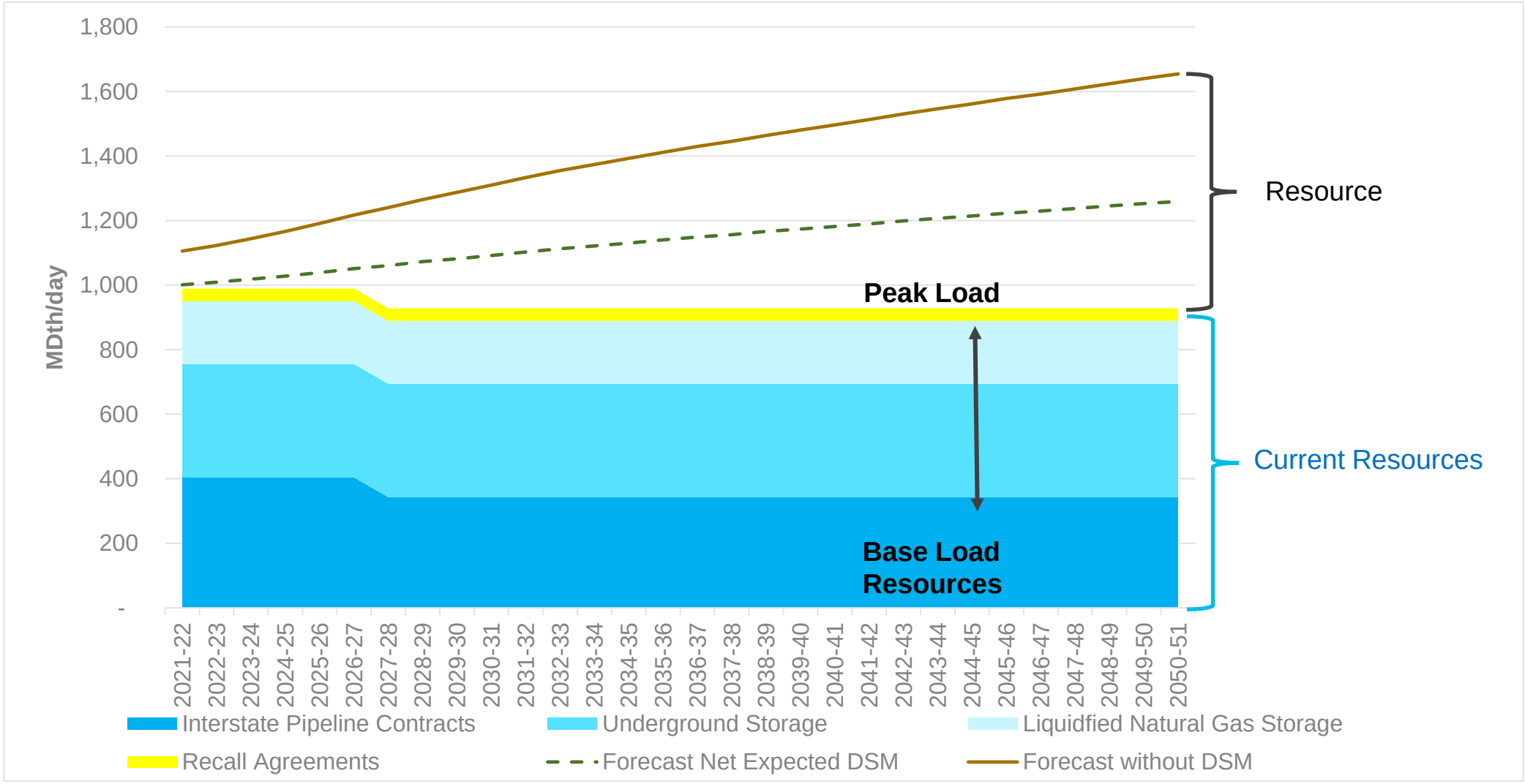


- Extreme weather causes energy usage spikes that drive building heating or cooling needs
- These spikes, or peak events, result in much higher usage than all other times
- The more of a utility’s load that is heating or cooling the “peakier” the load
- More than half of the energy NW Natural delivers is for space heating, so our load is very “peaky”
- Planning peak events occur far less frequently than each winter

Why Do IRPs Focus on Peak Planning?

- The most likely time for customers to lose service due to resource constraints occurs at the same time when it is the most dangerous time for customers to lose service
- Firm sales customers depend on the gas utility to provide reliable gas service to heat their homes and businesses
- Unexpected lack of heat during an extreme cold snap can be very dangerous for customers
- Natural gas LDC planning standards are typically strict due to the high stakes and consequences of outages which would occur during cold events if resources become constrained

Peak Load-Resource Balance



Options for Emissions Compliance Costs and Quantities

OR Community Climate Investments (CCI)			
Compliance Period	**Reference Case Cost**		**Reference Case Volumes**
	$/Metric Tones CO2e	$/Dth	
2022-2024	$109	$5.79	10% of Load
2025-2027	$112	$5.89	15% of Load
2028-2031 ….. 2049-2051	$115 …. $135	$6.10 …. $7.17	20% of Load

	Reference Case Bundled Cost ($ / Dth)	**Reference Case Volumes**
Biofuels RNG Tranche 1	$13.50	13 Million Dekatherms
Biofuels RNG Tranche 2	$19.00	27 Million Dekatherms
Hydrogen		20% combined blending and dedicated systems
2022	$23.00	
2050	$6.00	
Synthetic Methane		Unlimited
2022	$32.00	
2050	$9.00	

WA Carbon Credit Allowance			
	Reference Case Cost (Max of SCC/Allowance Price Forecast)		**Reference Case Volumes**
	$/Metric Tones CO2e	$/Dth	
2023	$82	$5.11	No Current Limits for NW Natural
2050	$120	$7.63	

Oregon

Washington

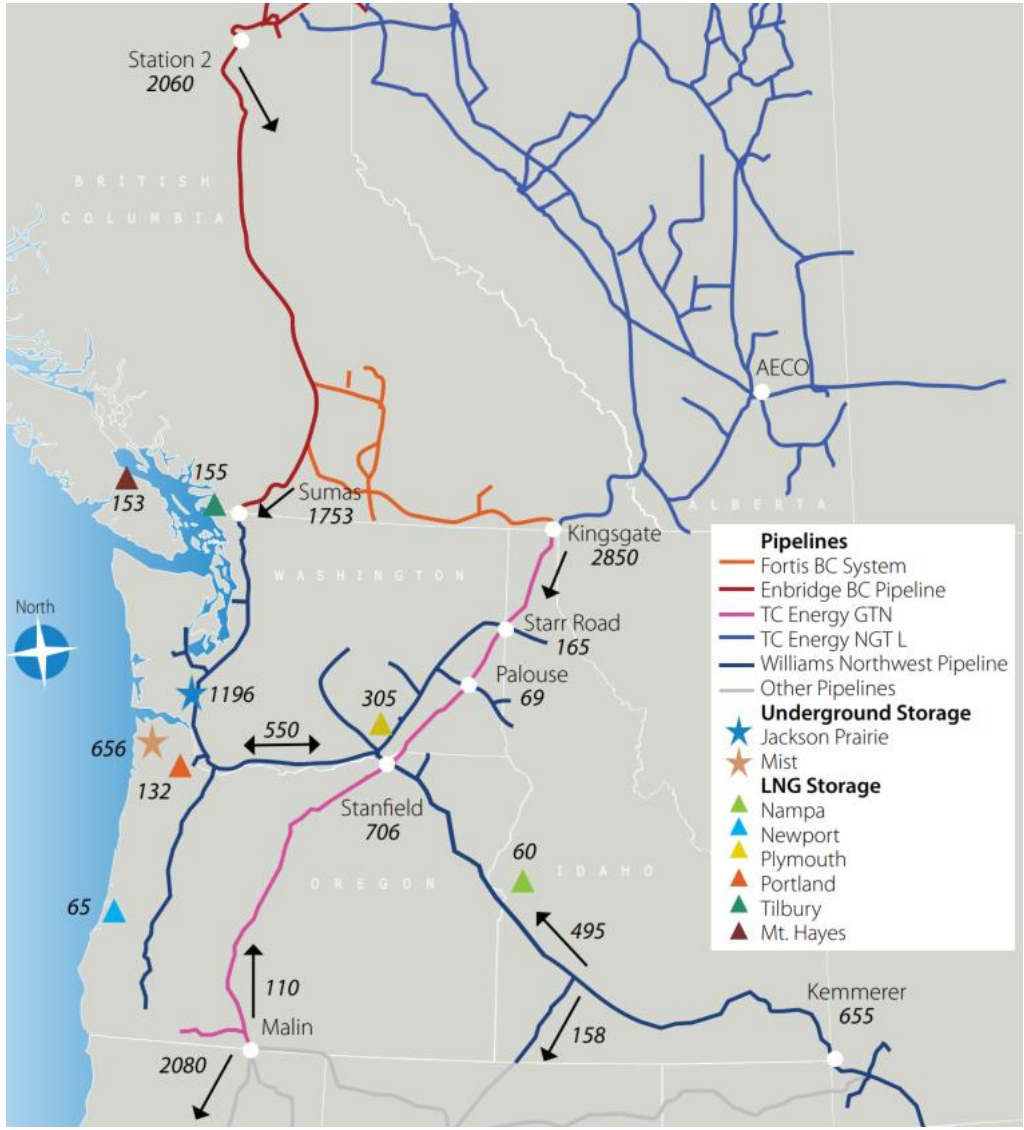
Resources Available Demand, Supply, and Renewable Fuel Sourcing

Key Takeaways

- Currently have a small peak resource deficit based on updated load analysis
  - Alternatives being evaluated; however, expecting Mist Recall for at least a portion of the gap
- 50% of peak day supply comes from on-system storage facilities, all of which are aging and require periodic evaluation for refurbishment
- How long we continue to rely on Segmented Capacity - which is not a long-term firm resource - is a key determinant of our future resource needs
- Mist Recall has been the most cost-effective resource addition, but it is a finite resource
- All upstream pipelines are fully contracted, so any decisions to add future pipeline capacity will require an extended planning lead time of at least 5 years

Interstate Pipeline Infrastructure in the Pacific Northwest

- NW Natural is one of many customers that holds capacity contracts on the interstate/interprovincial pipeline system
- These contracts reserve the right to ship gas from a receipt point (e.g., Station 2) to a delivery point (e.g., Molalla)
- Capacities numbers shown on the map are the total maximum capacity numbers for various segments of the interstate/ interprovincial pipeline system (thousand Dth per day)



Source: Northwest Gas Association, 2020 Gas Outlook

Mist Storage

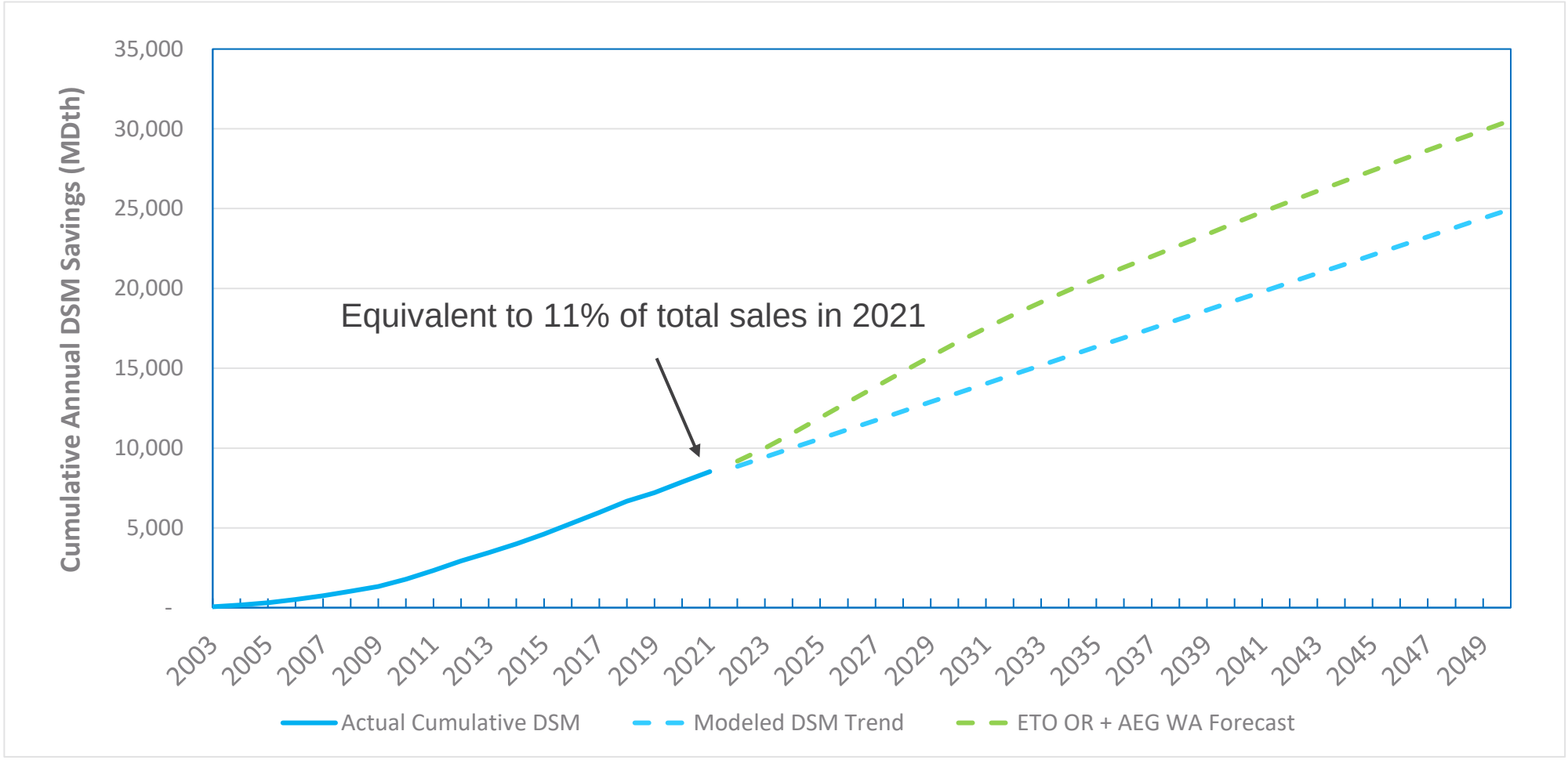
Pipeline takeaway

- North Mist Feeder (12”) to North Coast Feeder, Beaver lateral, and to Northwest Pipeline at Deer Island
- South Mist Pipeline (16” and 24”) and South Mist Pipeline Extension (24”) to west and south sides of Portland metro area and to Northwest Pipeline via Molalla gate

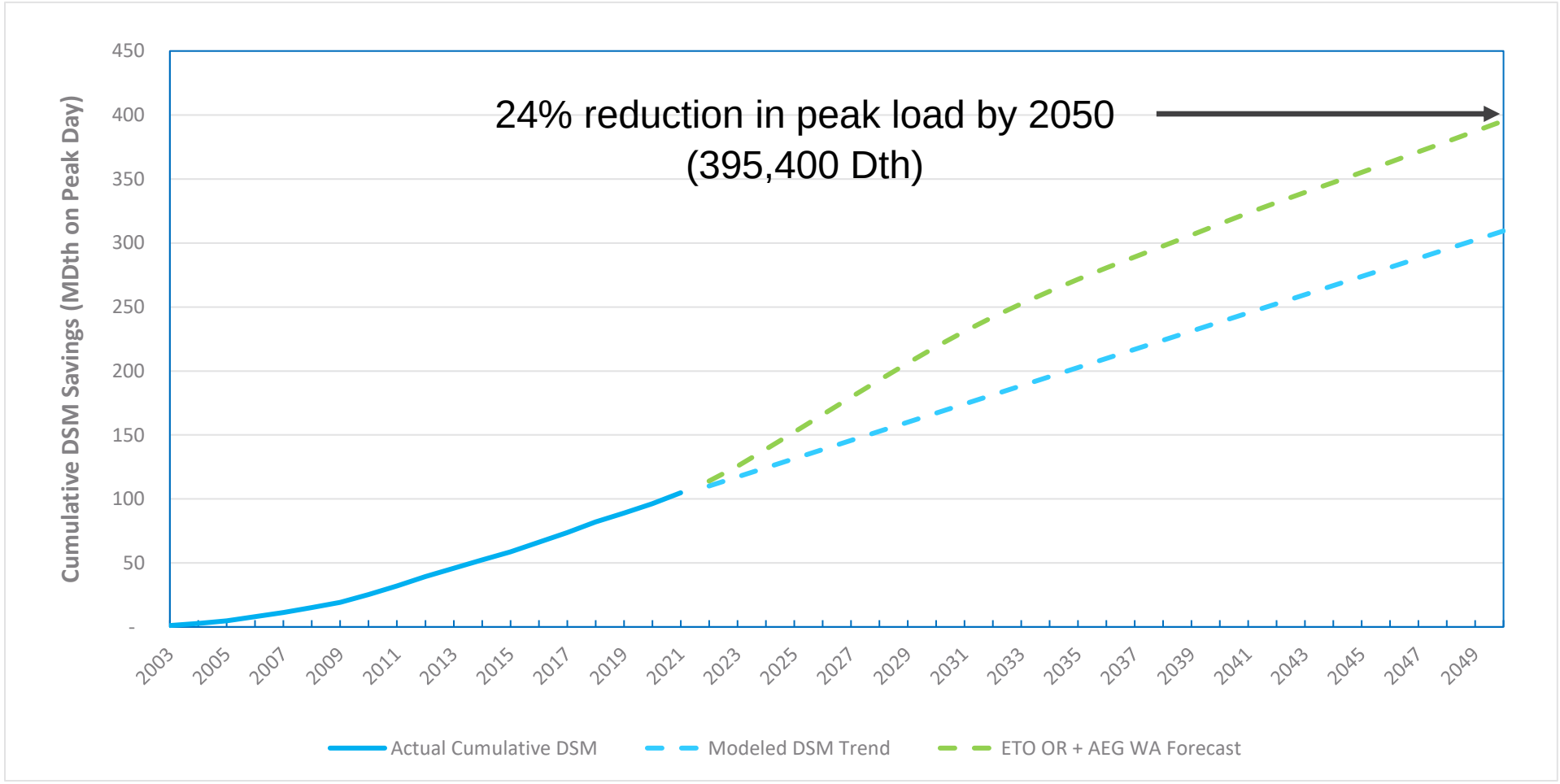
Key Traditional Supply Side Capacity Resources for Evaluation

- Mist Recall – 200,000 Dth/day of the existing Mist resource remains for future recall
  - Incrementally in units of 5,000 Dth of deliverability, as needed
- On-system Supply – Could be RNG or hydrogen, relatively small volumes could potentially have a large impact on distribution planning
- Central Coast Feeder – Three sequential projects to increase take-away from Newport LNG
- Citygate Deliveries – availability, cost, and duration dependent on third party marketers
- Segmented Capacity (60,700 Dth/day) – retention in the firm portfolio depends on its reliability, which in turn depends on future load growth patterns in the I-5 corridor and spot liquidity in the Sumas market on a peak day
  - Impacts from Woodfibre LNG coming online in 2027 are also being evaluated
- Upstream Pipeline Capacity Additions – cost and timing is dependent on expansion projects
- Further Mist Expansion – reservoirs are available but cost to expand pipeline deliverability will be significant

Cumulative Annual DSM Energy Savings: History, Trend and Forecast by ETO and AEG



Demand-Side Resources on Peak Day: History, Trend and Forecast by ETO and AEG

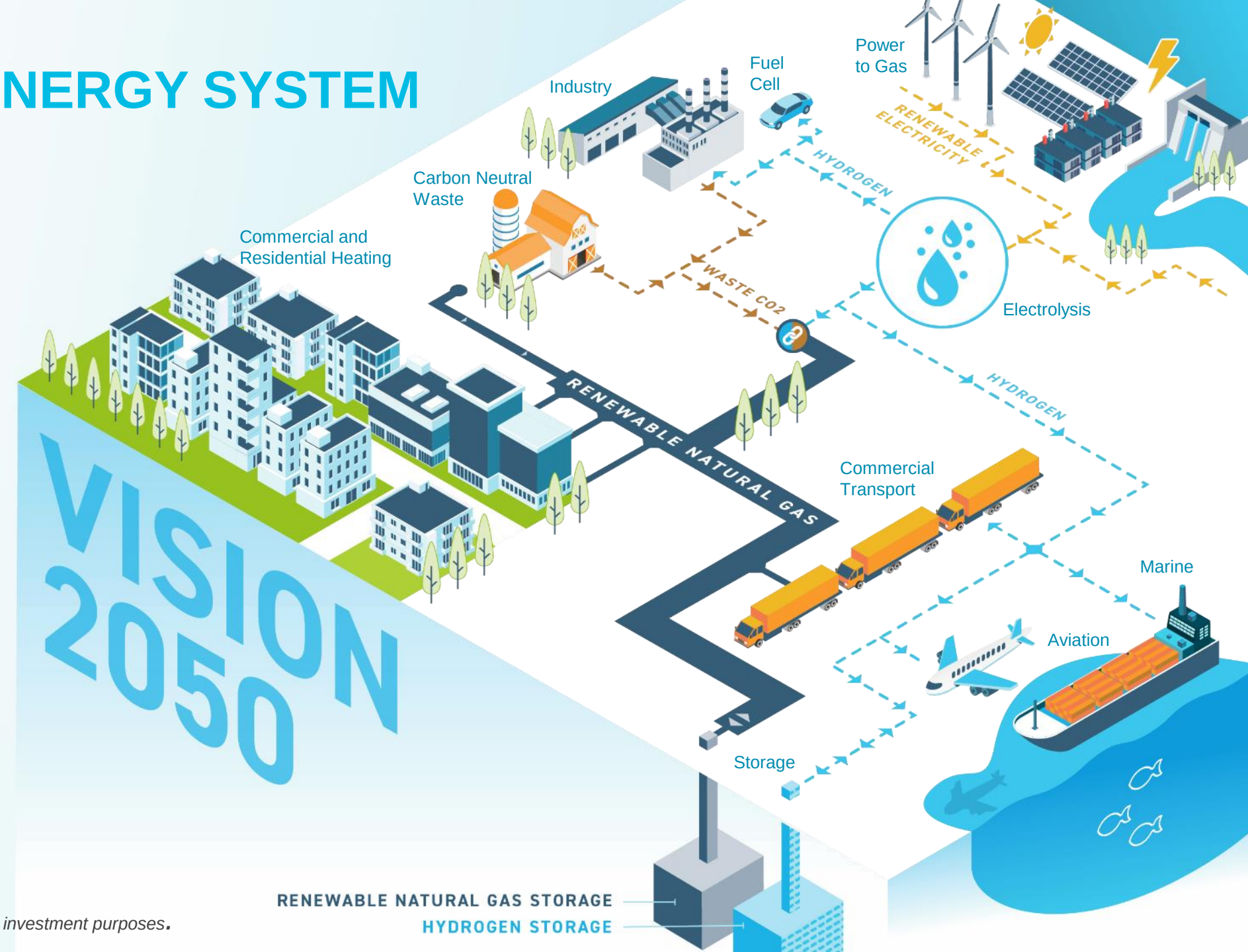


Renewable Natural Gas and other compliance resources

THE FUTURE ENERGY SYSTEM

A decarbonized gas network:

- Deep energy efficiency
- Renewable natural gas (RNG)
- Renewable hydrogen
- Blended and dedicated hydrogen systems



Prepared for IRP Working Group- Not to be used for investment purposes.

What is Renewable Natural Gas?

- RNG is *pipeline-quality gas* derived by cleaning up the raw biogas emitted as organic material chemically breaks down.
- For RNG going directly onto NW Natural's system, RNG must be:
  - **At least 97.3% methane**
  - **At least 985 BTUs/SCF**
- RNG on our system is fully interchangeable with conventional natural gas

Raw biogas can come from:

Wastewater Treatment Plants

Municipal Solid Waste

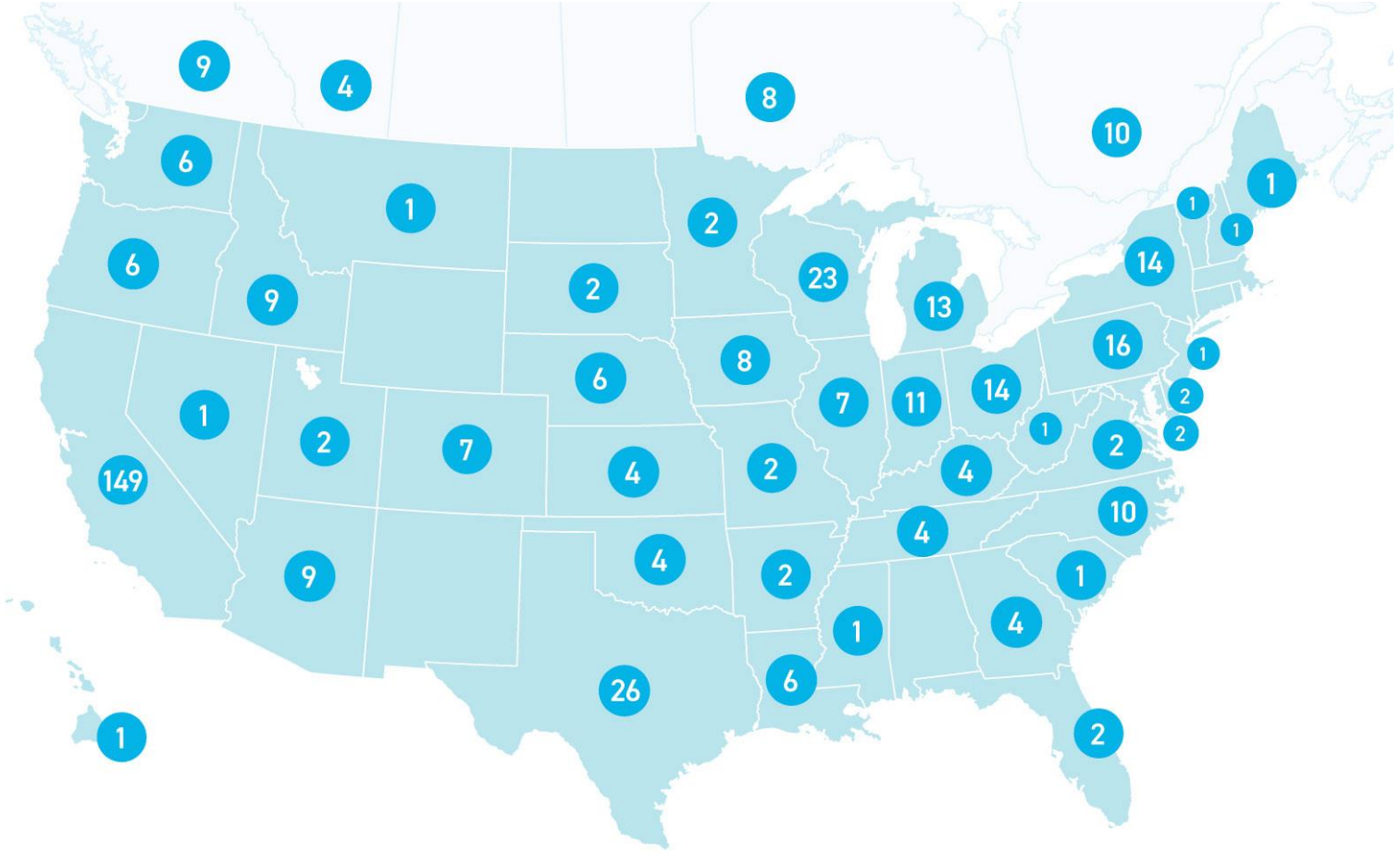
Animal Manures

Landfills

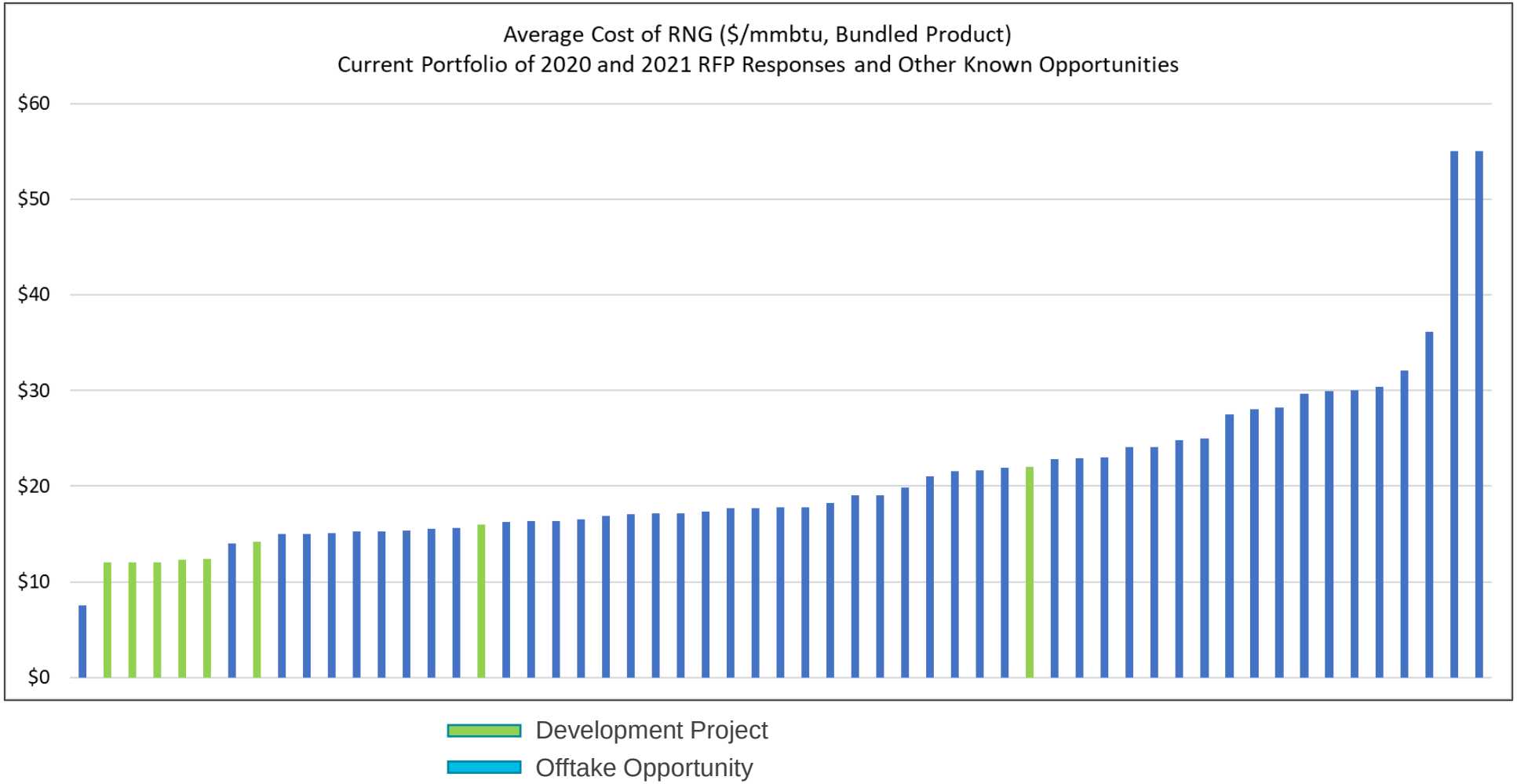
Wood Waste/Residue

RNG Projects Across the Country

- 325 RNG facilities operating or under development today in North America
- We have connected 3 RNG projects in Oregon onto our pipeline system
- Under SB 98, we have been procuring RNG for our customers from projects around the country
- Over the last year we have announced our first RNG agreements totaling 3% of our Oregon annual sales volume

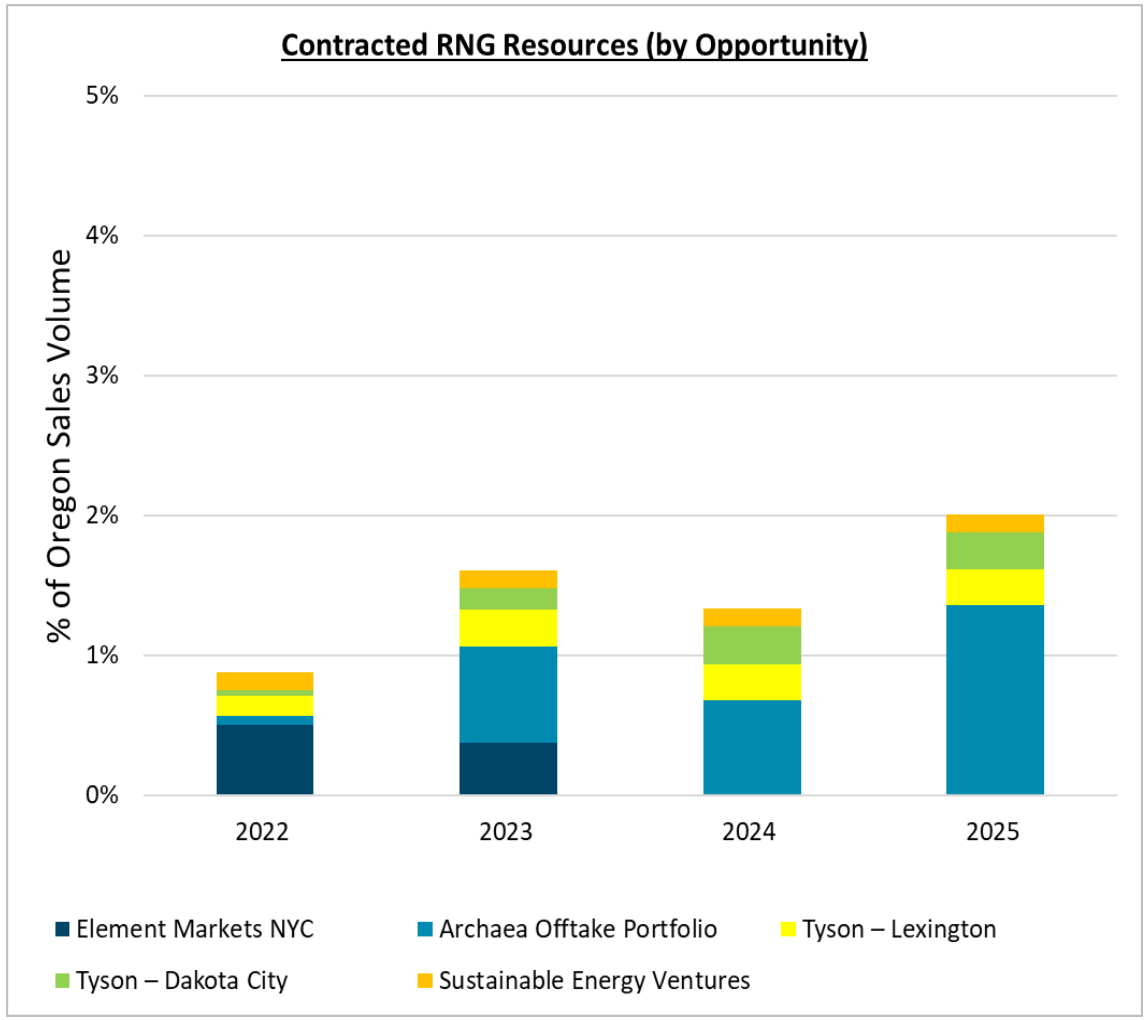


Building a Supply Curve for RNG



- Chart: 2020 and 2021 RFP responses, as well as the development projects NW Natural is currently evaluating
- Total production represented in chart: 35.3 million mmbtu/year (about 49% of all of NW Natural's annual sales in Oregon in 2021)
- New RFP to be issued next month
- Proposed supply tranches, +/- variability:
  - $14.00/mmbtu
  - $19.00/mmbtu

Summary: Current Committed RNG Portfolio

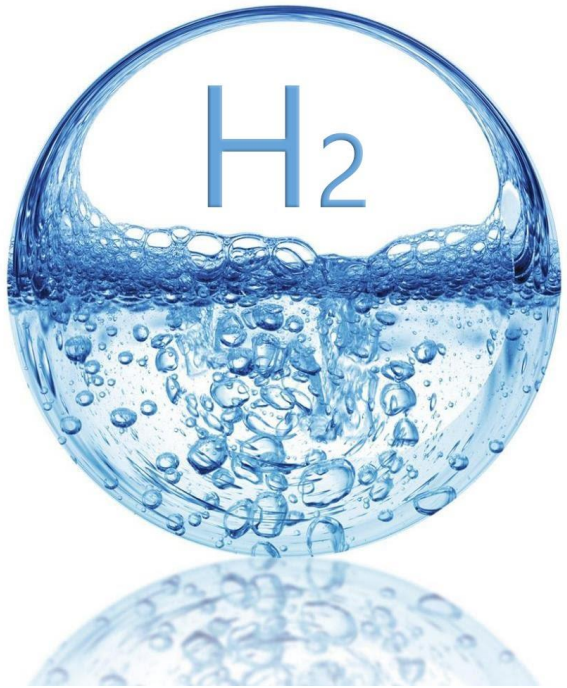


For these 5 resources, the weighted risk-adjusted incremental cost is projected to be $7.38/mmbtu

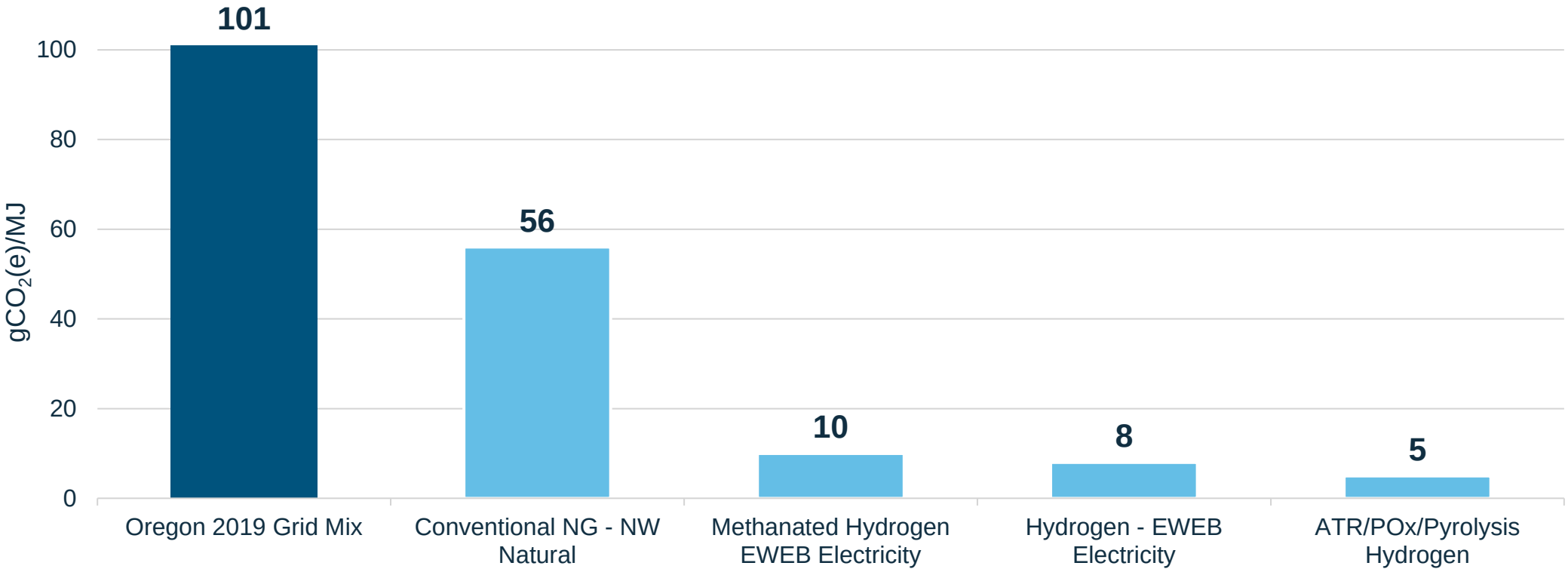
Hydrogen

Why Hydrogen?

- Needed molecules to deliver energy to customers
- Compatible with current gas operations: distribution, storage, appliances, etc.
- Diversity of supply
- Low-cost resource
- Critical for industrial process loads
- New markets
    - Trucking
    - Aviation
    - Marine
- Long-term renewable energy storage
- Backup generation for renewable intermittency



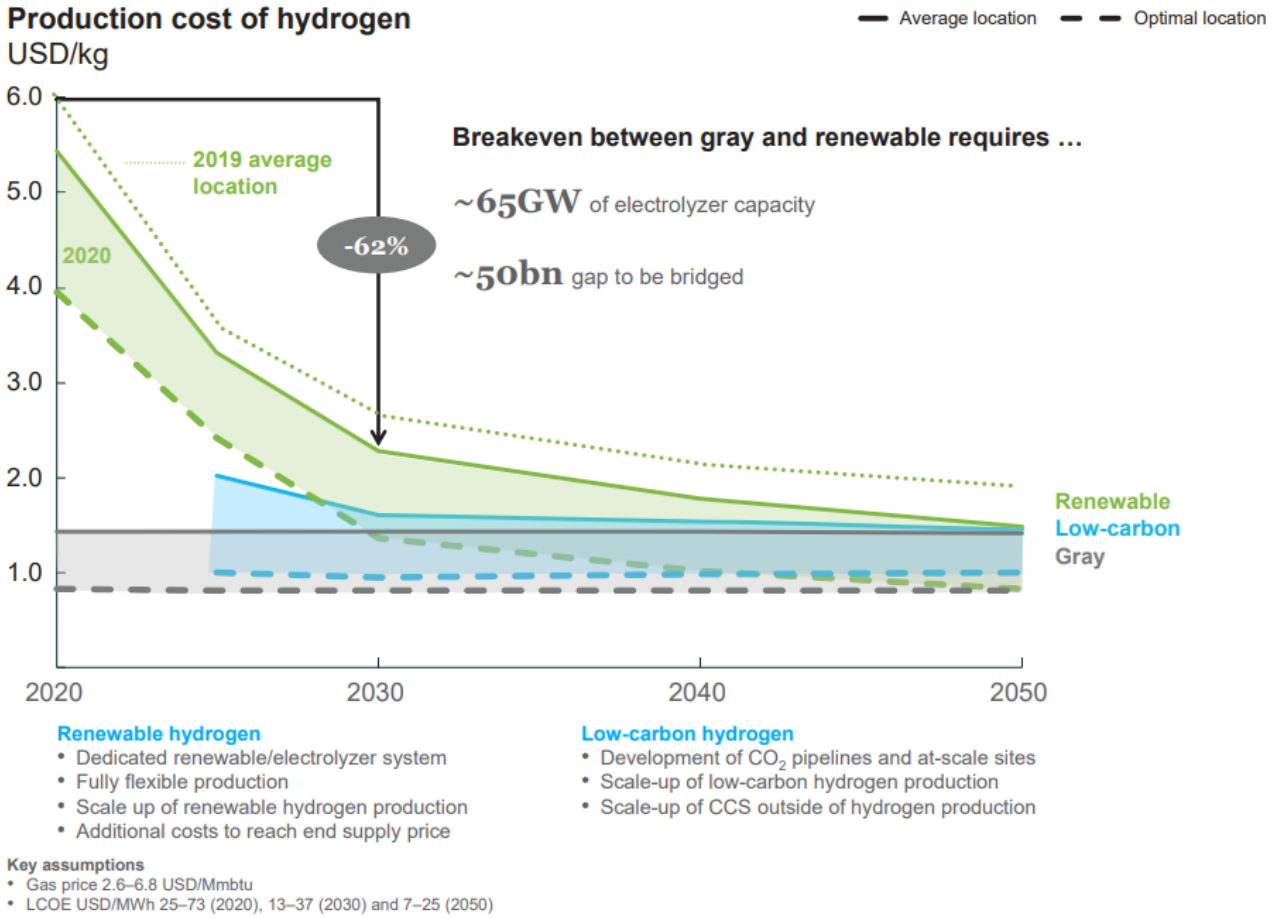
Carbon Intensities of Energy Sources



Estimates using power to gas efficiencies, Oregon DEQ, & California LCFS data

Cost of Hydrogen

- Hydrogen sourced from natural gas with carbon capture is the lowest cost today
  - $7-$14/MMBtu
- Electrolytic hydrogen predicted to be on-par 2030 and onward
  - Highly dependent on cost of electricity
- Hydrogen production tax credit could reduce costs even more ($3/kg or $22/MMBtu)



Source: Hydrogen Insights Report 2021
Hydrogen Council, McKinsey & Company

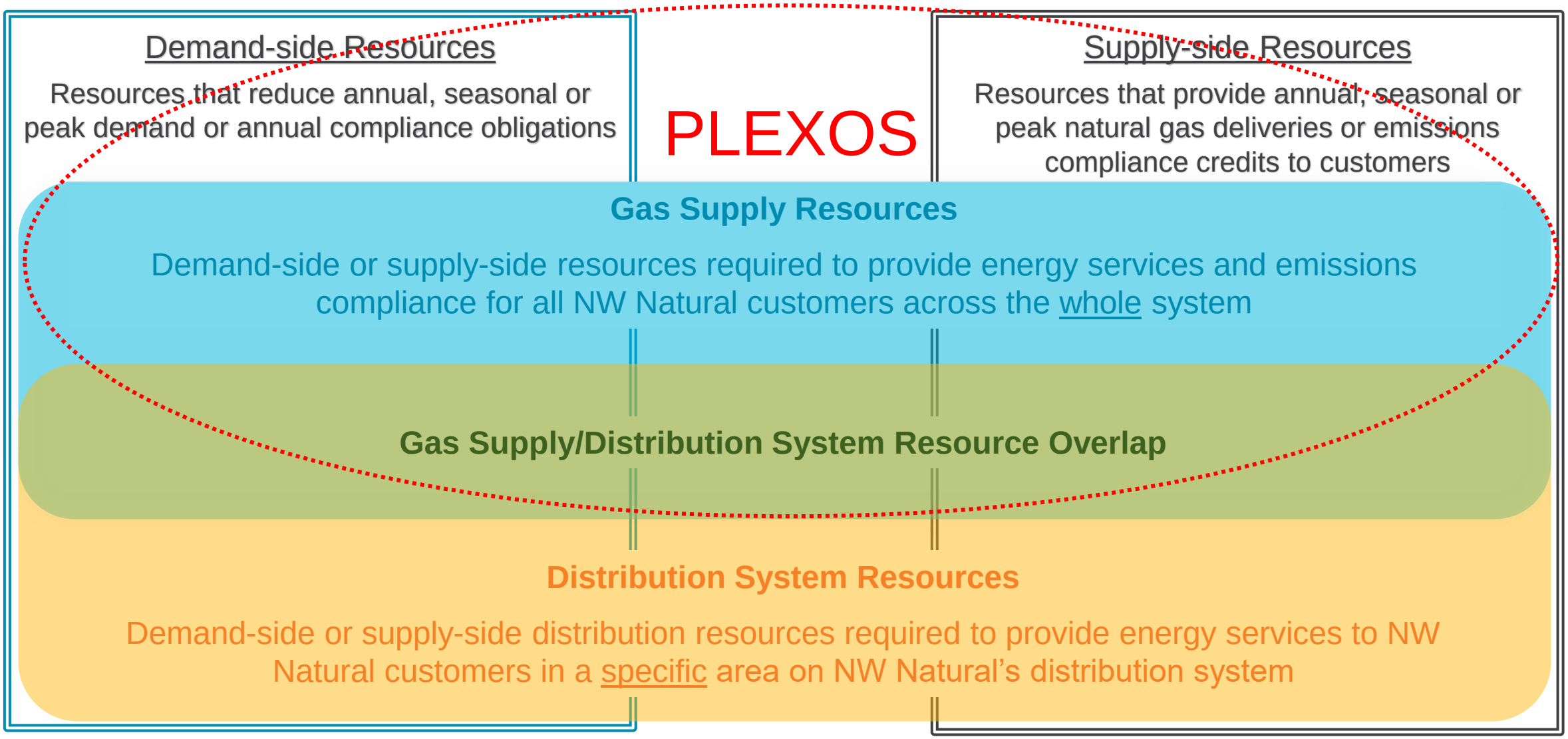
Other Compliance Resources

Community Climate Investment (CCI) Provisions

- Allowable usage of CCI Credits to demonstrate compliance is limited in the rule language:
  - Compliance period 1 (2022-2024): 10% of Emissions
  - Compliance period 2 (2025-2027): 15% of Emissions
  - All subsequent compliance periods(2028-2050): 20% of Emissions
- Price is fixed in the rule with a starting price of $107 per ton of CO2e
- Paying this price provides covered party with a credit for one metric ton of emissions to deduct from their compliance obligation
- Expire after two compliance periods (6 years)
- Availability not guaranteed

Portfolio Optimization and Risk Analysis

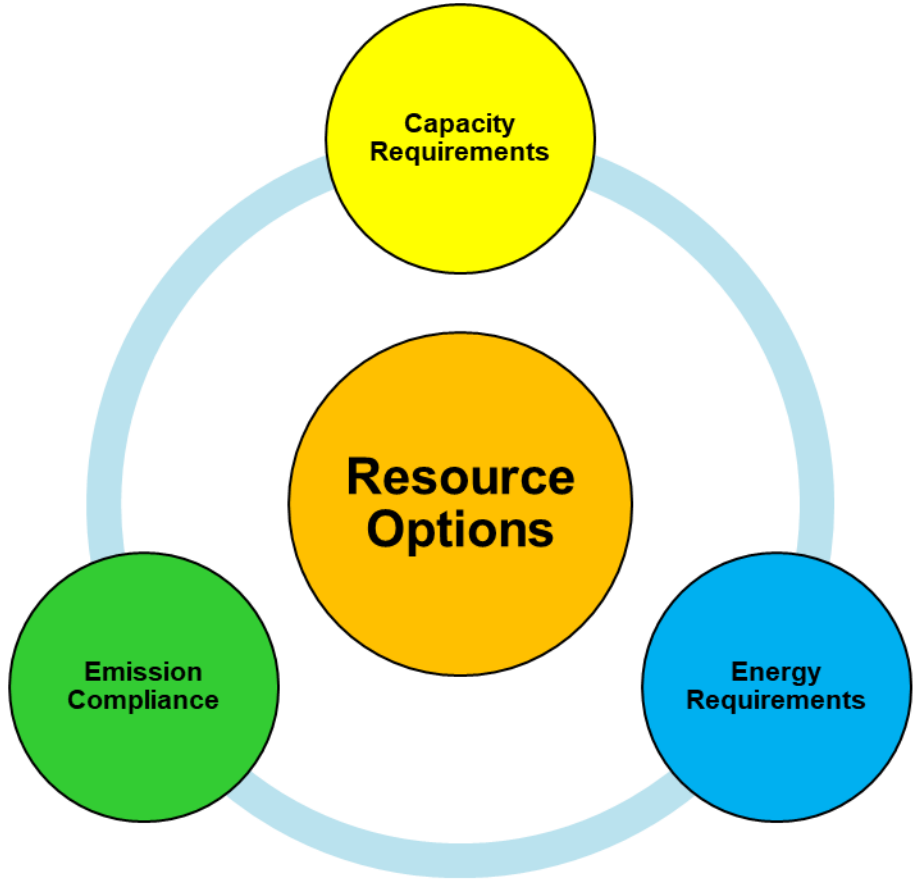
Resource Venn Diagram



Resource Portfolio Selection Under Emissions Compliance

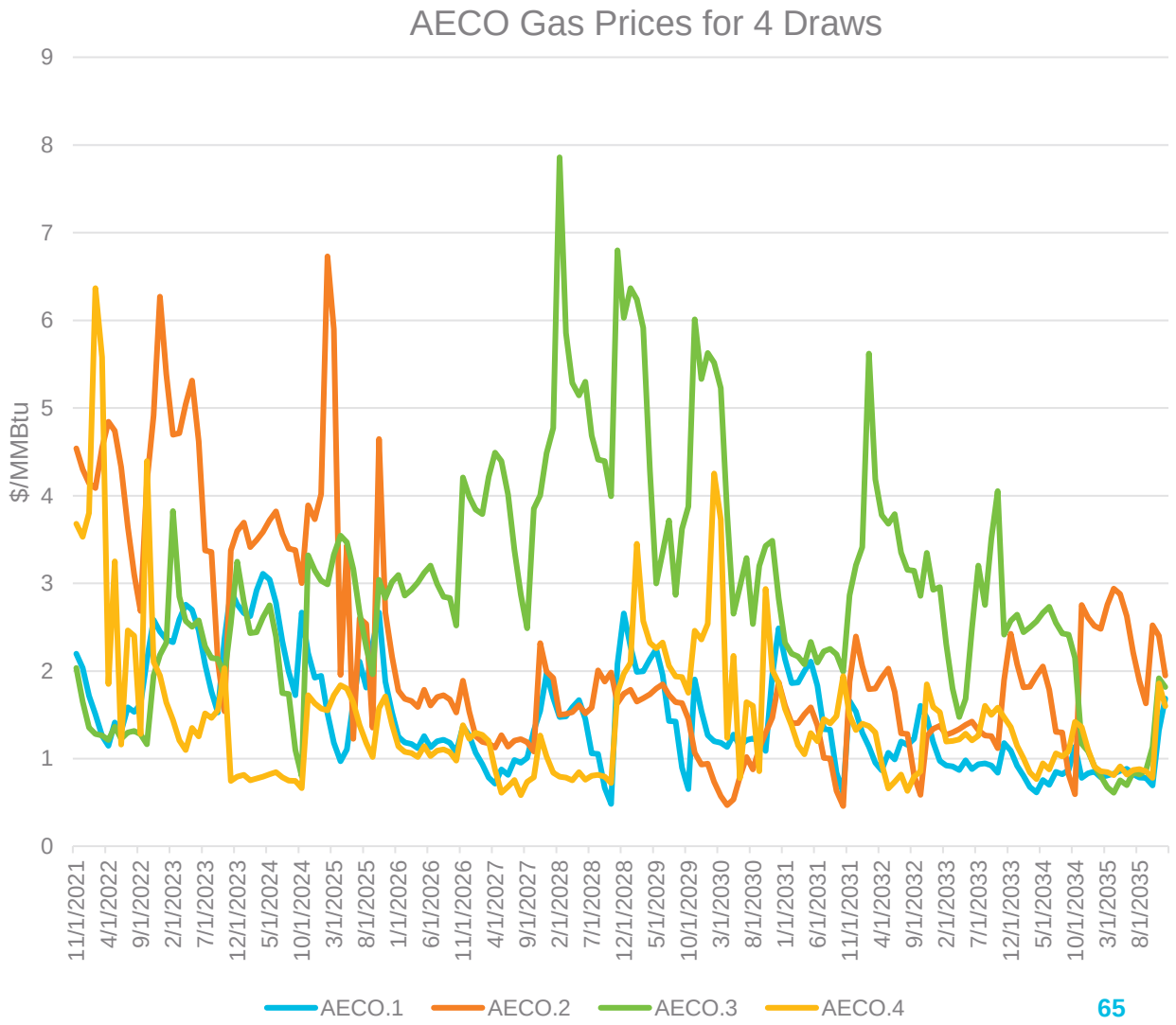
Type of Requirement	Load Forecast
Emissions Compliance	Plan resources based on expected weather annual load forecast
Capacity Requirement	Plan resources based on design peak day load forecast
Energy Requirement	Plan resources based on design weather annual load forecast

- In previous IRPs, the capacity requirement was the primary driver for resource acquisition
- Resource acquisition for emissions compliance will be another primary driver and a major focus for this IRP
- In order to ensure the model selects resources, which will comply with Oregon's and Washington's emissions targets and be able to meet the capacity requirements for peak demand, we are using expected weather load forecast, but inserting the single peak day demand on February 3rd for each year
- We will use design weather load forecast to test for energy adequacy and if the resource plan raises any annual energy requirements concerns, especially within the Action Plan window of the IRP



Monte Carlo Simulation Review

- In previous IRPs we've included variation in:
  - Gas prices (graph to the right)
  - Demand
  - Resource fixed costs
  - Emission compliance costs
- The transition PLEXOS allows for more uncertainties to be captured within the optimization
  - Quantity of RNG resource available
  - Amount of Hydrogen blending
  - RNG and Hydrogen cost
- PLEXOS optimizes resource selection for each draw in the Monte Carlo
  - The model has perfect foresight



Portland LNG Coldbox Project

Portland LNG Facility Needs

- Investments are needed to keep the Portland LNG facility as part of NW Natural's long-term resource portfolio
- Major investments in existing resources needed to keep them part of the resource portfolio undergo a complete alternatives analysis in IRPs
- Alternatives for evaluation include options to remove the resource from the portfolio and replace its capabilities with other resources
- The Portland LNG facility requires a new cold box in order to liquify natural gas for storage

Existing Cold Box

Portland LNG Project Alternatives Summary

NW Natural®

Installation Cost		Additional Resources Required
Cold Box Replacement	$11 Million	PLNG 10-Year Plan
“Central” NWN System Pipeline	$111 Million	Mist Recall
Interstate Pipeline Looping	$87 Million	Mist Recall

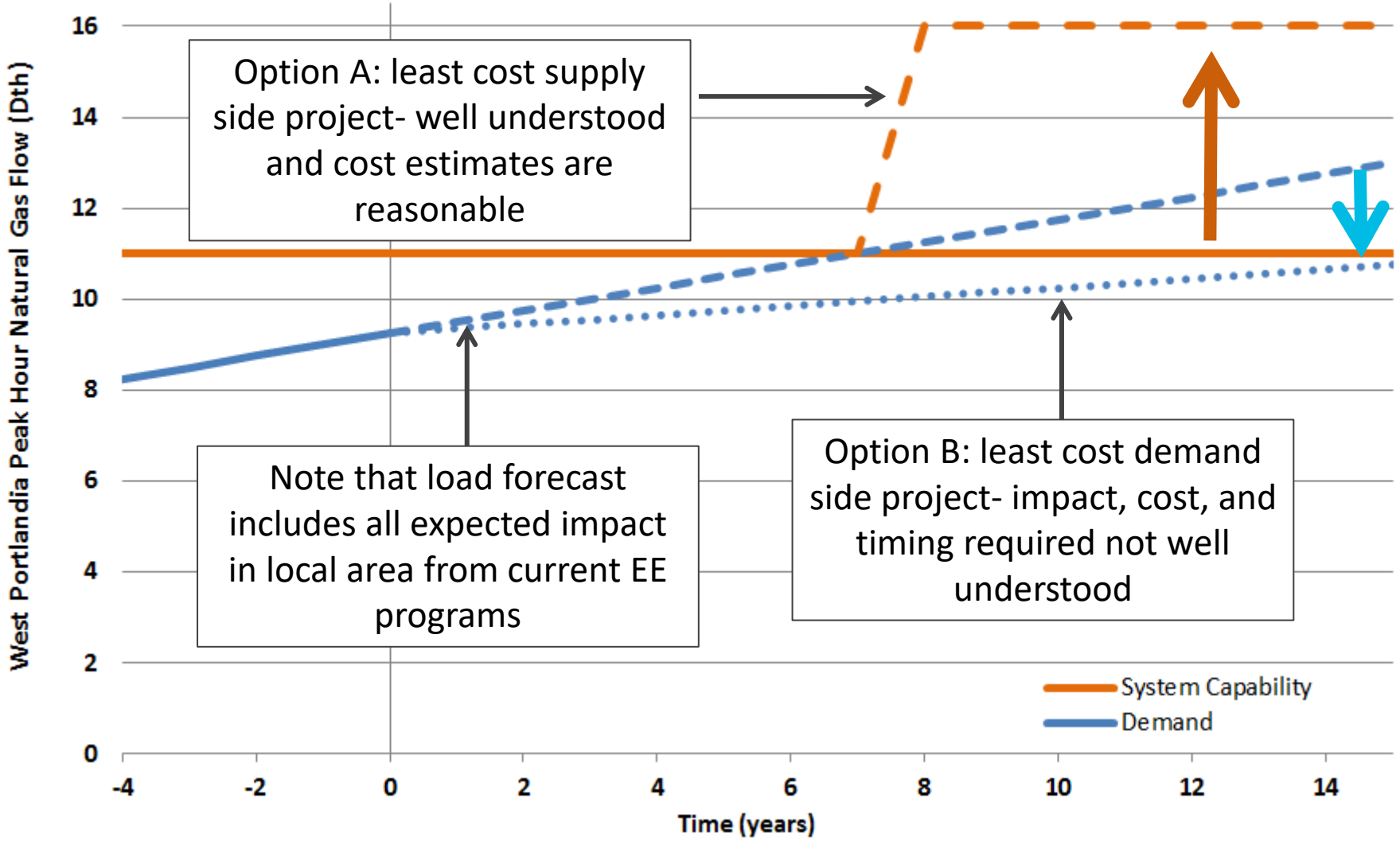
- Facility cost of service (COS) uses amortized payments to the investment
- Facility COS includes O&M and future expected investments
- Facility cost of service does **not** represent total cost to customers
- Total portfolio cost includes variable gas supply costs (i.e. gas costs)
- Total portfolio costs will be shown in future TWG where we show portfolio results

Distribution Systems Planning

Objectives of Distribution System Planning

- ✓ Operate a distribution system capable of meeting firm service customer peak hour requirements
- ✓ Address distribution system needs related to localized customer demand or growth
- ✓ Minimize system reinforcement costs by selecting the most cost effective alternative and implementing at the best time

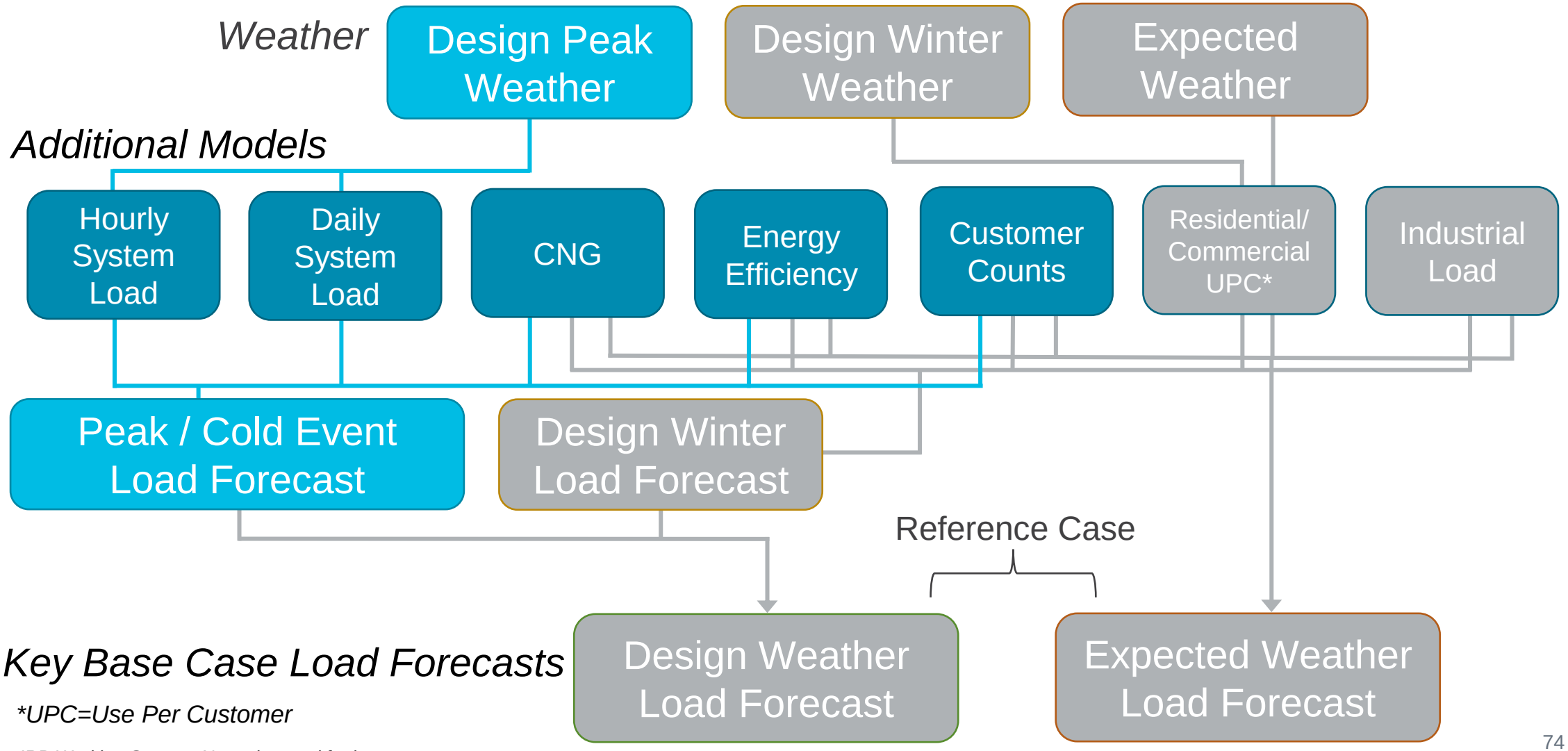
Forward-Looking Distribution System Planning



Distribution System Peak Load Forecasting Key Concepts

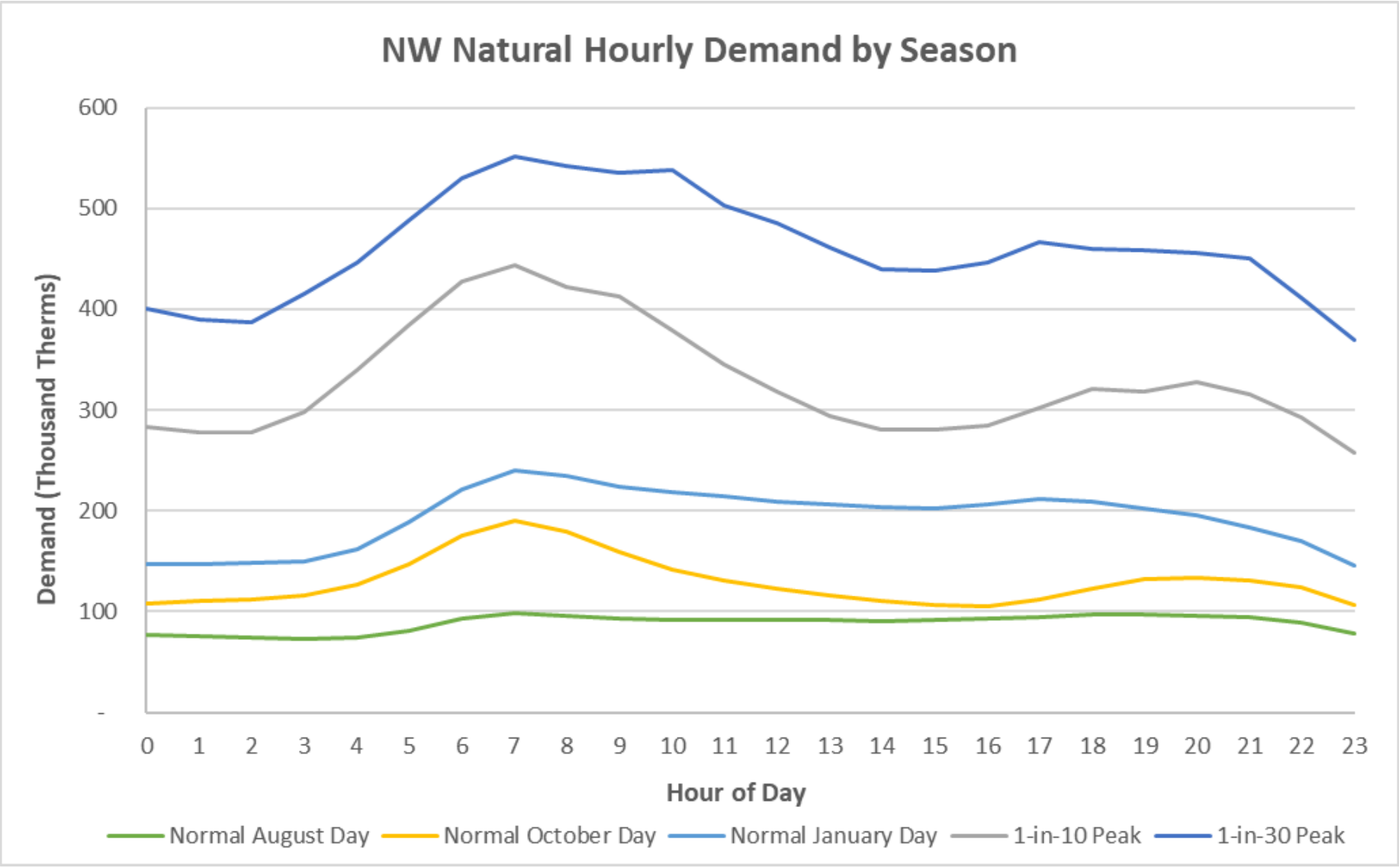
- Peak hour load driven primarily by space heating needs
- Combines top-down (system-wide) and bottom-up (customer-specific) information to forecast peak load
- Top-down methodology consistent with 2018 IRP, bottom-up estimates are undergoing process of improvement and peak estimates are now being made specifically for each customer
- Estimating peak demand for specific areas of the distribution system requires calibration of the system-wide top-down model with the bottom-up estimates
- Demand-response events are assumed to be in effect during peak events, so all interruptible customer loads are assumed to be zero in load forecast
- Includes transportation schedule loads that need to be delivered, even though NW Natural does not supply, but only delivers, gas to these customers

Peak Forecast



*UPC=Use Per Customer

Weather Most Important Driver



- NW Natural load is highest during the morning rush hour time frame, with the peak hour typically being the 7 a.m. hour
- Load is much greater in winter months than in summer
- Peak loads during cold events are far greater than even normal winter day loads
- Peak loads are driven by space heating needs
- Expected energy efficiency is accounted for in load forecasts

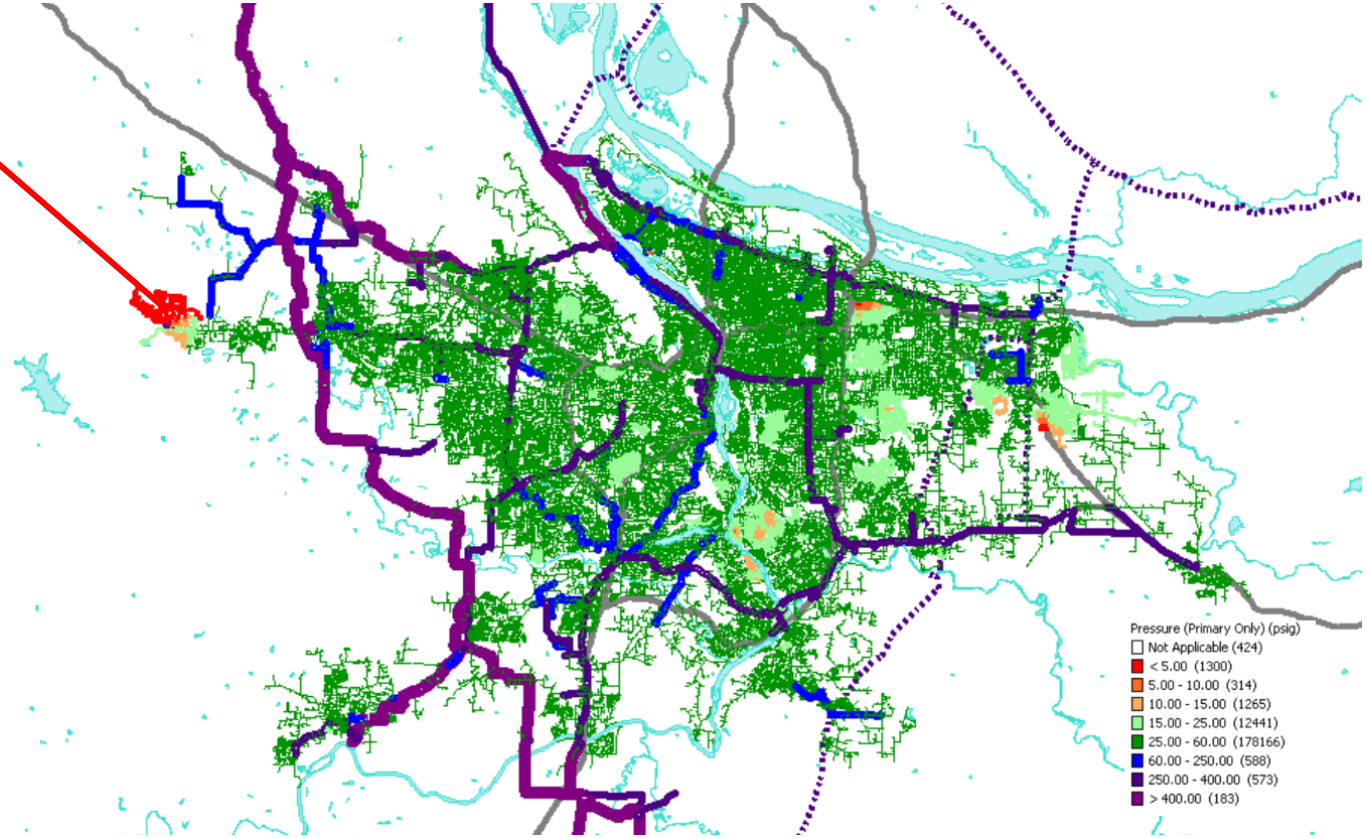
Distribution System Planning Options

NW Natural®

Distribution System Planning Alternatives (not all options are possible or applicable in all situations)				Option Currently Considered for Cost-Effectiveness Evaluation
Supply-Side Alternatives		Pipeline Related Capacity Options	Loop existing pipeline	✓
			Replace existing pipeline	✓
			Install pipeline from different source location into area	✓
			Uprate existing pipeline infrastructure	✓
			Add or upgrade regulator to serve area of weakness	✓
			Gate station upgrades	✓
			Add compression to increase capacity of existing pipelines	✓
	Non-Pipeline Solutions	Distributed Energy Resources (DER)	Mobile/fixed geographically targeted CNG storage	✓
			Mobile/fixed geographically targeted LNG storage	✓
			On-system gas supply (e.g. renewable natural gas, H2)	✓
			Geographically targeted underground storage	✓
Demand-Side Alternatives		Demand Response	Interruptible schedules (DR by rate design)	✓
			Geographically targeted interruptibility agreements	✓
			Geographically targeted demand response (GeoDR)	
		Energy Efficiency	Peak hour savings from normal statewide EE programs	✓
			Geographically targeted energy efficiency (GeoTEE)	

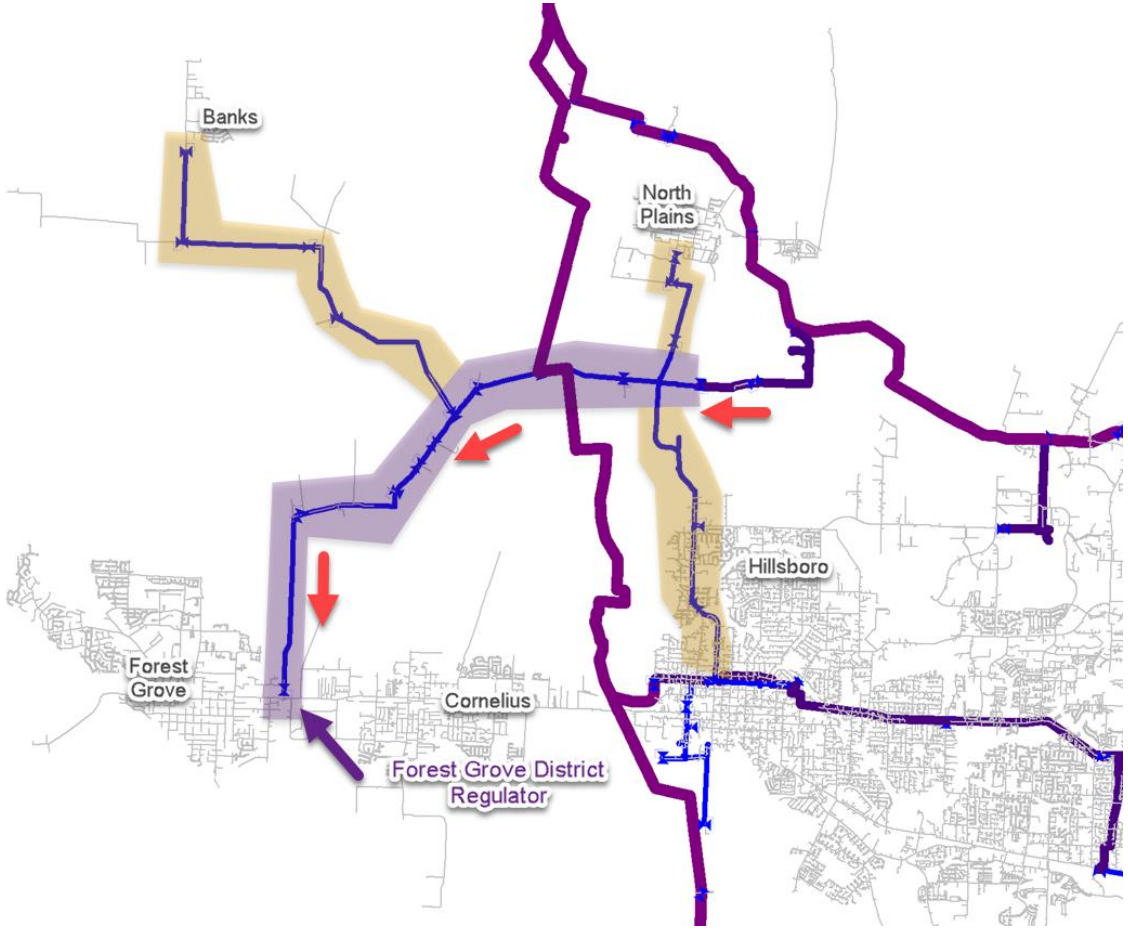
System Modeling

Low Pressures in Forest Grove



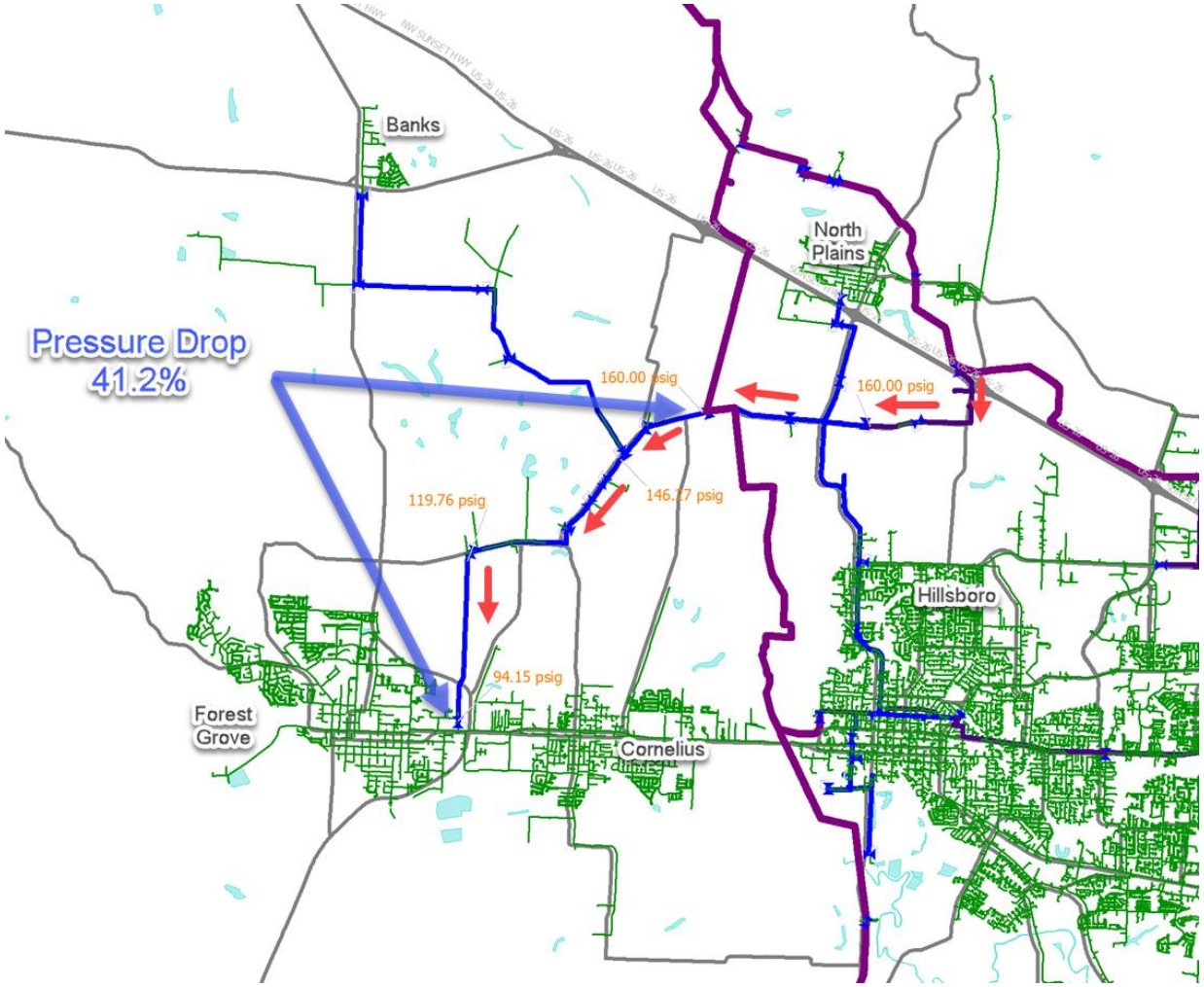
Areas of weakness in systems with less than 60 psig are easy to see:
Green is good … Red is bad

Forest Grove Feeder



- 6.3 miles of 175 MAOP HP main.
- Two district regulators supply the Forest Grove Feeder.
- Serves customers in Forest Grove, Banks, Cornelius, North Plains and Hillsboro.

Forest Grove Feeder



- Model results indicate that an average temperature of 25°F would cause the pressure on the Forest Grove Feeder to drop by over 40%
- This area experiences a cold event with an average temperature < 25°F about once every 3 years, with the last cold event occurring in January of 2017

Forest Grove Feeder

- Proposed System Reinforcement
  - Uprate approximately 6.3 miles of high pressure main from an MAOP of 175 to an MAOP of 390
  - Remove existing 400-175 District Regulator
  - Install two new 390-175 District Regulators
- The 175 MAOP laterals to Banks, North Plains, and Hillsboro would remain at their current 175 MAOP

Forest Grove Feeder

- Summary of the scope of work and preliminary cost estimate for the Forest Grove Feeder Uprate project for inclusion in the 2022 IRP:
- Note: All piping and regulators with insufficient test documentation must be retested or replaced before pressure uprate can occur.
  - 12 service regulator inlet piping replacement or full replacement
  - 4 district regulator inlet piping replacement or full replacement
  - Install 2 new pressure regulating stations
  - Abandon 1 District Regulator
- The preliminary total project cost estimate for the above scope of work for the Forest Grove Feeder Uprate is between $2.1M and $4.2M without COH.

Alternative Analyses

- **Targeted Interruptible Schedule Agreements**
  - Estimated technically potential load savings from large firm industrial loads in the affected area switching to interruptible service
  - Insufficient technical potential available
  - With **all** firm industrial loads curtailed in the model, Synergi Gas results demonstrate that the 175 MAOP system will continue to experience a greater than 40% pressure drop during peak hourly conditions
- **Satellite LNG Facility**
  - Estimated cost to site LNG facility to serve affected area
  - Cost significantly higher than pipeline uprate (more than double uprate project)
- **Geographically-Targeted RNG/Synthetic Methane**
  - Site not conducive to cost-effective RNG interconnection project

Questions/Feedback

Strategic Planning | Integrated Resource Planning Team

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We value your feedback!