



In the Community to Serve®

Integrated Resource Plan Targeted Technical Advisory Group Meeting #7

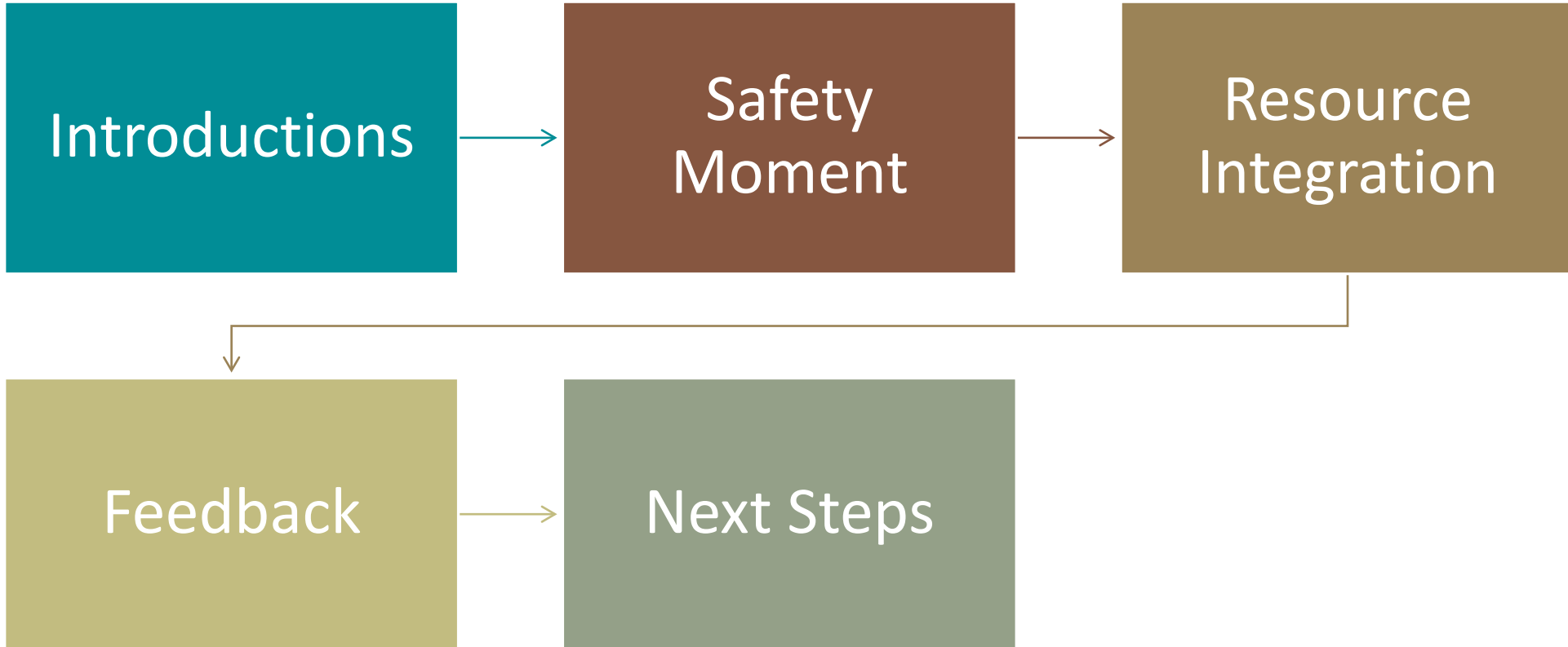
SEPTEMBER 23, 2026

MICROSOFT TEAMS/TELECONFERENCE



In the Community to Serve®

Agenda



Safety Moment

SAFETY MOMENT



[Image by: Skitterphoto at pixabay.com](#)

Be Prepared to Respond – Without Your Smartphone

Commit important numbers to memory

- ✓ Work
- ✓ Personal
- ✓ Local Emergency Providers

Create a card/list of numbers and keep in your wallet

- ✓ Include health related information if applicable
- ✓ Place a copy inside phone case

Create Emergency Contact List for a locked phone



Low Carbon Alternative Fuels

Low Carbon Alternative Fuels

- Cascade is utilizing a study from ICF that provides a detailed assessment of the levelized cost, resource potential, and carbon intensity of renewable natural gas (RNG), hydrogen, synthetic methane, and carbon capture and geologic storage (CCS) in Oregon and Washington.

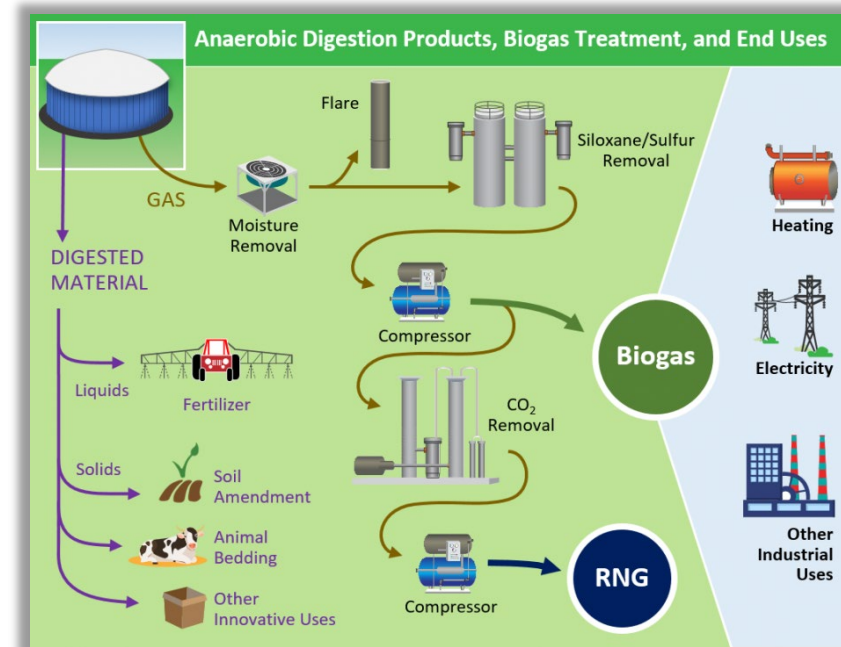
ICF's study methodology included:

- Evaluating the technical potential of each fuel based on feedstock availability and technological advancements.
- Calculating the levelized cost of energy (LCOE) for each low-carbon fuel and the cost of carbon capture and storage.
- Conducting stochastic analysis to yield a distribution of probabilistic outcomes for supply potential and LCOE, aiding the integrated resource planning process.

Renewable Natural Gas

Examples:

- Biogas from Landfills
 - Collect waste from residential, industrial, and commercial entities.
 - Digestion process takes place in the ground, rather than in a digester.
- Biogas from Livestock Operations
 - Collects animal manure and delivers to anaerobic digester.
- Biogas from Wastewater Treatment
 - Produced during digestion of solids that are removed during the wastewater treatment process.
- Other sources include organic waste from food manufacturers and wholesalers, supermarkets, restaurants, hospitals, and more.¹



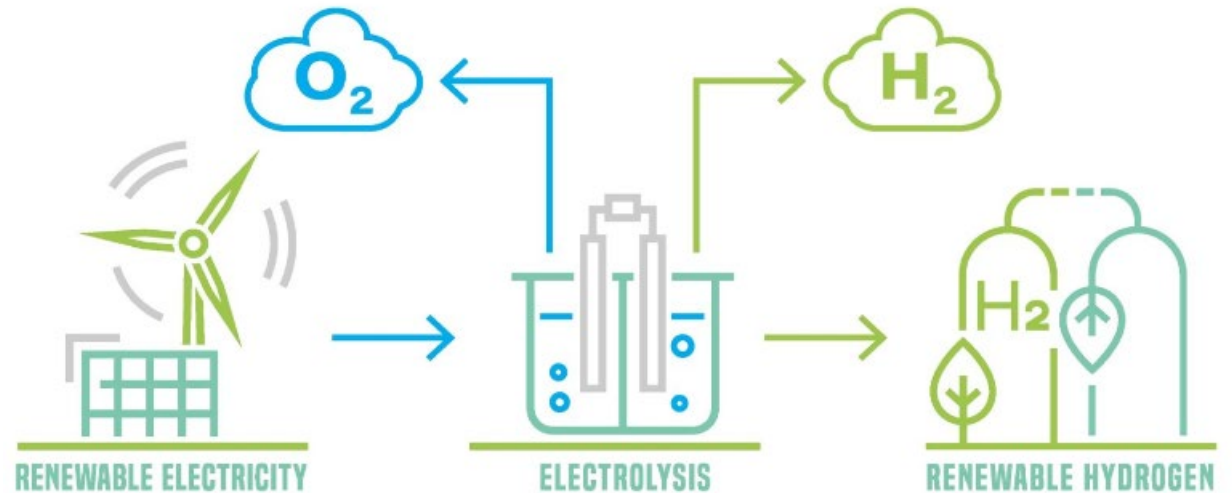
¹ U.S. Department of Energy, Alternative Fuels Data Center, Renewable Natural Gas

Hydrogen

Examples:

- Blue
 - Steam methane reforming with carbon sequestration
- Turquoise
 - Reforming methane into hydrogen gas and a solid carbon byproduct
- Green
 - Utilizing electrolysis from renewables to split the molecule into hydrogen and oxygen
- Pink
 - Similar to green, but utilizes electricity from nuclear power
- Gold
 - Microbe conversion of residual hydrocarbons from depleted, abandoned oil wells

GREEN HYDROGEN – 100% RENEWABLE ENERGY



Photo/[Innovation News Network](#)

¹ U.S. Department of Energy, Alternative Fuels Data Center, Renewable Natural Gas

Renewable Thermal Certificate

A Renewable Thermal Credit (RTC) is a market-based instrument designed to incentivize the use of renewable energy sources for heating and cooling purposes. While renewable energy credits (RECs) have traditionally focused on electricity generation from renewable sources like wind or solar, RTCs specifically target the use of renewable energy for thermal applications, such as space heating, water heating, and industrial processes.

The mechanism works by assigning a certain value or credit to each unit of renewable thermal energy produced or consumed. These credits can then be traded or sold on the market, allowing entities that generate excess renewable thermal energy to sell their credits to those who need them to meet regulatory requirements or sustainability goals.

RTC programs vary by region and may be implemented at the state or regional level, often as part of broader renewable energy or greenhouse gas reduction initiatives. By creating a market for renewable thermal energy, RTCs help drive investment in renewable heating and cooling technologies, reduce greenhouse gas emissions, and promote the transition to a more sustainable energy system.

Synthetic Methane

Green and pink hydrogen made through electrolysis can be combined with waste CO₂ to produce synthetic methane using chemical or biological processes. This process known as methanation entails incremental cost to the production of green and pink hydrogen.

Carbon Capture

Carbon Capture and storage is a process in which a relatively pure stream of carbon dioxide from industrial sources is separated, treated and transported to a long-term storage location.

Cascade is looking at Carbon Capture for all customers, but mainly large industrial users.

Cascade has identified seven candidate customers in Washington.

Electrification

Key Inputs

- Heat Pump Performance Specs at varying temperatures.
- Size and Efficiency of Home
- Climate Zone
- Natural Gas Equipment Efficiency
- Gas and Electric Rates
- Install Costs with IRA Rebates and Incentives

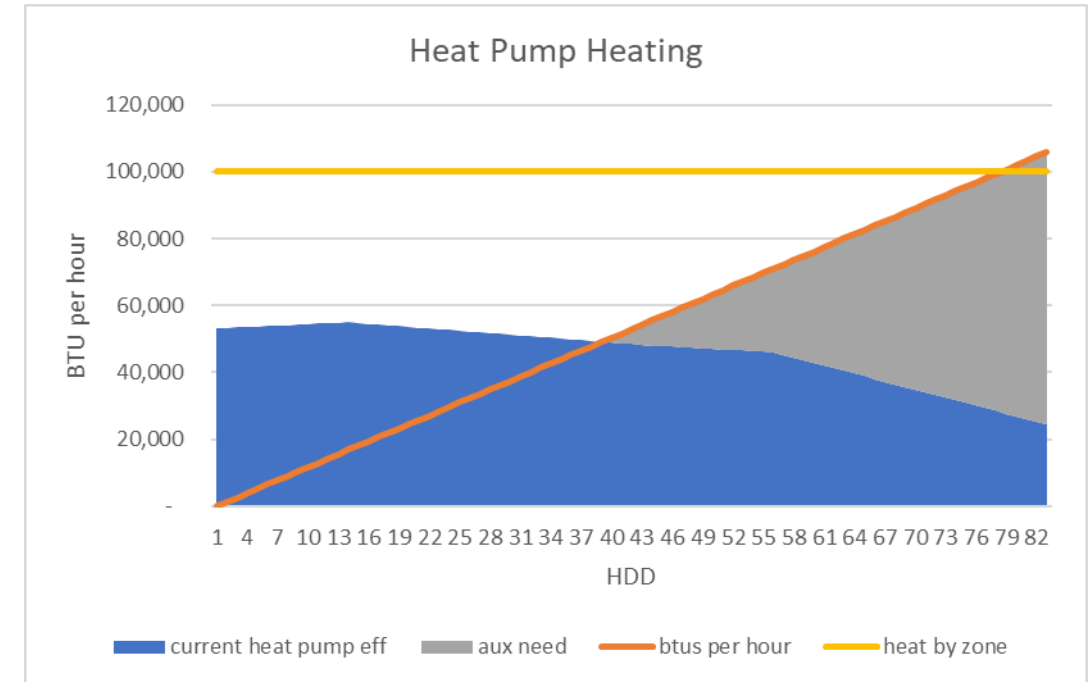
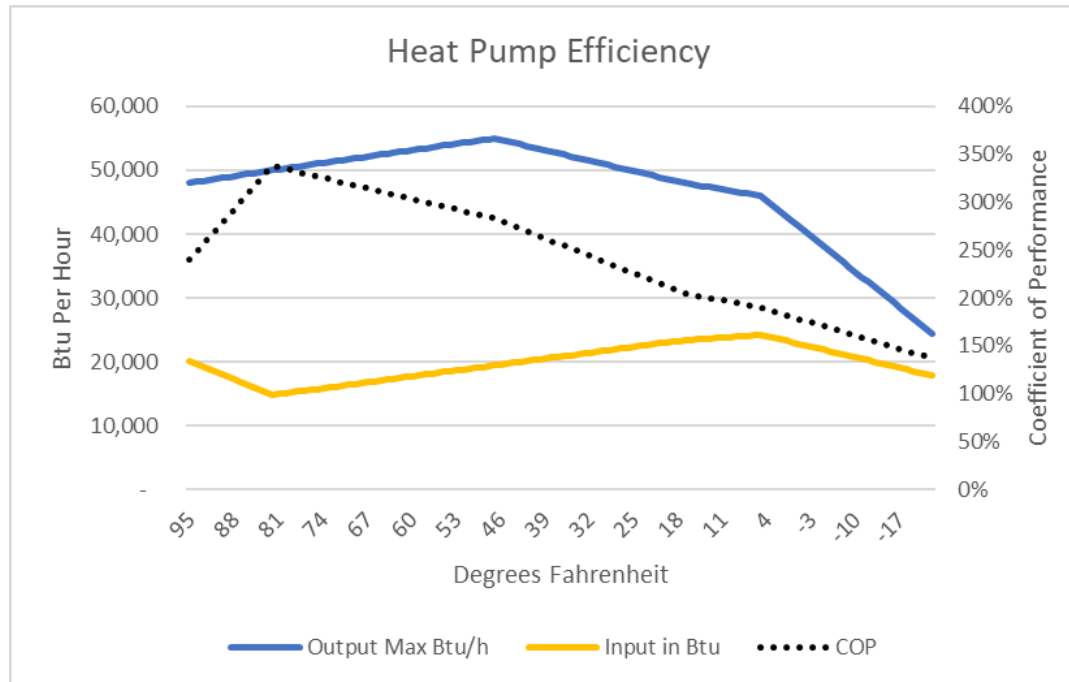
Heat Pump

- There are several hundred air-source heat pump models. Cascade must reduce this for modeling purposes.

	Output Max Btu/h	COP	Input kW
@95 deg F	48,000	240%	5.87
@82 deg F	50,000	338%	4.34
@47 deg F	55,000	283%	5.7
@17 deg F	48,000	205%	6.86
@5 deg F	46,000	190%	7.1
@-22 deg F	24,500	137%	5.24

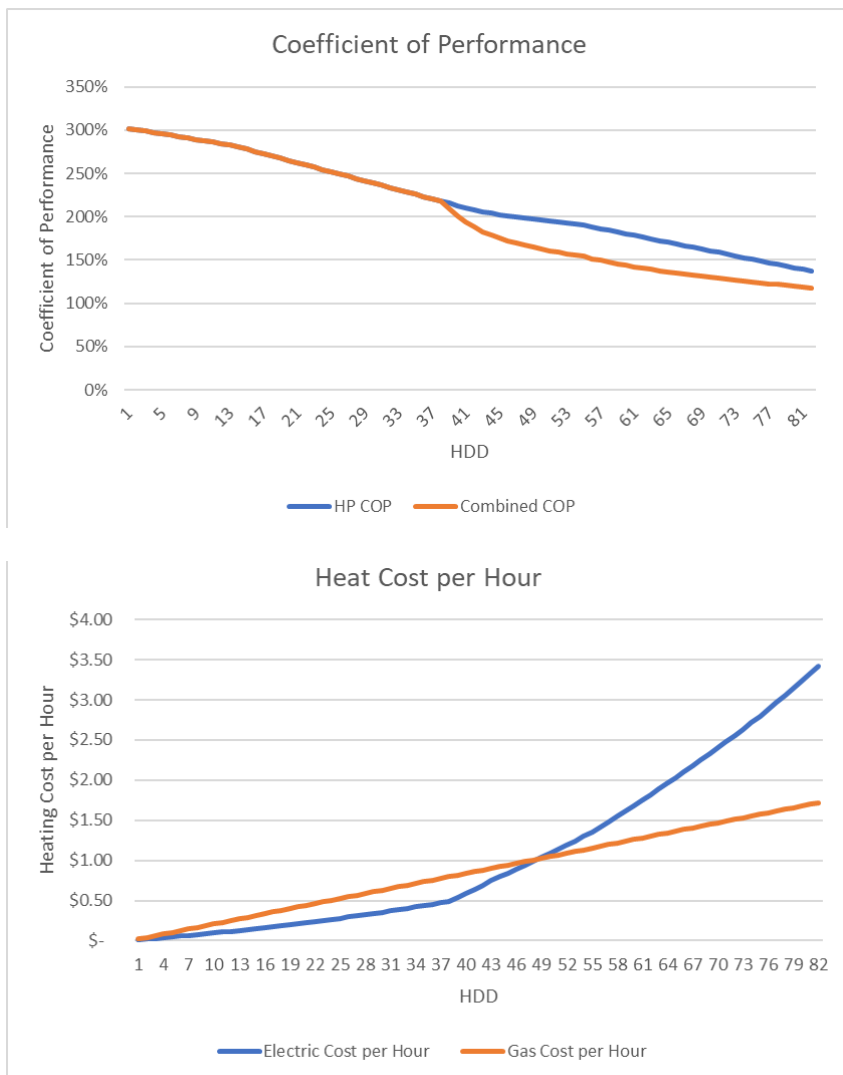
Coefficient of Performance

- Heat Pump Efficiency measures the amount of output produced given the amount of input received at different temperatures.
- Heat Pump Heating measures the amount of heat produced vs the amount of heat needed by zone, showing when auxiliary heat is needed.



Coefficient of Performance and Cost

- Coefficient of Performance (COP) measures the ratio of useful heating or cooling provided to the energy required to produce heating or cooling, broken out by heat pump only COP and heat pump and auxiliary heat combined COP.
- Heating Cost per Hour measures the cost to operate the heating system for electric vs gas at varying HDD levels.



Federal Energy Incentive Changes

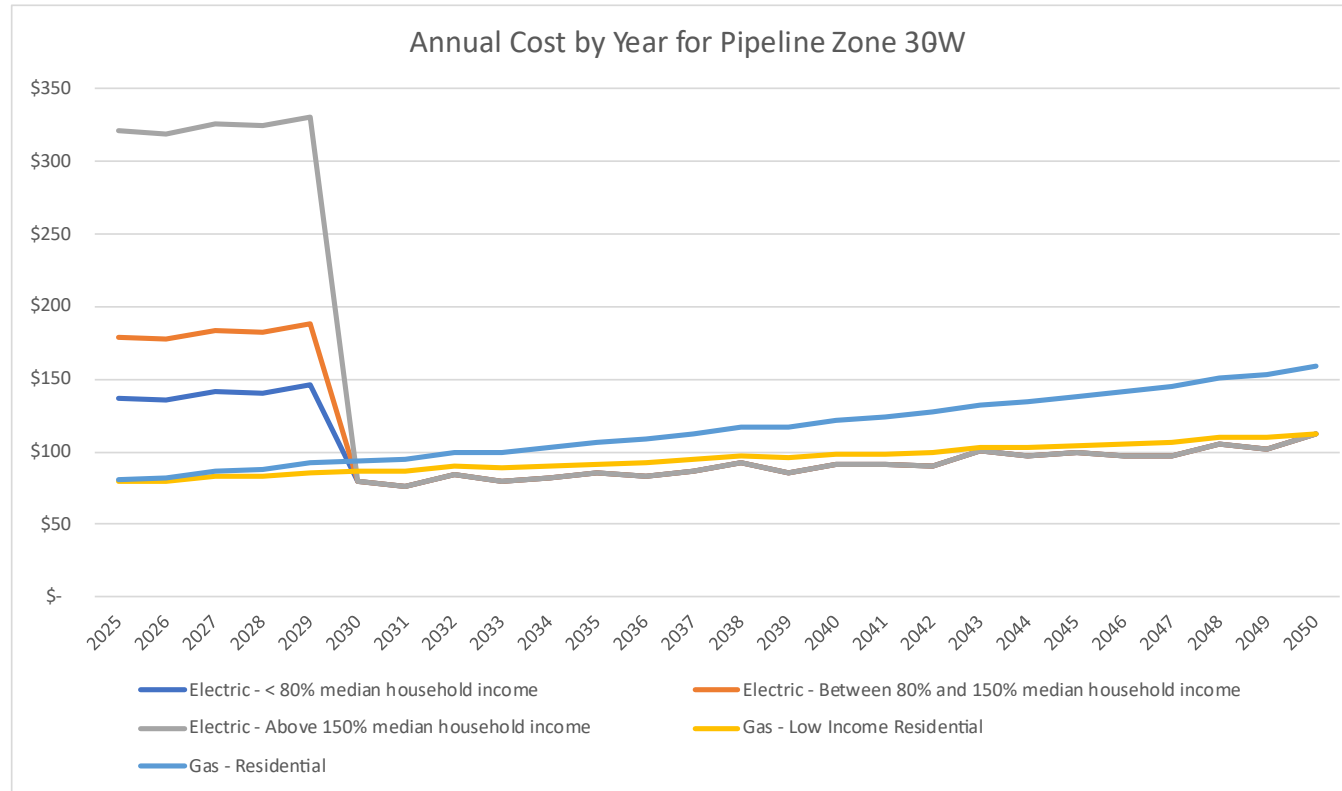
Program	Eligibility	Rebate/Tax Credit Amount	Details
HEEHRA - Electrification Rebates	Low- and moderate-income households	Up to \$14,000	Covers high-efficiency electric equipment and appliances. Low-income households can receive up to 100% of project costs; moderate-income households up to 50%. ¹
HEEHRA - Efficiency Rebates (HOMES)	Households at all income levels	Up to \$8,000 depending on energy savings and household income	Provides rebates for whole-house energy-saving retrofits. Amount depends on the percentage of energy savings achieved. ¹
IRA Tax Incentives - Energy Efficiency Improvements	All households	Up to 30% of project costs	Tax credits for energy-efficient improvements like heat pumps, solar panels, and insulation. Average tax credit ranges from \$2,000 to \$5,000.

- Green denotes rebate programs that remain available, although DOE revised program guidance in 2026, including restrictions on fuel-switching under HEEHR.
- Red denotes federal tax incentives accelerated or terminated by the One Big Beautiful Bill Act (OBBBA).

Install Costs with Rebates and Incentives

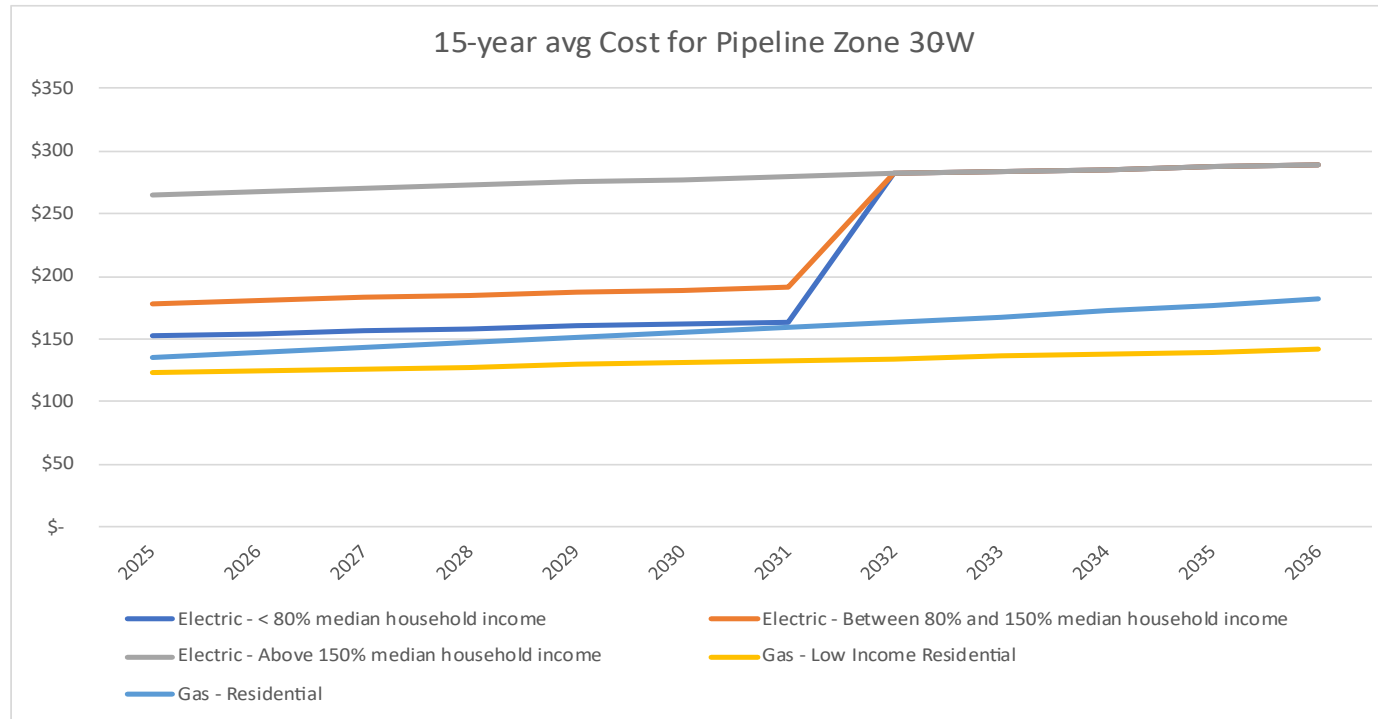
- Install Costs gathered from American Council for an Energy-Efficient Economy report.¹
- Modeled in three separate income groups; 1. Below 80% median household income, 2. Between 80% and 150% median household income, 3. Above 150% median household income.
- Assuming a lognormal distribution with a standard deviation of 1, 41.3%, 24.6%, and 34% of people would fall under the first, second, and third threshold from the above bullet, respectively.
- Although federal IRA tax credits expired after 2025 and HEEHR fuel-switching incentives were curtailed, Washington and Oregon continue to offer state-, utility-, and income-qualified programs that reduce the cost of converting from natural gas to electric heating.
- Electrification adoption modeling assumes a weighted average incentive level reflecting rebates available to all customers, with enhanced incentive levels applied to income-qualified customer segments that are eligible for state-funded electrification and energy assistance programs.

Annual Cost Preliminary Results (Whole Home)



- Annual Costs, including installation cost and cost of service.
- Includes different install costs based on IRA incentive.
- Includes costs to electrify vs remaining as a gas customer.

Levelized Cost Preliminary Results (Whole Home)



- Levelized costs over 15 years, including installation cost and cost of service.
- Includes different install costs based on IRA incentive.
- Includes costs to electrify vs remaining as a gas customer.
- Projects done after 2031 do not include IRA incentives.
- Cascade will produce results for all ten pipeline zones.

Plexos Optimization Modeling

Plexos Model

Cascade utilizes Plexos for resource optimization.

This model permits the Company to develop and analyze a variety of resource portfolios to help determine the type, size, and timing of resources best matched to forecast requirements.

Plexos is very powerful and complex. It operates by combining a series of existing and potential demand side and supply side resources and optimizes their utilization at the lowest net present cost over the entire planning period for a given demand forecast and emissions constraints.

Plexos is a unified energy modeling and forecasting software platform. Its powerful simulation engine analyzes zonal and nodal energy models ranging from long-term investment planning to medium-term operational planning and down to short-term, hourly, and intra-hourly market simulations.

It is important to recognize that Plexos provides helpful but not perfect information to guide decisions.

Modeling Challenges

Supply needs to get gas to the citygate.

Many of Cascade's transport agreements were entered into decades ago, based on demand projections at that point in time.

Sum of receipt quantity and aggregated delivery quantity can help identify resource deficiency depending on how rights are allocated.

The aggregated look can mask individual citygate issues for looped sections, and the disaggregated look can create deficiencies where they don't exist.

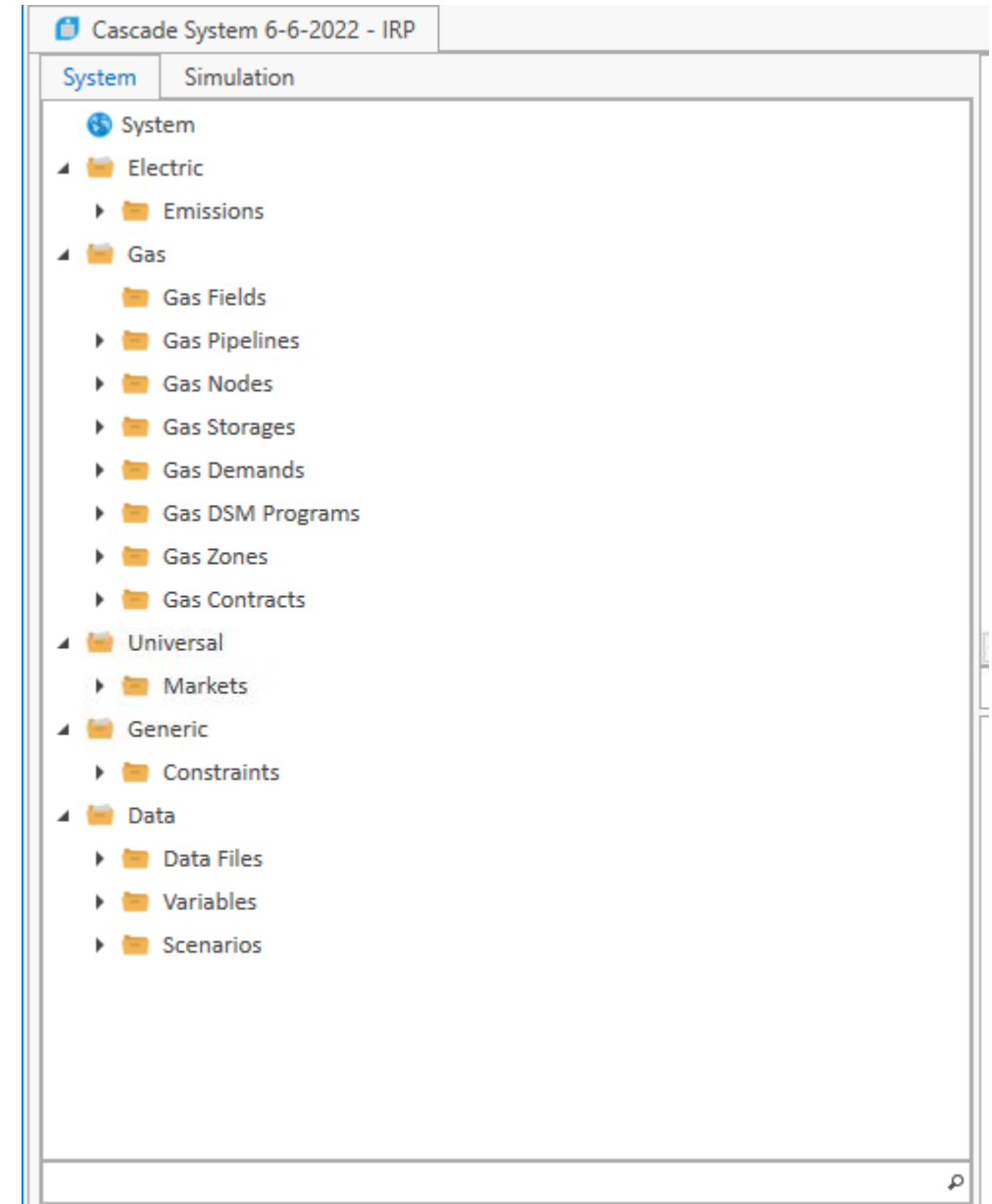
In many cases operational capacity is greater than contracted.

Supply, storage, and upstream transportation focuses on the core, but non-core must be included for emissions modeling.

Plexos has perfect knowledge.

Base Case Plexos Inputs

- Demand
- Supply
- Price Forecast
- Storage
- Transportation
- Constraints
- Emissions



Resource Integration

Resource Integration

Reference Case:

- Expected customer growth
- Expected price forecast
- Climate Commitment Act/Climate Protection Plan
- SSP 3-7.0 Climate Model
- Low Carbon Alternative Fuels – Expected Supply/Costs

Portfolio Modeling:

- Least Cost
- Accelerated Electrification (Full)
- Electrify low-income
- Hybrid Heating Future
- Low Carbon Alternative Fuels (High/Low, Individual pathways)
- Others?

Resource Integration Cont'd

Scenarios:

- Customer Growth
 - Low Growth: Linear 0% to 1.5% decay in building stock attrition for first 5 years, then 1.5% decay after
 - Return the historical high growth rates
- Climate Regulation
 - Climate Commitment Act/Climate Protection Plan
 - HB 1257 (In Washington)
 - Meet CCA needs with emission reductions rather than allowances
 - Cap and Trade (In Oregon)
- Weather
 - SSP 2-4.5
 - SSP 8-5.0
- Low Carbon Alternative Fuels
 - Monte Carlo Simulations (100+ draws)

Equity-focused portfolio analysis in the IRP

- Bill Impact Analysis
 - Compare projected customer bill impacts across portfolios over the planning horizon, including the timing and magnitude of changes.
- Energy Burden
 - Estimate changes in household energy burden at the HIC (WA) and Zip code (OR) level to identify geographic differences and potentially disproportionate impacts.
- Reliability Considerations
 - Evaluate whether portfolio choices maintain reliable service and whether reliability risks or benefits are distributed differently across communities.
- Technology-neutral decarbonization
 - Compare energy efficiency, low carbon alternative fuels, hybrid heating, electrification, and compliance resources using consistent cost and risk assumptions.
- What other equity-focused analysis or metrics should Cascade consider?

Role of Equity Analysis in Portfolio Selection

- Least-cost and reliability drive portfolio selection; equity analysis identifies where targeted considerations or mitigation may be needed.
- Primary
 - Least-Cost Planning
 - Present-value cost, customer bill impacts, and cost risk across scenarios
 - Reliability and Risk
 - Peak-day capacity, deliverability, resource performance, and resilience
- Equity Lens
 - Equity Matrix – Identifies where portfolio impacts may warrant targeted action:
 - HIC (WA) and Zip code (OR) level
 - Geographic concentration of impacts
 - Community reliability considerations
- Key principle: Equity findings inform implementation and mitigation, rather than duplicating least-cost portfolio scoring.

Weatherization as an Equity Strategy

Weatherization is an equity investment and a cost-effective resource that produces customer benefits

- Directing utility investments towards vulnerable customers, who face the greatest energy affordability challenges and housing-related inefficiencies
- Ensuring vulnerable households receive measurable economic, health, and comfort benefits
- Addressing disproportionate energy burden
- Expanding access to utility benefits
- Improving health, safety and preserving affordable housing

Weatherization benefits all residential rate classes by reducing overall system wide energy demand & cost

- Reduces greenhouse gas emissions
- Lowers peak demand which reduces the stress on gas distribution system resulting in and extending the life of existing infrastructure.
- Using less gas results in lower utility cost which benefit all customers not just participating weatherization customers
 - Reduced energy burden = Lower bad debt/reduced impact on ratepayers

Weatherization as an Equity Strategy

Weatherization produces system benefits

- Weatherization reduces overall system wide energy demand & cost. Weatherized homes require less natural gas for heating which results in:
 - Lower peak loads
 - Reduce throughput requirements
 - Defer infrastructure investments

Weatherization provides equitable access

- Reduces participation barriers
 - Program delivered at no cost vs. traditional energy efficiency programs
 - Program focuses on high energy burden customers
 - Prioritizes households with eligible income, senior citizens, young children and individual with chronic illness

Weatherization reduces energy burden while providing system-wide value and affordability benefits

- Equity, affordability, resource planning, and customer benefits are aligned through weatherization investments

Highly Impacted Communities: Washington

SITE_ADDRESS_CITY	SITE_ADDRESS_ZIPCODE	Project Completed	Measure Completed	Overall HIC Rank
ABERDEEN	98520	16	57	***
ANACORTES	98221	1	4	1
BELLINGHAM	98225	7	21	7
BELLINGHAM	98226	6	26	7
BELLINGHAM	98229	7	26	5*
BLAINE	98230	3	10	1
BURLINGTON	98233	1	2	9
ELMA	98541	3	11	3
EVERSON	98247	2	9	***
FERNDALE	98248	3	12	7
Grandview	98930	3	20	8
GRANGER	98932	1	6	9
HOQUIAM	98550	21	75	4**
LYNDEN	98264	1	5	3
MCCLEARY	98557	2	6	2
MOUNT VERNON	98273	5	21	7
MOUNT VERNON	98274	1	2	2
OAK HARBOR	98277	2	8	4
OTHELLO	99344	2	10	5*
PASCO	99301	7	21	9
Prosser	99350	1	2	9
SEDRO WOOLLEY	98284	1	5	2
SELAH	98942	1	5	7
SHELTON	98584	1	5	6*
SUNNYSIDE	98944	5	26	8
TOPPENISH	98948	2	10	10
UNION GAP	98903	3	9	8
WALLA WALLA	99362	1	4	10
Wapato	98951	2	14	10
YAKIMA	98901	4	14	7
YAKIMA	98902	6	23	10
Grand Total		121	469	

Third-Party Contractor

SITE_ADDRESS_CITY	SITE_ADDRESS_ZIPCODE	Project Completed	Measure Completed	HIC Ranking
STANWOOD	98292	1	8	4
ARLINGTON	98233	1	7	9
PASCO	99301	1	6	9
SUNNYSIDE	98944	4	26	8
WAPATO	98951	1	8	10
YAKIMA	98902	2	12	10
TOPPENISH	98948	2	10	10
Grand Total		11	69	

* Overall ranking low, but ranks high in Socioeconomic Factors

** Overall ranking low, but ranks high in Socioeconomic Factors & Sensitive Population

*** Tribal Automatic HIC

Highly Impacted Communities: Oregon

SITE_ADDRESS_CITY ▾	SITE_ADDRESS_ZIPCODE ▾	Project Completed	Measure Completed
☐ BEND	97701	4	21
BEND	97702	3	14
BEND	97703	1	5
☐ LA PINE	97739	1	2
☐ MADRAS	97741	2	11
☐ METOLIUS	97741	1	7
☐ NYSSA	97913	5	26
☐ ONTARIO	97914	1	2
☐ PRINEVILLE	97754	3	7
PRINEVILLE	98854	2	6
☐ REDMOND	97756	2	11
Grand Total		25	112

Bill Assistance as an Equity Strategy

Cascade offers **bill discounts** and **arrearage relief grants** in both Oregon and Washington to reduce high **energy burdens**.

- **CARES and Energy Bill Discount Program**
 - 15% to 95% Discount in Oregon
 - 8% to 90% discount in Washington
 - Discount aims to keep energy burden from 2.5 to 3.5 percent
- **Additional Bill Payment Assistance Resources**
 - Arrearage Relief Grants
 - CARES: 50% to 100% of arrearage forgiveness
 - OLIBA: 80% to 90% of arrearage forgiveness
 - LIHEAP
 - Winter Help

IMPLAN

Non-Energy Impacts

Cascade's Plan: Non-Pipe Alternatives

Non-Energy Impacts reported:

- Economic impact
- Employment Impact
- Environmental Impacts

IMPLAN: IMPLAN is an Input-Output model, which uses a massive Matrix to measure the spending relationships between different industries using multipliers based on the spending patterns. This is based on the work of Wassily Leontief, with the matrices being named after him.

5.7 Leontief Input-Output Models

Structure of an input-output model

The model

$$x_1 = a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n + d_1$$

$$x_2 = a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n + d_2$$

$$\vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots$$

$$x_n = a_{n1}x_1 + a_{n2}x_2 + \cdots + a_{nn}x_n + d_n$$

$$x_j = a_{1j}x_1 + a_{2j}x_2 + \cdots + a_{nj}x_n + d_j$$

sector1 $1000 = 0.15 \cdot 1000 + 0.25 \cdot 2000 + 350$

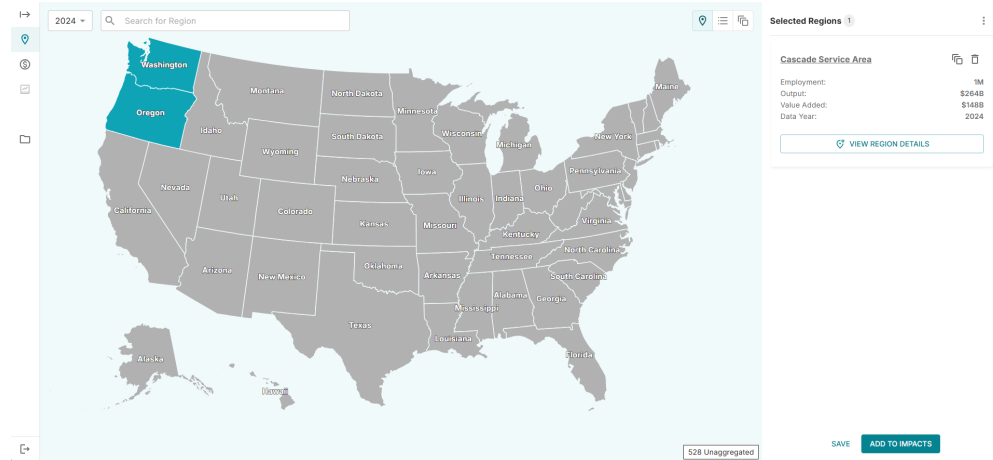
sector2 $2000 = 0.20 \cdot 1000 + 0.05 \cdot 2000 + 1700$

Ch. 5b: Linear Models and Matrix Algebra
5.5 - 5.8

20

IMPLAN Reporting

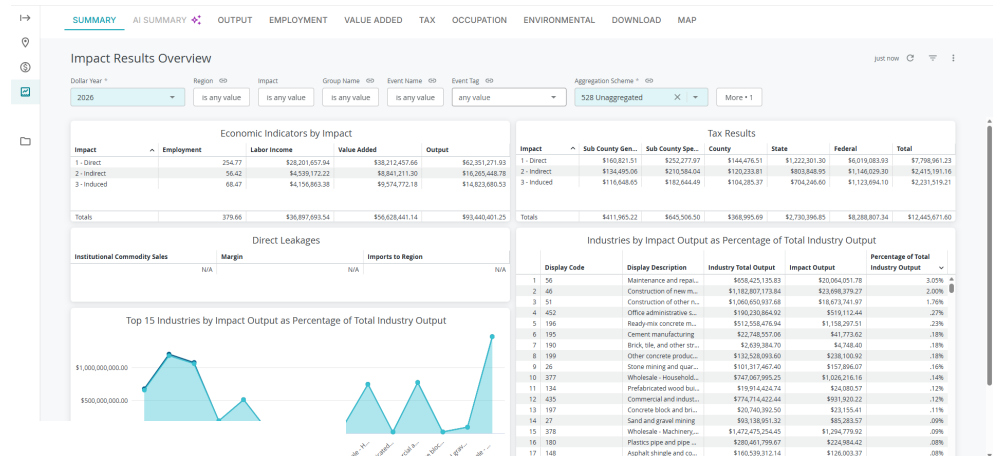
Custom Region Maker



Cost Value Reporting

Events	6	+ ADD EVENT	FILTER TAGS	0 / 6	SAVE	...	Groups	1	+ ADD GROUP	MRIO
Title	Type	Specification	Value	Sort	...	Sort: Order Added (Ascending)				
Electrification- Industry Spending	Industry Spending Pattern	56 - Maintenance a...	NAICS \$3,000,000							
Natural Gas Pipeline- Industry Sper	Industry Spending Pattern	51 - Construction o...	NAICS \$3,000,000							
Natural Gas Pipeline- Wage	Industry Employee Compens...	51 - Construction o...	NAICS \$7,000,000							
Electrification- Wage	Industry Employee Compens...	56 - Maintenance a...	NAICS \$7,000,000							
RNG- Industry Spending	Industry Spending Pattern	46 - Construction o...	NAICS \$4,000,000							
RNG- Wage	Industry Employee Compens...	46 - Construction o...	NAICS \$6,000,000							

Economic Impacts



Environmental Impacts

SUMMARY	AI SUMMARY	OUTPUT	EMPLOYMENT	VALUE ADDED	TAX	OCCUPATION	ENVIRONMENTAL	DOWNLOAD	MAP
Environmental Impact Summary									
Dollar Year	2026	Region	is any value	Impact	is any value	Group Name	is any value	Event Name	is any value
Aggregation Scheme	528 Unaggregated	...	More +	...	...	...	...	...	...
Industry Summary									
Environment Category	Environment Unit	Commercial No. NE	Commercial NE	Commercial NE	Commercial NE	Commercial NE	Commercial NE	Commercial NE	Commercial NE
Industry Display	Environmental Output	Environmental Output	Environmental Output	Environmental Output	Environmental Output	Environmental Output	Environmental Output	Environmental Output	Environmental Output
1 1 - Cattle farming	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 2 - Grain farming	10.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 3 - Vegetables and melon farming	41.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 4 - Fruit farming	30.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 5 - Tree nut farming	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 6 - Greenhouse, nursery and floriculture product...	22.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7 7 - Tobacco farming	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8 8 - Cotton farming	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9 9 - Sugarcane and sugar beet farming	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10 10 - All other crop farming	122.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11 11 - Beef cattle ranching and farming, including...	11.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12 12 - Dairy cattle and milk production	4.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13 13 - Poultry and egg production	4.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14 14 - Animal production, except cattle and poultry...	4.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 15 - Forestry, forest products and timber tract p...	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 16 - Commercial logging	50.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 17 - Commercial fishing	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18 18 - Commercial hunting and trapping	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19 19 - Support activities for agriculture and forestry	93.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20 20 - Oil and gas extraction	5.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21 21 - Coal mining	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22 22 - Copper, nickel, lead, and zinc mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	225,375.78	11,184,430.35	20,818.52	211,160.79	7,455,618.88	4,775,203.02	10,983,789.92	2,487.36	340.29

Questions? Comments? Suggestions?

Feedback for Cascade?

- Oregon IRP rule 860-090-0060(7)(g)(E) states “Community impacts, presented as plausible ranges for the future impacts of the portfolio on communities within or partly within the utility's Oregon service territory. The utility must demonstrate that community impact metrics are:
 - i. Developed with input from the public, including input from environmental justice communities;
 - ii. Quantitative and measurable as the utility implements its plan;
 - iii. Practically informative to utility implementation decisions, including investments, contracts, and program designs; and
 - iv. Distinct from other scoring metrics.
- Do you have any other comments or ideas that Cascade should consider regarding Resource Integration?

Process Item	Date	Process Element
TAG 1	Wednesday, October 14, 2026	Process, Key Points, IRP Team, Timeline, Regional Market Outlook, Planned Scenarios and Sensitivities, Stakeholder Engagement, Demand and Customer Forecast and Non-Core Outlook, Drilling down into segments of demand forecast. Upstream Pipeline presentation.
TAG 2	Wednesday, November 18, 2026	Respond to TAG 1 Feedback, Distribution System Planning, Alternative Resources, Price Forecast, Avoided Costs, Current Supply Resources, Transport Issues, Carbon Impacts, Energy Efficiency, Bio-Natural Gas, Preliminary Resource Integration Results.
First Draft	Wednesday, December 16, 2026	
Comments Due	Wednesday, January 20, 2027	
TAG 3	Wednesday, February 10, 2027	Respond to TAG 2 feedback, Final Integration Results, finalization of plan components, Proposed new 2- to 4-year Action Plan
Final Draft	Friday, March 12, 2027	
Comments Due	Friday, April 9, 2027	
TAG 4 (if needed)	Wednesday, April 28, 2027	
Final Complete By	Wednesday, May 19, 2027	
File	Friday, May 21, 2027	

2027 IRP Schedule



Questions/Next Steps



Review Plans for TAG 1 Discussion

- Regional Market Outlook
- Demand and Customer Forecast
- Weather Data
- Avoided Cost
- Upstream Pipeline Presentation
- Planned Scenarios and Sensitivities
- TAG 1 is Wednesday, October 14



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