Our Low Carbon Pathway: Renewables for the Pipeline

City of Milwaukie work session- July 2022

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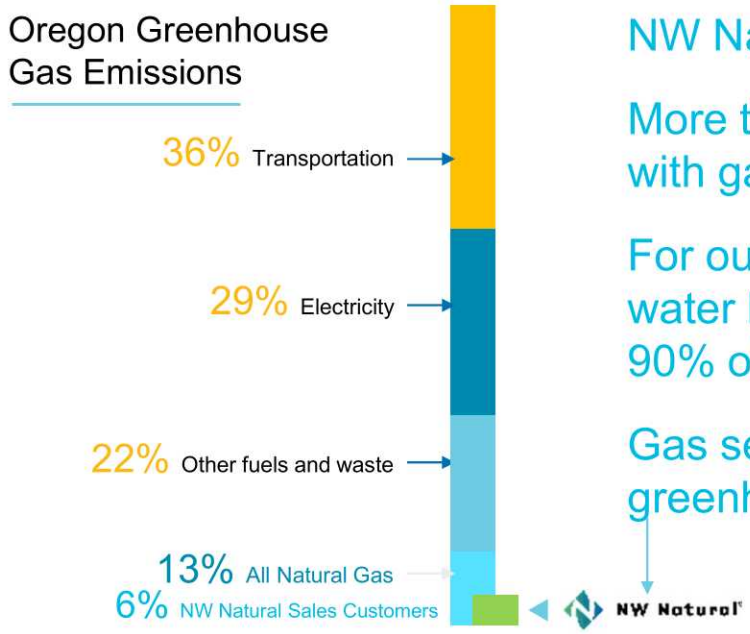
NW Natural®

ROLE OF THE SYSTEM TODAY



NW Natural provides essential energy to our region

More than 70% of residential square footage is heated with gas (in our territory where gas service is available)

For our customers who use our product for space and water heat, on the coldest days we provide as much as 90% of their energy needs

Gas service creates 6% of the current Oregon greenhouse gas emissions. (0.05% in Washington)

Source: ODEQ In-Boundary GHG Inventory 2019

A HISTORY OF LOOKING FORWARD

Manufactured gas for lighting and heat

Network expands with arrival of Northwest pipeline

- Modernized system
- Leads rate decoupling
- First carbon offset program, Smart Energy

RNG and Renewable Hydrogen to deeply decarbonize

Destination Zero:

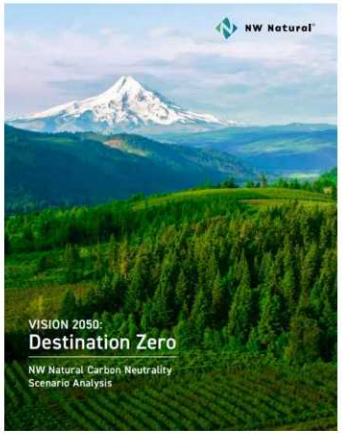
The pathway to our vision of carbon neutral

A decarbonizing network:

- Renewable Natural Gas
- Hydrogen
- Waste CO_2
- Renewable Electricity

COMMITMENT TO DECARBONIZATION

NWN's Vision 2050



- Detail released in November 2021, three scenarios to reach carbon neutrality by 2050
- Data-backed model of decarbonization options, including renewables
- Integrated Resource Plan is in process at OPUC

And More…

- DEQ Program (requiring 50% ghg reduction by 2035, 90% by 2050)
- SB 98 and SB 844 (renewable gas)
- Green tariffs
- Hydrogen hubs
- Federal policy
- Market transformation with new equipment
- Smart Energy offsets
- Carbon capture pilots
- Carbon sequestration
- ONE Future consortium

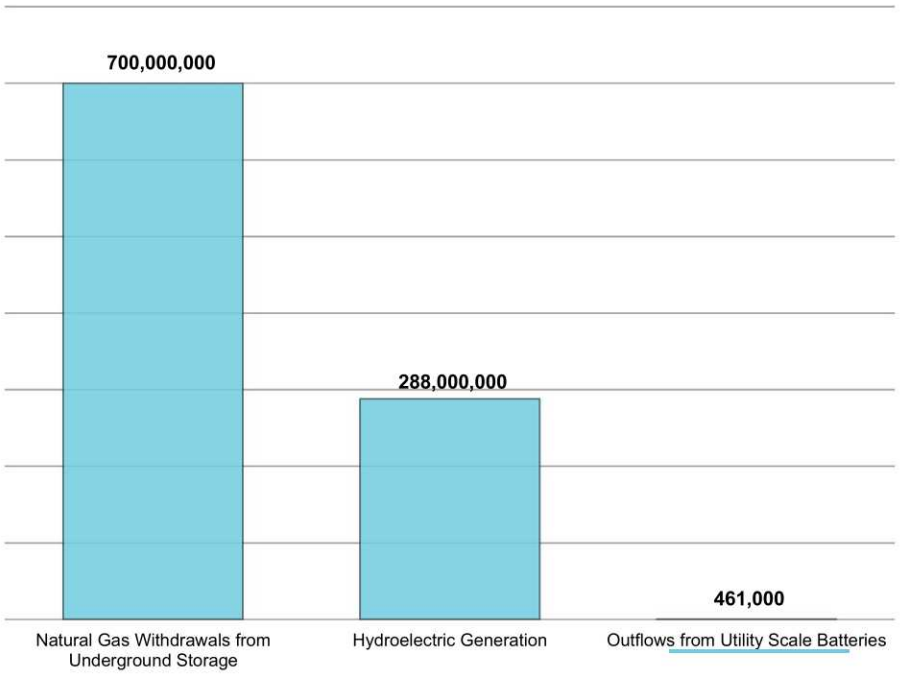
FROM WASTE TO RENEWABLES (RNG)

- Renewable natural gas is not a fossil fuel and does not add more CO_2 into the atmosphere. It's made by capturing and cleaning GHGs from landfills, food waste, farm waste, wastewater and wood waste and then using those emissions as a carbon-neutral fuel. The potential supply is vast and there's no need for new appliances or pipelines
- RNG lifecycle emissions are similar to wind and solar energy
- 487 RNG facilities are operating or under development in the North America
- NWN is currently connecting 3 RNG projects in Oregon onto our pipeline system
- NWN announced first RNG agreements totaling 3% of sales volume in Oregon (currently at 12% wind and solar nationally)

Oregon Senate Bill 98 supports volumetric RNG targets:	2025	2030	2035	2040	2045
	10%	15%	20%	25%	30%

GAS SYSTEM: LONG-DURATION STORAGE

2019 U.S. Energy Output by Facility Type (MWh)



- 2.5 times the energy of hydro facilities and about 1,500 times the energy delivered from current large-scale utility batteries
- Existing facilities can be used to store renewable natural gas and methanated hydrogen
- NW Natural's current storage can hold 6 million MWh of energy that can be delivered whenever needed
- To replicate that with a Li-ion battery, that's $2 trillion at today's prices[5]

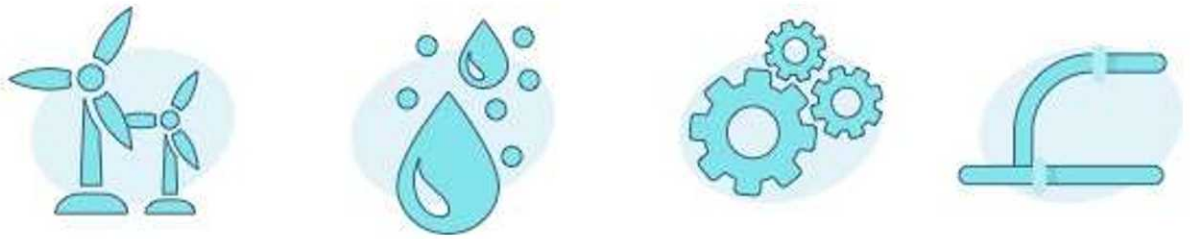
1. Source: EIA Weekly Natural Gas Storage Report - Withdrawals are calculated and aggregated from a weekly regional report. This understates the total volumes withdrawals if data was available for daily withdrawals from individual storage facility.
2. To convert natural gas volumes to MWh for comparison, this figures uses a national average heat content of 1036 btu/cf and a direct energy conversion of 0.29307 MWh/MMBtu.
3. Source: EIA 923 Form – Hydroelectric and battery generation are pulled from generator level data identified with prime movers "HY" and "BA", respectively. Net generation is aggregated for hydroelectric generators and gross generation is aggregated for batteries.
4. The figure for hydroelectric generation is the total net generation from hydroelectric facilities and does not distinguish between what can and cannot be stored.
5. https://www.nrel.gov/docs/fy19osti/73222.pdf

POWER TO GAS

Converting wind, solar, or hydro to renewable hydrogen for use in our pipeline system

- Partners with renewable electric system to solve peak capacity gap
- Renewable hydrogen blended or methanated into the *existing* pipeline system for immediate use
- Can use ***existing***, flexible and long-duration gas storage facilities
- 100+ projects in Europe, 5 in North America

Wasted power turned into useable, renewable energy



Take excess renewable electric energy

Add water (electrolysis) to create hydrogen

Blend hydrogen (or create RNG by methanating with waste carbon) into pipeline

Use now or store for the future

HYDROGEN AT NW NATURAL

2020-2021

- 5% blending at NW Natural Sherwood facility (appliance testing)
- Training Town injection
- System monitoring and evaluation
- Equipment checks
- 2022: 24/7 blending begins (summer)
- Increasing blends by 5% increments with goal of 15% by year-end
- Additional equipment testing
- Upcoming: Clean hydrogen project in Eugene with EWEB and Bonneville Environmental Foundation

NATURAL GAS + HYDROGEN BLENDING PROJECTS

UNITED STATES

CenterPoint (Minnesota)
1 MW electrolyzer, 5% blend, gas flowing

New Jersey Natural Gas
<1 MW electrolyzer, 5% blend, gas flowing

Pacific Gas & Electric (California)
Hydrogen to Infinity transmission blending study and demonstration facility

SoCal Gas (California)
Solar hydrogen home under construction

CANADA

Enbridge (Toronto)
2%, to 1,500 customers, electric grid balancing

ATCO (Edmonton)
5%, construction starting 2022 for 2,000 customers

FortisBC (Port Moody)
Pilot hydrogen production facility

UNITED KINGDOM

HyDeploy (Keele & Winlaton)
20% blending, serves more than 600 mixed-use buildings

H21 (Northern Gas Networks)
100% hydrogen network underway

The gas blending building in Mainz, Germany, home to a 6 MW electrolyzer and direct hydrogen blending into the natural gas system

RENEWABLES IN SYSTEM & IN DEVELOPMENT

MWMC RNG Project – flowing!

- Partnership between Eugene-Springfield and NW Natural
- Provides 100% methane recovery
- Will save 7,500 MT tons of CO2e annually
- Benefits local ratepayers

EWEB H2 Project

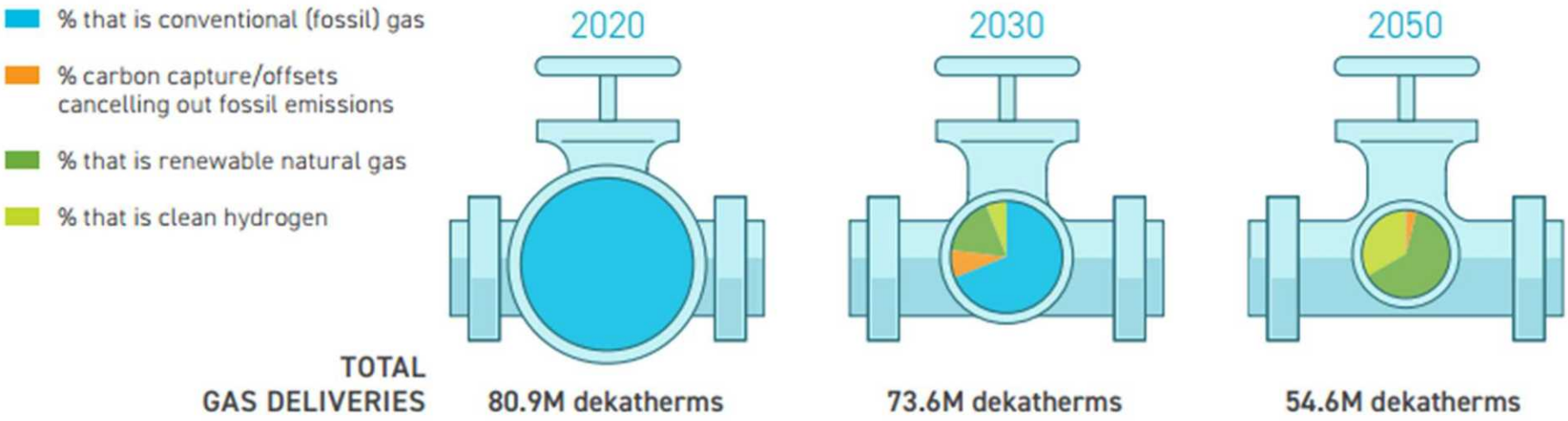
- Partnership/MOU between EWEB, BEF and NW Natural
- Clean hydrogen production relying on renewable zero-emissions excess electricity
- Plans include the potential for a facility within Eugene city limits

EWEB

VISION 2050: DESTINATION ZERO

Reducing overall consumption, increasing renewable supplies

Balanced Approach Scenario, Vision 2050: Destination Zero



SUMMARIZING OUR VIEW

We embrace the change that's needed. With the electric and gas systems working together, we can meet our shared climate goals.

We're committed to a carbon neutral pipeline by 2050
With policy support, we see no technical barrier.

No such thing as a "ban on natural gas"
Nearly half of Oregon natural gas use is for power generation, and more will be needed without coal; we'll be using it directly in our system or in less efficient power plants.

Reliability must be a part of the solution
Gas system designed for winter; with 3x the peak capacity of the electric grid and seasonal storage, gas system can also operate when the power is out.

Electric resistance: most common, costly, highest emitting.
It's about double the emissions and up to 60% more costly than gas furnaces or electric heat pumps – and it's prevalent in low-income housing.

Residents choose gas and choice.

[1]

- 70% oppose a ban on gas for new hookups
- 73% of voters agreed that families and businesses should have a choice of energy options to meet their needs
- 78% of voters believe use of renewable natural gas should be encouraged`

[1]DHM Research in NW Natural Service area, Nov. 2021.

Discussion