

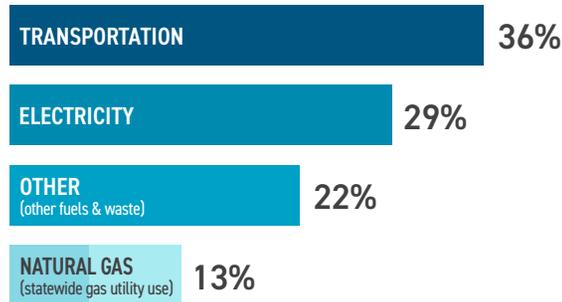
Facts and Analysis About Our Energy System

NW Natural is committed to effectively addressing climate change by actively supporting sound energy policy, informed by facts and transparent analysis in service to those that depend on us.

WE ARE PROUD OF THE ESSENTIAL SERVICE WE PROVIDE

- We serve 2.5 million people in Oregon and Southwest Washington, meeting about 90% of the energy needs for our residential space and water heat customers on the coldest winter days.
- Emissions from our residential and commercial customers account for about 6% of Oregon's total greenhouse gas emissions:

OREGON GREENHOUSE GAS EMISSIONS BY SECTOR



Does the 6% include fugitive emissions from NW Natural's system?

YES. It also includes emissions associated with our pipelines and storage facilities.²

6% NW Natural Residential and Commercial Customer Use

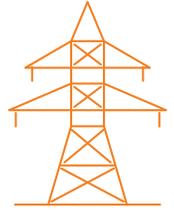
Source 1: Oregon DEQ In-Boundary GHG Inventory 2019 data.

- Our distribution system is one of the tightest, newest pipeline networks in the country.³
- We are pursuing renewable natural gas⁴ and clean hydrogen gas⁵ to drive toward a carbon neutral future.
- We delivered an Integrated Resource Plan⁶ to the Public Utility Commission that provides paths to comply with the Climate Protection Program requiring GHG emission reductions of 90% below the established baseline by 2050.

Emissions from our residential and commercial customers account for about 6% of Oregon's total greenhouse gas emissions.

ELECTRICITY DEPENDS ON FOSSIL FUELS

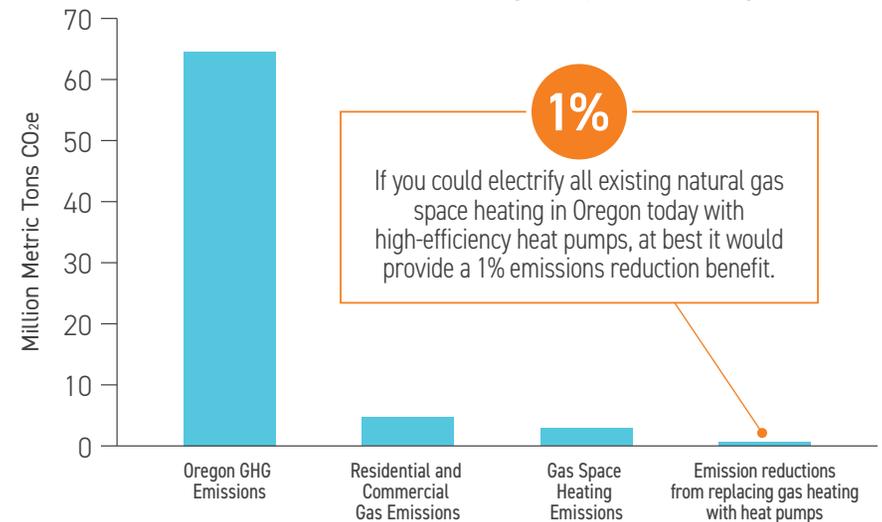
- Oregon electric utilities rely on about as much natural gas for power generation as all the natural gas utilities in the state deliver to customers.⁷
- Coal is also still used to generate Oregon electricity.⁸ As the electric system transitions off coal in the years ahead to make progress toward the 100% clean electricity by 2040 law,⁹ how much natural gas will be needed to generate power is unknown.
- For example, this past summer, in the face of yet another series of outages, California passed emergency grid reliability legislation that allows for **\$2 billion in funding for gas-fired power generation** to meet electric demand, despite California's renewable electricity mandates.¹⁰



WHAT IF OREGON REPLACED FURNACES WITH HEAT PUMPS?

NW Natural analysis for its 2022 General Rate Case showed if you electrified **all existing gas space heating** in Oregon today with high-efficiency electric heat pumps, at best it would provide a **1% emissions reduction benefit**:

Emissions Reduction Potential for Electrification of Oregon Space Heating



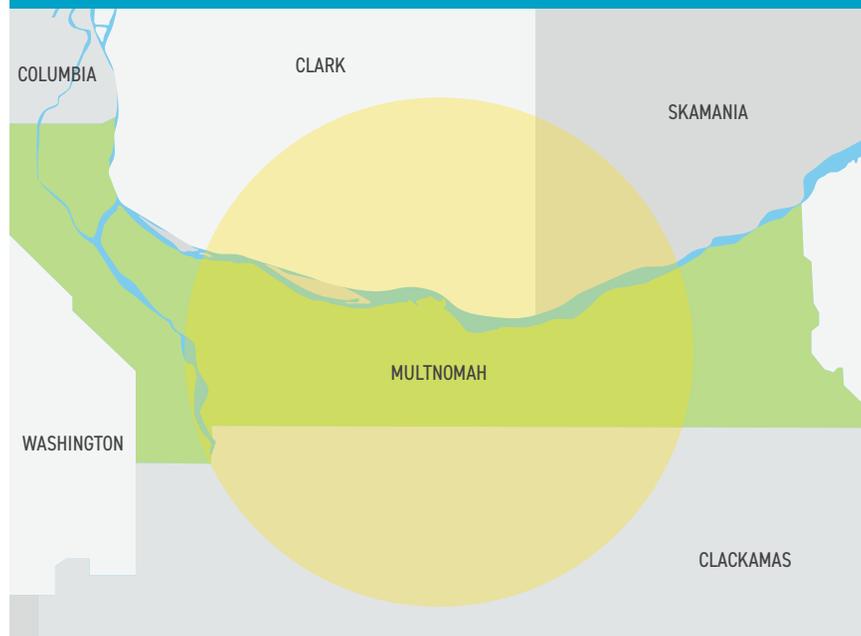
Source 11: 2022 NW Natural General Rate Case, CUB Data Request Response 73

WHAT WOULD IT TAKE TO ELECTRIFY OUR RESIDENTIAL GAS USE?

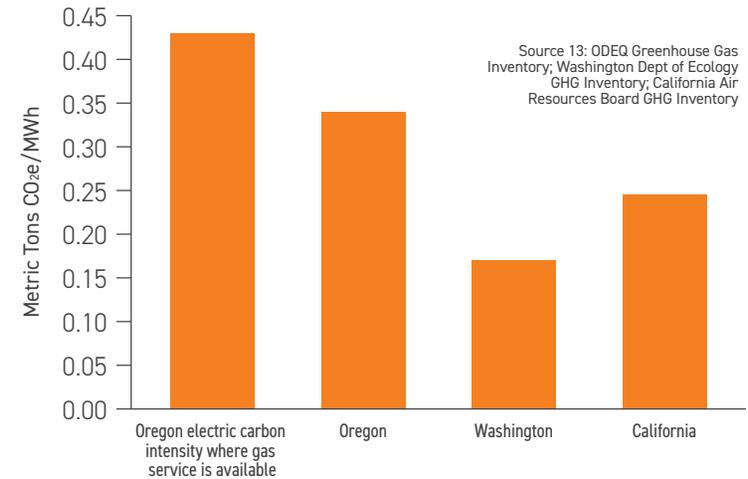
NW Natural estimated what it would take for the local electric system to serve our residential customer load for only one hour on one winter day:¹²

- On Dec. 22, 2022, from 8-9am NW Natural delivered approximately 23 million cubic feet of gas to our residential customers.
- If all those customers' gas appliances were replaced with electric appliances, it would require more than **3.4 GW of electric capacity** to provide the same amount of energy.
- Using renewable electricity to serve that gas use with 75% wind, 20% solar, and 5% battery storage would cost the local electric system approximately **\$20 billion**, according to the National Renewable Energy Lab and Berkeley National Labs capital cost estimates.

Electrifying NW Natural's residential gas use would require about 700 square miles of land to build all that new infrastructure on.



Carbon Intensity of Electric Sector by State



Oregon's electric sector is more emissions intensive where the electric and gas systems overlap.

WHAT ARE THE IMPLICATIONS OF ELECTRIFICATION?

Before electrification policies are considered, there are many critical questions that should be addressed by gas and electric utility energy system planners using actual—**not estimated or assumed**—customer usage data. This has not been done in Oregon.

For example:

- What are the emissions impacts using *actual* electric heat pump performance data in cold and peak conditions, including all supplemental heat emissions?
- What mix of renewable resources will serve all this new electric load?
- What amount of new high voltage electric transmission will be needed?
- Where will it go, who will be impacted, and how long will it take to be sited?
- What upgrades to substations and distribution lines will be required?
- What investments in new capacity at the home or neighborhood level would be needed to serve this additional heating load and transportation?
- What would be the timing of those upgrades to ensure reliability?
- How would all this new electric energy be stored?

How much will this all cost and is there a more affordable way to achieve the same climate goals?

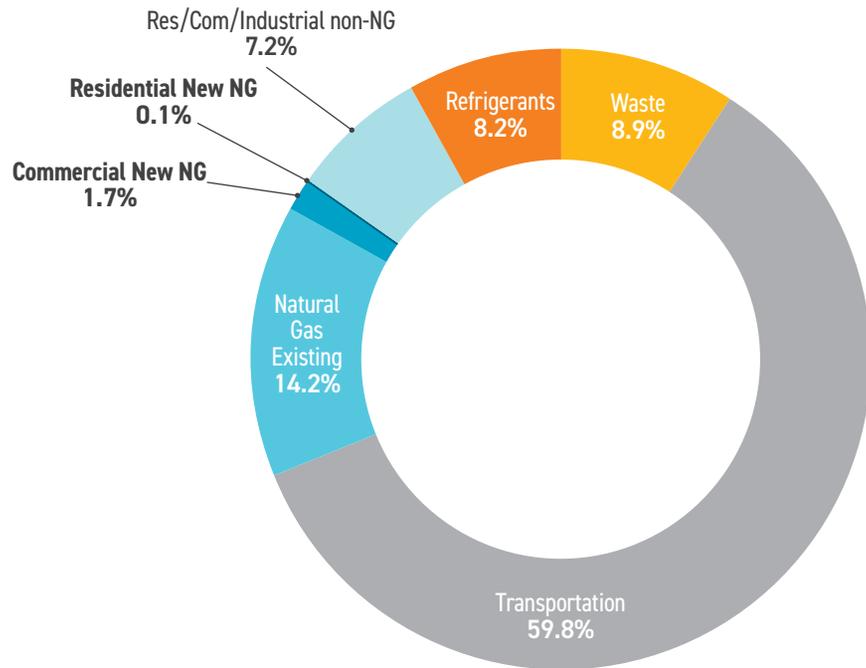
WHAT IF WE JUST ELECTRIFIED NEW CONSTRUCTION?

Assessing this kind of policy starts with the fact that all-electric homes or buildings for new construction **are not emissions free**.

While there is no statewide analysis looking at this issue, the City of Eugene and the City of Portland did their own assessments.

In July 2022, the City of Eugene disclosed [analysis](#) showing the potential benefit of banning natural gas in new construction to be a **0.1% of emission reduction for residential and 1.7% emission reduction for commercial in 2037**:

City of Eugene - New Residential & Commercial Natural Gas GHG Emissions in 2037 compared to other sources



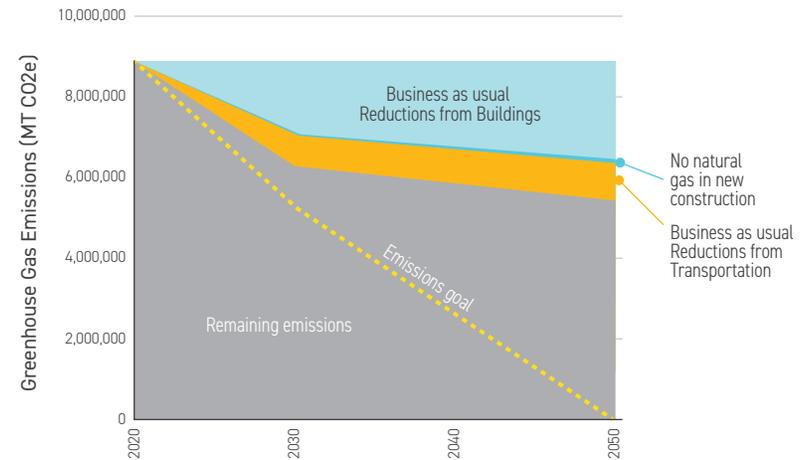
Source 14: Eugene City Council Agenda Item Summary, Follow-Up to Potential Code Changes to Require that all New Construction be Electric-Only Beginning January 1, 2023, July 25, 2022, Attachment A, page 10

Also in July 2022, the City of Portland Bureau of Planning and Sustainability published a [technical memo](#), **Portland Decarbonization Pathways Analysis**, showing a **1% emission reduction benefit by 2050 of banning natural gas in all new construction**.

An excerpt of the City's technical memo states:

*"An additional strategy to reduce emissions from natural gas is to limit the use of natural gas in new construction buildings as cities like Seattle and Berkeley have done. Because new buildings are anticipated to meet advanced building energy codes, there are less reductions available from this activity. **Removing natural gas as a heating source for new construction has the potential to reduce Multnomah County carbon emissions by about 1% by 2050 in the maximum action scenario.**"¹⁵*

Portland Decarbonization Pathways Analysis New Construction without Natural Gas



Maximum Cumulative Reductions from this strategy

2020 - 2030	401,909 MT CO ₂ e
2030 - 2050	1,633,630 MT CO ₂ e
2020 - 2050	2,035,539 MT CO ₂ e
Percent reduction 2020 - 2050	-1% of cumulative emissions

Source 14: City of Portland, Bureau of Planning and Sustainability, Portland Decarbonization Pathways Analysis Technical Memo, page 19

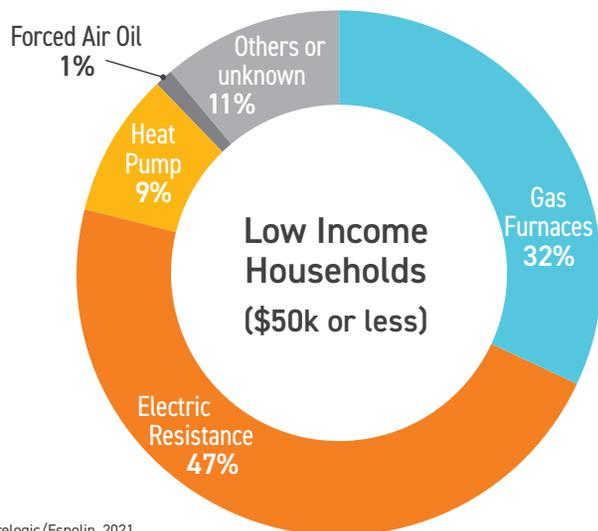
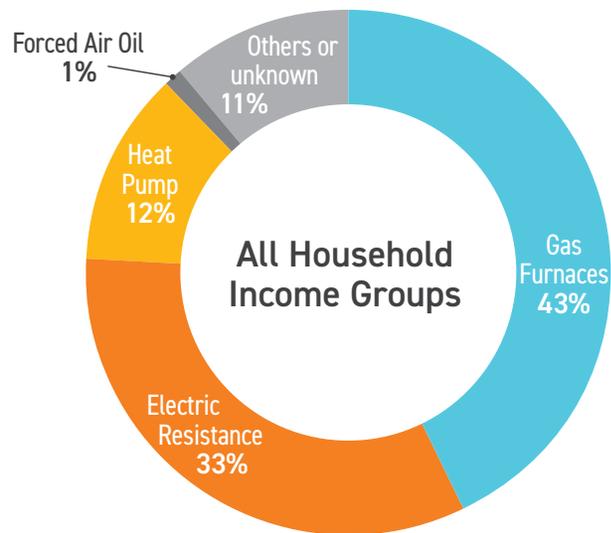


The question for policymakers: How does removing energy system diversification and choice for new communities, increasing reliability risks, and closing the door on a mix of solutions to address climate change make sense?

ISN'T ELECTRIC RESISTANCE HEAT A CLIMATE AND SOCIAL EQUITY PROBLEM?

- **Nearly half of low-income residents** in NW Natural's service area rely on electric resistance heat, which costs about twice as much to operate as a natural gas furnace and emits up to twice the amount of greenhouse gas emissions.¹⁷
- **Yet, electric resistance continues to be installed in new construction.**

Heating Types & Incomes
(Includes Single Family and Multifamily Housing)



Source 18: Corelogic/Esplin, 2021

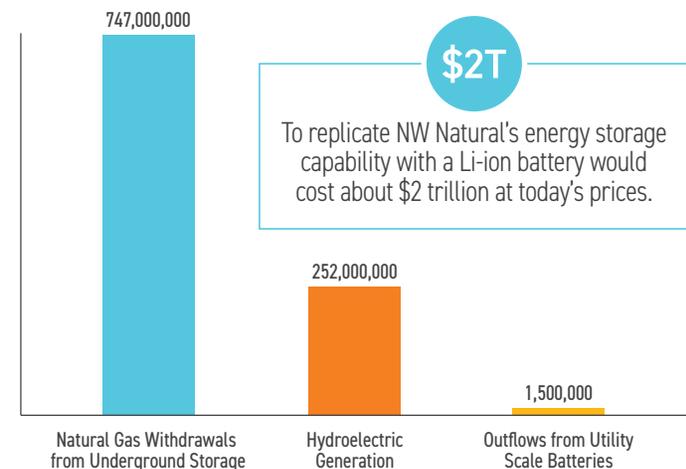
SEVERE WEATHER CAN KNOCK OUT POWER. WE NEED DIVERSIFICATION.

- No energy system is without challenges—gas or electric—which is why diversification has been a pillar of sound energy policy for decades.
- The Pacific Northwest power grid is already facing challenges—even before electrifying any existing gas space heating load or passenger vehicles.¹⁹
- New proposals intended to drive reliance on one, above ground electric system more susceptible to severe weather and wildfire risks—to serve all energy needs for homes, businesses, and passenger vehicles—creates unprecedented reliability and resiliency risks.
- Recognizing the increasing grid challenges, the White House launched a call to action for utilities across the country to provide real-time, standardized, and transparent power outage data.²⁰
- Many natural gas appliances can operate in a power outage, making access to two energy systems as important for communities going forward as it is now.

WHAT ABOUT THE ABILITY TO STORE RENEWABLE ENERGY?

The electric system does not have the ability to store energy seasonally at scale like the gas system does.

2021 US Energy Output by Facility Type (MWh)²¹



- In 2021, gas storage provided about 3x the energy of hydro facilities and about 500x the energy delivered from large-scale utility batteries.
- Existing gas storage can be used to store renewable natural gas and clean synthetic gasses.
- NW Natural's existing storage can hold 6 million MWh of energy that can be delivered whenever it's needed.

WHAT ABOUT IMPACTS OF BATTERY STORAGE?

Batteries are an important option but developing them to scale poses significant challenges.

- A special report from the **International Energy Administration's World Energy Outlook**, "The Role of Critical Minerals in Clean Energy Transitions"²² provides an overview of the environmental, geopolitical and human rights challenges related to the development of batteries:

*"Significant greenhouse gas (GHG) emissions arising from energy-intensive mining and processing activities; Environmental impacts, including biodiversity loss and social disruption due to land use change, water depletion and pollution, waste related contamination, and air pollution; Social impacts stemming from corruption and misuse of government resources, fatalities and injuries to workers and members of the public, human rights abuses including child labour and unequal impacts on women and girls."*²³

- How the emissions related to batteries will be tracked and accounted for in the context of 100% clean electric bills is unknown, but given the vast amount of battery capacity needed to support any kind of electrification drive, these emissions could be significant.
- For a socially just and effective climate strategy to be implemented, we believe these issues need to be evaluated and addressed.

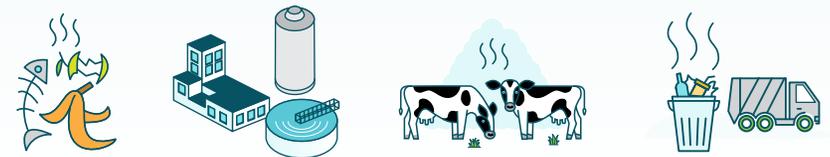
A CLOSER LOOK AT INDOOR AIR QUALITY AND GAS COOKING.

- Indoor air quality is an important issue, which is why there are government agencies responsible for its oversight. We fully support an unbiased examination of indoor air quality and cooking with gas and electric stoves by qualified experts in the relevant fields.
- Multiple studies²⁴ demonstrate that ventilation plays an important role in mitigating cooking-related pollutants that come from both gas and electric stoves. **That's why kitchen exhausts are required for all new homes in Oregon.**
- If you remove your gas stove for an electric one but don't use proper ventilation—there are still potential indoor air quality issues from cooking. Proper ventilation is needed when cooking, regardless of fuel type.

WE MUST INNOVATE AND EVOLVE TO ADDRESS CLIMATE CHANGE, LEAVING NO ONE BEHIND.

- Renewable natural gas can provide similar climate benefits to wind and solar using the existing pipeline system.²⁵
- NW Natural is pursuing renewable resources and new technologies with a goal of delivering carbon neutral energy by 2050. ([Review our report at nwnatural.com/destinationzero](https://nwnatural.com/destinationzero))
- **Do we have a lot of work ahead? Yes.** We are at the beginning stages of developing renewables for the gas system. As our nation's electric system works to increase wind and solar generation from 12% annually,²⁶ we also need to aggressively accelerate development of renewables for our pipeline networks.
- A diverse energy system—with renewable electrons delivered over wires and renewable molecules delivered underground provides a hedge against potential risks while supporting shared climate goals.

Renewable natural gas (RNG) is derived from biogas, which is produced from decomposing organic waste from landfills, agricultural waste and wastewater.²⁷ It is not a fossil fuel.



RENEWABLE NATURAL GAS

- We can capture and clean the gasses from those waste streams to deliver in our system, lowering emissions and turning the problem of waste into a powerful energy solution.
- National estimates for RNG supply show enough current potential in the U.S. to serve 95% of residential energy needs now met with natural gas.²⁸
- While RNG costs more than natural gas today, it could help lower the alternative costs and environmental impacts of new electric infrastructure.

SOURCES

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3. NW Natural 2021 Environmental, Social and Governance (ESG) Report, page 9, available at: <https://www.nwnatural.com/about-us/the-company/sustainability>
4. EPA, "An Overview of Renewable Natural Gas from Biogas," 2021, available at https://www.epa.gov/sites/default/files/2021-02/documents/lmop_rng_document.pdf, See Senate Bill 98 at <https://olis.oregonlegislature.gov/liz/2019R1/Downloads/MeasureDocuments/5B98/A-Engrossed>
5. As defined in the federal Inflation Reduction Act, the clean hydrogen emissions standard is 4kgCO₂e/kgH₂ or less
6. See <https://www.nwnatural.com/about-us/rates-and-regulations/resource-planning>
7. In 2021, Oregon's natural gas deliveries for electric power was 140.1 Bcf. Natural gas deliveries for residential, commercial and industrial sectors were 134.5 Bcf. Source: EIA annual natural gas deliveries to consumers, Oregon, 2021, available at: <https://www.eia.gov/beta/states/states/or/data/dashboard/>
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12. See <https://www.nwnatural.com/about-us/the-company/carbon-neutral-future/understanding-peak-demand-for-data-and-assumptions>
13. Electric sector emissions in the figure are from data available from the official greenhouse gas inventories in Oregon (Oregon Department of Environmental Quality (ODEQ)), Washington (Washington Department of Ecology), and California (California Air and Resource Board). Oregon electric deliveries are also sourced from ODEQ, while California and Washington electric sector deliveries are sourced from the U.S. Energy Information Administration. Per NW Natural's analysis, a weighting of 61 percent for PGE, 27 percent for PacifiCorp, and 12 percent for the average of public power in Oregon were applied to the emissions intensities of these utilities from data reported to ODEQ from the respective utilities.
14. Eugene City Council Agenda Item Summary, Follow-Up to Potential Code Changes to Require that all New Construction be Electric-Only Beginning January 1, 2023, July 25, 2022, Attachment A, page 10, available at: https://omninetworks3-s-us-west-2.amazonaws.com/sites/134/documents/cc_agenda_pack-et_7-25-22_ws_council_postpdf?dzuWhxlt...3SweK9Y_Fkh0EWSw4...#page=11; See City of Eugene City Council Work Session July 25, 2022 (W8i0W9ek8t&t=17146)
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20. See <https://www.whitehouse.gov/ostp/news-updates/2022/11/22/a-white-house-call-for-real-time-standardized-and-transparent-power-outage-data/>
21. The figure is derived from the following sources: U.S. Energy Information Administration (EIA) Weekly Natural Gas Storage Report, available at: <https://r.eia.gov/ngs/ngs.html>. Withdrawals are calculated and aggregated from a weekly regional report. This regional aggregation understates the total volume withdrawals if data was available for daily withdrawals from individual storage facilities; To convert natural gas volumes to MWh for comparison, the figures use a national average heat content of 1036 btu/cf and a direct energy conversion of 0.29307 MWh/MMBtu; EIA 923 Form available at: <https://www.eia.gov/electricity/data/eia923/>. Hydroelectric and battery generation are pulled from generator level data identified with prime moves "HY" and "BA" respectively. Net generation is aggregated for hydroelectric generators and gross generation is aggregated for batteries; The figure for hydroelectric generation is the total net generation from hydroelectric facilities and does not distinguish between what can and cannot be stored; National Renewable Energy Lab battery cost projections available at: <https://www.nrel.gov/docs/ft/y21osti/79236.pdf>
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25. Internal calculations based on Oregon Department of Environmental Quality GREET database, available at: <https://www.oregon.gov/deq/ghgp/ctp/pages/clean-fuel-pathways.aspx>; Columbia University's Center on Global Energy Policy's "Investing in the US Natural Gas Pipeline System to Support Net-Zero Targets" highlights the value "Retrofitting and otherwise improving the existing pipeline system are not a choice between natural gas and electrification or between fossil fuels and zero-carbon fuels. Rather, these investments in existing infrastructure can support a pathway toward wider storage and delivery of cleaner and increasingly low-carbon gases while lowering the overall cost of the transition and ensuring reliability across the energy system. In the same way that the electric grid allows for increasingly low-carbon electrons to be transported, the natural gas grid should be viewed as a way to enable increasingly low-carbon molecules to be transported." available at: <https://www.energypolicy.columbia.edu/publications/investing-us-natural-gas-pipeline-system-support-net-zero-targets/>
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