METHANE GAS:
HEALTH, SAFETY, & DECARBONIZATION

Setting the record straight

Eric Gay/AP

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POWER PAST FRACKED GAS

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Introduction

On May 6, 2021, the United Nations released its Global Methane Assessment and the UN Environment Programme (UNEP) director, Inger Anderson stated "Cutting methane is the strongest lever we have to slow climate change over the next 25 years...We need international cooperation to urgently reduce methane emissions as much as possible this decade."[1]

A few weeks later, the historically fossil fuel-friendly International Energy Agency issued a roadmap to net zero emissions by 2050 that recommends a rapid decline in the use of coal, oil, and gas, notably including banning the sale of new oil and gas furnaces by 2025.[2]

In truth, the only way to reach carbon emissions reduction targets at the global, national, and state level, and to improve indoor and ambient air quality for vulnerable communities, is to switch to renewable electricity wherever practically feasible (i.e. residential customers) and reserve limited biomethane and green hydrogen resources for hard-to-electrify mobile combustion uses, heavy industry, and energy storage.

In Oregon and Washington, we have seen a surge in the use of methane in direct conflict with our states' climate goals. Even as the gas industry actively undermines climate goals, expands fossil fuel infrastructure, and lobbies against climate policy, it is claiming to be working towards carbon neutrality and sustainability. While misleading green branding can have an effect on public opinion, it is of utmost importance that policy makers are able to 1) identify false expressions of environmental care as a cover for climate-damaging activities; 2) know where to find accurate data about the many impacts of the gas industry; 3) avoid undue influence by fossil fuel interests; and 4) make sound policy decisions for the health and safety of our communities in the just transition to a decarbonized economy.

For years, NW Natural and the gas industry at large have promoted methane gas as a clean, safe energy alternative. From images of happy people at home, nestled by their gas fireplaces to using the name "natural," NW Natural wants everyone to believe it is an environmentally conscious corporation you can trust. Recently, in an attempt to grow its customer base and stave off regulation of its dangerous product, NW Natural and the gas industry have ramped up their greenwashing efforts, promoting gas as a fuel that is helping Oregon and SW Washington reach their carbon emissions reduction targets.

But the science on health, safety, feasibility, economics, and climate is not on the side of NW Natural, nor any other gas corporation using similar marketing tactics. The many dangers and limitations of gas are clear. Fracked gas has become the largest contributor to global fossil fuels emissions increases. We no longer have time to entertain fossil fuel corporations' deceitful public relations campaigns or delay necessary action to benefit their shareholders.

This report is intended to counter the confusion created by NW Natural and other fossil fuel entities' purposeful misinformation campaigns targeted at elected officials and the public. Contrary to assurances made by NW Natural in the public record and in their advertising materials, this report demonstrates the following indisputable facts:

- Electrification is the lowest-cost method to decarbonize buildings, increase efficiency, and protect families and communities from the hazards presented by gas.[3,4]
- The Northwest's gas supply comes primarily from hydraulic fracturing, or "fracking," a dangerous extraction method that poses immense health and safety risks to communities living near fracking wells, harming both the climate and drinking water for millions of people.[5,6]
- Methane is a potent greenhouse gas, with up to 86 times the global warming potential of carbon dioxide.[7]
- Biomethane, commonly referred to as "renewable natural gas" (RNG), is still methane and is not a solution to the climate crisis, nor the health impacts associated with burning gas.
- Burning methane indoors generates byproducts known to be harmful to human health, including nitrogen oxides, carbon monoxide, and particulate matter. These pollutants have been shown to cause or exacerbate respiratory conditions, including asthma, in children, the elderly, those with underlying health conditions, low-income, and Black, Indigenous, People of Color (BIPOC) communities.[8]
- The dangerous health and safety impacts of gas—from extraction to compromised indoor air quality from gas stoves—fall disproportionately on low-income and BIPOC communities.[6,8]
- Each year in the US there are massive and often fatal accidents involving gas explosions. An October 2016 gas explosion in Northwest Portland injured eight people and caused $17.2 million in property damages.[9]

Given these facts, governments have a strong policy rationale for restricting new gas infrastructure and legislating a rapid and just transition toward electric and other non-greenhouse gas-emitting alternatives in new and existing buildings. Efforts must be taken to allocate resources for electrifying low-income households that cannot afford to replace gas appliances, as well as sharing information on how to mitigate the health impacts of gas stoves while the transition occurs. Renters and low-income homeowners must be protected from costs passed on to customers as NW Natural's consumer base declines, and prevented from displacement as a result of energy efficient upgrades.[10,11] Allowing disinformation to delay or prevent evidence-based decision-making will result in enormous costs to human health, higher utility bills, stranded assets, and further harm to our climate.

The undersigned 64 organizations contributed to and/or support the findings in this report to ensure that elected officials, community and business leaders, journalists, and the broader public are equipped with knowledge to safeguard our climate and the health and safety of our communities. Members of the undersigned organizations stand together to promote building electrification and counter recent misleading claims by NW Natural and others seeking to prolong and expand the use of methane gas.

This report was compiled during a time Washingtonians and Oregonians may never forget. Just days after Oregon legislators passed groundbreaking climate justice legislation, shaped and championed by grassroots environmental justice groups across the state, a heat dome settled over the Pacific Northwest claiming hundreds of lives, while desert-like winds dried out our forests. The record-setting Bootleg Fire and a dozen others followed. "Business as usual" has dire consequences and it's time to make important policy choices, including dramatically refocusing our infrastructure resources. Research supports rapid building electrification as an affordable way to help meet Oregon and Washington's carbon reduction goals and keep our communities healthy and safe.

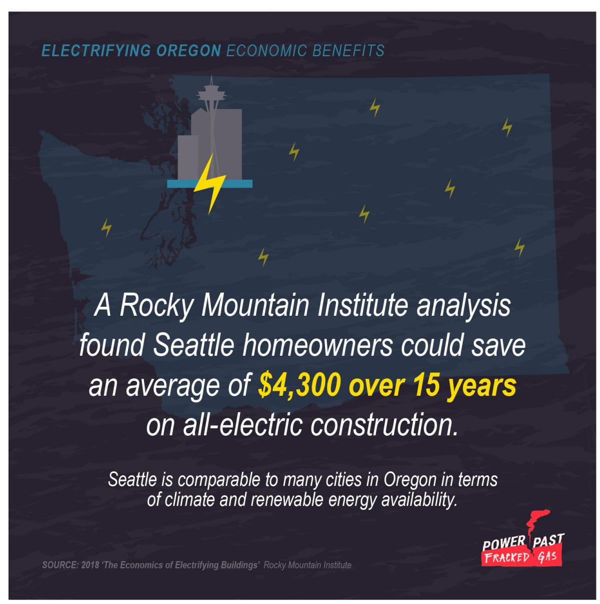
Rapid Electrification of Residential & Commercial Buildings is the Clear Path Forward

Numerous major studies examining alternative methods for meeting our climate goals all reach the same conclusion: utilizing clean electricity rather than fossil gas for heating is the most effective and lowest-cost pathway to decarbonize our built environment. Many of these studies compare multiple scenarios for building decarbonization including scenarios that assumed high use of RNG within the gas distribution system. In every case, the high building electrification scenarios were found to be a lower cost and more effective way to reduce greenhouse gas emissions. Below is a list of recent studies with key findings describing the advantages of electrification over gas for heating in buildings.

UC Davis Western Cooling Efficiency Center (April 2021), Greenhouse Gas Emission Forecasts for Electrification of Space Heating in Residential Homes in the United States
This study modeled the 15-year greenhouse gas emissions and lifecycle impacts resulting from replacing a natural gas furnace with an electric heat pump in single-family homes in various climatic regions across the US. It utilized the most sophisticated projections available for long-run marginal emissions rates for electricity in each region and included emissions from methane leakage in gas distributions systems as well as methane combustion in the home and estimates for leakage of refrigerants. Over a 15-year period, heat pumps for residential space heating were found to reduce global warming emissions by 70% to 85% compared to high efficiency gas furnaces in the Pacific region.[12]

Rocky Mountain Institute (RMI) (October 2020), All-Electric New Homes: A Win for the Climate and the Economy
RMI compared construction costs for new all-electric versus mixed fuel (fossil gas plus electric) single-family homes in seven cities. It also modeled lifetime greenhouse gas emissions for each scenario.

> "The new all-electric, single-family home has a lower net present cost than the new mixed-fuel home in every city we studied: Austin, TX; Boston, MA; Columbus, OH;



Denver, CO; Minneapolis, MN; New York City, NY; and Seattle, WA."

> "The all-electric home results in substantial carbon emissions savings over the mixed-fuel home in all cities. The greatest savings are found in Seattle (93%) and New York City (81%). Minneapolis, Columbus, Boston, and Austin all save more than 50% over the lifetime of the equipment compared with the mixed-fuel home." [3]

Sierra Club (April 2020), New Analysis: Heat Pumps Slow Climate Change in Every Corner of the Country
In this study, the Sierra Club conducted a detailed analysis of the current and future electricity grid and assessed the impact of converting homes heated by gas to electricity in every state.

> "Our analysis demonstrates that, while states with more ambitious clean energy deployment benefit the most, advanced electric appliances like heat pumps installed today will reduce greenhouse gas emissions in every state over the next 10 years of the appliance's life."
>
> "In fact, for the average house, installing electric heat pumps in place of a gas furnace and gas water heater will reduce heating emissions more than 45 percent over the next 10 years."[13]

Evolved Energy Research (December 2020), Washington State Energy Strategy Decarbonization Modeling Final Report
This research updated the Northwest Deep Decarbonization Pathways model with current cost and technology information. It examined multiple scenarios to achieve Washington State's 100% clean electricity grid target as well as its 2030, 2040, and 2050 greenhouse gas emissions reductions targets including both electrification of buildings and continued use of methane gas and decarbonized gas for heating.

> "Electrification of buildings lowers costs over retaining gas use – long-term benefits of avoiding the need for clean gas: 0.2% of GDP savings annually in Electrification case vs. Gas in Buildings case by 2050."[14]

American Council for an Energy Efficient Economy (ACEEE) (October 2020), Electrifying Space Heating in Existing Commercial Buildings: Opportunities and Challenges
ACEEE explored the greenhouse gas emission reduction opportunities and the expected payback periods for converting space heating and central boiler/chiller systems from fossil gas to electric heat pumps in commercial buildings across the United States.

> "The electrification opportunities we examined could reduce total commercial-sector site energy use in the portion of the commercial building stock we analyzed by about 37% and greenhouse gas emissions by about 44%."
>
> "Buildings with the best paybacks are more likely to be located in the southern United States and the Pacific region…"[15]

California Energy Commission, Energy Research and Development Division (April 2020), Final Project Report: The Challenge of Retail Gasin California's Low-Carbon Future

This study evaluated scenarios that achieved an 80% reduction in California's greenhouse gas emissions by 2050 from 1990 levels, focusing on the implications of achieving these climate goals for gas customers and the gas system.

> "In all the long-term GHG reduction scenarios evaluated here, electrification of buildings, and particularly the use of electric heat pumps for space and water heating, leads to lower energy bills for customers over the long term than the use of renewable natural gas. Likewise, building electrification lowers the total societal cost of meeting California's long-term climate goals."
>
> "Building electrification is found to improve outdoor air quality and public health outcomes..."[4]

Energy and Environmental Economics (E3) (April 2019), Residential Building Electrification in California

This study evaluated the consumer economics, greenhouse gas savings, and grid-impacts of electrification in residential low-rise buildings across six representative home types in six climate zones in California. Consumer economics were evaluated in three ways, by comparing: 1) upfront installed capital costs, 2) energy bills, and 3) lifecycle savings between gas-fired and electric technologies.

> "Electrification is found to reduce total greenhouse gas emissions in single family homes by ~30% - 60% in 2020, relative to a natural gas-fueled home. As the carbon intensity of the grid decreases over time, these savings are estimated to increase to ~80% - 90% by 2050, including the impacts of upstream methane leakage and refrigerant gas leakage from air conditioners and heat pumps."
>
> "All-electric new construction is expected to be lower cost than gas-fueled new construction homes in homes that have air conditioning, resulting in lifecycle savings of $130 - $540/year. These findings are based on commonly available technology, without incentives or intervening policies."
>
> "87% of the simulated single family retrofit homes (all of which are assumed to have air conditioning) see lifecycle savings from switching from a gas furnace and air conditioner to an electric heat pump HVAC system".[16]

Synapse Energy Economics Inc. (October 2018), Decarbonization of Heating Energy Use in California Buildings

This report focused on electrification as one of the major pathways for building decarbonization in California.

> "Renewable gas produced from decay of wastes in sources like landfills or digesters, and other bio-energy and synthetic options for zero- or low-emission combustible fuels, are important

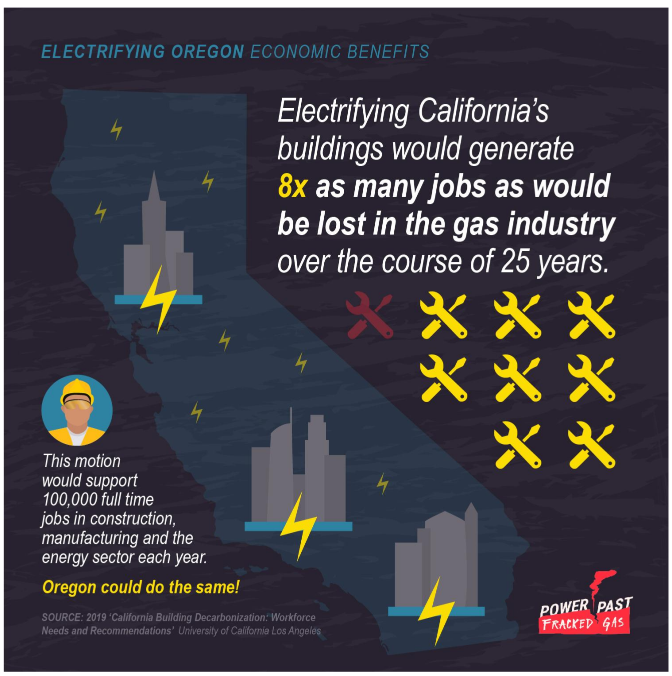
parts of a cost-effective solution to California's climate challenges. Their contribution comes in part through the need to capture methane from biogenic sources such as dairies and landfills. However, their limited availability and high cost limit them to be a piece of the solution, not a wholesale alternative to large-scale electrification of the building sector."

"Residents that choose electric space heating, water heating, or all-electric homes will substantially reduce the GHG emissions from their energy use, and that reduction will increase over time as California's electric grid decarbonizes".[17]

UCLA Luskin Center for Innovation (November 2019), California Building Decarbonization Workforce Needs and Recommendations

This study estimated the potential employment impacts of electrifying buildings to achieve California's climate goals.

"In total, building electrification in California could support an average of 64,200 - 104,100 [additional] jobs annually, after accounting for losses in the gas industry".[18]



Cumulatively, these reports leave no doubt that electrification is a superior and more cost-effective solution for building decarbonization across the US and specifically in the Pacific Northwest. Further expansion of methane gas infrastructure is inconsistent with these findings and, in fact, it is essential for our region to consider strategies for scaling back existing gas infrastructure, in a way that supports our most vulnerable neighbors.

It is critical that this transition is just and equitable, leaving no one behind. As the use of gas declines and NW Natural's customer base shrinks, without a well-planned transition, costs may shift to remaining customers.[10] Low-income households—who are least able to afford increased rates—must not be left to shoulder these higher costs. Cities such as Portland and Seattle have implemented green building and sustainability projects that have not only failed to benefit all residents but have resulted in gentrification and displacement, undermining the success of these efforts.[19, 20] To ensure that the wide array of benefits of electrification extend to all residents, a just transition must encompass housing stability and anti-displacement, and center the leadership of people with low incomes, BIPOC, and renters.[21,22]

Methane Gas – Trying to Stay Relevant in a Decarbonizing World

The Northwest's Gas Supply Comes Primarily from Fracking

The majority of the Northwest's methane gas supply comes from the extraction process of hydraulic fracturing, or "fracking," explaining why many people in the region use the term "fracked gas" as a more accurate name than "natural gas." Fracked gas is a fossil fuel with tremendous health, safety, climate, and economic impacts. The process of fracking has led to earthquakes and puts drinking water at risk. Fracking causes economic losses and human suffering through toxic contamination of air, land, and water; human-caused and natural disasters; displacement of economic activities such as fishing, recreation, and tourism; desecration of culturally and historically significant sites; loss of habitat and despoliation of the environment; and dramatic increases to greenhouse gas emissions in our energy supply. All of these deleterious effects are associated directly or indirectly with increased sickness and death in affected communities.[6] These impacts disproportionately affect Black, Indigenous, People of Color, rural, and low-income communities, as documented by the Concerned Health Professionals of New York and Physicians for Social Responsibility:

> "Studies consistently show that Black, Indigenous, Hispanic, rural, and impoverished white communities bear the brunt of exposures to toxic waste and fossil fuel-derived air pollution. These patterns extend to fracking and its infrastructure. In multiple regions where fracking is practiced, well pads and associated infrastructure are disproportionately sited in non-white, indigenous, or low-income communities. A 2019 analysis of socio-demographic characteristics of people living close to drilling and fracking operations in the states of Colorado, Oklahoma, Pennsylvania, and Texas found strong evidence that minorities, especially African Americans, disproportionately live near fracking wells."[6]

"Renewable Natural Gas," or RNG, usually refers to methane captured in landfills, large animal farms, and other methane-generating facilities. Hydrogen is sometimes produced using fracked gas, and it can be produced using other sources as well. As we describe in detail below, according to reports from Oregon, Washington, and industry observers, fracked gas will remain the dominant source of methane gas in our system for the foreseeable future. RNG will likely comprise only a small portion of our region's overall gas supply, possibly one-fifth in a best-case scenario.[23] Recent Energy Information Administration data indicate that roughly two-thirds of the Northwest region's gas comes from fracking, and the proportion is likely to increase over time as fracking wells replace conventionally produced gas in the market.[5] Accordingly, most of the gas we use in Oregon and Southwest Washington will continue to be sourced from fracking until we transition away from the use of gas entirely.

When state and local governing bodies incentivize gas infrastructure expansion or offer special treatment to this form of polluting fossil energy, they are investing in or "locking in" a carbon-based energy system that delays inevitable and essential renewable energy upgrades.[24] Projects that lock in gas infrastructure are also locking in all the water and air pollution created by the fracked gas production and transmission process. Research from the Green Energy Institute and other experts shows that locking in fracked gas poses a tremendous risk to decarbonization efforts. Ultimately, quitting fracked gas and methane will be essential to a clean energy transition.[25]

Gas System Leaks Make Fracked Gas Carbon Impacts Similar to Coal

Until recently, the carbon emissions from producing and burning methane gas have been considered to be lower than emissions from burning coal. More and more research into the true extent of methane leaks from production, transmission, distribution, gas meters, and even the final stage of use in homes and buildings, has shown that leakage is much higher than previously thought and higher than the US EPA has reported.

Since unburned methane has a dramatically higher impact on global warming than burned methane, even a small increase in unburned methane due to distribution leakage significantly increases the carbon intensity of fossil gas. A recent report called The Gas Index[26] compiled data from multiple studies measuring gas system leakage in 71 cities across the US and leakage data from major production sites within the US. While the EPA estimates system leakage to be less than 2%, the study concludes that leakage rates for commercial and residential applications are more than twice that estimate. Leakage from the residential and commercial gas system in Portland, Oregon, was found to be nearly 3 times higher than the EPA estimates, and far higher than the national average despite the claim by NW Natural to have "one of the tightest, lowest emitting systems in the nation."[27]

Scientists estimate that a gas system that leaks unburned methane at rates higher than 2.7% will have the same global warming impact as burning coal.[28] The Gas Index reports that national leakage rates for residential and commercial gas systems average over 4%. In Portland, Oregon, the leakage rate is reported at over 5.5%. These leakage rates mean that burning fossil gas to heat homes and buildings in Oregon is as bad as or potentially worse than burning coal.[26]

“Renewable Natural Gas” and Green Hydrogen are Not Viable Replacements for Gas in Buildings

Background on “Renewable Natural Gas" and Green Hydrogen

Renewable natural gas (RNG) and green hydrogen are often held up by the fossil gas industry as green fuels that will one day replace the gas used in homes, buildings, and transportation across the US. While most experts agree that green hydrogen and RNG have a role in achieving full decarbonization — particularly in hard-to-decarbonize sectors — the use of gas in homes and buildings is not one of those applications. Exaggerating the potential of these fuels is a political strategy employed by the gas industry to allow for the continued expansion of gas infrastructure, muddying the water on electrification and greenwashing the industry’s anti-environmental lobbying efforts.

Renewable Natural Gas Cannot Meet Energy Demand and is not Cost-effective

The gas industry is actively developing RNG projects using agricultural and other forms of waste, but the potential of this technology is extremely limited. A 2018 Oregon Department of Energy Renewable Natural Gas Inventory report to the Oregon legislature found that in the best-case scenario, RNG could only replace about one fifth of the state’s current gas demand and even that amount is largely dependent on technology that is not currently operational in the US. Studies conducted in Washington[29] and California[30] have come to similar conclusions. Limited availability alone makes RNG infeasible as a replacement for current fracked gas consumption.

Despite the Oregon Department of Energy’s conclusion that RNG is not a viable replacement for methane gas, the 2018 report[23] is often cited by NW Natural. This study found that, *theoretically*, RNG has the potential to generate 22.1% of Oregon’s 2018 natural gas use via anaerobic digestion (4.6%) and thermal gasification (17.5%).

However, to achieve this output, significant logistical, economic, and technological barriers would need to be overcome. Barriers for generating methane through anaerobic digestion at manure lagoons, landfills, or sewage treatment plants, etc. include the distance of agricultural operations from pipe infrastructure, high costs, and a lack of guaranteed supply. In addition, incentives to utilize some of these sources could lead to perverse outcomes, such as favoring soil-depleting industrial agriculture or causing food waste to be sent to landfills instead of compost facilities. The process of "thermal gasification" entails using energy to turn agriculture and commercial forest harvest residues into methane but, currently, there are no commercial thermal gasification plants in the US. The report states, "Once technical obstacles are overcome, thermal gasification could produce about 17.5% of annual natural gas use." In other words, the vast majority (nearly 80%) of the potential for RNG in Oregon relies on technology that, according to the Oregon Department of Energy, is not commercially available and would require significant research efforts to "bring down the cost of conversion."[23]

NW Natural has misrepresented the top-line findings of this report by asserting that RNG has the real potential to replace all current residential gas consumption (which makes up a little less than 20% of all methane used in Oregon). Even an industry-influenced study by the international management consultant firm ICF found that, nationally, RNG could meet at most 16% of current gas demand.[31] Furthermore, most authorities agree that our limited RNG resources should not be wasted on residential use, which can be easily and cost-effectively electrified.[32]

Instead, the limited quantities of RNG that can be produced must be saved for hard-to-electrify sectors, such as marine, aviation, and industry. A Rocky Mountain Institute report emphasized that allocating RNG to homes and buildings would be a grievous misuse of a resource that could be critical in decarbonizing heavy industry.[33] Wise allocation of RNG is essential if Oregon is to achieve economy-wide emissions reductions in line with a trajectory to limit warming to 1.5°C or even 2°C.

Even if the fundamental issue of RNG availability were solved, renewable natural gas is very expensive to produce. As the Sightline Institute reported in March 2021,

> "Today, a million BTUs (MMBTU) of natural gas costs $3.67. According to a 2019 study prepared for the American Gas Foundation, about 44 percent of prospective RNG projects can be developed at a cost of $7 to $20 per MMBTU, with a median cost among those of approximately $18. The remaining 56 percent of potential projects exceed $20 per MMBTU. Many of the lowest-cost RNG projects (those developed from waste streams that are large, centrally contained, and conveniently located near existing pipelines) have for the most part already been developed. What remains are the costlier projects: smaller facilities farther away from pipelines, and biomass that is dispersed and therefore costly to gather and process".[34]

Green Hydrogen is Incompatible with Existing Gas Pipelines

Contrary to what the gas industry states, green hydrogen is also not the answer. Producing hydrogen is expensive and energy intensive.[35] While green hydrogen does have potential applications as a means to store renewable energy, it cannot be transported through existing gas lines in meaningful quantities. According to a report from the National Renewable Energy Laboratory, hydrogen can only be added to natural gas at 5-15% before it becomes incompatible with existing gas infrastructure, weakening pipeline integrity.[36] According to the US Department of Energy's Hydrogen Program Plan, additional research and development is needed to address issues such as mixing requirements, materials issues, nitrogen oxides (NO_x) emissions, and other combustion-related phenomena.[37]

While burning hydrogen does not produce greenhouse gas emissions, the combustion of green hydrogen in buildings emits NOx,[35] exacerbating many of the indoor air quality threats currently posed by gas use in buildings, as discussed in the following section. These emissions also pollute air and water, and negatively impact human health.[38,39] Pollution concerns specifically connected to green hydrogen were reported by the Union of Concerned Scientists in December 2020,

> "When hydrogen is combusted (as opposed to being used in a fuel cell), it can generate significant NO_x emissions, commensurate with that of natural gas combustion—or worse. While hydrogen can be carbon-free, an oft-overlooked fact is that unless dedicated NOx-mitigation research is advanced and combustion improvements made, hydrogen combustion may not be pollution free, unacceptably risking a further perpetuation of pollution harms."[35]

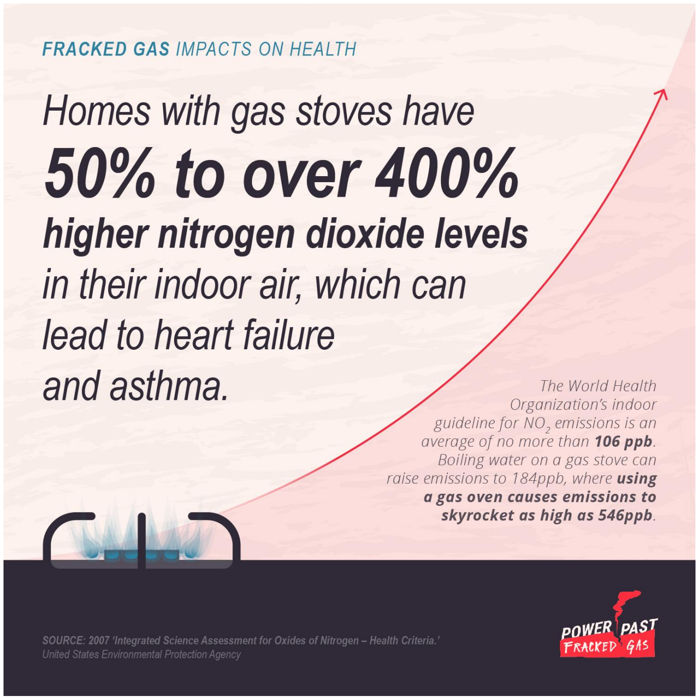
For these reasons, mixing hydrogen into existing methane distribution lines is not a practical, cost-effective, or safe solution to building decarbonization.

Methane Significantly Impacts Health and Indoor Air Quality

Methane Appliances Cause Hazardous Indoor Air Quality, Impacting Public Health and Perpetuating Environmental Injustice

While NW Natural denies that natural gas appliances cause hazardous indoor air quality, it is an accepted fact that the combustion of fossil fuels, including gas, emits pollutants including nitrogen oxides, carbon monoxide, and particulate matter into both indoor and outdoor air. Two comprehensive reviews, one conducted jointly by Physicians for Social Responsibility, the Rocky Mountain Institute, Mothers Out Front, and the Sierra Club and the other by researchers at the UCLA Fielding School of Public Health analyzed peer reviewed studies concluding that the pollutants emitted by gas burning stoves and ovens in residential homes are, in fact, harmful to health, especially the health of children, the elderly, those with underlying health conditions, and vulnerable minority and low income communities.[8, 40]

Both the World Health Organization and the Canadian government have established indoor air pollution standards. Despite the fact that most Americans spend at least 90% of their time indoors, the US has not set similar standards.[8] Research on indoor air pollution shows that concentrations of many pollutants in homes and buildings are often higher than outdoor air pollutants.[8, 41]



Cooking food itself produces certain air pollutants, especially particulate matter. Combustion of gas from stoves and ovens produces additional NO_x and carbon monoxide. Average nitrogen dioxide (NO_2) levels are approximately 50% to over 400% higher in homes with gas rather than electric cookstoves,[42] especially where individuals live in smaller homes and cook for longer periods of time. In addition, poorly maintained gas stoves are more likely to emit elevated levels of carbon monoxide.[8]

In many instances, the short- and long-term NO_2 levels in homes with gas stoves exceed outdoor EPA air quality limits, which, in turn are higher and less stringent than the indoor air quality guidelines issued by the World Health Organization and Health Canada (as stated above, there are no indoor guidelines issued by the US EPA).[41] In other words – cooking with gas can lead to levels of indoor air pollution, which, if outdoors, would exceed legal limits.

Numerous Scientific Studies Confirm the Negative Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health

In its communications with policy makers, NW Natural dismisses the UCLA report entitled "The Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health"[40] because they said "it collected no new information."[43] However, a literature review is not only a commonly-accepted scientific publication, it is recognized as an extremely valuable resource. This particular report reviewed data from more than 300 publications and government reports as well as conducting its own analyses to draw its conclusions.[40]

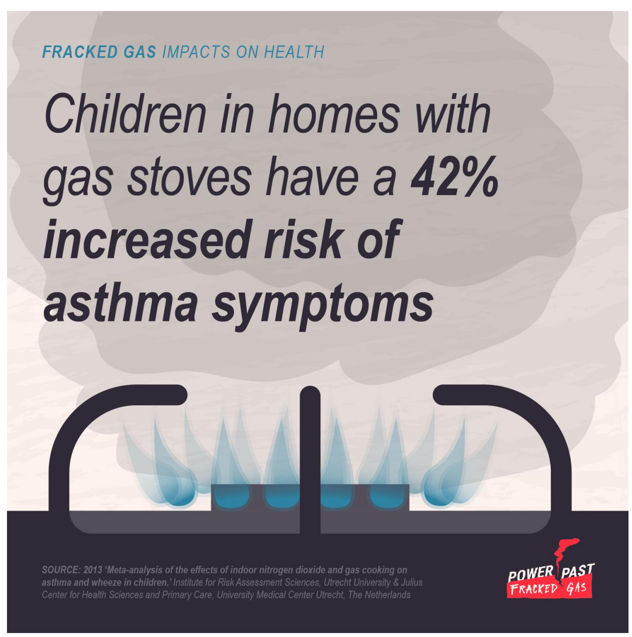
NW Natural quoted a line from the UCLA study out of context, implying that the authors' statement about "data paucity" somehow made their conclusions invalid. However, with regard to data limitations, the authors stated, "particularly for conducting future quantitative analyses with regard to equity, the development of additional, publicly available databases to include more detailed and higher spatial resolution data would be a significant asset."[40] In other words, the authors were challenging entities to collect higher quality data to enable further analyses of equity factors related to gas appliances and air quality.

NW Natural also stated that the UCLA study "focused primarily on misuse of equipment or improper ventilation, issues not generally relevant in today's homes. Current Oregon mechanical code requires vent hoods that exhaust to the outdoors for all cooktops, ranges and stoves – electric or gas."[43] In truth, misuse of equipment and improper ventilation is a minor part of the UCLA report; it provides data from California confirming the health impacts of elevated pollutants from gas appliances (CO, NO_2 and NO_x), and the disproportionate impact on vulnerable populations. It also uses an equity lens to qualitatively assess the vulnerability of specific populations' exposure to indoor air pollution from gas appliance usage.[40]

Furthermore, while it is true that Oregon's current mechanical code requires vent hoods for all cooktops, ranges, and stoves, this doesn't mean that homes in Oregon are properly ventilated. 54% of homes in Oregon were built before 1978 and may or may not comply with code.[44] A study of 1,000 California homes describes real-world hood configurations that impact efficacy. Only 17% of homes cooking with natural gas had hoods that covered all burners.[45] Not all range hoods are equally effective, as performance varies with installation location and duct route, and many are not as effective as advertised.[46] In addition, the UCLA study notes that fewer than 35-54% of households actually use their range hoods while cooking.[40]

NW Natural's statements imply that the combustion of gas indoors is not harmful as long as it is properly ventilated. Even if buildings are vented and functioning exactly as designed, pollutants are still being emitted indoors and out. In fact, a recent Harvard T. H. Chan School of Public Health study estimates that 3,000-4,200 people died as a result of health impacts from residential gas use in 2017 alone.[47] Based on this study, in Oregon burning fossil fuels in buildings was responsible for 20 premature deaths and over $2 billion in health costs in 2017, of which 89% were from the combustion of gas. This is a conservative estimate because it only includes the health impacts from outdoor PM 2.5 pollution.

NW Natural bases its claim that "gas does not cause hazardous indoor air quality" on a single 2013 study by Wong et al. which found no association between gas cook stoves and asthma in children.[48] However, this study is not a good model to examine the safety of cooking with methane. The study was actually designed to investigate whether cooking with open fires, burning wood, and other biomass products was associated with asthma in children. In addition, the study had methodological issues in that participants may have inadvertently misclassified their cooking fuel (i.e. liquefied petroleum gas vs. methane), which reduces the power of this study to find any ill effects.



In contrast to this single study, a 2013 meta-analysis by Lin et al., published in the *International Journal of Epidemiology*, analyzed data from 41 studies.[49] The goal of this meta-analysis was to update a

1992, 11-study meta-analysis by Hasselblad et al. which concluded that children exposed to a long-term increase of 15 ppb NO_2 indoors suffer a 20% increase in respiratory illness risk.[50] This early quantitative analysis became a benchmark study for the relationship between indoor NO_2 and respiratory illness in children, and an important reference for the outdoor NO_2 Air Quality Guideline value established by the World Health Organization (WHO) in 1997 and confirmed in 2005. Lin et al.'s findings supported those of the earlier study:

> "Our meta-analyses suggest that children living in a home with gas cooking have a 42% increased risk of having current asthma, a 24% increased risk of lifetime asthma and an overall 32% increased risk of having current and lifetime asthma; per 15 ppb increase in indoor NO_2 level, children have a 15% increased risk of having current wheeze. In summary, this meta-analysis provides quantitative evidence that gas cooking increases the risk of asthma in children, and indoor NO_2 increases the risk of current wheeze in children."[49]

In a 2013 study in *Epidemiology* entitled, "Household Levels of Nitrogen Dioxide and Pediatric Asthma Severity," Belanger et al. concluded that "Asthmatic children exposed to NO_2 indoors, at levels well below the U.S. Environmental Protection Agency outdoor standard (53 ppb), are at risk for increased asthma morbidity."[51] Risks are not confined to children in the inner city, but also occur at NO_2 concentrations common in urban and suburban homes. The study, involving more than 1,342 patients, found that:

> "Every 5-fold increase in NO2 exposure above a threshold of 6 ppb was associated with a dose-dependent increase in risk of higher asthma severity score (odds ratio = 1.37 [95% confidence interval = 1.01–1.89]), wheeze (1.49 [1.09–2.03]), night symptoms (1.52 [1.16–2.00]), and rescue medication use (1.78 [1.33–2.38])."[51]

These studies clearly link the ordinary use of gas stoves with harm to human health, especially children. NW Natural's casual dismissal of scientific research shows a callous indifference to the well-being of its customers.

NW Natural's Claim that Gas Cooking is Safe Relies on Outdated and Irrelevant Reports

NW Natural has stated that: "Neither the U.S. Consumer Product Safety Commission (CPSC), the U.S. Environmental Protection Agency (EPA) nor the Federal Interagency Committee on Indoor [Air] Quality identify gas-fired cooking appliances as having a significant negative effect on indoor air quality."[43] In support of this statement, they reference an undated EPA publication with latest reference from 1993 entitled "Indoor Air Pollution: An Introduction for Health Professionals."[52] In contrast to NW Natural's claims, this EPA publication actually identifies significant impacts of common gas stove pollutants such as nitrogen dioxide (NO_2), carbon monoxide (CO), and sulfur dioxide (SO_2) on respiratory health. For instance, the section on NO_2 states the following:

> "Recent studies indicate that low-level $N0_2$ exposure may cause increased bronchial reactivity in some asthmatics, decreased lung function in patients with chronic obstructive pulmonary disease, and an increased risk of respiratory infections, especially in young children."[52]

While indoor air pollution research has come a long way in the nearly 30 years since that EPA report was published, the American Lung Association still lists the following range of harmful pulmonary effects caused by NO_2 emissions from indoor combustion:[53]

- Increased inflammation of the airways;
- Worsened cough and wheezing;
- Reduced lung function;
- Increased asthma attacks; and
- Greater likelihood of emergency department and hospital admissions.

The EPA publication also discussed the role of carbon monoxide as an asphyxiant (i.e. can cause death due to lack of oxygen):

> "The elderly, the fetus, and persons with cardiovascular and pulmonary diseases are particularly sensitive to elevated CO levels. Tissues with the highest oxygen needs -- myocardium, brain, and exercising muscle -- are the first affected. Studies involving controlled exposure have also shown that CO exposure shortens time to the onset of angina in exercising individuals with ischemic heart disease and decreases exercise tolerance in those with chronic obstructive pulmonary disease (COPD)."[52]

In a section entitled "Health problems caused by other combustion products (stoves, space heaters, furnaces, fireplaces)," the EPA report lists the following signs and symptoms:

- Dizziness or headache;
- Confusion;
- Nausea/emesis;
- Fatigue;
- Tachycardia;
- Eye and upper respiratory tract irritation;
- Wheezing/bronchial constriction;
- Persistent cough;
- Elevated blood carboxyhemoglobin levels; and
- Increased frequency of angina in persons with coronary heart disease.[52]

NW Natural's statement that gas-fired cooking appliances "do not have a significant negative effect on indoor air quality"[43] is not supported by the publication they cite. As explained above, the EPA publication[52] actually *confirms* the harmful health effects of gas appliances.

Exposure to Indoor Air Pollution from Burning Methane is an Issue of Health and Environmental Justice

In their 2018 Climate Change and Health Report, the Oregon Health Authority concluded that the "communities more affected by air pollution are communities of color and low-income households, who already bear a disproportionate burden of disease in Oregon."[54] These communities include people with existing illnesses, people with disabilities, older adults, mothers, infants and children, indigenous peoples, immigrants, refugees, linguistically isolated, and communities of color. The connection between exposure to air pollution and the increased risk of heart disease, stroke, respiratory disease, and cancer – four of the top five leading causes of death in Oregon – is well established, as is air pollution's disproportionate effect on communities of color and low-income communities.

According to a 2017 report jointly published by the NAACP and Clean Air Task Force:

> "More than 1 million African Americans live within a half mile of existing natural gas facilities and the number is growing every year. As a result, many African American communities face an elevated risk of cancer due to air toxics emissions from natural gas development: over 1 million African Americans live in counties that face a cancer risk above EPA's level of concern from toxics emitted by natural gas facilities."[55]

COVID-19 death rates have also been associated with fossil-fuel air pollutants, including PM 2.5, NO_2 , ozone, and formaldehyde.[56,57,58] These rates are 49% higher in places with a high Black population.[55]

Low-income and Black, Indigenous, and People of Color (BIPOC) communities are at much greater risk of harm from indoor pollution caused by gas stoves and ovens. Members of these communities are disproportionately renters and have no control over the quality of, or fuel used in their appliances, which are often older, poorly maintained, and not adequately ventilated. Frequently, people in these communities occupy smaller living spaces and experience overcrowding, resulting in increased use of appliances and the potential for increased concentrations of indoor pollutants. Finally, individuals have greater exposure to the products of gas combustion when they use gas ovens for home heating.[8] In Multnomah County, there is a strong correlation between air pollution and asthma, with the highest rates in low-income and BIPOC communities.[59,60] The average rate of asthma is 11% in Oregon and 10% in Multnomah County but is much higher (>14%) among those who earn less than $20,000 per year or who are on the Oregon Health Plan.[61]

The impacts of our methane use are not just experienced locally. Frontline communities (those living adjacent to any part of the fracked gas extraction cycle) experience increased exposure to contaminated air, water, and soils. The process of methane extraction itself causes increased illnesses in nearby communities and contaminates surface and groundwater. Transportation of methane gas through pipelines, and burning it as fuel increases emissions of methane, and exacerbates climate disruption, with the worst health and economic impacts borne by frontline communities.[62] Our use of gas in

Oregon puts all communities that are located adjacent to extraction, processing, and transportation sites at greater risk.

Creating an equitable energy future depends on much more than switching fuels. The Emerald Cities Collaborative[63] and The Greenlining Institute[64] offer valuable resources that lay out key questions and steps to use when planning and implementing electrification. These tools help to grow energy democracy, center human rights, and ensure that low income and BIPOC people, neighborhoods, and communities are not further disenfranchised in terms of health, jobs, housing, energy costs, and political power.

Methane Gas is a Threat to Public Safety

Transporting Gas in Any Form is Dangerous

NW Natural states that, according to the US Department of Transportation, pipelines are the safest form of methane gas transportation.[43] NW Natural argues that methane gas is safe by attempting to redefine safety. Transporting gas via pipelines may be safer than transporting gas via vessel, rail, or truck, but pipelines still pose major risks to our communities. For example, in the last three years, the US has averaged 76 "significant incidents" per year in gas distribution lines, which are defined to "include a fatality, or an injury requiring overnight, in-patient hospitalization, or $50,000 or more in total costs."[65]

Portland residents experienced one such incident in 2016, when an explosion in northwest Portland caused multiple injuries and approximately $17 million in damages.[9] This tally of "significant incidents" does not include leaks, leading to evacuations like the one experienced by northwest Portland business owners and residents in early 2021, when NW Natural discontinued service and cleared a multiple block area to manage a major natural gas leak.[66] NW Natural's own safety report identifies the following safety concerns and "highest ranking threats" to its distribution system: excavation damage; material, weld, or joint failure; and equipment failure.[67] Should NW Natural introduce hydrogen into pipelines as planned, it would further exacerbate existing safety concerns, due to the highly corrosive and flammable nature of this fuel.[68]

In addition, drawing attention away from real safety concerns related to transportation, NW Natural attempts similar misdirection when offering another example of safety — namely, that natural gas ranges cause fewer kitchen fires than electric ranges. Again, this narrow focus disregards not only the other types of fires associated with gas,[69] but also the myriad risks that methane presents during its lifecycle.

Other methane-related risks surround fracking[6], storage,[70] leaking/poisoning,[71] and combustion. In addition to the everyday impacts to indoor air quality, and the routine leakages and explosions discussed above, NW Natural stores and transports methane gas through areas where pipelines are at high risk of rupturing during the impending Cascadia subduction zone earthquake.[72] (See the 2021 joint study by the City of Portland's Bureau of Development Services and Multnomah County to quantify these risks in detail.)[73]

Finally, continued reliance on methane gas exacerbates the many safety concerns attending a planet destabilized by climate change, including safety issues related to increased fires, smoke, drought, heat waves, flooding, food insecurity, and more.[74] To summarize, NW Natural's narrow focus on the potential dangers of other means of transporting gas misleadingly side-steps pipeline safety issues and ignores the sweeping consequences of continued methane gas use and development.

Methane Gas and Extreme Weather and Fire Events

NW Natural has run advertisements implying that if customers have natural gas in their homes, they will be less affected by extreme weather.[75,76] In truth, most home heating systems and other gas appliances require electricity to ignite pilot lights and, as such, may not function in the event of power outages. Outages also impact the function of essential ventilation systems, which, as discussed, are critical to mitigating the worst impacts of gas combustion on indoor air quality. Insufficient ventilation concentrates pollutants from gas appliances, exposing families to noxious fumes and associated health impacts.

Oregon's 2020 wildfire season increased awareness about gas stoves and indoor air quality. As the climate crisis progresses and our region experiences hazardous air quality from more frequent summer wildfires, gas stoves are a significant liability. On hazardous air quality days, the EPA guidance includes the following: "Avoid activities that create more fine particles indoors, including smoking cigarettes or using gas, propane or wood-burning stoves and furnaces."[77] On these hazardous air-quality days it is dangerous to open windows or run fans as recommended while cooking with gas. This means that the primary way to decrease the indoor air pollution of gas stoves is no longer available during periods of hazardous air quality.

The devastating Texas storms of 2021 led to massive grid failures, and despite what the fossil fuel industry would have us believe, renewable energy infrastructure did not lead to the outages. According to the Electric Reliability Council of Texas (ERCOT), which operates the state's power grid, "while some wind turbines did freeze, failures in natural gas, coal and nuclear energy systems were responsible for nearly twice as many outages as renewables."[78] Experts agree, the solution for extreme weather events (climate-driven or otherwise) is a more resilient grid and greater investments into emergency energy storage, decentralized renewable energy generation (i.e. rooftop solar), and housing retrofits to increase energy efficiency, insulation, and climate resilience, *not* more explosive gas infrastructure.

Continuing to Build Gas Infrastructure is Inconsistent with Oregon's Climate Goals

Gas in buildings is one of the fastest growing sources of emissions in Oregon[79] and is directly at odds with Governor Brown's 2020 Executive Order,[80] the 100% Clean Energy for All standard passed in the

Oregon State Legislature in June 2021,[81] and the best available science on mitigating the climate crisis. Decarbonizing the electricity grid, combined with aggressive building electrification and energy storage, is the primary path toward reducing emissions in Oregon's built environment.[82]

Oregon has the fastest timeline to eliminate greenhouse gas emissions from the electric sector in the US, with the goal of reducing emissions 80% below baseline emission levels by 2030, 90% by 2035, and 100% by 2040.[81] As of 2015, Oregon's overall emissions were 42% above 1990 levels.[83] As described in Oregon Senate Bill 98's RNG plan,[84] continued pipeline expansion would not decarbonize Oregon's built environment. The bill set a goal of reaching 30% RNG in Oregon's methane gas pipelines by 2050. This implies that 70% would still be methane — the greenhouse gas that is up to 86 times more potent than CO_2.[7]

The Gas Industry is Misleading the Public with False Promises of Decarbonization while Opposing Climate Policy at All Levels of Government

NW Natural is currently conducting an advertising campaign, which can be viewed on television and on its "Less We Can" website.[85] It features images of people riding bikes, planting home gardens, and recycling. It implies that customers can continue to use gas ranges and other gas appliances if they "join [NW Natural] to find more ways to do less;" together, we will achieve "a Low Carbon Pathway for energy." The "Less We Can" campaign is an example of a gas industry greenwashing strategy claiming to be "saving" carbon emissions and minimizing the harmful effects of its product while NW Natural actually increases its annual carbon emissions as it adds more customers, incentivizes home builders to install gas appliances, and lobbies elected officials at the local, state, and federal level to prevent laws and efficiency standards that reduce emissions.[86]

At the center of the "Less We Can" campaign is NW Natural's "voluntary carbon savings goal of 30% by 2035." NW Natural first made this pledge in 2016. A footnote in the NW Natural 2019 Environmental, Social and Governance Report clarifies that "this is an emissions savings goal equivalent to 30% of the carbon emissions from our sales customers' gas use and company operations from 2015."[27]

A 30% "savings goal" may sound impressive, but to achieve that goal by 2035, NW Natural will only need to "save" approximately 1% of its emissions every year for the next 20 years. As their emissions grow each year due to increased sales of fossil gas, as they have for the past four years, these small annual "savings" add up to an amount equivalent to 30% of the emissions they created in 2015.

In its 2019 Environmental, Social and Governance Report, NW Natural claims that it is "on track to meet or exceed [its] voluntary carbon savings goal of 30% by 2035."[27] The report includes a chart showing annual "savings" achieved for the last 4 years. Roughly half of these "savings" are achieved through energy efficiency measures funded through Energy Trust of Oregon (ETO). The other half are achieved through biogas "Smart Energy" offsets funded by NW Natural customers who sign up for additional voluntary charges of 10.5 cents per therm. "More than 8% of our customers—about 58,000—are enrolled in the Smart Energy program. In 2019, they funded approximately 160,000 metric tons in emission reductions."

In effect, these relatively insignificant savings (1% per year) come from NW Natural's compliance with the state-mandated ETO program and offsets that their customers pay for as an additional charge on their gas usage. Meanwhile NW Natural's annual gas sales and associated emissions have increased by 18% since making this pledge.[27]

As more attention is paid to the massive emissions associated with the gas industry, and public desire for regulation grows, the industry is working to ensure not only its survival, but its growth. Recently, NW Natural CEO David Anderson was promoted to Chairman of the Board of Directors of the American Gas Association (AGA), the industry group that supports the methane gas industry.[87] In late 2020, the AGA successfully pressured the US Department of Energy to abandon a proposed efficiency standard for gas furnaces, which would have raised performance from 80% to 92% Annual Fuel Utilization Efficiency (AFUE).[88] The DOE estimated that this measure would have avoided 143 million metric tons of CO_2 emissions, thousands of tons of other air pollutants, and saved ratepayers $5.6 to $21.7 billion in gas utility bills.[89] The AGA and the gas industry shut down this proposal, which would have made the readily-available condensing gas furnace the new standard and eliminated inefficient older, non-condensing furnaces.[20]

It is clear that NW Natural and the wider gas industry are making highly misleading statements that make it appear they have "an important role to play in helping our region move toward a low-carbon, renewable energy future."[85] Not only are they failing to do something substantive to achieve that future, they are actively and systematically fighting government efforts to reduce carbon emissions.

Conclusion

Gas is now the leading contributor to global fossil fuel carbon emissions increases.[21] Despite what the fossil fuel industry would have us believe, methane gas has no role in decarbonizing Oregon and Washington's built environment. Ongoing and expanding gas use is, instead, putting Oregon and Washington's communities' health and safety at risk, especially low-income and BIPOC communities. Both public health concerns and climate research support rapid electrification of buildings. Numerous safety concerns, coupled with the recent International Energy Agency report on necessary reductions in methane to address the climate crisis, and the multiple studies comparing methane gas, RNG and building electrification, build a strong case for prohibiting expansion of methane gas infrastructure and beginning to prioritize ways to equitably scale back existing gas infrastructure. It is imperative that all levels of government take decisive action to adopt policies to ensure a just transition to a more healthy, equitable, and electric future.

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