

Defining the role of gas utilities in a decarbonized energy future

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ABSTRACT

A number of emerging local, state, and federal climate policies are geared toward widespread electrification of natural gas end uses in conjunction with zero-carbon power generation strategies. However, in some regions, this approach may be challenging to use to successfully reach deep decarbonization or net-zero targets, and there's been little robust evaluation of alternative approaches. The authors' research suggests that taking a multi-fuel approach to decarbonization (with efficiency as a core component) could enable more pragmatic and ultimately effective pathways to net-zero emissions that minimize customer impacts, maintain high levels of energy reliability and system resiliency, allow flexibility for new technologies that can help meet decarbonization targets, and support a range of synergistic decarbonization strategies across the electricity and gas sectors.

Drawing on the authors' in-depth regional decarbonization analyses for governments and energy utilities, national-level net-zero pathway analysis and renewable natural gas studies for the gas industry, and related experience with electric and gas utilities across North America, this paper will advance the practice of analytics and planning for the role that gas and natural gas infrastructure could play in deep decarbonization pathways. The paper will help readers understand the potential for gas-based measures in net-zero emissions pathways (including emerging energy efficiency technologies, low-carbon fuels, and carbon-negative technologies); better understand where comprehensive electrification approaches may run into practical challenges; and improve decarbonization planning efforts by defining key regional considerations that can support a cost-effective, resilient, and equitable transition to a net-zero energy system.

Introduction

The Intergovernmental Panel on Climate Change has indicated that economy-wide net-zero greenhouse gas (GHG) emissions are needed by 2050 to limit global warming to 1.5°C (in line with the Paris Agreement), or 2070 for 2°C (IPCC 2021). As a result, policymakers at the federal, state, and local level are increasingly committing to clean energy or GHG reductions with a focus on meeting net-zero emissions targets in the coming decades. Particularly since the electricity sector is already making strong progress towards decarbonization through the use of zero-carbon power generation and distributed energy resources—and continued electric vehicle growth seems likely in the transportation sector—some policies have begun to focus on “electrifying” natural gas and other non-electric energy end uses with the idea that, once the grid is decarbonized, the energy sector will then reach net-zero. However, it's also possible for other technologies, such as those offered by gas utilities, to support deep decarbonization or even net-zero emissions targets by directly reducing their emissions and helping their customers reduce emissions as well. In some regions, decarbonization pathways that maintain a role for gas in the energy system may help improve the likelihood of meeting climate goals on the basis of such considerations as feasibility, reliability and resilience, flexibility, customer impacts, and energy equity. While utility business models are likely to change significantly in the decades ahead, gas

utilities that proactively engage stakeholders and customers around decarbonization planning—and successfully implement those plans—may be better positioned to withstand disruptive market and policy changes.

The following sections discuss a range of strategies available to gas utilities that can enable deep decarbonization, opportunities for collaboration between gas and electric utilities, complexities associated with comprehensive electrification policies, and regional considerations that are vital to creating effective and achievable energy decarbonization pathways.

Gas Utility Pathways to Net-Zero

GHG emissions associated with gas utilities can be thought of in terms of direct emissions (those created directly by the utility); customer emissions (when the gas is consumed at the end-use level); and upstream emissions (from gas production, processing, and transportation). Of these, customer emissions comprise the bulk of overall emissions linked to gas utilities (AGA 2022), as shown in Figure 1.

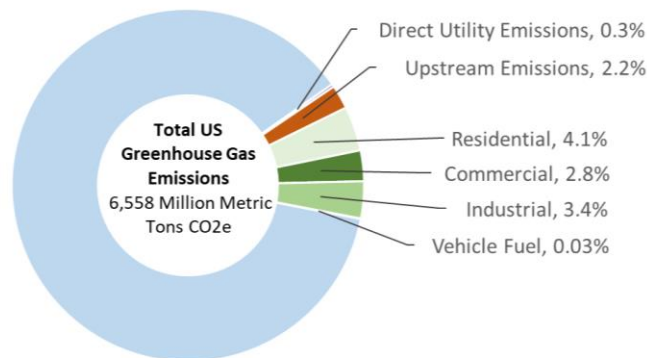


Figure 1. Total 2019 US greenhouse gas emissions, and emissions categories associated with gas utilities (excluding combustion or upstream emissions for natural gas use by the electricity generation sector and natural gas that is not delivered by gas distribution companies). *Source:* American Gas Association, using data from the US EPA and EIA

At a high level, GHG reduction strategies for gas utilities can be separated into four general categories:

- Reducing customer gas consumption through efficiency and/or electrification
- Decarbonizing the gas supply required to meet the remaining demand
- Reducing utility system and upstream emissions from methane leaks
- Using negative emissions technologies to offset remaining GHG emissions.

These strategies can often be employed simultaneously, and they collectively offer a range of options that may allow gas utilities to contribute to deep decarbonization or net-zero climate targets (AGA 2022). However, the preferred mix of strategies is likely to vary widely based on a number of regional, regulatory, and system-specific factors, and the timing of emissions reductions and overall reductions in delivered gas volumes could vary significantly depending on the approach taken. For these reasons, it's essential to create detailed and regionally-specific decarbonization plans that account for key local considerations.

Reducing Gas Demand

The most straightforward way to reduce gas-related emissions is simply to consume less of it. There are two fundamental approaches to reducing gas consumption at the customer level: improving the energy efficiency of gas end-uses and reducing existing sources of waste (e.g. by improving the building shell) or replacing natural gas-consuming equipment with alternatives that use a different source of energy, such as renewably-produced electricity or hydrogen, that result in lower emissions even if overall energy consumption remains the same or increases. In both cases, a range of established and emerging technologies will likely be needed to meet net-zero targets.

Improvements in energy efficiency are typically the lowest-cost approach to reducing emissions and offer a range of benefits to customers, from reduced bills to increased comfort. For example, researchers from Lawrence Berkeley National Laboratory found an average overall levelized program cost of \$0.40/therm of natural gas saved across nearly 37 different utilities/program administrators in 12 states over six years (Schiller et al. 2020). That level of cost-effectiveness is difficult to match through non-efficiency approaches to gas demand reduction, and it underscores the importance of energy efficiency in any successful decarbonization plan (for both gas and electricity). Large reductions in gas demand will likely be needed to meet net-zero targets: in a decarbonization pathways analysis for New York City, all pathways resulted in gas demand falling by at least 60% between 2020 and 2050 (ICF 2021).

Space and water heating typically represent the largest sources of gas consumption in residential and commercial buildings and there are many existing efficiency measures to reduce energy consumption and associated emissions in these end uses. There are also promising emerging measures that could greatly reduce consumption. For example, hybrid heating systems (described in more detail below) can offer a compelling mix of the emissions and performance benefits of electric heat pump and gas heating, and may represent a unique decarbonization opportunity in some regions. Additionally, gas heat pumps offer the potential to provide highly efficient space heating and cooling, water heating, or even clothes drying, with potential energy savings of more than 50% compared to baseline gas equipment. Although the number of commercially-available products is currently limited, a range of new products are expected to emerge in the coming years to meet residential and commercial needs (GTI 2019).

Low-Carbon Gaseous Fuels

To mitigate GHG emissions from customer gas consumption (particularly after a wide range of energy efficiency measures have already been adopted), there's potential for low- and no-carbon gaseous fuels to offset emissive geologic natural gas. The extent to which these fuels will be able to displace natural gas at scale over the coming decades will depend on a wide range of factors, from the adoption of extensive market transformation efforts to the availability of needed feedstocks.

In a discussion with industry experts, partners and think tanks, the Energy Futures Initiative found that interest in low- and no-carbon gaseous fuels is currently being driven by both investor and customer demand (EFI 2021), noting that: *“North American companies are increasingly adopting net-zero goals and financial institutions face pressure to or are actively limiting investments in new fossil fuel projects. Increasing investor pressure for “clean” natural*

gas is also a critical driver of market differentiation.” and that “Traditionally, energy sources have been prioritized first by cost, then by reliability, and then other attributes like low carbon intensity. This prioritization may be reversing in [North America]—an emerging group of consumers are beginning to express preferences for low-carbon sources even at higher cost and reliability risks associated with renewables and intermittency.”

Two of the most promising low-carbon fuel options include renewable natural gas (RNG) and hydrogen.

Renewable natural gas.

RNG is a pipeline-quality natural gas replacement that can be produced from a wide range of feedstocks (such as biomass, other renewable resources, and existing waste streams) and through a variety of production techniques. Although it offers promise for deep carbon reductions, the claimed GHG benefits vary by carbon accounting strategy. For example, since the emissions released when the RNG is burned are essentially the same as the carbon that its feedstock originally sequestered in the first place (biogenic carbon), RNG is generally considered to yield zero CO₂ on a combustion basis. On a lifecycle emissions basis, RNG production entails added emissions upstream, but also affords opportunities to avoid emissions relative to the material handling baseline, such that RNG can range from being net-carbon negative (in cases where its production reduces existing sources of GHG emissions—such as the methane produced by swine manure lagoons) to carbon positive, and the emissions benefits associated with RNG may decline over time if local policies evolve to reduce existing GHG emissions from biogenic sources. For these reasons, it’s vital that decarbonization plans carefully identify and evaluate potential sources of RNG and ensure that those sources will be able to adequately support emissions reduction targets.

Most of the focus on developing RNG resources to date has been for the transportation sector, and significant market transformation efforts will be needed to make it widely available for residential, commercial, and industrial customers using existing pipelines. New production technologies and techniques are emerging that may significantly increase RNG supply and availability, and gas industry research suggests that, by 2050, annual RNG production in the US could potentially be as high as 6,700 tBtu (AGA 2022). However, much of the additional RNG assumed in the highest supply forecasts is likely to come from sources such as thermal gasification that are not carbon-negative on a lifecycle basis. Additionally, even as the market for RNG matures (likely leading to increased production volumes and the development of long-term contracts that could help drive down prices), RNG is likely to continue to cost more than geologic gas, which could ultimately lead to rate increases if broadly adopted by gas utilities. For example, in the decarbonization pathway analysis for New York City, biogenic RNG at a medium and low supply potential was projected to cost about five to seven times more than fossil gas in 2050 (ICF 2021). This cost differential underscores the importance of strategies like energy efficiency that can reduce the total quantity of RNG needed to meet decarbonization targets. At the same time, even if increased adoption of RNG drives up gas rates, it may still be more cost-effective per ton of GHG reduced than other decarbonization measures that could be considered as part of a broader plan.

Hydrogen.

Hydrogen has historically been used as an industrial feedstock and fuel and has not generally been used to reduce GHG emissions due to technical viability and high cost. As a result, approximately 95% of US commercial hydrogen production is currently derived from

natural gas, and the additional processing makes this hydrogen even more GHG-intensive than conventional geologic natural gas. However, several strategies exist for producing low- and no-carbon “clean” hydrogen, which has the potential to reduce GHG emissions from the gas industry through direct use (in transportation or building end use equipment designed specifically for its use); as an addition (up to 20% by volume) to the natural gas being transported on existing pipes; or following conversion to methane in order to create a unique form of RNG (sometimes called synthetic natural gas) that can directly replace geologic gas. Although the market for clean hydrogen is still nascent, the federal Energy Earthshots Initiative sees hydrogen as being so crucial to decarbonization that, in 2021, it announced that its first effort would aim to drop clean hydrogen prices 80% by 2030, with a targeted hydrogen production cost of around \$9/MMBtu.

Reducing System and Upstream Emissions

Because methane—the primary component of natural gas—has a global warming potential much higher than the CO₂ that results from its combustion, any gas utility pathway to deep decarbonization or net-zero will necessitate a reduction in utility gas system methane leakage and upstream emissions.

Gas utilities have been making progress on reducing methane leakage: as EFI notes, a survey of industry experts suggests that “...methane emissions from local distribution systems have declined about 70 percent since 1990 because of pipeline replacement programs and modernization of gas infrastructure to make the system safer and more reliable” (EFI 2021). However, current industry standards and guidelines represent a simplified approach to methane accounting—for example based on national average emissions applied to a specific activity, such as pipeline mileage or meter counts—that may potentially overestimate emissions at individual gas utilities and limit their ability to demonstrate methane emission reductions. To improve reporting accuracy and reward successful leakage reduction efforts, there is potential for gas utilities to collaborate with key stakeholders to develop emission factors that leverage more accurate measurements to better reflect their unique system.

Fully addressing upstream emissions associated with gas production, gathering, processing, and transportation will necessitate deeper fundamental shifts in the gas industry. However, one option that could allow utilities to make rapid and cost-effective progress is the use of certified gas (also called differentiated gas or responsibly sourced gas), which is geologic natural gas that has been certified by an independent third party to meet certain environmental and social criteria, including limits on upstream methane emissions. There are currently three major gas certifiers—International Environmental Standards (IES), RMI & SYSTEMIQ, and Equitable Origin—and each certifier has a different assessment methodology. Costs and potential GHG reductions can vary depending on the specific gas source and certification used, though some certifiers have suggested that emissions reductions of up to 10% may be possible. The market for certified gas is growing rapidly: a Platts survey of gas certifiers indicated that, as of October 2021, companies had committed to certifying nearly 7 Bcf/d of production and an additional 5.3 Bcf/d was anticipated to become available in 2022 (Hallahan and Corral 2021). That collectively represents around 14% of U.S. gas production, and Platts indicated that this total does not include some pilot projects that did not disclose their size. The Gas Technology Institute is also working on an initiative to develop standardized, verified methane emissions protocols for certified gas called Project Veritas. This project aims to develop standard measurement methodologies that could be used by certifiers and could enable more widespread use of certification focused on GHG reductions.

Negative Emissions Technologies

The fourth pillar of gas decarbonization comprises negative emissions technologies, carbon capture and storage (CCS), and high-quality carbon offsets, which can be employed to reduce net GHG emissions in the atmosphere after other decarbonization measures have been implemented. CCS in particular has potential to play a significant role: in its *Net-Zero by 2050 Scenario*, the International Energy Agency estimates that, by 2050, 7.2 Gt CO₂ (~21% of worldwide emissions) will be captured and permanently stored each year (IEA 2021). To capture those levels of CO₂, an expansion in the number of projects planned and in operation is needed. Currently, there are just 26 commercial-scale carbon capture projects operating around the world, including some natural gas processing projects. In addition, 21 projects are in an early stage of development, and 13 are in advanced development.

Opportunities for gas and electric utilities to work collaboratively

Reaching economy-wide net-zero emissions or deep decarbonization targets will require transformative changes in producing, transporting, storing, and consuming energy (gas, electricity, and other forms). By including both the gas and electric systems in a decarbonization plan, not only is there more optionality to leverage different decarbonization strategies across fuel types, but there are also additional opportunities for gas and electric utilities to collaboratively bolster each other's efforts (or for dual-fuel utilities to implement more effective decarbonization strategies). A few such examples are highlighted below.

Hybrid Heating Systems

Heating is typically the largest energy end use in a home, making gas furnaces a prime target for electrification. However, electric air-source heat pumps (ASHPs)—which are generally suggested as an energy-efficient option to replace gas furnaces—often have high upfront costs and they rely on electric resistance backup heating during particularly cold times. That backup heat can be problematic for electric utilities since it can result in large spikes in peak power demand (which may in some cases ultimately lead to reliability challenges or rate increases if adopted at scale). One potential solution is a so-called hybrid heating system, also referred to as a dual-fuel system, which consists of an electric ASHP paired with a natural gas furnace.

By using gas instead of an electric resistance element for backup heating, hybrid systems have potential to yield many of the emissions benefits of ASHPs while reducing stress on the electric grid when temperatures drop. Hybrid systems also have potential to make installation easier and less expensive since customers with gas furnaces can replace their air conditioner with an electric ASHP (rather than having to simultaneously replace their furnace) and incorporate new controls to yield the desired performance. Having multiple heating fuel sources may also add flexibility, redundancy, and resiliency compared with an electric-only approach. As the electric grid transitions to net-zero generation, there may also be opportunities to control hybrid systems dynamically (switching between gas and electric heating when needed) to maximize carbon reductions, help support the electric grid, and enable deeper levels of decarbonization.

Although the underlying technology is well-established, there are relatively few commercialized hybrid heat pump systems currently available, and additional work needs to be done to improve the controls needed to effectively optimize performance based on different

criteria. Additionally, existing regulatory structures in many regions aren't well-suited to allocating energy and emissions benefits between gas and electric utilities with this kind of approach, necessitating future changes to better support multi-fuel decarbonization pathways. As a result, for gas and dual-fuel utilities, the largest near-term opportunities will likely be to support research, development, and demonstration initiatives that could help improve recognition and availability of hybrid heating systems.

Power-to-Gas

As electric utilities work to increase the level of renewable generation on the grid, green hydrogen may offer an opportunity to make effective use of excess generation (on days where renewable generation is higher than electric demand) that can simultaneously support the decarbonization of both the power and gas sectors. This may become particularly relevant in areas where electric utilities “overbuild” renewable generation to assure reliability and meet growing peak demands. If supported by regulators and policymakers, this approach—called “power-to-gas”—could offer a variety of opportunities for gas and electric utilities to effectively support each other’s decarbonization goals.

Energy Storage

Both RNG and hydrogen can be stored for extended periods and used to generate electricity. As a result, they could represent a key resource to add flexibility and energy storage while also supporting decarbonization of both the electric and gas systems. In particular, green hydrogen can be stored in a variety of ways—from compressed cylinders or liquid tanks at smaller scales to salt caverns for large-scale storage—and could represent a new opportunity to improve reliability and resilience.

The Complexities of Comprehensive Electrification

Emerging policies in cities such as Seattle, WA, Berkeley, CA, and New York City are intended to begin the process of fully phasing out gas (generally starting with bans on natural gas connections in new construction), as are state-level initiatives such the recently passed mandate for electric heat pumps in new buildings in Washington State. However, such approaches may ultimately face challenges that might be reduced or avoided with a more holistic strategy using multiple energy sources. Several core considerations that are especially likely to affect the success of comprehensive electrification initiatives are highlighted below at the system, end-use technology, and customer levels.

Energy Reliability and Resilience

Deep decarbonization of the energy system represents unprecedented change, and maintaining reliability and resilience during and after the transition will be critical. This is particularly true as climate change drives new extreme weather events that will further stress energy infrastructure. For example, in spring 2022, the Midcontinent Independent System Operator (MISO) projected an unprecedented 5 GW shortfall in firm generation to meet

projected summer loads due largely to an anticipated warmer-than-normal summer, ongoing drought conditions, and an active hurricane season (MISO 2022a), in combination with the ongoing evolution of electricity generation resources “driven by such factors as utility and state policies to reduce carbon emissions” (MISO 2022b). In its public announcement, MISO said its summer preparations included “training and conducting exercises with member companies to prepare for the worst-case scenarios.”

Maintaining a role for gas in decarbonization plans may—in some regions—help support reliability by reducing the magnitude of change needed on the electric system. For instance, as shown in Figure 4, winter gas demand in Massachusetts is typically more than double summer peak electricity demand (ICF Climate Center 2022). The ratio is lower in Georgia and California, which have lower winter heating loads and higher summer peaks due to warmer temperatures. In all cases, significant electric system expansions would likely be required under a comprehensive electrification scenario, and such a change could fundamentally shift many utilities systems from summer-peaking to winter-peaking, creating potential for additional logistical and demand management challenges.

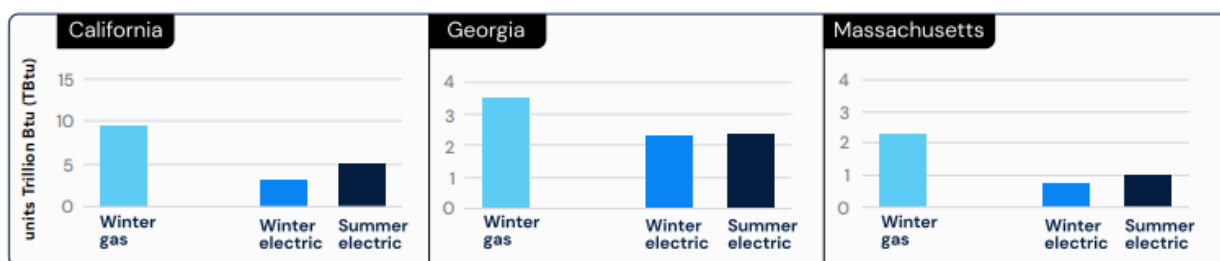


Figure 4. Comparison of peak natural gas consumption with seasonal electric consumption in three illustrative states.

Beyond electric system capacity and generation mix, the existing gas system also has substantial energy storage capabilities that allow it to meet large winter peaks; fashioning a comparable electric system (particularly one relying largely on renewable generation) will likely require significant build-out of energy storage systems (such as grid-scale batteries) to be an effective replacement that maintains reliability and resilience.

Ultimately, broad electrification efforts are likely to be most effective in areas with comparatively small winter peaks, or where summer electric peaks are currently substantially larger than winter ones (if this results in excess winter generation and distribution capacity). In many regions, however, a mixed approach of electrification and low-carbon fuels delivered through the existing gas distribution system may be better suited to effectively and more quickly decarbonizing the energy system than electrification alone.

Technological Feasibility

Regardless of the energy sources prioritized in a decarbonization plan, emerging technologies will be essential to realizing deep emissions reductions—as the International Energy Agency notes: “*Reaching net-zero by 2050 requires further rapid deployment of available technologies as well as widespread use of technologies that are not on the market yet. Major innovation efforts must occur over this decade in order to bring these new technologies to market in time. Most of the global reductions in CO₂ emissions through 2030 in our pathway*

come from technologies readily available today. But in 2050, almost half the reductions come from technologies that are currently at the demonstration or prototype phase.” (IEA 2021). However, correctly predicting in advance which technologies are most likely to be successful in the market is very challenging and it’s possible for “fringe” technologies to quickly expand to a market-leading position. To maximize the likelihood of successful decarbonization, plans should incorporate a high level of optionality where possible and maintain flexibility to pivot to new technologies as needed based on such factors as GHG reductions, system reliability, risk management for extreme events, and evolving environmental justice needs. Taking an entire energy source (such as gas) off the table prematurely—particularly one that’s widely used—has the potential to limit the flexibility and overall effectiveness of regional decarbonization plans.

Even with more-established technologies, a variety of practical—but not necessarily insurmountable—challenges exist to widespread electrification. For instance, electric heat pumps are largely proven from a technological perspective and are increasingly being commercialized for multiple sectors, but they currently have low market penetration and relatively high incremental costs, suggesting that significant market transformation initiatives will be required to drive increased adoption. Similarly, the multifamily and industrial sectors have traditionally offered challenges to utility energy efficiency programs (such as split incentive challenges, logistical barriers to widespread building retrofits, the need for highly customized process equipment, etc.) that are also relevant for electrification initiatives. And some end uses—such as industrial process heating equipment or long-haul heavy-duty vehicles—simply don’t yet have comparable electric alternatives.

Role of the Customer

Continued customer support of decarbonization initiatives will be critical to ensure success over multiple decades. At present, there is growing support for action to address climate change in both the residential and commercial sectors. The rise of initiatives such as the RE100—a group of organizations, including many of the world’s Fortune 500 companies, that have publicly committed to purchasing 100% renewable energy—have already helped drive the development and expansion of renewable electricity offerings, and increasing adoption of environmental, social, and governance (ESG) goals by many corporations are likely to support continued climate action.

Despite this growing support, however, many customers rely heavily on gas and are likely to resist electrification efforts (even if these ultimately yield emissions, energy, and non-energy benefits). Gas utilities’ existing duty to serve is also likely to pose challenges to broader electrification and/or gas system decommissioning efforts unless fundamental coordinated changes are made at the regulatory and policy levels. Emerging electric technologies, such as induction stoves, might help increase customer interest in voluntarily converting from gas to electric end uses (Snell 2021), as could increased awareness of potential non-energy benefits associated with electrification. However, customers that choose not to electrify can reduce the potential cost savings associated with gas system decommissioning as gas utilities must maintain much of their existing infrastructure while their customer base decreases—a scenario that could inflate gas prices and present challenges to energy equity (for customers who aren’t able to transition to electric end uses) and gas utility business models.

Energy Equity

Customer equity and broader environmental justice concerns are an important and growing focus for many utilities, policymakers, and advocacy groups, and utilities across the country are increasingly devoting significant resources and internal efforts to address these issues. However, many utilities still have limited visibility into the equitability of impacts from their existing demand-side management offerings (such as energy efficiency initiatives) and electrification has the potential to further complicate these issues. For example, some electrification strategies may offer unique opportunities to improve air quality and building systems in disadvantaged communities. At the same time, current incremental costs to adopt electrified technologies are often high, and the older building stock common in many lower-income areas tends to be the hardest to effectively retrofit, suggesting potential equity challenges from a customer cost and feasibility standpoint. There are also likely to be additional impacts on the local workforce, and there's a possibility that premature adoption of emerging technologies could disproportionately impact vulnerable customers who are least likely to be able to fix them if issues arise. Alternatively, straight gas bans could potentially result in the installation of low-efficiency electric resistance heating systems in lower-income areas given the lower upfront equipment costs, which could then increase energy bills for customers who can least afford them. Such considerations are vital to evaluate at a local level to ensure that proposed decarbonization plans are both effective and equitable.

Regional considerations for decarbonization planning

Given the many geographic, technological, sectoral, and customer differences that greatly increase the complexity of decarbonization planning, it's vital that utilities, regulators, policymakers, and other stakeholders perform careful and objective analyses to find the most effective, equitable, achievable, and least-cost path to decarbonization or net-zero that is tailored to their region. Such analysis should aim to avoid getting tunnel vision on any one approach or fuel by considering multiple scenarios; maximize flexibility by avoiding committing to specific decarbonization paths sooner than necessary; and keep the customer top of mind by considering local needs and preferences.

Specific metrics that should inform any regional energy decarbonization strategy include:

- The level of overall GHG emissions reductions desired and the baseline trajectory of emissions
- Flexibility and risk management (maintaining optionality and flexibility to respond to market changes)
- Safety impacts
- Energy costs and price volatility
- Affordability (for both customers and the utility)
- Customer needs and preferences
- Impacts to the energy system (such as reliability, resiliency, maintenance requirements, peak demand impacts, etc.)
- Customer equity and environmental justice
- Industry and business needs in the region

- Feasibility and ability to scale
- Renewable and low-carbon supply considerations (for both electric and gas)
- Implementation support required
- Technological readiness
- Expected future technology developments (performance, costs, installation considerations, user behavior/preferences)
- Changes in expected utility customer bases

It's also important to acknowledge that utilities cannot implement decarbonization pathways on their own. Gas and electric utilities operate under strict regulations by state and federal regulators and must adhere to many rules and processes. Environmental and climate policy must be aligned with utility regulatory constructs for utilities to continue to invest in infrastructure while advancing cost-effective emissions reduction opportunities, and regulators will have a key role to play in enabling and advancing decarbonization initiatives.

Conclusions and Recommendations

Despite a growing policy focus on broad electrification, gas utilities that are proactive in reducing GHG emissions and supporting the electric system may continue to play a role in a decarbonized, resilient and reliable energy future. By combining deep energy efficiency, upstream/system-level methane emissions reductions, low-carbon fuels, and negative-emissions technologies, gas utilities may be able to support deep decarbonization or even net-zero emissions targets by directly reducing their emissions while simultaneously helping their customers reduce emissions. In many regions of the US there may be multiple benefits to leveraging the gas system in energy decarbonization pathways on the basis of such considerations as feasibility, reliability, resilience, customer impacts, and energy equity. Electrification is likely to play a key role in any decarbonization pathway, but policies that promote electrification exclusively have potential to run into challenges that might be avoided by taking a more holistic, data-driven, and regionally-specific approach. As decarbonization efforts accelerate in the coming decades, it will be important to make the best use of all available energy supply and demand options, and gas and electric utilities will likely both have critical roles to play.

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