Xcel Energy®

TRANSITIONING NATURAL GAS FOR A LOW-CARBON FUTURE

TO OUR STAKEHOLDERS,

Xcel Energy has made a commitment to lead the clean energy transformation across our entire business. That means that we will continue to provide affordable, reliable energy services while we reduce emissions of greenhouse gases. We have already announced our aspiration to provide 100% carbon-free electricity by 2050. In this report, we present a plan focused on emissions from our natural gas system.

Technology is driving progress in clean electricity — more efficient fossil generation, lower cost wind generation, improved solar panels and even batteries are already providing customers with clean, reliable and affordable electricity. By generating more electricity with renewables balanced with natural gas-fired generation, we have reduced carbon emissions 44% since 2005, and in 2019, had our largest one-year decline. Through the limited but judicious use of natural gas for electric generation, we can more rapidly reduce our use of coal and promote cost-effective emission reductions. This approach allows us the much-needed time to develop the carbon-free generating technologies that we will need to realize our vision of an affordable, zero-carbon electricity system.

We need those same types of technology breakthroughs to reduce carbon emissions from our natural gas distribution system, which includes about 40,000 miles of underground infrastructure that enables 80% of our customers to heat their homes and buildings. Altogether, we serve 2.1 million customers in our colder states — Colorado, Michigan, Minnesota, North Dakota and Wisconsin.

When it comes to heating homes and buildings, there is no substitute today for natural gas, especially in colder climates. It is a highly flexible and efficient fuel that offers our customers comfort and security. It does so at the lowest possible cost, something that during these challenging economic times is more important than ever, especially for our customers in need. While there are currently very few cost-effective technologies available to reduce carbon emissions from buildings, we plan to make the most of today's resources while creating policies and programs that will build the technology and market for the future, just as we have done with electricity.

Our plan is simple, straightforward and will result in a reliable, affordable and lower-emissions natural gas system.

1) **Reduce the methane emissions of our natural gas suppliers as well as from our own operations.** Methane is a potent greenhouse gas, and more than a decade ago, we recognized the need to address it. We joined the EPA's Natural Gas STAR program, and later signed on to its Methane Challenge, to voluntarily reduce emissions. We've proactively improved our system, replacing all the old cast iron and nearly all the bare steel pipe. Additionally, we participate in Our Nation's Energy (ONE) Future, a group of natural gas companies committed to limiting methane emissions to 1% or less across the supply chain by 2025.

2) **Require transparency and disclosure of methane emissions and encourage sharing of best practices to reduce emissions.** We will leverage our buying power with our suppliers and encourage others as well. As a substantial purchaser of natural gas for both our electricity and natural gas businesses, we are encouraging our suppliers to disclose their methane emissions and adopt best practices for reducing emissions from their operations, with the goal of purchasing natural gas with lower methane emissions.

3) **Create programs that help customers reduce their carbon emissions from their natural gas appliances**. In partnership with our regulators, we can provide incentives for helping customers conserve natural gas and manage demand. And through other customer choice programs, we can help customers switch from natural gas to new electric technologies, such as air source heat pumps, if they choose to do so. As always, we will support our customers' energy vision, whether they participate in our voluntary programs or continue using the existing natural gas system as they do now.

4) **Create new sources of energy supply for our natural gas system customers.** We will continue to pursue renewable natural gas supply options or potentially the blending of hydrogen into the system as these projects become available and affordable.

Through this plan, we will begin the process of reducing emissions associated with natural gas and will enable and encourage the creation of new technologies that will lead to a low-carbon future.

As a country, we have faced many challenges in 2020, but at Xcel Energy, we remain committed to leading the clean energy transition. Programs like the natural gas strategy discussed in this report will help us meet these challenges and build a brighter, cleaner future. We look forward to the ongoing collaboration and partnership that is essential to our success.

Sincerely,

Ben Fowke
Chairman and CEO

CONTENTS

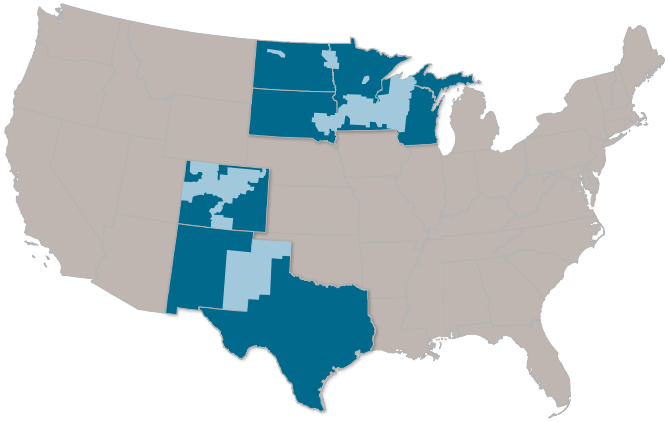
ABOUT US

Xcel Energy is a major U.S. electricity and natural gas company with annual revenues of $11.5 billion. Headquartered in Minneapolis, we operate across parts of eight Western and Midwestern states and provide a comprehensive portfolio of energy-related products and services to 3.7 million electricity customers and 2.1 million natural gas customers.

Addressing climate change is a priority for many of our customers, communities, investors and other stakeholders, and is a priority for us as well. In delivering on our strategic focus to lead the clean energy transition, we are the country's first major power company to announce its vision to provide customers 100% carbon-free electricity by 2050 and are successfully reducing carbon emissions reliably and affordably.

We constantly work to offer a cleaner energy mix, smarter solutions and seamless experiences for our customers. We are delivering modern energy leadership and services — everything from electric vehicle charging stations to an extensive portfolio of energy-saving programs and renewable choices.

More information on our clean energy strategy, corporate governance and risk management is available at xcelenergy.com in our corporate reports, including Xcel Energy's Annual Report, Proxy Statement, Corporate Responsibility Report and EEI-AGA Environmental, Social, Governance and Sustainability Report.



FORWARD LOOKING STATEMENTS

The material in this report contains forward-looking statements that are subject to certain risks, uncertainties and assumptions. Such forward-looking statements include projections related to emission reductions, changes in our generation portfolio, planned retirements, and planned capital investments and are identified in this document by the words "aim", "aspire", "assuming", "believe", "could", "expect", "may", and similar expressions. Actual results may vary materially. Factors that could cause actual results to differ materially include, but are not limited to: general economic conditions, including the availability of credit, actions of rating agencies and their impact on capital expenditures; business conditions in the energy industry: competitive factors; unusual weather; effects of geopolitical events; including war and acts of terrorism; changes in federal or state legislation; regulation; actions of regulatory bodies; and other risk factors listed from time to time by Xcel Energy in its Annual Report on Form 10-K for the fiscal year ended Dec. 31, 2019 (including the items described under Factors Affecting Results of Operations) and the other risk factors listed from time to time by Xcel Energy Inc. in reports filed with the SEC.

EXECUTIVE SUMMARY

We are proving that with current advances in technology and careful planning, we can significantly reduce greenhouse gas emissions from the electric side of our business while keeping customer bills low. Thanks to the availability of low-cost wind, solar and other clean energy technologies, Xcel Energy has reduced carbon emissions 44% since 2005 — putting us more than halfway to our goal to reduce carbon emissions 80% by 2030 and significant progress toward our aspiration to deliver 100% carbon-free electricity.

To address the risk of climate change, we understand that we must go beyond electricity to reduce methane emissions from our natural gas operations and support our customers in reducing their carbon emissions from natural gas use. While the building sector — homes and businesses — is currently a much lower source of carbon emissions economy-wide compared to other sectors, building sector emissions are increasingly important to our customers and other stakeholders. It is a sector of the economy that must be addressed to achieve aggressive global greenhouse gas reduction goals. That is why we are developing solutions to reduce emissions associated with natural gas use while delivering the affordable and reliable energy our customers require.

Natural gas is an energy workhorse for our customers, safely delivering incredible amounts of energy at an affordable cost. Nationwide, natural gas provides half of all non-transportation energy in the United States. Our natural gas system delivered an average of almost 16,000 megawatts of energy equivalent in January 2020, nearly the capacity of our electric system that operates across eight states. In the states where we serve customers with natural gas — Colorado, Michigan, Minnesota, North Dakota and Wisconsin — temperatures can drop to extremely low levels for extended periods. For example, Minnesota's Twin Cities experienced 17 consecutive days of temperatures below zero degrees Fahrenheit in 2014. Today, electric air source heat pumps are unable to effectively provide space heating at these extremely low temperatures.

In contrast to electricity, there are no reliable, low-cost substitutes or technology solutions available today to replace natural gas. It remains the most efficient fuel for heating homes and businesses — especially in colder climates and during difficult economic times. Absent affordable substitutes, a large-scale move away from natural gas also creates equity concerns. Extreme electrification mandates could increase heating bills by more than 40% for customers remaining on the natural gas system. As more customers invest in electrifying their homes, customers in need, who are especially vulnerable, are left with increased heating costs as fewer customers remain to cover the cost of the natural gas system.

Xcel Energy contracted with the Analysis Group to study the impact of different approaches to reducing carbon emissions associated with customer natural gas use. The study evaluated four scenarios that ranged from mandatory electrification of all residential buildings to a combination of voluntary electrification and low-carbon gas supply options, such as renewable natural gas. Overall, the study shows that there is a role for electrification to help drive down emissions reductions from homes, but full electrification leads to significant costs and system impacts that will be borne by customers. Large-scale electrification could even result in the electric system experiencing the most use during winter months when renewable energy resources are at lower capacity. Voluntary approaches that incorporate a variety of solutions permit flexible adoption of available mechanisms for carbon reduction as technology improves and costs decline.

Acknowledging these realities and challenges, our strategy seeks to build the technology and market to drive future emission reductions while reducing greenhouse gas emissions across the entire natural gas supply chain, from the producer to the customer.

Delivering the Cleanest Natural Gas Possible to Customers
We are committed to reducing methane emissions from our natural gas system. We have a long history of implementing operational improvements that support this, including our system upgrades and participation in EPA's Natural Gas STAR and Methane Challenge programs.

Leveraging our Buying Power to Influence Suppliers
Through the natural gas we purchase for both our natural gas distribution and electric generation businesses, we can exert buying power to influence the practices of our suppliers. In addition to our industry partnerships to develop more consistent and transparent disclosure, we are advancing efforts to better understand and influence our own supply chain.

We have started gathering information directly from our suppliers on their methane emissions intensities and best practices for reducing emissions. This information will help us better understand the emissions footprint of the

natural gas we purchase and allow us to take future action. We have also joined Our Nation's Energy (ONE) Future to partner with others in the industry to expand our emissions reporting and collectively limit methane emissions intensity across the entire natural gas supply chain to 1% or less of throughput by 2025.

This strategy, to continue using natural gas infrastructure while deploying carbon reduction solutions including low-carbon fuels, electrification and energy efficiency, is aligned with aggressive climate action — a view that the science affirms. In climate studies, natural gas continues to play a role in providing energy, even as the world achieves the goal of maintaining temperature increases below 2 C.

As one part of a much larger supply chain, we cannot be successful on our own. Achieving the cleanest and most efficient natural gas system will require joint action with our suppliers and customers to implement new measures and solutions. We need innovation across all segments of the supply chain. Such innovation will take partnerships and a renewed focus on the technology that is required for the natural gas system to serve its role in a low-carbon future.

With the shared goal of reducing emissions, we are focused on a comprehensive approach. While electrification will play a role in the transition of natural gas to a low-carbon future, we will still rely on the natural gas system to deliver critical energy for customers and to enable further emissions reductions in the electric sector. We will need solutions that make electrification more cost effective as well as solutions to operate the remaining natural gas system efficiently and to deploy clean wind and solar resources. Policy must support the development of a broad range of solutions and innovation across both systems.

Helping Customers Reduce their Carbon Emissions through Voluntary Programs

We will provide voluntary, customer choice programs to help customers reduce emissions in their homes and businesses at a price and pace that works best for them. We will start with small pilot programs that send a market signal to encourage the development of low-carbon technologies and customer solutions and will then ramp up our programs as technology improves and costs decline.

These customer choice programs focus in three areas, including:

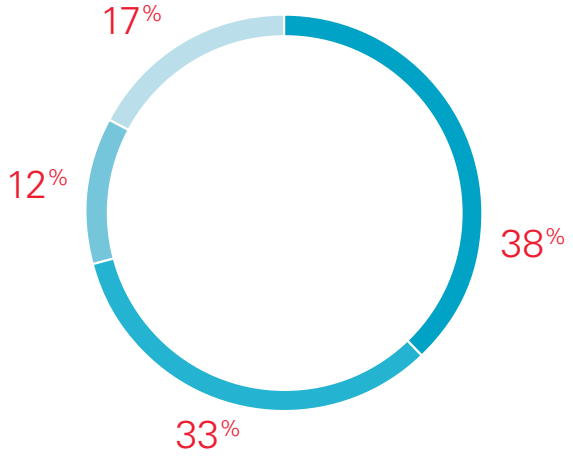
- Reducing natural gas use through efficiency
- Deploying beneficial electrification
- Supplying low-carbon and even carbon negative gas

NATURAL GAS IS AN ENERGY WORKHORSE

Throughout the United States, 75 million customers rely on natural gas to meet essential needs, such as space and water heating, cooking, clothes drying, vehicle fueling and industrial processes.[1] According to the Energy Information Administration, about half of the nation's homes use natural gas for heating. This includes more than 80% of Xcel Energy customers in parts of Colorado, Michigan, Minnesota, North Dakota and Wisconsin.[2]

Natural gas delivers incredible amounts of energy that would be very difficult to replace with other fuels. On the average day during winter of 2018 to 2019, we delivered approximately one billion cubic feet (Bcf) of natural gas to customers, equivalent to more than 12,000 megawatts of electric capacity.[3] In January 2020, Xcel Energy's natural gas system delivered an average of almost 16,000 megawatts of energy equivalent.[4]

Natural Gas Use in the United States



38% Electricity Generation

33% Industrial Processes (heating and feedstock for chemicals, fertilizers and other products)

12% Commercial Use (space and water heating, refrigeration equipment, cooking, clothes drying, and combined heat and power equipment)

17% Residential Use (space and water heating, cooking and clothes drying)

Source: Energy information Administration 2015 Residential Energy Consumption Survey

The true value of the natural gas system comes in the ability to meet the days with the highest energy demand in the middle of winter, when natural gas is a lifeline. In the climates we serve, temperatures can drop to extremely cold levels for extended periods of time. As recently as 2014, the Twin Cities in Minnesota experienced 17 consecutive days with low temperatures below zero degrees Fahrenheit. The United States experienced a Polar Vortex in early 2019, a period of cold that resulted in temperatures in Minneapolis dipping to -28 F. Across our system, Xcel Energy provided 2½ times its typical daily natural gas delivery in winter during this period, which is equivalent to nearly 57,000 wind turbines, or nearly all the turbines currently installed in the United States, running at 35% capacity factor.[5] However, on very cold days, many electric resources including wind and solar are often unavailable, making it more difficult to reliably meet this demand with clean electricity.

When it comes to delivering the amount of energy required to keep customers warm and safe during these cold events, there is no clear substitute for natural gas. Current electric air source heat pump technologies for space heating — even versions designed for cold climates — require backup heat at low temperatures.[6] The declining efficiency of air source heat pumps, combined with relatively inefficient electric resistance heating (the only electric backup option), means that providing the necessary heat for the coldest day of the year requires a significant increase in the peak demand capacity of the electric system. Analysis that Energy + Environmental Economics (E3) performed for our most recent Upper Midwest electric resource plan suggests that the required build-out in an all-electric scenario could shift our Upper Midwest electric system to a winter-peaking system almost 2½ times its current size.[7]

Natural gas service is also extremely reliable and resilient during storms. With the infrastructure buried underground, the natural gas system is far less susceptible to damage and long-term outages in cases of extreme weather events. Moreover, the vast infrastructure of storage and pipelines allows for reliable, on-demand delivery of natural gas to customers all year.

Reliability and affordability are further enhanced by the increase in geographic diversity of natural gas production. Natural gas prices began declining in 2008 and have remained affordable since, benefitting customers. On average, a residential customer saves more than $870 per year if their appliances use natural gas instead of electricity.[8] These low prices are expected for several decades as reliable supply of domestically produced natural gas continues.[9]

Compared to other sectors of the economy, the building sector — heating in homes and businesses — is the fourth largest source of carbon emissions — lower than transportation, electricity and industry.[10] This is primarily because natural gas production and delivery is very efficient with minimal loss in the process and because appliances that use natural gas average more than 90% efficiency.[11] Energy efficiency programs continue to help customers use less natural gas. While the number of customers requesting natural gas service is steadily increasing, Xcel Energy's use per customer has decreased more than 20% since 2000.

Regulation and Planning

As a regulated utility, Xcel Energy is legally obligated to serve all customers within its service territory with safe, reliable, affordable energy. This means we cannot choose our customers and are obligated to serve every customer equally, from residential to business, industrial and income-qualified customers. As long as customers continue to use natural gas, we have a responsibility to invest in the reliability and safety of the system. State public utilities commissions fully regulate our business, with oversight over our investments and cost recovery, customer rates, and our rate of return.

Accordingly, we perform extensive resource planning to accommodate current and future expected load growth. On a state-by-state basis, we look at ten-year capacity forecasts and assess system requirements to meet peak days and hours, to ensure there is always enough natural gas to reliably serve our customers. We use a variety of tools to perform this analysis such as Geospatial Information Systems (GIS), flow and pressure data from supervisory control and data acquisition (SCADA) remote monitoring points, along with customer growth forecasts. Based on our analysis, we develop potential operational solutions, address system challenges and customer growth, and develop projects to mitigate any issues. This work informs our rate reviews and other filings with regulators.

THE NATURAL GAS SUPPLY CHAIN

Our distribution system is just one piece of a much larger natural gas supply chain that meets customer demand for natural gas.

1) Production
Producers identify resources and extract natural gas from underground deposits.

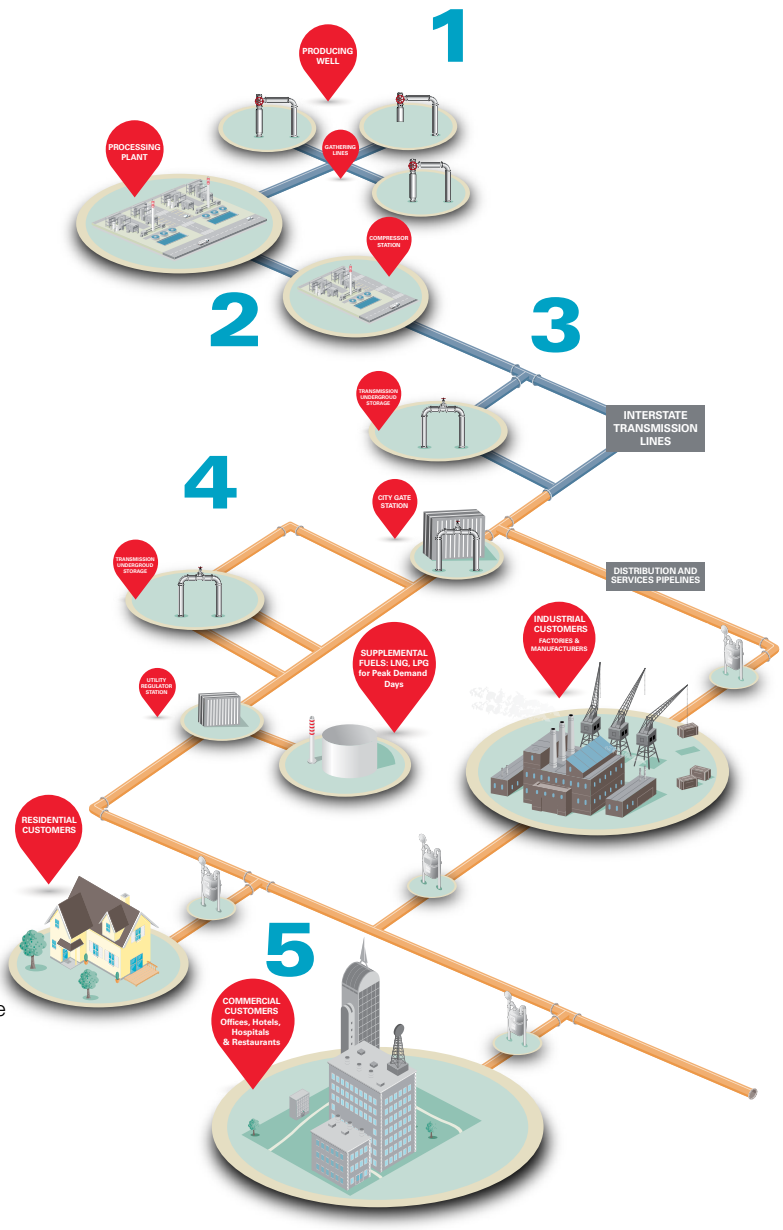
2) Processing
Natural gas is processed to remove impurities and stripped down to a composition that customers can safely use. While some limited processing is done in the field at the wellhead, natural gas is transported from the field through gathering pipelines to plants where larger scale processing takes place.

3) Transmission and Storage
Natural gas is transported from processing plants to consumer markets through an elaborate transmission pipeline system. Compressor stations located along the system compress natural gas to higher pressures, allowing more volume to travel through the pipelines and facilitating flow between locations.

To balance production supply, which generally flows at a consistent rate throughout the year, and customer demand, which can vary dramatically hour to hour and season to season, natural gas is stored in underground fields throughout the country. These storage fields use depleted gas reservoirs, aquifers and salt caverns. On a smaller scale, natural gas can be stored as liquefied natural gas (LNG) and compressed natural gas (CNG).

4) Distribution
Xcel Energy operates a distribution system that delivers natural gas to customers. The interconnection point between the interstate transmission system and distribution system is commonly referred to as the "city-gate". Distribution systems are generally comprised of smaller diameter pipelines operating at lower pressures compared to transmission systems. They also include compressor stations and storage.

5) Customers
Millions of customers use natural gas to fuel their essential heating, cooking, transportation and other needs.



Xcel Energy Resources for Serving Customers

- Xcel Energy is the nation's 10th largest natural gas provider, based on customers, serving 2.1 million homes, businesses and industrial users.
- Xcel Energy does not produce natural gas but purchases about 580 Bcf of natural gas per year from 58 producers or marketers.
- With more than 35,600 miles of distribution pipelines, our primary business is delivering natural gas to customers.
- We own nearly 2,200 miles of transmission pipelines and 16 compressor stations.

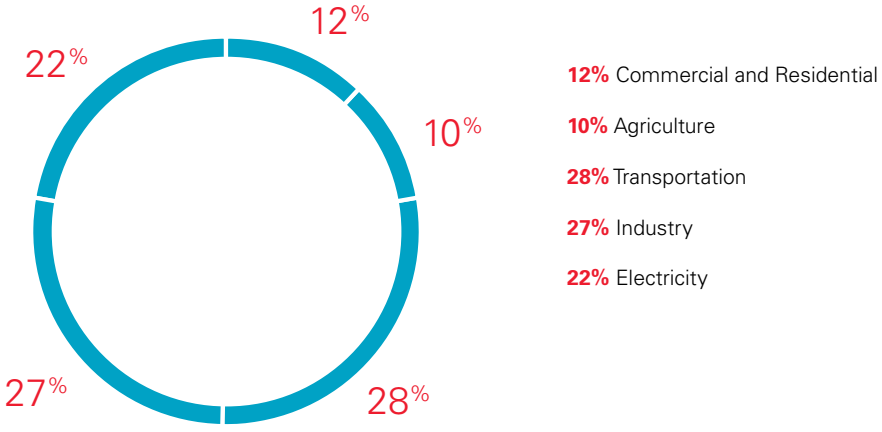
GREENHOUSE GAS EMISSIONS FROM NATURAL GAS

There are two greenhouse gas emissions associated with the natural gas supply chain. Methane — a potent greenhouse gas — can be released during the production, transmission and distribution of natural gas, and carbon dioxide is emitted when natural is burned in equipment or appliances, such as furnaces and water heaters.

In the United States, agriculture, oil and gas operations, and waste management are the largest sources of methane.[12] Methane emissions from the production of natural gas account for 3% of annual greenhouse gas emissions nationally, and most of these releases occur upstream of the distribution system, during the production, processing and transmission of natural gas.[13] The most significant sources of methane emissions in the natural gas supply chain are equipment leaks, vented emissions and pneumatic controllers.

Of the nation's total greenhouse gas emissions, carbon emissions from the building sector make up 12% of the total while industrial emissions are 27%. Both are significantly lower than the transportation and electric sectors, which combined are more than 50% of the total.[14]

Greenhouse Gas Emissions by Sector



Source: U.S. Environmental Protection Agency

While the building sector is a relatively small portion of total U.S. emissions, reducing energy use in buildings is increasingly of interest to our customers and other stakeholders. This is driven in part because, as electric sector emissions decrease, natural gas use will become a proportionally higher source of emissions for our cities and large customers. For some of our cities, notably Minneapolis, emissions from natural gas use have already surpassed electricity and are now the largest single source.[15]

Reporting and Disclosure
Xcel Energy supports transparent public reporting of greenhouse gas emissions from our electricity and natural gas businesses. We compile our greenhouse gas measurements based on federal, state and voluntary reporting protocols. This includes the EPA's Greenhouse Gas Reporting Protocol. Under this program, we report methane emissions from our natural gas operations as well as carbon emissions on behalf of customers who are not subject to this federal reporting and who use natural gas in their homes or businesses. In the coming year, we plan to do additional reporting using the Natural Gas Sustainability Initiative Methane Intensity Protocol and ONE Future.

We are also a founding member of The Climate Registry (TCR), a nonprofit organization established to develop a consistent standard for measuring and reporting greenhouse gas emissions. Under TCR's general reporting protocol, we have reported and obtained third-party verification of our greenhouse gas emissions from both our electricity and natural gas operations going back to 2005.

A LEADING STRATEGY TO REDUCE EMISSIONS ACROSS THE SUPPLY CHAIN

Natural gas is a low cost, abundant and versatile energy source. While it produces fewer emissions than other fossil fuels, its continued use depends on minimizing its emissions footprint.

Building on a history of environmental leadership, our strategy addresses both methane and carbon dioxide emissions across the natural gas supply chain. Xcel Energy's plan is to operate the cleanest natural gas delivery system possible, while helping customers reduce their emissions associated with natural gas use and influencing our suppliers to do their part.

METHANE EMISSIONS		CARBON EMISSIONS
Producers and Suppliers	**Xcel Energy System**	**Customers**
		
Leverage our buying power	**Reduce system emissions**	**Enable new technology**
Require reporting transparency and disclosure	Invest $1.4 billion in ongoing upgrades, keeping our methane emissions rate below 0.2%	Increase conservation
Purchase natural gas from suppliers with low methane emissions	Continue reductions through EPA Natural Gas STAR and Methane Challenge	Launch voluntary programs for all-electric zero-carbon new communities, smart water heaters, combination cooling-heating
Support ONE Future goal to limit the industry's methane emissions to 1% or less by 2025	Pursue renewable natural gas and hydrogen blending	Offer customers a low-carbon gas choice

Delivering the Cleanest Natural Gas Possible to Customers

Similar to our electricity business, we have a track record of environmental leadership in minimizing and reducing methane emissions on our system and are stepping up to do more.

We achieved significant emissions reductions to date by implementing best management practices under the EPA's Natural Gas STAR program, which we joined in 2008. This includes:

- Identifying and replacing aging distribution pipe. We have removed all cast iron and nearly all bare steel and unprotected steel pipe. A recent study shows that replacing cast iron and bare steel with protected steel pipe can reduce distribution system emission rates well below the national average.[16]
- Working actively to avoid natural gas releases during system construction work. When we enter a pipe for scheduled construction or other work, we try to move the natural gas into low-pressure mains or defuel the system to avoid releasing methane directly to the atmosphere.
- Increasing surveys to detect methane releases during inspections and maintenance. We conduct multiple leak surveys within a year to decrease repair time.
- Replacing existing high-bleed controllers with low-bleed or no-bleed controllers where possible.

We became a founding partner in the EPA's Methane Challenge program in 2016 to expand our efforts to reduce methane emissions. Under this program, we pledged to reduce by 50% or more the venting of pipelines during scheduled natural gas construction projects. We reduced venting of methane by 95% in 2018 and 87% in 2019, avoiding approximately 51,000 million cubic feet of natural gas from venting to the atmosphere.

Leveraging our Buying Power to Influence Suppliers

As a natural gas distribution company, we depend on suppliers for the natural gas we deliver to customers. While we do not have direct control over our suppliers' activities, we can use our relationships and purchasing power to move suppliers to improve transparency and adopt best practices for reducing methane emissions. Our goal is for the natural gas we purchase to be produced, processed and delivered with the lowest methane emission rate possible.

The first step is to better understand the practices and methane intensity of natural gas producers, which is challenging in a dynamic market. We participate in two industry groups that engage producers and the natural gas supply chain in transparency and best practices:

- The MJ Bradley Natural Gas Supply Collaborative (Supply Collaborative) is a group of natural gas purchasers calling for producers to disclose a set of quantitative and qualitative performance indicators, for methane and other environmental and social issues. The goal is to promote reporting and implementation of leading practices in the natural gas industry.

- The Natural Gas Sustainability Initiative (Sustainability Initiative), sponsored by the Edison Electric Institute and American Gas Association, is developing a uniform protocol for calculating methane intensity that can be used across the entire natural gas supply chain. This protocol is essential to assess and understand performance of different suppliers.

To expand on these industry efforts, we plan to gain more insight into the methane intensity of the natural gas we purchase. One challenge is fully understanding where the natural gas originates. While we buy some natural gas directly from producers who may have information on their own methane intensity, or reduction practices, we also buy a significant amount of natural gas from marketers. Marketers buy and sell natural gas as a financial product and are often unable to provide transparency in the origin.

Given the lack of transparency in the origin of natural gas, we are asking our suppliers directly for information. Starting with our 2021 natural gas procurement, we will request suppliers to disclose information on their methane performance. This will include the methane intensity calculated with the Sustainability Initiative protocol and information on management best practices that minimize or prevent high emission events following the Supply Collaborative best practices. The combination of reported methane intensity and implemented best practices will allow us to identify which suppliers are producing natural gas with low methane emissions.

Based on responses to this year's information request, we will identify specific marketers who are willing and able to collect and disclose more information from suppliers. The process will also help us identify barriers and potential solutions to working with natural gas marketers and producers to increase transparency in the origin of their supply.

In addition, we joined ONE Future in early 2020. ONE Future is a consortium of more than 20 natural gas companies formed in 2014 that seeks to collectively limit methane emissions across the entire natural gas supply chain to 1% or less of throughput by 2025. Participation in ONE Future allows us to share technology solutions with other companies and influence the entire natural gas supply chain to reduce emissions. The emission rates for participants in ONE Future are at least 25% lower than the national average, according to independent modeling by the National Energy Technology Laboratory.[17]

The 1% emissions target represents a rate that is technically achievable and can significantly reduce the emissions impact of natural gas as an energy source. ONE Future member companies have successfully reduced their emissions below the proposed target, primarily by replacing leak prone equipment, implementing voluntary leak surveys and installing systems to collect vented natural gas.

Within the overall 1% target, ONE future set individual emission targets for each segment of the natural gas supply chain. The targets for each segment are shown in the table below. By joining, we are committing to go beyond these targets and keep our methane emissions rate at less than 0.2% from all areas of our natural gas operations, including the distribution system and some minor transmission and processing facilities.

ONE Future Segment Targets	
Segment	**Target**
Production	0.28%
Gathering and Boosting	0.08%
Processing	0.11%
Transmission and Storage	0.30%
Xcel Energy's Target Distribution	**0.22%**

We will annually report a comprehensive methane emissions rate to ONE future using its reporting protocol that goes beyond current state and federal reporting. ONE Future requires reporting from all emission sources, including sources that fall below the reporting threshold of the EPA Greenhouse Gas Reporting Protocol, which is 25,000 metric tons carbon dioxide equivalent (MT CO_2e). This additional data will provide a more accurate count of our methane emissions.

Helping Customers Reduce Their Carbon Emissions Through Voluntary Programs
As leaders in clean energy and reducing carbon emissions, we are committed to helping customers reduce their emissions from natural gas use. Our strategy starts with what we can do affordably and reliably through technology that is available today and voluntary, customer choice programs. By focusing in the areas described below, we can help to build the market and advance technologies needed for tomorrow.

Approach	Strategic Reduction Opportunities
Reducing Use	Expand energy efficiency
Beneficial Electrification	New all-electric community developments
	Grid-integrated, managed electric water heaters
	Heat pump systems with natural gas backup for cooling and heating
Lower Carbon Supply	Renewable natural gas
	Hydrogen and methanation (power to gas) demonstration

Reducing Natural Gas Use

Since we know many customers will continue to choose natural gas for heating and other needs, our strategy is to ensure they have access to the most efficient options and to drive the market toward more advanced solutions. Energy efficiency improvements will be achieved through a combination of sophisticated equipment controls, more efficient equipment, and improvements in building envelopes.

Xcel Energy has a long history of promoting cost-effective energy efficiency. Our customers have reduced their natural gas consumption more than 20% since 2000 through conservation programs and more efficient appliances and buildings. Working with many stakeholders and our regulators, we plan to expand our annual natural gas efficiency targets and spending in both Minnesota and Colorado.

There are also opportunities for advancements in natural gas technology. For example, natural gas heat pumps have potential to compete with electric heat pumps on efficiency and emissions reductions while using existing infrastructure. As discussed in the policy section, further innovation in natural gas efficiency products is needed.

Beneficial Electrification

Nationwide, the electric sector can enable the transition to a low-carbon economy. With aggressive carbon reduction goals for our electric business, we plan to help our customers reduce their carbon emissions through electrification across our service territory. However, we need to make sure the electrification we pursue is beneficial, achieving the goals consistent with emerging state policy, of reducing emissions, keeping customer bills low, and optimizing use of the power grid.

What is Beneficial Electrification?

The definition of beneficial electrification is constantly evolving with developing technology and regulatory statutes. In Colorado, beneficial electrification is defined in statute (SB 19-236 Section 40-3.2-106(5). More generally, beneficial electrification refers to electrifying fossil fuel equipment and appliances when the switch to electricity reduces overall costs, reduces net greenhouse gas emissions, or optimizes use of the power grid.

Today, the clear choice for electrification is the transportation sector — the largest source of carbon dioxide emissions in the country. Charging an electric vehicle on our system today emits 50%-60% less carbon dioxide than a conventional internal combustion engine car and will emit 80%-90% less carbon dioxide in 2030 and zero emissions in 2050. In addition, electric vehicles can charge at night during off-peak times which is an efficient use of the power grid and helps lower electricity prices for all customers. Furthermore, electric vehicles that charge overnight during off-peak hours cost less than the equivalent of $1 per gallon of gasoline. Given that it meets all the criteria of beneficial electrification, Xcel Energy is actively pursuing electrification of the transportation sector.[18]

In the building sector, achieving emissions reductions through electrification depends on appliance efficiency and the emissions intensity of the power grid. Some technologies, such as heat pump water heaters, already achieve emissions reductions, while other technologies, such as air source heat pumps, may require a cleaner power grid than is currently available. Electrification today also comes at a cost premium for customers willing to switch and could increase costs for those who do not switch, if not done carefully. While options are limited today, we know that the power grid will become cleaner, technologies will improve, and costs will likely decline, opening new opportunities.

While we seek beneficial electrification, we see significant challenges with full or mandatory approaches to electrification. Full electrification of this sector is technically challenging and could result in unintended consequences, such as:

- Electric system build-out. Replacing all the energy that natural gas provides on the coldest days in winter will require significant investment in electric capacity, increasing peak demand up to two or more times our current system.[19]
- Costs of the remaining natural gas system. The system was built to serve customer demand for natural gas; to the extent those preferences change, customers who remain on the system will still pay to maintain the safety and reliability of the existing assets.
- Wealthier customers are more likely to electrify first, leaving natural gas customers, especially vulnerable customers in need, with higher natural gas bills to cover the costs of the remaining natural gas system. For instance, there are thousands of people that require assistance today from the Low Income Home Energy Assistance Program (LIHEAP) in our states: 79,000 in Colorado, 133,000 in Minnesota and nearly 200,000 in Wisconsin, and this is with only 20%-30% of eligible households receiving assistance from the program. Due to economic conditions alone, the Colorado LIHEAP budget increased almost 15% to $61.6 million from 2019 to 2020. Rising natural gas bills will require increased LIHEAP budgets with more families in need of energy assistance. We estimate that in Colorado if winter heating bills increased more than 40% because of electrification,[20] the state's LIHEAP budget would increase by 66%, costing almost $100 million annually.[21]
- Loss of customer choice. All-electric mandates take away the ability for customers to choose the type of energy they want to meet their needs.
- Higher carbon emissions. Depending on the electric system emissions intensity, full electrification of buildings today may not lead to net carbon reductions in the near term. Moreover, heating demand occurs in the winter when renewable electricity may be less available.
- More expensive carbon emission reductions. Mandatory electrification is a relatively expensive way to reduce carbon emissions on a dollar-per-ton basis.

Nevertheless, there are opportunities today to engage in voluntary beneficial electrification in a strategic way that avoids the potential, unintended consequences of the full or mandated electrification pathway.

We are seeking select opportunities with proven ability to lower costs, reduce carbon emissions, or optimize use of the power grid. Based on current technology, the opportunities ready for testing are water heaters, all-electric new builds, and combination cooling and heating systems.

New All-Electric Communities

With new builds, every aspect of the design and construction can focus on making electric space and water heating and cooking work for residents. Unlike retrofits, which can be expensive, the initial investment can start with the right building envelope and efficiency practices specific to electricity use. Plus, developers can avoid the expense of pipeline extensions and buildout of the natural gas system. By flattening load growth on the natural gas system, we also avoid the expense and environmental disruption of system expansions.

Building on our current ENERGY STAR® New Homes program that offers developers incentives for using energy efficient materials and appliances regardless of fuel type, we will work with developers and other stakeholders to identify the best projects and provide the choice to go all electric. These are new building developments where it is more difficult and costly to tap into the existing natural gas system, but there is easy access to a strong electric distribution network.

Grid Management Key to Successful Electrification

For electrification to reduce emissions cost-effectively, new electric devices must run on clean, low-cost energy. This requires that the devices interact with the power grid to operate during times when the lowest cost renewable energy is on the margin or in excess. For all our electrification programs, we have actively developed and deployed tools and management systems to operate fleets of appliances to optimize use of the power grid while meeting customer demand.

Electrification must be deployed carefully for the building sector to achieve desired emission reductions. We are seeking select opportunities with proven ability to reduce carbon emissions, maximize grid use and reduce costs. Based on current technology, those opportunities ready for testing are water heaters, all-electric new builds, and combination cooling and heating systems.

Water Heaters

Electric heat pump water heaters can increase the interaction between houses and the power grid to maximize the use of clean energy. If installed to operate with the power grid, they also offer immediate carbon benefits compared to natural gas water heaters.

Since water holds heat for extended periods of time, water heaters are essentially a distributed energy storage device. If connected to the power grid, these water heaters can be programmed to run when renewable energy is available or when electricity costs are lower. Under today's operations, electric water heaters would likely heat at night using available wind energy to provide hot water for the morning, allowing customers to help reduce emissions without sacrificing affordability, comfort or convenience.

By offering incentives, we plan to give customers the option to purchase new grid-enabled heat pump water heaters when it is time to replace their natural gas hot water heaters. For commercial and industrial customers with more space available, they can choose to do a full replacement or install an electric pre-heater on an existing natural gas water heater that will operate with available renewable energy.

Combination Cooling and Heating Solution

The primary alternative to natural gas heating is currently the electric air source heat pump (ASHP). ASHPs provide cooling similar to air conditioners and work in reverse for heating. They work well in warmer climates where the ASHP provides cooling and mild heating. However, in colder climates, deployment potential is limited because ASHP performance decreases significantly as outdoor air temperature drops. The only way to use ASHPs in cold

climates is with a backup heating source. An all-electric option would use electric resistance heat as backup, which is inefficient and more costly for customers and requires more electric infrastructure.

A targeted, more efficient solution for colder climates is a combination cooling and heating option that uses ASHPs with existing natural gas infrastructure as backup. We see an opportunity for customers upgrading air conditioning units to replace them with grid-enabled ASHPs to provide summer cooling as well as some level of winter heating. As the ASHPs lose efficiency and capacity on colder days, existing natural gas furnaces would kick in for backup heating. Customers would only replace one appliance and maintain their comfort levels while using our existing natural gas system as needed.

This combination cooling and heating option can be advantageous when paired with a smart thermostat. Smart thermostats enable energy providers to reduce operating cost and maximize the environmental benefits of using both electric and natural gas appliances while meeting the heating demands of the customer.

Lower Carbon Supply

Some energy uses are likely to remain dependent on natural gas because they are extremely difficult to electrify and some customers may prefer natural gas for specific purposes, such as cooking. In these instances, we need solutions that reduce the environmental footprint of natural gas and improve efficiency, including renewable natural gas and more advanced hydrogen or power to gas solutions.

Renewable Natural Gas

We plan to deliver renewable natural gas (RNG), along with the associated environmental attributes, to natural gas customers, subject to pricing, availability and demand. This supply option helps customers to reduce their carbon footprints without replacing heating systems or other appliances. To achieve the desired emissions benefits, the environmental attributes must be verified, tracked and attributed to customers.

The cost for RNG may be five to ten times higher than the price of natural gas — our research shows it varies significantly depending on the type of project, location and volume of gas produced. For RNG projects, additional analysis is needed to compare the cost with other reduction strategies.

Initially, we support an optional approach that allows interested customers to choose to use RNG without imposing the additional cost on the system and other customers. Early surveys suggest there is customer demand for RNG, and as the market grows, there may be opportunities to incorporate RNG resources system-wide to benefit all customers.

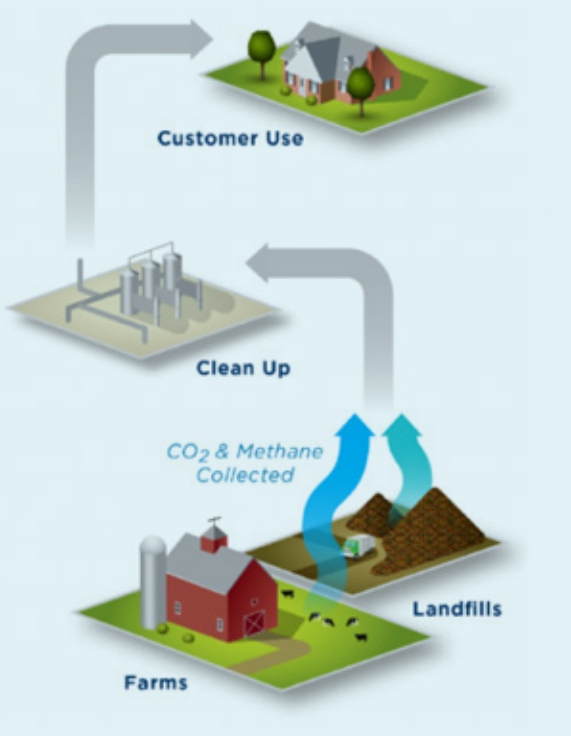
What is Renewable Natural Gas?

Renewable natural gas (RNG) is any pipeline-compatible, gaseous fuel derived from biogenic or other renewable sources that has lower lifecycle CO_2e emissions than geological natural gas. Today, most RNG is produced by capturing emissions from existing waste streams found in landfills, wastewater treatment plants and animal manure. This gas must be treated and cleaned, raising it to a standard where it can be injected into the existing system and used instead of geological or conventional natural gas.

RNG can also be produced using wind or solar power. The clean electricity powers an electrolyzer that splits water into hydrogen and oxygen. Hydrogen can be captured, stored and used or combined with a source of carbon to produce renewable methane. Power to gas also offers a long-term energy storage solution for renewable electricity.

It combines low to negative life cycle carbon emissions with the high-energy density, storage capability and transportability of natural gas. Because of this, it is highly valued for fueling cars and trucks, as well as meeting building heating needs.[22]

Based on life cycle impact assessments, greenhouse gas emission reductions vary depending on the source of RNG. RNG produced from landfills can be 44% less carbon intensive than conventional natural gas while RNG produced from wastewater sludge can be 77% less intensive and RNG produced from anaerobic digestion of food and waste and from dairy manure can be more than 100% less intensive.[23]



Source: American Gas Association, diagram does not include all sources of renewable natural gas, such as gas collected from wastewater treatment plants or hydrogen production.

Hydrogen Demonstration

Longer term, we expect to deploy new, advanced technologies such as hydrogen produced by carbon-free electricity. The innovation supports our electric system carbon goals while making use of the existing natural gas system. For example, hydrogen can be produced using renewable or nuclear electricity on the electric system and then injected into the natural gas system, reducing the carbon intensity of natural gas supplied to our customers while turning the natural gas system into a large-scale battery.

As a first step, we partnered with other energy providers and several Department of Energy national labs to study producing hydrogen with nuclear power. Through a $10 million grant from the U.S. Department of Energy, we are now implementing a pilot project to produce hydrogen with high-temperature steam electrolysis at one of our nuclear plants.

We plan to continue researching and testing the viability of directly injecting hydrogen into the natural gas system or conducting the full process to convert the hydrogen back to methane. To launch future pilot projects, we are working with policy makers and regulators.

Analysis Group Study on Potential Impacts of Mandated Electrification of Natural Gas Use in Colorado Homes

The way we transition to low-carbon natural gas solutions or electrification will have ramifications for customer costs and the use of electric and natural gas systems. To better understand these impacts, Xcel Energy contracted with Analysis Group (AG) to explore the implications of different approaches to reducing greenhouse gas emissions that result from residential customers' direct use of natural gas. AG was tasked with analyzing the impacts of alternative strategies, including switching to electricity for heating and other appliances, specifically for Xcel Energy's Colorado residential customers.

In Colorado, Xcel Energy's natural gas residential customers account for about 5% of statewide greenhouse emissions, or 5.7 million short tons of CO_2e. These emissions result from use of natural gas for space heating, heating water, cooking, drying clothes and other household energy needs. Reducing emissions from these activities can come from possible actions like switching from natural gas to electricity, making homes more energy efficient, and using lower carbon gas resources like RNG.

AG performed a 'what if' analysis to explore the impacts on customer costs, greenhouse gas reductions, cost per ton of emissions reductions, and system costs needed to provide reliable service under four scenarios that varied in terms of policy approach and emission reduction strategy:

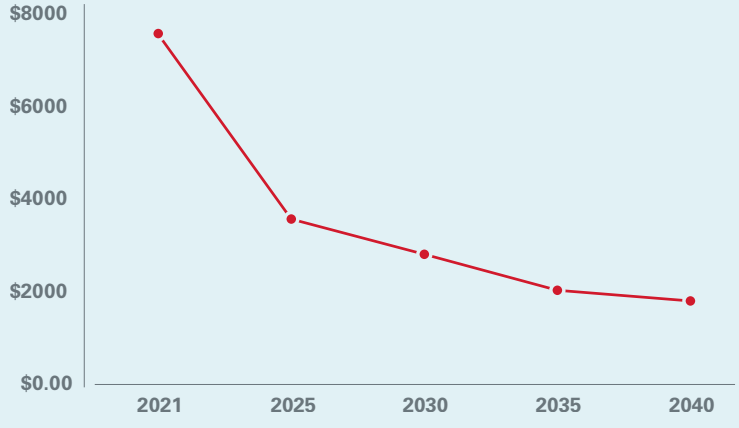
1. Mandatory policy that all new residential buildings may only be all-electric and that heating systems and appliances in existing residential buildings switch to electricity at end of appliance life
2. Mandatory policy that all new residential buildings may only be all-electric
3. Voluntary electrification of new and existing buildings, plus energy efficiency (EE)
4. Voluntary electrification of all new and existing buildings, plus RNG/low-carbon gas (H2)

The scenarios are not predictions of the future and were not assigned any probabilities of occurrence. Rather, they were designed to provide the boundary conditions about potential pathways to reducing emission reductions in homes.[24]

Overall, the study shows that the timing and design of policies to reduce greenhouse gas emissions in homes matter. Faster adoption of fuel switching introduces trade-offs in the outcomes for customers that electrify their homes and those that remain on natural gas, for emissions levels and cost of emissions reductions, and system costs.

A voluntary approach that allows customers to capitalize on upcoming improvements in appliance technologies and in electric system emissions can help reduce costs and achieve emissions reductions. In fact, the value proposition of electrifying homes improves starting in the mid-2020s as commercially available electric technologies for space and water heating and other appliances become more efficient and as Xcel Energy's electric system becomes less carbon intensive. The table below shows the estimated cost premium for a new customer to adopt and operate an all-electric home which is more than $7,000 today but would decrease quickly over the next few years.[25]

Cost Premium ($NPV) Per Residential Customer by Adoption Year (New-Builds Mandate)



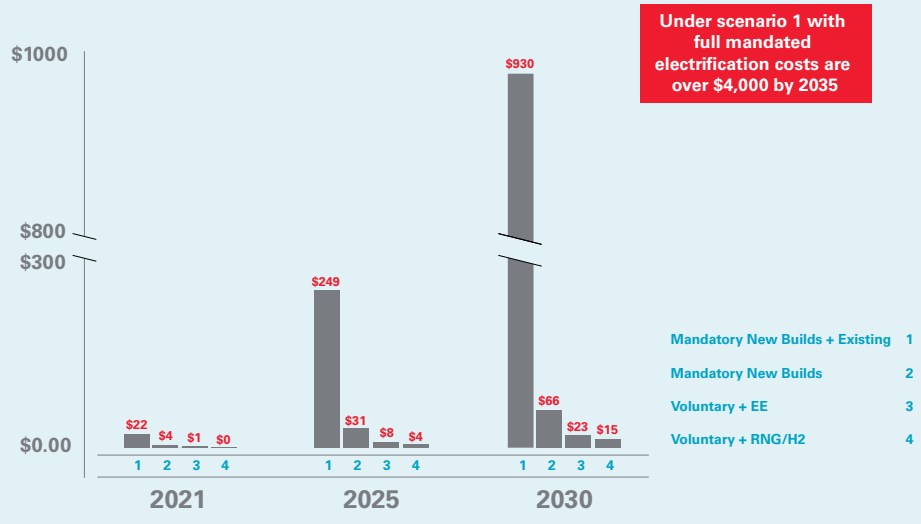
The study also analyzed the implications of the four scenarios' different levels of electrification for the need to add new electric system resources while also continuing to assure reliable natural gas service for those customers who remain on the natural gas system. The results highlight that large-scale electrification requires attention to several important operational, planning, investment and customer-impact considerations.

First, the full mandatory scenario would require millions of customers to make decisions about and take actions on switching out every natural gas appliance and energy system in their homes. Even if cost were not an issue, moving every customer from existing natural gas appliances to new electric ones would be a monumental undertaking for every homeowner or landlord of buildings that use natural gas. In the near term, other options like increasing reliance on renewable natural gas would allow the company to leverage current infrastructure and make changes at scale that will reduce emissions for the natural gas system.

Second, immediate electrification would lower revenues on Xcel Energy's natural gas system without commensurate reductions in the costs of maintaining the system. Meanwhile, the utility's electric business would experience increasing electric demand, revenues and capital costs over time. Presuming that lost revenues on the natural gas side would be recovered from remaining natural gas customers, those customers would see increased bills for gas delivery service over time. In the case of the full mandated scenario, the natural gas business would shrink quickly, delivering only one-third the natural gas now delivered by the mid-2030s but with continuing costs to maintain a safely operating natural gas system. Notably, the voluntary scenarios only add $15-$23 per year to non-participating customers' bills (as of 2030) in comparison to the $930 increase in the full mandated scenario.

Incremental Impact on Annual Bills of Residential Natural Gas Customers

(assuming lost revenues are recovered from customers who remain on the natural gas system)



Third, aggressive electrification would significantly change Xcel Energy's Colorado electric system, moving its peak energy needs to the winter as homes shift from natural gas to electric heating. In Colorado, Xcel Energy currently sees the most demand from customers in the summer and the utility is increasing its reliance on wind and solar power. A winter-peaking electric system that relies increasingly on renewable resources faces two realities: The system will need to add considerably more resources to meet the new winter peak demand because wind and solar projects do not produce as much power in the winter. In the absence of long-duration electric storage technologies, the system will need even more redundant capacity in the winter to make sure that electric supply can provide heat and light even during a sustained cold winter period. These two factors drive up electric system costs. With aggressive electrification, the electric system could shift to a winter peak in the 2030s, possibly earlier, and even before then, the electric system could require more than 4,000 megawatts of new capacity to cover the increased demand — more than a 50% increase in the system's capacity.[26]

The study shows mandatory electrification scenarios, which impose a higher cost, do not produce greater emissions reductions compared to voluntary approaches. Program and policy designs are important to helping drive down emissions reductions from homes while also maintaining affordable natural gas and electric utility bills. Further study is needed to better understand the sensitivity of the assumptions and system impacts of the electrification scenarios.

THE ROLE OF NATURAL GAS IN CLIMATE SCENARIO ANALYSIS

While we continue to pursue further study of the climate science, a review of representative climate scenarios suggests that the continued use of natural gas is consistent with the economy-wide greenhouse gas reductions needed to meet the Paris climate agreement goals. Similar to Xcel Energy's strategy, the scenarios discussed below suggest the natural gas system will continue to play a role in delivering critical energy, but will need to evolve to deliver new lower carbon supply and incorporate electrification and energy efficiency measures.

Moreover, the scenarios suggest that emissions reductions will vary across sectors of the economy, with sectors such as electricity reducing more than others, including buildings, where emissions reductions may be more challenging. Xcel Energy's combination electricity and natural gas strategy aligns with this outcome.[27]

The analysis below reflects a summary of high-level, global findings in publicly available scenarios from the International Energy Agency and the Intergovernmental Panel on Climate Change. These scenarios demonstrate the consistency of our natural gas strategy with achieving broader societal climate ambitions. We note that the scenarios often reflect data at the national or even global level and do not provide actionable guidance that can be applied to an individual company, so we believe there is a need for further expert analysis to better understand opportunities and pathways for the natural gas system that are consistent with climate science.

International Energy Agency's 2019 World Energy Outlook (IEA)
In the most ambitious climate scenario laid out by the International Energy Agency's 2019 World Energy Outlook, the Sustainable Development Scenario (SDS), natural gas distribution continues to play a role in delivering necessary energy even as the world achieves the Paris climate agreement's goal of limiting global temperature increase to 2 C above preindustrial levels, with an aspiration to limit this to 1.5 C.[28] Natural gas use under this scenario grows globally to the late 2020s and still plays a role in 2050.

Further, the SDS suggests that eliminating today's extensive natural gas networks could narrow the options for achieving future emissions reductions. Instead, electricity and natural gas systems can work in tandem to reduce emissions while continuing to deliver the energy customers rely on to heat their homes. The scenario finds that there are limits to how quickly and extensively electrification can occur, and that established natural gas networks can deliver as much as two times more energy than existing electric grids while also providing vital flexibility to maintain the reliability of energy delivery. The scenario does suggest that at some point, natural gas use may start to peak with new builds moving to electric systems.

In this scenario, over time natural gas networks are repurposed to blend different types of fuels, such as hydrogen or renewable natural gas. Using the network in new ways increases the diversity of energy types our customers can use while keeping the resiliency of the underground network.

The IEA also published a detailed study in 2019 about the role of buildings in the clean energy transition. This study highlighted the importance of timing the reduced use of natural gas in buildings with the increase in renewable electricity. If increased electricity use in buildings outpaces the decline in carbon intensity of electricity, emissions will not decrease.[29] Our plan aligns the timing of our emissions reductions on the power grid with the improved technology for all-electric new builds.

Intergovernmental Panel on Climate Change (IPCC)
The IPCC's 2018 Special Report on Global Warming of 1.5 C reinforces the findings above from IEA. The report notes that "in pathways limiting global warming to 1.5 C with no or limited overshoot, the electricity share of energy demand in buildings would be about 55%–75% in 2050 compared to 50%–70% in 2050 for 2 C global warming."[30] This illustrates that even in 1.5 C and 2 C scenarios, electricity will not provide 100% of building energy demand, so some level of natural gas will be needed, along with significant energy efficiency improvements. All three — electrification where beneficial, energy efficiency, and maintaining a natural gas system with lower carbon fuels — are key components of our strategy.

POLICIES FOR REDUCING EMISSIONS ACROSS THE SUPPLY CHAIN

To reduce greenhouse gas emissions associated with natural gas, we need new technologies or alternative fuels to meet customer demand for affordable, reliable energy for heating and cooking, especially during winter months. While there is no clear replacement for natural gas today, policy can work at the pace of technology to promote those solutions that are available now. It can also drive the incentives, pathways and innovation to develop new solutions to this challenging issue. Success depends on policy advancement in three areas:

- Regulatory pathways for electric and natural gas solutions
  - Dedicated beneficial electrification pathway
  - Building sector market for RNG
- Equitable cost sharing
- Innovation and investment in the most efficient natural gas system

Regulatory Pathways for Electric and Natural Gas Solutions
We are in the early days of solving the issue of carbon emissions associated with natural gas use and all solutions need to be considered. Rather than natural gas bans or mandates that may pick one specific solution, policy can create pathways for both beneficial electrification and low-carbon gas supply solutions.

Dedicated Beneficial Electrification Pathway
To promote beneficial electrification, we must move beyond traditional demand side management (DSM) programs to a dedicated policy construct for beneficial electrification. This includes three specific policy changes:

- Separating beneficial electrification from DSM policy
- Reforming DSM to remove fuel switching prohibitions and focus on carbon
- Equitable attribution of carbon emissions to motivate beneficial electrification

While traditional DSM programs focus on energy savings, beneficial electrification must meet three criteria: reduce greenhouse gas emissions, reduce customer costs or optimize use of the power grid. As an emerging technology, beneficial electrification may not meet the cost-effectiveness requirements of DSM programs, severely limiting the ability of utilities to pursue ambitious programs. Further, many states prohibit utilities from offering rebates for fuel switching, hamstringing a utility from offering any programs.

Given these challenges, a dedicated beneficial electrification pathway would support utility involvement and cost recovery, allow testing and deployment of emerging options, and address unique challenges of fuel switching. Under this policy, the utility would propose electrification programs through a dedicated budget and receive cost recovery under a rider or performance-based incentives. The programs would be evaluated on their own merits, based on the ability to achieve the three criteria rather than confined cost-effectiveness tests. This type of solution would also address challenges to electrification, such as the incremental cost to customers, managing system costs, stranded assets, and mitigating equity impacts for customers who remain on the natural gas system.

A dedicated approach would also allow policy makers the opportunity to consider more system-level beneficial electrification approaches. The DSM model largely relies on premise-level approaches to electrification, targeted to specific customers and solutions. As we move forward, there may also be opportunities at the system or community level to deploy electrification to the benefit of both the gas and electric system. For instance, avoiding significant build out of the gas system to reduce costs.

In the long-term, there could be the opportunity to merge DSM and beneficial electrification. Such a merger would require significant reform of DSM programs including using carbon reductions as the primary metric over energy savings and lifting the fuel switching prohibitions. With successful reform, programs could compete based on the ability to reduce carbon emissions cost effectively, putting beneficial electrification on an even playing field with traditional energy efficiency programs.

In promoting beneficial electrification, policy must also address the treatment of emissions across sectors and ensure the electric sector is appropriately motivated. While beneficial electrification reduces customer emissions from natural gas use, it could increase carbon emissions from the electric sector. Any increase in emissions as a direct result of electrification (from the building sector or otherwise) that creates a net greenhouse gas benefit should be equitably attributed to electric sector emissions budgets for purposes of achieving corporate or state-level goals. This attribution accounts for the pivotal role the electric sector plays in creating the desired net economy-wide reductions and will encourage utilities to pursue the most aggressive electrification programs possible.

Building Sector Market for Renewable Natural Gas

While there are clear opportunities for beneficial electrification, some end uses will be difficult to electrify due to customer preference or physical constraints, such as larger commercial and industrial uses, large heating loads in cold climates, or restaurants reluctant to forego natural gas cooking. For these uses, replacing natural gas with a lower-carbon gas supply will play a key role in reducing emissions. Policy is needed to promote the use of RNG in the building sector, in addition to transportation.

Currently, RNG and the associated environmental attributes are primarily going to the transportation sector because of the market created by the federal Renewable Fuel Standard and the Low Carbon Fuel Standard (LCFS) in California and the Pacific Northwest. Developers can make up the cost of their projects by selling environmental attributes for prices significantly higher than the production cost, making it difficult for other sectors to compete. In the case of the LCFS, the effect is that RNG projects are developed in many states, but all the environmental benefit flows back to California, limiting the ability of other states to meet aggressive carbon reduction goals.

Similar policies are needed to support use of RNG in the building sector. One solution is for states to adopt a standard carbon accounting and tracking mechanism to determine RNG carbon intensity. A uniform standard for RNG carbon intensity will allow utilities to determine carbon reductions from providing RNG to customers in place of conventional natural gas. Further, states can incentivize investment by allowing utilities to recover costs associated with RNG investments and approving RNG green tariff pilots. These types of policies signal that RNG is an important pathway to achieving state emissions reduction goals.

Equitable Cost Sharing

The basic premise of the utility compact is the obligation to serve any customer, meeting energy demands affordably and reliably. As a dual fuel utility, this means we must maintain and invest in the shared infrastructure that delivers electricity and natural gas. As of today, the demand for natural gas continues to grow, with very few customers switching to electricity, given the cost and infrastructure barriers associated with electrification. Regardless of potential future shifts in customer preferences, the utility requires regulatory certainty that investments can be recovered over the life of the assets.

Going forward, policy plays a key role in managing the costs and implications of a transition to electric heating options. Increased system costs will impact both electricity and natural gas customers if there is a large-scale shift to electric heating. On the electric side, significant capacity, transmission and distribution build-outs will be required to deliver significant amounts of energy to meet winter heating demand. On the natural gas side, there will be fewer customers left to pay the costs of maintaining a safe and reliable natural gas system. Those left on the natural gas system are more likely to be customers in need without the means to pay for new electric appliances or the cost increases to natural gas service.

Given that any transition to electrification of the building sector is likely to happen slowly over time, policy makers should create pathways today to manage these potential costs and to ensure they are equitably shared. Natural gas customers switching to electricity should pay all or some portion of any stranded costs given the infrastructure was built to serve their original energy needs. For dual fuel utilities, it may be appropriate for the electricity side of the utility to pay for some of the costs if the additional electricity sales are sufficiently beneficial to justify that payment. For instances where a customer may switch from one natural gas utility to a new electric utility, state regulators will need to establish a fair structure to compensate the customers of both utilities.

Innovation and Investment in the Most Efficient Natural Gas System
The primary obstacle today to reducing emissions from natural gas use is the lack of low-cost, effective technology substitutes for heating buildings, powering industrial processes, and generating firm dispatchable electricity. In part, this is due to limited investment in this type of innovation.

For the natural gas supply chain, innovation needs to focus on three areas:

- Continuous emissions monitoring to measure and reduce emissions from the production, processing and distribution of natural gas
- Low-carbon supply, such as RNG, hydrogen and ammonia, to reduce the carbon intensity of current end uses served by natural gas, and ultimately, transform the natural gas system into long-duration energy storage, like a battery
- Customer appliance efficiency and effectiveness, including natural gas and electric options

By focusing further investment in research, development and deployment opportunities in these three areas, we can continue to make the natural gas system as clean as possible and reduce emissions associated with natural gas use affordably. Moreover, this innovation would seek to optimize existing natural gas assets in which customers have already invested.

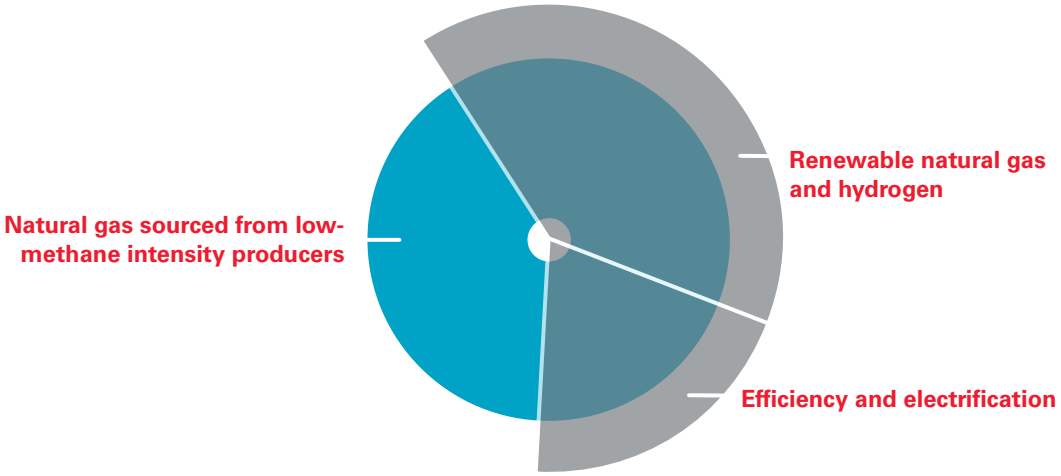
Like our advocacy for technology innovation for electricity, success in transforming natural gas will require considerable investment and further research and demonstration to develop viable technology solutions at the cost and scale that are needed. Federal and state policies must support this development. Through our natural gas strategy, we are signaling the need for innovation for both electricity and natural gas. In this way, utilities provide the market signal — the technology pull — from which the private sector and national laboratories and federal agencies can align their investments, research and assets.

CONCLUSION

Just as we have ambitious carbon reduction goals for our electricity business, we are equally committed to finding cost-effective solutions to reduce greenhouse gas emissions across the entire natural gas supply chain. This includes working with suppliers, helping customers and continuing to reduce emissions from our natural gas system. While there are no reliable, cost-effective substitutes for natural gas available today, investing in the policy and technology to drive innovation for both electricity and natural gas can deliver the solutions we need.

Under Xcel Energy's strategy, the natural gas system will evolve and change over time, delivering new fuels and serving new roles. Increased energy efficiency and electrification will offset the need for natural gas, and the system will deliver a mix of fuels, including renewable natural gas, hydrogen, synthetic gas and potentially new forms of energy. Remaining traditional natural gas will be sourced from suppliers with low methane emissions. Longer term, this pipeline and storage network can potentially serve as a long-duration battery — solving a major barrier for the electric sector to using more wind and solar energy. While we do not know the exact mix of these different solutions, we know that some combination will be needed to achieve our goals, as shown in the illustrative graph below.

Natural Gas in a Low-Carbon Future
(Illustrative Only)



We share the common goal of significantly reducing greenhouse gas emissions and building a clean energy future. Natural gas can play a continued role in this future: delivering new and cleaner forms of energy, enabling the increased use of renewable electricity, and supporting the continued heating needs of the economy. While some natural gas end uses will be converted to electricity, technological and policy innovation is required to ensure the remaining natural gas system is as efficient and clean as possible.

We are committed to the shared goal of reducing greenhouse gas emissions to achieve a low-carbon future. We believe there is a path forward for the natural gas system to play a role in this future: delivering new and cleaner forms of energy, enabling the continued growth of renewable electricity, and supporting the continued heating needs of the economy. While some natural gas end uses will be converted to electricity, technological and policy innovation is required to ensure the remaining natural gas system is as efficient and clean as possible.

REFERENCES AND NOTES

1 Natural Gas, The Facts. American Gas Association. 2019. https://www.aga.org/contentassets/03db82d44079403c9bfe7328a004d5ca/2019-natural-gas-facts.pdf

2 2015 Residential Energy Consumption Survey. Energy information Administration. 2017. https://www.eia.gov/todayinenergy/detail.php?id=30672; Xcel Energy values are based on internal survey of customers

3 Average gas sales from Nov 2018-March 2019 of 1,035,337 MMBtu/day, converted to MW. (1,035,337 MMBtu * 1,000,000 Btu/MMBtu ÷ 3413 Btu/kWh) ÷ 1000 kWh/MWH) ÷ 24 hours/day) = 12,640 MW

4 Average gas sales for January 2020 of 1,305,275 MMBtu/day, converted to MW. 1,305,275 MMBtu * 1,000,000 Btu/MMBtu ÷ 3413 Btu/kWh) ÷ 1000 kWh/MWH) ÷ 24 hours/day) =15,935 MW

5 Hoen, B.D., Diffendorfer, J.E., Rand, J.T., Kramer, L.A., Garrity, C.P., and Hunt, H.E., 2018, United States Wind Turbine Database (ver. 3.0.1, May 2020): U.S. Geological Survey, American Wind Energy Association, and Lawrence Berkeley National Laboratory data release, https://doi.org/10.5066/F7TX3DN0. Analysis assumes 1.8MW wind turbines, at winter capacity of 35%

6 Jadune, Paige, Colin McMilan, Daniel Steinberg, matteo Muraotri, Laura Vimmerstedt, and Trieu Mail. 2017. Electrification Future Study: End-use Electric Technology Cost and Performance Projections through 2050. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy18osti/70485.pdf

7 Xcel Energy. 2020-2034 Upper Midwest Integrated Resource Plan. July 1, 2019. Minnesota Public Utilities Commission Docket No. E002/RP-19-368. See Appendix F4, High Electrification Scenario Description

8 Natural Gas, The Facts. American Gas Association. 2019. https://www.aga.org/contentassets/03db82d44079403c9bfe7328a004d5ca/2019-natural-gas-facts.pdf

9 Annual Energy Outlook 2020. U.S. Energy Information Administration. 2020.. https://www.eia.gov/outlooks/aeo/

10 As of 2018; Combining commercial and residential. See U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks, at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

11 Natural Gas, The Facts. American Gas Association. 2019. https://www.aga.org/contentassets/03db82d44079403c9bfe7328a004d5ca/2019-natural-gas-facts.pdf

12 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018. U.S. Environmental Protection Agency. 2020. https://www.epa.gov/sites/production/files/2020-02/documents/us-ghg-inventory-2020-chapter-executive-summary.pdf

13 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2018. U.S. Environmental Protection Agency. 2020. https://www.epa.gov/sites/production/files/2020-02/documents/us-ghg-inventory-2020-chapter-executive-summary.pdf

14 Sources of Greenhouse Gas Emissions. U.S. Environmental Protection Agency. Accessed 2020. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#:~:text=The%20largest%20source%20of%20greenhouse,Greenhouse%20Gas%20Emissions%20and%20Sinks

15 Natural gas largest source of greenhouse gas emissions in Minneapolis for the first time. City of Minneapolis. 2019. http://news.minneapolismn.gov/2019/08/27/natural-gas-largest-source-greenhouse-gas-emissions-minneapolis-first-time/

16 Direct Measurements Show Decreasing Methane Emissions from Natural Gas Local Distribution Systems in the United States; Brian K. Lamb, Steven L. Edburg, Thomas W. Ferrara, Touché Howard, Matthew R. Harrison, Charles E. Kolb, Amy Townsend-Small, Wesley Dyck, Antonio Possolo, and James R. Whetstone; Environmental Science & Technology 2015 49 (8), 5161-5169; DOI: 10.1021/es505116p

17 S. Rai, J. Littlefield, S. Roman-White, G. G. Zaimes, G. Cooney, T. J. Skone, "Industry Partnerships & Their Role in Reducing Natural Gas Supply Chain Greenhouse Gas Emissions – Phase 2," National Energy Technology Laboratory, Pittsburgh, June 30, 2020

18 Xcel Energy. 2020. Electric Vehicles. https://www.xcelenergy.com/programs_and_rebates/residential_programs_and_rebates/electric_vehicles

19 January 2020 natural gas sales equivalent electricity capacity was 16,000MW versus Xcel Energy's owned, net dependable electric capacity of 18,730 MW

20 Implications of Policy-Driven Electrification. American Gas Association. 2019. https://www.aga.org/research/reports/implications-of-policy-driven-residential-electrification/

21 In Colorado the 2019 LIHEAP budget was almost $54million; Estimate of 25% more families enrolling because of higher energy costs

22 Renewable Natural Gas. American Gas Association. https://www.aga.org/natural-gas/renewable/

23 Gasper, Rebecca and Tim Searchinger. The Production and Use of Renewable Natural Gas as a Climate Strategy in the United States. World Resources Institute. April 2018. http://www.wri.org/publication/renewable-natural-gas

24 The study was based on assumptions about future conditions such as changes in the number of Xcel Energy's Colorado customers over time, their demand for gas versus electricity, the emissions profile of the electric system, efficiency of gas and electric appliances and equipment, future natural gas and electric bills, the availability of renewable gas resources, and other variables

25 This cost premium reflects the following comparison: the cost of fitting out an average new dwelling unit with all electric appliances and heating systems, compared to the cost of gas-using appliances and heating systems; and the cost to purchase electricity to operate those devices and systems over their lifetimes, versus the cost to purchase natural gas to run the gas equipment; the cost premium reflects the present value of these cost differences (electric v. gas), and takes into consideration the relative energy-using efficiencies of electric appliances and heating systems versus those that use gas

26 Note: this calculation only considers residential conversions to heat pumps without back-up in 2030; actual conversion of the entire system would require additional capacity

27 World Energy Outlook 2019, International Energy Agency. 2019, Annex A, Electricity and CO2 Emissions: World, United States. https://www.iea.org/reports/world-energy-outlook-2019

28 World Energy Outlook 2019. International Energy Agency. 2019, pages 579-580. https://www.iea.org/reports/world-energy-outlook-2019

29 The Critical role of Buildings. International Energy Agency. April 2019. https://www.iea.org/reports/the-critical-role-of-buildings

30 IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. See Summary for Policymakers, section C.2.4, available at https://www.ipcc.ch/sr15/