Table of Contents

03  Our Mission

04  Summary and Key Highlights

07  Dominion Energy Methane Emissions Reduction Report

08  Dominion Energy’s Natural Gas Operations

09  Understanding Methane Emissions and Sources
   09  Methane Emissions in the U.S.
   09  Methane Emissions in Dominion Energy’s Natural Gas System

12  How Methane Emissions Are Reported
   12  Volume Based Inventory Reporting
   14  Emission Rate Based Reporting

15  Historic Progress: Dominion Energy’s Methane Emissions Reduction Initiatives

17  The Future of Methane Reduction at Dominion Energy

21  Energy Efficiency and Renewable Natural Gas

23  Public Safety and Pipeline Integrity
   23  Pipeline Safety and Methane Reduction: Working Hand-in-hand
   23  Natural Gas Storage Initiatives
   24  Pipeline Integrity Management
   25  Protecting the Public

27  Glossary & Appendices
**Our Mission**

Dominion Energy provides safe and reliable energy to the homes and businesses of millions of Americans. Every single day, our employees are hard at work powering the economy, heating and cooling people’s homes, and serving some of our nation’s most critical national security assets.

Providing natural gas and electricity to America’s homes and businesses is what we do, but as corporate citizens we know our responsibilities extend far beyond that.

We have an obligation to serve our communities and to be careful, long-term stewards of the environment. For Dominion Energy, this is more than a professional responsibility. We live and work in the communities where we do business. We breathe the same air and drink the same water. So do our children – and so will theirs. We share a deeply personal stake. Dominion Energy is taking bold action to support that vision.

As society addresses the challenge of global climate change, our company has a role in helping to address this issue. That is why we are taking meaningful actions to reduce greenhouse gas emissions from our operations and helping our customers do the same.

Dominion Energy has made significant progress over the last two decades. We have reduced our impact on the environment, while providing safe and reliable energy to the customers who depend on us. For example, we have substantially cut greenhouse gas emissions across our electric and natural gas infrastructure. And we have expanded our role in generating and delivering renewable energy across the country while relying less on coal generation and more on no- and low-carbon nuclear and natural gas generation.

For more about our efforts to transition to cleaner generation ▶

Over the next decade, we are determined to go much further. To that end, Dominion Energy is harnessing the power of innovation and transforming the way we do business.

Earlier this year, Dominion Energy announced a historic undertaking to reduce methane emissions from our natural gas infrastructure: by 50%, by 2030. This industry-leading initiative will prevent more than 430,000 metric tons of methane from entering the atmosphere. That is equivalent to taking 2.3 million non-electric cars off the road for a year – or planting nearly 180 million new trees.

While we are lowering emissions from Dominion Energy systems, we are also helping other industries reduce their own methane emissions. The agriculture industry produces over a third of the methane emissions in the United States. In late 2018, Dominion Energy announced a $250 million joint venture with Smithfield Foods to capture waste methane from hog farms and convert that waste into clean, renewable natural gas (RNG). The Align RNG partnership will substantially reduce agricultural methane emissions, while creating a renewable resource for energy consumers.

Efficient, reliable natural gas infrastructure is a key pillar of building a reduced-carbon economy for our country. Dominion Energy’s natural gas businesses are facilitating the transition to cleaner power generation and home heating fuels. Our highly flexible storage and transportation services serve as the ‘battery’ to quick-start natural-gas-fired power stations, which act as an essential complement to the growing share of intermittent renewable generation.

At Dominion Energy, we know that actions speak louder. This report is more than a statement of our commitment. It is a comprehensive overview of our recent progress and our plan of action to reduce methane emissions even more in the future.

Through this Dominion Energy Methane Emissions Reduction Report, we demonstrate our commitment to transparency and accountability. We want our investors, customers, and the communities we serve to understand that Dominion Energy is taking serious action to reduce our impact on the environment.

Future generations deserve to inherit both a thriving environment and a comfortable, prosperous way of life. Dominion Energy is doing our part to ensure a sustainable and bright future for generations to come.

Sincerely,

Diane Leopold

President and CEO
Dominion Energy’s Gas Infrastructure Group

“**We are taking meaningful actions to reduce greenhouse gas emissions from our operations and helping our customers do the same.”**

— Diane Leopold
Dominion Energy is transforming the way the company does business to build a more sustainable future. Substantial reductions in greenhouse gas emissions are at the core of this transformation and are a high priority for the company. Dominion Energy has made significant progress over the last decade, substantially lowering methane emissions from its natural gas infrastructure since 2010. Dominion Energy has committed to reduce overall methane emissions from its natural gas infrastructure by 50% from 2010 levels, by 2030. This industry-leading effort will prevent more than 430,000 metric tons of methane from entering the atmosphere. This bold action is the equivalent of taking 2.3 million non-electric cars off the road for a year, or planting nearly 180 million new trees.

This report provides a comprehensive overview of the sources, amounts and reductions of methane emissions across Dominion Energy’s natural gas businesses through 2017. It describes actions that have reduced the company’s methane emissions over the last decade and outlines initiatives that will result in even greater reductions in the future.¹

Methane Emissions and Sources in the U.S.

Methane is a naturally-occurring compound and the primary component of natural gas, which is used to heat 118 million American homes, to generate one-third of the nation’s electricity, and to power manufacturing and other industries. When released into the atmosphere from industrial and natural sources, methane – like carbon dioxide – acts as a “greenhouse gas.”²

There are many sources of methane emissions. Agriculture is the largest source, accounting for approximately 36% of total methane emissions in the United States. The natural gas industry accounts for 25%.

Natural gas is transported across the U.S. through a 2.5 million-mile underground pipeline system. The natural gas delivery chain starts with production, processing, liquefaction and storage to transmission and local distribution. As natural gas travels through each stage in that chain, small amounts of methane may be released into the atmosphere.

Dominion Energy’s natural gas operations span the entire gas delivery chain. There are three primary sources of methane emissions from Dominion Energy’s natural gas infrastructure: venting during maintenance and inspections; releases from infrastructure and equipment such as uncoated low-pressure pipes and valves; and releases from processing, storage and metering stations.

¹ This Methane Emissions Reduction Report describes operations, activities and methane emissions of Dominion Energy, Inc., and its wholly-owned business units, particularly its Gas Infrastructure Group, focusing on 2017 and historical trends. This report does not address the operations, activities or methane emissions of suppliers, contractors, end users or other consumers, or other facilities or sources that are not operated by the company.

² In the U.S. EPA’s greenhouse gas reporting rule, it is estimated that methane when released to the atmosphere has 25 times the Global Warming Potential (GWP) of carbon dioxide. This GWP was used in estimating the carbon equivalent emissions reported in this report.

Methane Emissions from Dominion Energy’s Natural Gas System

There are two primary ways Dominion Energy monitors and reports methane emissions from its natural gas operations.

Volume-Based Methane Emissions Inventory

The first is a volume-based inventory, measured in metric tons, which the company submits annually to the U.S. Environmental Protection Agency (EPA) under the EPA’s greenhouse gas reporting rules. Dominion Energy voluntarily includes emission estimates beyond those required by the EPA in its corporate inventory. Figure 1 recaps Dominion Energy’s corporate inventory of methane emissions from 2011 to 2017, as reported to the EPA. Methane emissions from the company’s natural gas system declined substantially during this period.

Emission Rates

The second method Dominion Energy uses for monitoring and reporting is an emission rate, which measures methane emissions as a percentage of the total amount of gas that travels through the Dominion Energy gas delivery chain. Dominion Energy voluntarily discloses methane emission rates through its participation in the ONE Future Coalition. Table 1 provides 2017 emission rates for our natural gas assets that report under EPA’s Greenhouse Gas Reporting Rule (GHGRP).
Methane Reduction at Dominion Energy: Building on Historic Progress

Dominion Energy is at the forefront of the natural gas industry’s efforts to curb methane emissions. The company is a founding member or leading participant in landmark methane emissions reduction initiatives, including EPA’s NgSTAR program, EPA’s Methane Challenge, and the ONE Future Coalition.

By participating in these voluntary initiatives and by changing its operating procedures, Dominion Energy has substantially reduced the methane emissions from its natural gas infrastructure since 2010. These emissions reductions have saved more than 10 billion cubic feet of gas and prevented more than 180,000 metric tons of methane from entering the atmosphere. That’s equivalent to taking almost 1 million non-electric cars off the road for a year, or planting 75 million new trees.

Dominion Energy has launched an industry-leading initiative to reduce methane emissions by 50% across the company’s entire natural gas infrastructure by 2030, compared to 2010 levels.

There are three primary ways the company will achieve these historic goals:

Reducing or eliminating gas venting during planned maintenance and inspections

Gas venting during planned maintenance and inspection is one of the largest sources of methane emissions from Dominion Energy’s natural gas system. To perform this work, natural gas sometimes has to be removed from the system, which was historically done by venting it into the atmosphere. Instead of venting, the company is now using pressure reduction protocols and innovative equipment to limit, capture, recycle and reuse gas where feasible.

Replacing targeted infrastructure and equipment with new, lower-emission equipment

While gas venting is one of the largest sources of methane emissions, other minor sources can add up to larger volumes. The company is reducing these emissions by replacing equipment such as bare-steel pipe, valves and fittings with new lower-emission equipment. Another example is the company’s program to replace natural gas-powered pumps at its producing wells with solar-powered electric pumps, which reduces emissions at these facilities by more than 90%.

Expanding leak detection and repair programs

Other minor methane emissions can be hard to detect. Over the last decade, Dominion Energy has implemented tools and techniques, such as the use of infrared cameras, to identify such minor emission sources. The company is now expanding these programs across every part of its system — from production, processing and storage to transmission and distribution.

Reducing Methane Emissions from Agriculture: Renewable Natural Gas

While Dominion Energy is lowering emissions from its own infrastructure, the company is partnering with the world’s largest pork producer to curb methane emissions from the agriculture industry. In late 2018, Dominion Energy joined forces with Smithfield Foods to form the largest renewable natural gas (RNG) partnership in history. The $250 million joint venture, known as Align RNG®, will capture waste methane from hog farms and convert it into clean renewable energy to heat homes and power local businesses. In addition to supplying RNG to energy providers across the country, Dominion Energy is also working to bring more RNG onto its own system. The company aims to meet 4% of its gas distribution customers’ needs with RNG by 2040.

Pipeline Safety and Methane Emissions Reduction

Dominion Energy’s pipeline safety and methane emissions reduction programs work hand in hand. When natural gas infrastructure is monitored closely and operated safely, it also releases less methane to the atmosphere. In fact, many of the company’s methane emissions reduction initiatives originally stem from pipeline safety and integrity programs, including programs for pipeline and equipment replacement, storage well inspection and interior pipe
inspection. Since 2008, Dominion Energy has replaced 1,800 miles of bare-steel or cast-iron pipe across its distribution system and plans to replace over 5,500 miles in total. At the same time, the company is expanding its storage well casing inspection program and plans to complete inspections on all 2,300 of its wells by 2025. The goal of these programs is simple, but extremely important: continuously improve the safety of communities and build a more sustainable future.

### TABLE 1: 2017 Methane Emission Rates from Dominion Energy’s Natural Gas Operations.

<table>
<thead>
<tr>
<th>Natural Gas System Segment (GHGRP)</th>
<th>Methane Emission Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>1.57%</td>
</tr>
<tr>
<td>Gathering &amp; Boosting</td>
<td>0.04%</td>
</tr>
<tr>
<td>Processing</td>
<td>0.00%</td>
</tr>
<tr>
<td>Storage</td>
<td>0.01%</td>
</tr>
<tr>
<td>Transmission Compressor Stations</td>
<td>0.01%</td>
</tr>
<tr>
<td>Transmission Pipelines</td>
<td>0.01%</td>
</tr>
<tr>
<td>LNG Import/Export</td>
<td>0.11%</td>
</tr>
<tr>
<td>Distribution</td>
<td>0.34%</td>
</tr>
</tbody>
</table>

Note: Consistent with EPA regulations, this data reflects Dominion Energy facilities and emissions subject to Subpart W of the Greenhouse Gas Reporting Program (GHGRP). See Table 3 on page 14 of the Methane Emissions Reduction Report.

Overhead view of the Optima KV renewable natural gas project in Kenansville, N.C. Align RNG will use a similar technology, and process in developing its first four projects in North Carolina, Utah and Virginia.
Dominion Energy is among the nation’s premier energy delivery companies. Nearly 7.5 million customers in 18 states energize their homes and businesses with electricity or natural gas from Dominion Energy, which is headquartered in Richmond, Virginia. The company is committed to sustainable, reliable, affordable and safe energy and is one of the nation’s largest producers and transporters of energy with about $100 billion of assets providing electric generation, transmission and distribution, as well as natural gas storage, transmission, distribution, and import/export services. As one of the nation’s leading solar operators, the company intends to reduce its carbon emissions by 55 percent by 2030.

Dominion Energy is transforming the way the company does business to build a more sustainable future. Substantial reductions in greenhouse gas emissions are at the core of this transformation and are a high priority for the company.

Dominion Energy has made significant progress over the last two decades, substantially lowering methane emissions from its natural gas infrastructure since 2010. Going forward, Dominion Energy has committed to reduce overall methane emissions from its natural gas infrastructure by 50% from 2010 levels, by 2030. This industry-leading effort will prevent more than 430,000 metric tons of methane from entering the atmosphere.

This report provides a comprehensive overview of the sources, amounts and reductions of methane emissions across Dominion Energy’s natural gas businesses. It describes actions that have reduced the company’s methane emissions over the last decade and outlines initiatives that will result in even greater reductions in the future.3

---

3This Methane Emissions Reduction Report describes operations, activities and methane emissions of Dominion Energy, Inc., and its wholly-owned business units, particularly its Gas Infrastructure Group, focusing on 2017 and historical trends. This report does not address the operations, activities or methane emissions of suppliers, contractors, end users or other consumers, or other facilities or sources that are not operated by the company.
Dominion Energy’s natural gas business operations span the entire natural gas delivery chain – from production, processing, liquefaction and storage to transmission and local distribution. Dominion Energy is the second largest operator of natural gas storage infrastructure in the country.

In 2017, the company produced and processed natural gas in five states. It operated more than 100,000 miles of natural gas gathering, transmission, storage and distribution pipelines across 16 states, as well as the only liquefied natural gas import and export terminal on the East Coast.

Through three local distribution companies, in 2017 Dominion Energy provided regulated retail natural gas service to 3.4 million homes and businesses across 5 states, including Ohio, West Virginia, Utah, Wyoming and Idaho.

On January 1, 2019, PSNC and SC Gas were acquired through merger. This report does not include information for those businesses.

In sum, Dominion Energy’s natural gas businesses provide energy to safely and reliably heat the homes and power the businesses of millions of Americans, and millions more overseas.
Understanding Methane Emissions and Sources

Methane Emissions in the U.S.
In the United States, methane emissions comprise approximately 10% of all greenhouse gas emissions. Agriculture is the country’s largest source, accounting for approximately 36% of methane emissions. These come mostly from manure and the natural digestive process of livestock. The natural gas industry contributes approximately 25% of U.S. methane emissions, or about 2.5% of the national total of carbon dioxide equivalent (CO₂e). The remaining methane emissions come from landfills, coal mining and petroleum systems, and other sources such as wetlands, composting and wastewater treatment.

When the sum of methane emissions and other greenhouse gases from across the natural gas value chain is compared to the carbon and other greenhouse gases from our generation business, the emissions from the company’s natural gas business accounted for 10 percent of Dominion Energy’s carbon equivalent emissions in 2017.

For more information about our efforts to provide cleaner generation

Methane Emissions in Dominion Energy’s Natural Gas System
Methane is the primary component of natural gas, which is used to heat 118 million American homes, generate one-third of the nation’s electricity, and power manufacturing and other industries. Natural gas is transported to power plants, homes and businesses across the U.S. through a 2.5 million-mile national underground pipeline system.

As natural gas travels through each stage in the supply chain – from production, gathering, processing and storage to transmission and distribution to end-users – small amounts of methane may be released from the system and into the atmosphere.

The primary sources of methane emissions from Dominion Energy’s natural gas system are: 1) gas venting from maintenance and inspection activity; 2) minor releases from targeted infrastructure and equipment such as uncoated vintage pipe, valves and fittings; and, 3) small releases from processing, storage and metering, compressor stations and regulation stations. Each of these emission sources is subject to a variety of state and federal regulations, and Dominion Energy maintains programs to ensure strict compliance.

Production
Natural gas is created from the decomposition of organic material. Whether from plant or animal sources, this biological process yields methane and other hydrocarbons. Over the course of millennia, these efficient-burning hydrocarbons were deposited deep in layers under the earth’s surface. When natural gas is
produced from underground geologic formations, the methane may be accompanied by other volatile organic compounds. These compounds are strictly regulated as air pollutants, so controls on these emissions also serve to significantly reduce the methane emissions associated with production. Through compliance with these strict regulations, Dominion Energy also minimizes releases of methane to the atmosphere.

Gathering & Processing
After the gas is extracted from the ground, gathering facilities take the gas through a network of small pipes. Small compressor stations boost line pressure to move the gas along, and hydrocarbon liquids may be removed by filter until the gas reaches a processing or transmission facility. The processing facility will further refine the gas and extract useful liquid by-products, such as propane or butane. Sources of methane emissions along the gathering and boosting system include possible releases from equipment used in liquids handling, dehydration, compressor vents, and pipeline components such as valves and flanges. Other methane emissions sources include extraction columns, transfer equipment, flares, piping, and tank storage. The company employs comprehensive Leak Detection and Repair programs to ensure that leaks are identified and mitigated promptly to minimize emissions. Dominion Energy has effective Leak Detection and Repair programs in place at its processing plants.

Liquefaction
When cooled, methane moves from a gaseous state to a liquid form, which occupies substantially lower volume for the same energy content. Natural gas can be liquefied for efficient storage along the transportation and distribution system, or for delivery utilizing specialized ships. Dominion Energy’s Cove Point LNG facility in Calvert County, Maryland, has been importing natural gas by ship for decades and began exporting natural gas in 2018. Sources of methane emissions at liquefied natural gas facilities may include the liquefaction, storage and vapor recovery equipment.

An extensive flaring system at Cove Point prevents methane from venting into the atmosphere, in the unusual event of a release. In addition to annual Greenhouse Gas Reporting Program (GHGRP) surveys required by the U.S. Environmental Protection Agency, Cove Point conducts a state-of-the-art quarterly program.

Transmission & Compression
Compressor stations are utilized both in conjunction with underground storage facilities and spaced periodically along transmission pipelines to add pressure to the gas and keep it moving through the system. The primary source of methane emissions from compressor stations is the gas venting that occurs prior to maintenance or inspections. In order to perform maintenance or inspection on compressor stations, natural gas sometimes has to be removed from the system, which was historically done by venting it into the atmosphere.

Best management practices have

### TABLE 2: Sources of all methane emissions from Dominion Energy’s facilities supporting underground natural gas storage.

<table>
<thead>
<tr>
<th>Storage Facility Emission Source</th>
<th>Corporate Inventory (Metric Tons)</th>
<th>EPA Reported (Metric Tons)</th>
<th>Total Emission Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Field Wellheads</td>
<td>348</td>
<td>328</td>
<td>0.56%</td>
</tr>
<tr>
<td>Compressor Station Pneumatic Devices</td>
<td>253</td>
<td>167</td>
<td>0.38%</td>
</tr>
<tr>
<td>Compressor Station Venting</td>
<td>1,440</td>
<td>1,190</td>
<td>2.21%</td>
</tr>
<tr>
<td>Compressor Station Compressors</td>
<td>649</td>
<td>480</td>
<td>0.99%</td>
</tr>
<tr>
<td>Compressor Station Fugitive Leaks</td>
<td>356</td>
<td>271</td>
<td>0.56%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4.7%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
been implemented to reduce these emissions. Many compressor stations are large enough individual point sources to require state air permits. These permits contain regulatory requirements to minimize methane emissions. Approximately a quarter of Dominion Energy’s compressor stations are subject to the GHGRP and conduct annual leak surveys.

Storage
Natural gas storage operations are a key component of the Dominion Energy delivery chain, providing reliable and flexible service to customers. This large-scale ‘battery’ also facilitates the development of power from intermittent renewable sources, while preserving the dependable energy that consumers expect. Dominion Energy operates 926 Bcf of natural gas storage, in both the Eastern and Western United States. The general locations of these storage assets are shown in Figure 2.

Emissions controls and safety procedures surrounding natural gas storage operations have received heightened scrutiny and increased regulation in recent years. Dominion Energy stands at the forefront of compliance with those regulations. The general locations of our storage operations are provided in Appendix A.

Under normal operations, methane emissions from Dominion Energy’s underground storage wellheads account for less than 1% of the company’s natural gas business total methane emissions. The sources of all methane emissions from Dominion Energy’s underground storage facilities are displayed in table and chart on page 10, Table 2.

Distribution
The distribution system delivers natural gas to end-use customers, including homes, commercial businesses and industries. Sources of methane along this vast network of small pipes and service lines consist mainly of metering and regulating stations and other piping components. The GHGRP requires annual leak surveys at a portion of these facilities.

Electric Generation
In addition to methane emissions from Dominion Energy’s natural gas system, a small amount of methane emissions is emitted by the company’s electric generation operations. Combustion methane emissions from Dominion Energy’s electric power generation totaled 2,319 metric tons in 2017. To put this figure in perspective, the electric generation amount is under 4% of the methane emissions inventory for Dominion Energy’s natural gas businesses in that same year. Given the natural gas business focus of this Methane Emissions Reduction Report, all other data compiled in this report excludes Dominion Energy’s limited electric generation methane emissions.
How Methane Emissions Are Reported

Dominion Energy reports emissions of methane and other GHGs from its natural gas and electric generation facilities to the EPA pursuant to the EPA’s greenhouse gas reporting rule. Figure 5 shows Dominion Energy’s methane emissions from the natural gas businesses that it operated as of calendar year 2017 compared to previous years. Subsidiaries with an asterisk (*) indicate a new reporting requirement beginning in 2016.

There are two primary ways Dominion Energy reports methane emissions from its natural gas operations. The first is a volume-based inventory of emissions released, measured in metric tons. The second is an intensity or “emission rate”, which measures the amount of methane released as a percentage of the total amount of gas that travels through the system.

Volume-Based Inventory & Reporting

Dominion Energy has maintained a Corporate Methane Inventory to document methane emissions from its natural gas infrastructure for a number of years. During 2018, the company conducted a comprehensive review of its emissions tracking and reporting processes, to find opportunities for improvement and to ensure that the inventory is all-encompassing across the delivery chain. The company looked for potential gaps in included or unrepresentative emissions factors used for estimating emissions. For example, Dominion Energy considered whether on-site sampling or updated factors would be more consistent with industry protocols, such as the 2016 ONE Future Coalition Protocol.

Based on these activities, Dominion Energy identified over a dozen areas of improvement for the Corporate Methane Inventory, which resulted in an approximate 15% increase in reported methane emissions compared to a traditional inventory. Going forward, Dominion Energy will base its Corporate Methane Inventory on the enhanced

Figure 5 // Methane Emissions Reported to EPA by Subsidiary

Additional information on the emissions reported to the EPA under the GHGRP, including station-by-station information, can be found at: https://ghgdata.epa.gov/ghgp/main.do.

*For purposes of this report, a methane ‘emission rate’ includes methane released into the atmosphere as a result of leaks, venting or releases.
Dominion Energy is now reviewing its 2010 Corporate Methane Inventory, which serves as the baseline for its prospective methane emissions reduction targets, to apply the 2018 enhanced methodology. The enhanced 2010 Corporate Methane Inventory, as well as the enhanced 2018 Corporate Methane Inventory report, will be available by the end of 2019.

**How Dominion Energy’s Inventory Compares to the EPA’s Inventory**

Because the EPA’s greenhouse gas reporting rule sets boundaries for reporting, Dominion Energy is not required to report methane emissions from a number of the company’s smaller compressor stations and other sources. However, in the interest of transparency and to hold the company to a higher standard of accountability, Dominion Energy voluntarily includes emission estimates from these smaller methane sources in its Corporate Methane Inventory.

*Figure 6* compares Dominion Energy’s more comprehensive Corporate Methane Inventory for 2017 to the inventory the company reports to the EPA under the Agency’s greenhouse gas reporting rule.

For some segments of the natural gas delivery chain, such as local distribution, the EPA’s greenhouse gas reporting rule is quite comprehensive, so there is little difference between reported and corporate emission totals. For other segments, such as transmission, there is a greater difference between EPA-reported emissions and Dominion Energy’s corporate inventory. This is because Dominion Energy has a number of small transmission compressor stations that are below mandated reporting levels – but which Dominion Energy includes in its corporate figure.

The corporate inventory numbers presented in this section are not yet based on the enhanced reporting methodology developed in 2018. The corporate inventory will be revised to reflect the enhanced methodology and will be disclosed in a revised report later this year.

*Figure 7* shows Dominion Energy’s corporate inventory compared to what is required to be reported to the EPA under the GHGRP since 2011 when the mandatory reporting program began. Since 2011, our methane emissions have declined when comparing the same sources and assets. The orange section of the 2016 and 2017 bars represent emissions associated with transmission pipeline maintenance activities, a new EPA reporting requirement not previously part of Dominion Energy’s corporate inventory. As previously noted, the numbers represented do not yet reflect the enhanced inventory developed in 2018.
As Dominion Energy prepared for the new 2016 EPA reporting requirement and began tracking the volume of gas released during planned maintenance events and unplanned safety releases, the company realized an opportunity to implement additional best management practices (BMPs) to reduce gas loss during these events going forward. In 2016, Dominion Energy Transmission made a commitment to reduce planned pipeline blowdown volumes by a minimum of 50% by the end of 2021 under the EPA’s voluntary Methane Challenge Program. Dominion Energy Transmission achieved the goal in 2017 and is continuing to implement BMPs for even greater savings.

**Emission Rate-Based Reporting**

To evaluate the real and evolving efficiency of natural gas infrastructure, stakeholders need a consistent method for determining and reporting natural gas emissions. Developing an emission rate calculation that compares performance among companies is complicated. The natural gas grid is robust and flexible; so, the methodology must account for the movement of gas through various chains, from wellhead to delivery to the customer. For example, gas may be produced (and reported) by one company, then stored, then transported by another and finally distributed to consumers by still another. In this case, the “throughput” of the same natural gas could be reported four times by several different companies.

A standard approach would enable a more effective assessment of trends, as a percentage of total natural gas produced in the United States. And for individual companies, this method would support a more accurate assessment of natural gas emissions as a percentage of throughput. As a member of the ONE Future Coalition, Dominion Energy is working with its peers to develop and improve the methane emission rate and reporting standard to ensure clarity and consistent results. While the EPA has not published a standard for reporting an emissions rate or intensity, it has supported the protocol published by ONE Future. All Dominion Energy natural gas companies joined the ONE Future Coalition in 2018 and participated in the coalition’s inaugural progress report.

In addition to our participation in the ONE Future Coalition, Dominion Energy has calculated methane emission rates from its natural gas system based on federally-reported emissions and throughput values (converted to thousands of standard cubic feet of methane). Table 3 provides the emission rates from Dominion Energy’s natural gas operations in 2017.

### Table 3: Emission rates from every part of Dominion Energy’s natural gas operations in 2017

<table>
<thead>
<tr>
<th>Natural Gas System Segment (GHGRP)</th>
<th>Total GHGRP Methane Emissions (mcf CH₄) (numerator)</th>
<th>Total Gas Throughput GHGRP (mcf CH₄) (denominator)</th>
<th>Methane Emission Rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>762,788</td>
<td>48,657,430</td>
<td>1.57%</td>
</tr>
<tr>
<td>Gathering &amp; Boosting</td>
<td>144,188</td>
<td>345,183,263</td>
<td>0.04%</td>
</tr>
<tr>
<td>Processing</td>
<td>916</td>
<td>51,726,956</td>
<td>0.00%</td>
</tr>
<tr>
<td>Storage</td>
<td>53,748</td>
<td>685,982,435</td>
<td>0.01%</td>
</tr>
<tr>
<td>Transmission Compressor Stations</td>
<td>147,565</td>
<td>1,932,881,920</td>
<td>0.01%</td>
</tr>
<tr>
<td>Transmission Pipelines</td>
<td>396,720</td>
<td>3,413,159,570</td>
<td>0.01%</td>
</tr>
<tr>
<td>LNG Import/Export</td>
<td>6,444</td>
<td>5,692,582</td>
<td>0.11%</td>
</tr>
<tr>
<td>Distribution</td>
<td>1,668,183</td>
<td>485,999,179</td>
<td>0.34%</td>
</tr>
</tbody>
</table>

Note: The data includes only facilities and emissions reported under EPA’s Subpart W segments as defined by its greenhouse gas reporting rule. Values reported are based on measurements of standard cubic feet of methane.

Emission Rate Measurement

Unlike with a power generating facility, there is no single point source along the natural gas delivery chain. This makes fugitive emission sources unrealistic to monitor individually in real time. At fossil fuel fired power stations, owners install continuous emission stack monitors, including CO₂ monitors to gauge real time emissions in compliance with federal regulations. A stack is one point source through which thousands of tons of GHG emissions flow. The denominator normalizing the stack emissions based on throughput from power stations is the amount of energy produced in net megawatt hours (MWH). So in the power generation context, an intensity metric (pounds of pollutant per net megawatt hour) is a universally accepted standard.
Dominion Energy is at the forefront of the natural gas industry’s efforts to curb methane emissions. The company has been a founding member or leading participant in several landmark methane emissions reduction initiatives, including the EPA’s NgSTAR Program, the EPA’s Methane Challenge Program, and the ONE Future Coalition. In addition, the company has fostered a culture of innovation that empowers employees to design and implement creative ways to reduce methane emissions from operations.

Through the company’s participation in these voluntary initiatives and changes to the company’s operating procedures, since 2010 Dominion Energy substantially reduced methane emissions from its natural gas infrastructure, saving more than 10 billion cubic feet of gas and preventing more than 180,000 metric tons of methane from entering the atmosphere. That’s equivalent to taking almost 1 million non-electric cars off the road for a year or planting 75 million new trees.

**Natural Gas STAR Program**

The EPA’s Natural Gas STAR (NgSTAR) Program has provided a platform where proactive and progressive natural gas companies can voluntarily report methane emissions reduction from their operations through implementation of best management practices. Dominion Energy subsidiaries began participating as early as 2011, submitting historical emissions reductions back to 2008. Through its participation in the EPA NgSTAR Program, Dominion Energy achieved cumulative methane emissions reductions of 7.3 billion cubic feet (bcf) through 2017, preventing more than 137,000 metric tons of methane from being released into the atmosphere. These emissions reductions are equivalent to preventing more than 3.4 million metric tons of CO₂ from entering the atmosphere. As of 2018, all eligible Dominion Energy natural gas businesses have joined as members of the NgSTAR Program.

**Methane Challenge Program**

Through the EPA’s Methane Challenge Program, natural gas companies voluntarily commit to implement best management practices and report their annual progress in reducing methane. Dominion Energy took a leadership role as a founding member of EPA’s Methane Challenge Program in 2016. Three Dominion Energy companies collaborated with EPA as pilot companies and began disclosing results prior to the reporting deadline. Additional commitments have been implemented by Dominion Energy companies since the initial pilot. As of 2018, all eligible Dominion Energy natural gas businesses are now partners of the EPA Methane Challenge Program.

**ONE Future Coalition**

In 2018, Dominion Energy’s Gas Infrastructure Group joined the ONE Future Coalition, an industry-led partnership that is driving toward a collective goal of reducing the industry’s methane emissions rate or intensity to less than 1% by 2025. Dominion Energy participated in the November 2018 Initial Progress Report, which reported that ONE Future members achieved a
2017 methane emission rate of 0.552%.

Lost and Unaccounted for Gas

For years, Dominion Energy has focused on reducing rates of lost and unaccounted for gas. To identify these losses, the company measures gas exiting the pipeline system, along with gas used as fuel in operations, and calculates volumes of gas released during operations (from purges, emergency shut downs, and other activities). Those volumes are subtracted from the amount of gas entering the pipeline system; the difference is referred to as ‘unaccounted-for’ gas. It can be caused by measurement uncertainty, theft, reporting errors, equipment malfunction, or unmeasured activities. Both gas losses and ‘unaccounted-for’ volumes are an expense for the pipeline and its shippers.

Dominion Energy monitors its infrastructure carefully to identify and remediate losses from the transmission pipeline system. The system is segregated into zones and gas is measured in and out of each zone to monitor flows daily. The process allows Dominion Energy to identify losses on the system faster and to remediate them promptly. By addressing indications of gas loss, and putting systems in place to track releases of gas during operations, Dominion Energy has been able to reduce the loss rate across its pipeline and gathering operations.

Natural Gas STAR and Methane Challenge Methane Reductions by Business Unit

Figure 8 shows annual methane emissions reduction credits calculated under the NgSTAR and Methane Challenge Programs for various Dominion Energy natural gas businesses.⁵

---

⁵ Credits attributed to 2015 include historical emissions reductions reported to the EPA by Dominion Energy West Virginia (DEWV) and Dominion Energy Carolina Gas Transmission (DECG) during their first year in the program. Also included are pre-2010 emissions reductions reported by Dominion Energy Questar Pipeline and Dominion Energy Overthrust Pipeline (collectively, DEQP), and emissions reductions reported to the EPA for a 2014 gas-driven high bleed pneumatic changeout effort by Dominion Energy Wexpro. Credits attributed to 2017 include emissions reductions reported to the EPA under the Methane Challenge Program by Dominion Energy Transmission, Inc. (DETI), The East Ohio Gas Company, and Hope Gas, Inc.
Building on the substantial progress we’ve made, Dominion Energy launched an initiative in early 2019 to reduce methane emissions by 50% across the company’s entire natural gas infrastructure system by 2030, over 2010 levels. This initiative will prevent more than 430,000 metric tons of methane from entering the atmosphere, the equivalent of taking 2.3 million non-electric cars off the road for a year or planting nearly 180 million new trees.

The company is achieving these goals primarily by:

- Reducing or eliminating gas venting during planned maintenance and inspections
- Replacing targeted infrastructure and equipment with new, lower-emission equipment
- Expanding leak detection and repair programs

Reducing or eliminating venting during planned maintenance and inspection

Gas venting during planned maintenance and inspection is one of the largest sources of methane emissions from Dominion Energy’s transmission and distribution pipelines. In order to perform maintenance or inspection, natural gas sometimes has to be removed from the system, which was historically done by venting it into the atmosphere. A primary focus of the company’s initiative will be to reduce or eliminate venting during maintenance activities. There are three primary ways the company will achieve this:

- Reducing pressure and capturing gas prior to maintenance or inspection, by using portable compression to pump captured methane to other parts of the system.
- Recycling gas from compressors that are being taken offline, and then feeding the recycled gas into on-site fuel systems to power other facility operations.
- Reducing the frequency of venting by upgrading compressor engine controls so they remain pressurized when idled.

One innovative example is the company’s use of Zero Emissions Vacuum and Compression (ZEVAC®) technology to capture methane before maintenance or inspection so it can be recycled for use. After piloting the technology on a limited scale, Dominion Energy recently purchased 20 ZEVAC® units from TPE Midstream for widespread use across its distribution and transmission pipeline systems.

Replacing targeted infrastructure and equipment with new, lower-emission equipment

There are other minor sources of methane emissions across all natural gas infrastructure that can add up to larger volumes. Dominion Energy is focused on reducing minor sources by replacing certain components with lower-emission equipment.

For example, Dominion Energy is replacing natural gas-powered pumps at its gas producing wells with solar-powered electric pumps. This equipment reduces methane emissions at these facilities by more than 90%.

The company is replacing other relatively high-emitting equipment across the natural gas supply chain, including bare-steel pipe, cast-iron pipe, valves, and fittings to reduce or eliminate other emission sources. There are additional examples:

- Using pneumatic controllers that are air-activated when station air is available as opposed to natural gas-activated or continuous-bleed devices;
• Implementing Green Completion technology on completed and recompleted wells;
• Replacing high-bleed pneumatic devices with low- or no-bleed devices such as thermal electric generators;
• Replacing orifice meters with ultrasonic meters; and
• Installing compressed air (as opposed to natural gas) compressor engine start systems.

Expanding leak detection and repair programs
Even after reducing emissions from gas venting and targeted equipment, there are still other minor leaks that are often the hardest to detect. Over the last decade, Dominion Energy has made significant progress by implementing voluntary and required programs, including the use of infrared cameras, to detect and repair these minor emissions sources. With the new initiative launched earlier this year, the company is dramatically expanding these programs across every part of its system – from production and storage to transmission and distribution.

Table 4 identifies the mandatory leak programs required by federal or state regulations.

Best Management Practice Results
Below is a description of the most successful BMPs implemented by Dominion Energy under NgSTAR and the emissions reductions achieved in 2017. Copies of the full reports, including all emissions reductions, can be found in Appendix B. Copies of the EPA’s summary reports showing its calculation of methane emissions reductions and cumulative credits attributed to Dominion Energy for each NgSTAR report are provided in Appendix B.

Directed Inspections and Maintenance
This technique is a more cost-effective approach to identifying and fixing leaks than the traditional, reactive leak detection and repair program. Dominion Energy Transmission conducts biannual surveys, called Atmospheric Gas Loss Surveys, of the sources most likely to leak based on the type of source and fixes them. This BMP has resulted in 33,219 MCF of natural gas or 622 MT of methane emissions reductions in the gas transmission business. Dominion Energy Carolina Gas Transmission reduced 25,620 MCF of gas or 480 MT of methane in 2017 through directed inspections. At its local distribution companies, Dominion Energy West Virginia and Dominion Energy Ohio, directed inspections and maintenance at city gate delivery stations and surface facilities has resulted in 78,895 MCF of natural gas avoided loss or 1,477 MT of methane emissions reductions, and 20,230 MCF or 379 MT of methane emissions reductions, respectively.

Compressor Venting Recovery
In this technique, natural gas vented from compressors is captured and re-routed for use with other combustion sources, including engines and turbines at the facility. This technique reduced 26,617 MCF, or 498 MT of methane emissions in 2017. Several more stations are being considered for similar modifications. This technique works best when other design changes are being planned at the facility or during design of new facilities.

Reducing Pipeline Pressure before Maintenance
Significant savings in natural gas emissions are possible from reducing pipeline pressure before venting for maintenance and repair, as the NgSTAR Program recognizes. In this technique, the pipeline pressure is reduced using inline compressors or portable compressors. Alternatively, hot taps8 may be utilized to avoid venting. Typically, pressure can be reduced up to 50% using inline compressors, and by up to 90% using additional portable compressors. In 2017 Dominion Energy Transmission reduced 326,777

---

TABLE 4: Mandatory leak programs required by federal or state regulations

<table>
<thead>
<tr>
<th>LDAR Program</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual GHG Leak Surveys</td>
<td>Federal Regulation</td>
</tr>
<tr>
<td>Quarterly LDAR Surveys</td>
<td>Federal Regulation</td>
</tr>
<tr>
<td>Monthly AVO Facility-Wide Inspection</td>
<td>State Requirement</td>
</tr>
<tr>
<td>Monthly Gas Leak Inspection</td>
<td>State Requirement</td>
</tr>
<tr>
<td>Weekly AVO Facility-Wide Inspections</td>
<td>State Requirement</td>
</tr>
</tbody>
</table>

---

8 Green Completion technology is used to mitigate the loss of methane and other hydrocarbons during an initial completion of a well or well refurbishment operations. This equipment separates the gas from liquids which allows the gases to be collected rather than vented to the atmosphere.

7 A gate station (also known as a city gate station, a metering and regulator station, or a distribution station) takes high pressure gas from a larger pipeline, reduces the pressure and distributes gas to local homes.

8 Hot tapping is an alternative procedure that makes a new pipeline connection while the pipeline remains in service, flowing natural gas under pressure. Hot tapping avoids product loss, methane emissions, and disruption of service to customers.
MCF of natural gas emissions, or 5,960 MT of methane emissions, using this technique. Under the Methane Challenge Program, Dominion Energy Transmission has begun implementing measures to reduce methane emissions from planned pipeline venting systems by at least 50%. The emissions reductions achieved will be reported annually to the EPA and published on its website. Dominion Energy’s report to the EPA under the Methane Challenge Program for this BMP appears in Appendix D.

Dominion Energy Carolina Gas Transmission reduced 20,780 MCF of gas or 379 MT of methane in 2017 using pump-down measures. Additionally, one of Dominion Energy’s gas distribution companies, Dominion Energy Ohio, reduced 3,301 MCF of natural gas emissions or 60 MT of methane emissions using this measure.

**Capped Emergency Shutdown Testing**

Full compressor-station venting must be conducted periodically for regulatory safety evaluations. Dominion Energy Transmission staggered these shutdowns at five-year intervals to minimize annual emissions. During the other four years, stations do their annual safety test using enclosures to prevent gas loss. The enclosures work like a cap at the end of the pipe and prevent gas loss. In 2017, Dominion Energy Transmission saved 22,394 MCF of natural gas or 419 MT of methane emissions using this technique. Dominion Energy Carolina Gas Transmission reduced 682 MCF of gas or 13 MT of methane emissions in 2017 through capped emergency shutdown testing.

**Replacing High-Bleed Pneumatic Devices and Gas-Driven Pneumatic Pumps**

A continuous-bleed pneumatic device is used to modulate process conditions for operational or safety purposes. A pneumatic device using natural gas with a bleed rate of greater than 6 standard cubic feet per hour is a high bleed device. Replacing high-bleed pneumatic devices with either low- or no-bleed devices (using instrument air instead of natural gas to activate the device) reduces methane emissions. By implementing this technique, Dominion Energy Transmission has reduced 1,040 MCF of natural gas or 19 MT of methane in 2017. Dominion Energy Ohio reduced 14,244 MCF of gas or 267 MT of methane emissions in 2017 by replacing high-bleed pneumatic devices. Finally, Dominion Energy Wexpro reduced 160,739 MCF of gas or 3,009 MT of methane emissions in 2017 by replacing gas-driven pneumatic pumps with either solar powered pumps or thermal electric generators. New construction projects undertaken by Dominion Energy typically involve installation of instrument air pneumatic devices only.

**Pipeline Infrastructure Replacement Programs**

Since 2008, Dominion Energy Ohio has been actively replacing more than 5,500 miles of bare steel mains, and it has less than 2 miles of cast-iron pipes left to replace. The pipeline infrastructure replacement program was initiated by DEO and approved by the Public Utilities Commission of Ohio. In 2017, bare-steel and cast-iron mains made up less than 25% of the distribution pipeline system in Dominion Energy Ohio’s service territory. DEO schedules about 200 miles of main line and about 17,000 service lines for replacement per year. In 2017, we replaced 231 miles of main line, of which 190 miles were bare-steel or cast-iron, and 19,093 service lines were replaced. Dominion Energy Ohio reduced 49,129 MCF of gas or 920 MT of methane in 2017 through replacement of mains and services. Starting in 2018, this BMP will be reported under the Methane Challenge program. Results from Dominion Energy’s report are provided in Appendix D.

In 2016, Dominion Energy West Virginia began its pipeline replacement program — through which approximately 1,000 miles of unprotected steel and bare steel pipes will be replaced. In 2017, 14 main line miles and 1,044 service lines were replaced. Dominion Energy West Virginia reduced 3,301 MCF of gas or 62 MT of methane in 2017 through replacement of mains and services. Starting in 2018, this BMP will be reported under the Methane Challenge program.

---

**Figure 9 // Replacement for Bare Steel, Cast Iron, Wrought Iron and Copper Distribution Pipe for Reliability and Reduced Methane Emissions**

![Figure 9](image-url)
TABLE 5: 2017 Dominion Energy NgSTAR Best Management Practices: The table summarizes the best management practices utilized to avoid natural gas emissions from our businesses.

<table>
<thead>
<tr>
<th>Dominion Energy Natural Gas STAR (NgSTAR) and Methane Challenge BMP Commitments</th>
<th>DETI</th>
<th>DEO</th>
<th>DEWV</th>
<th>DECG</th>
<th>DE Wexpro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed Inspection &amp; Maintenance (DI&amp;M)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Replace Older Pipe/Services (PIR and PREP)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace High Bleed Pneumatic Devices or Install Air-driven Devices</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damage Prevention Program</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Blowdown Recovery</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce Pressure before Maintenance</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Orifice with Ultrasonic Meters</td>
<td>✔️</td>
<td></td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Use of Hot Taps</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Capped Emergency Shutdown Tests</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
</tr>
</tbody>
</table>

Dominion Energy’s report are provided in Appendix D.

Dominion Energy Utah, Dominion Energy Wyoming, and Dominion Energy Idaho (collectively, DEUWI) replaced all cast-iron and unprotected steel (3,400 miles) prior to 1996. The company now has a proactive program to replace certain portions of coated, high-pressure infrastructure on an annual basis.

**Dominion Energy NgSTAR Best Management Practices and Methane Challenge**

Table 5 summarizes the best management practices utilized in 2017 to avoid natural gas emissions that are implemented and reported under the NgSTAR voluntary program. In some instances, these same practices also support Dominion Energy’s participation in the Methane Challenge voluntary program.
Energy Efficiency and Renewable Natural Gas

At the same time Dominion Energy is lowering emissions from its own infrastructure, the company is working to lower methane emissions from other industries and reduce its customers’ carbon footprint.

Renewable Natural Gas

The agriculture industry is the largest source of methane emissions in the U.S., accounting for approximately 36% of all emissions. That’s why Dominion Energy is partnering with the world’s largest pork producer to dramatically lower methane emissions from hog farms across the U.S.

In late 2018, Dominion Energy joined forces with Smithfield Foods to form the largest renewable natural gas partnership in history. The $250 million joint venture, known as Align RNG®, will capture waste methane from hog farms and convert it into clean renewable energy to heat homes and power local businesses.

The use of renewable natural gas makes a substantial contribution to reducing greenhouse gas. More greenhouse gas emissions are captured from hog farms than are released from the use of RNG in homes and businesses – by a factor of 25 to 1. That’s because the raw methane that would otherwise be released from hog farms is 25 times more powerful as a greenhouse gas, than the CO₂ that is generated when that natural gas is consumed to heat homes or generate electricity.

The partnership’s first four projects in Virginia, North Carolina and Utah will produce enough energy to reliably power 14,000 homes and businesses. These efforts will reduce the same amount of greenhouse gas emissions as taking 120,000 non-electric cars off the road for one year, or planting 14 million new trees. Over the next decade, Align RNG plans to expand RNG operations across 90% of Smithfield’s hog farms in Utah and North Carolina, plus additional operations in Virginia.

Energy Efficiency

Regardless of its source, the cleanest energy is the energy you never use. Dominion Energy has developed several programs to help its customers benefit the environment by lowering their energy consumption, while saving money in the process.

The ThermWise energy-efficiency program in our Western-state operations provides customers with visits by experts to design an in-home energy conservation plan. Customers who need them receive, free of charge, energy-saving tools such as household pipe insulation and low-flow shower heads. ThermWise provides cash rebates to customers who install energy-efficient appliances or make weatherization improvements such as insulation, new windows and duct sealing. The program has conducted more than 2,200 weatherization inspections and provided more than...
27,000 home energy plans.

In 2017, ThermWise granted more than $22 million in incentives for installation of high-efficiency natural-gas equipment and home improvements, saving nearly 900,000 dekatherms (Dth) — the equivalent of annual natural gas consumption by roughly 11,000 residential customers.

ThermWise provides funds for extensive home retrofits and furnace and duct replacements for low-income customers in Utah and Idaho. These funds, administered by the states’ low-income assistance agencies, have totaled more than $5 million in the 12-year history of the program. As of the end of 2017, cumulative natural gas savings from ThermWise total 6.7 million Dth — equivalent to the annual consumption of roughly 84,000 residential customers. A total of $212 million in incentives has been paid to Dominion Energy customers.

Dominion Energy Ohio offers similar efficiency programs to its customers. In Ohio, Home Performance with Energy Star (HPwES) provides home assessments that include diagnostic and safety testing, the installation of free energy-efficiency products such as high-efficiency shower heads and pipe wrap, and rebates worth up to $1,250 for additional energy-saving home improvements such as insulation, duct sealing, and natural gas furnaces and water heaters. The cost to the customers is $50 plus an additional $50 if they opt to have a Nest Thermostat installed. From 2016 through 2018, HPwES performed nearly 9,000 assessments and provided rebates of more than $1.9 million. The current program has a $3 million annual budget.

Dominion Energy Ohio’s Housewarming Program, which offers help to low-income customers, has a $6.5 million annual budget. Through a third-party vendor, the Housewarming Program provides health and safety inspections on furnaces, boilers, space heaters, hot water tanks, stoves and other appliances. Home improvements, including weatherization, follow. There is no cost to the customer. The third-party vendor leverages multiple assistance programs available to the customer to ensure all improvements can be made. The average cost to weatherize a home is approximately $4,000. Since 2015, the Housewarming Program has weatherized more than 7,000 residences at a total cost of $28.6 million.

Dominion Energy is determined to build on the momentum of these well-established programs, to help its customers reduce their own environmental impacts. To that end, the company has committed to increase the customer savings realized through energy efficiency programs by 5% from 2018 to 2019. In addition, the company has made a commitment to increase the annual savings that its customers achieve from energy efficiency endeavors by 50% by 2025, against a 2017 baseline.

---

9 Dominion Energy encourages the use of advanced technology such as smart thermostats. The thermostat’s features can trigger changes that save an average of 10% to 12% on heating bills, and 15% on cooling bills. Smart thermostats connect to smart phones, allowing customers to adjust home temperatures whenever they wish, and the thermostat learns the customer’s schedule and will adjust accordingly. It also allows customers to view their energy history to find additional savings, and can even detect problems with furnaces and filters.
Safety and Methane Emissions Reduction: Working Hand in Hand

At Dominion Energy, pipeline safety and methane emissions reduction go hand in hand. When natural gas infrastructure is monitored closely and operated safely, it is also likely to release less methane emissions. Many of the company’s methane emissions reduction initiatives originally stem from pipeline safety and integrity programs, including programs for pipeline and equipment replacement, storage well inspection and interior pipe inspection with instrumented tools.

Dominion Energy is committed to ensuring the safety of its natural gas operations. Safety ranks first among the company’s five core values. Through an unrelenting focus on safety, the company has cut the number of federally-recordable incidents among employees by more than half since 2010. Dominion Energy considers this measure to be a leading indicator of the excellent operations that are essential to consistent environmental stewardship.

The company applies several basic practices to drive continuous safety improvements. These fundamentals include: active leadership commitment, strong personal accountability, high situational awareness, minimized workplace hazards, and regulatory compliance. Through these practices, Dominion Energy has developed a strong safety culture that plays a demonstrable role in the company’s overall success.

Each Dominion Energy business unit builds on this foundation, through further safety considerations that are specific to its domain. For the natural gas businesses, at least three of these supplemental safety efforts – storage initiatives, pipeline integrity management and public safety programs – also yield meaningful environmental benefits.

Natural Gas Storage Initiatives

Dominion Energy’s more than 2,300 storage wells and reservoirs are designed to withstand the high pressures associated with compression, injection and withdrawal of natural gas from year to year. The company performs inspection logging to monitoring the integrity of the casing that contains the storage pressure in the wells. Dominion Energy storage injection and withdrawal wells contain up to three concentric linings. On many, the innermost casing is cemented to the surface to provide additional leak prevention.

Dominion Energy has been using electronic logging tools to monitor these essential assets since 1967, many years before it was required by the Pipeline and Hazardous Materials Safety Administration (PHMSA). The process involves lowering a high-resolution electronic device into the well to take electromagnetic readings over its entire length. These readings provide important information regarding the condition of the well, which is then used to determine what, if any, remedial work will be performed.

In deciding how often to perform casing inspection logging on its storage wells, the company factors in the following:

- Well design and construction
- Operational history
- Environmental conditions
- Regulatory requirements

Gina Rundo is a gas operations supervisor in Ohio. Pictured here, she is showcasing our innovative use of Zero Emissions Vacuum and Compression (ZEVAC®) technology that captures methane before maintenance or inspection and recycles it for use in other parts of the system.
Dominion Energy takes into account a variety of parameters such as well depth, operating pressure, and location. Dominion Energy has a formally documented risk ranking program for its storage wells that continues to evolve as technology and methodology advance.

The company has adjusted the documentation of these processes to address recent PHMSA requirements for underground storage. Its formal risk management strategy includes an initial evaluation of risk based on threats and consequences of potential events. Each storage well is ranked according to its particular risk, and Dominion Energy manages these risks through the application of preventive measures. Feedback and validation measures ensure continual improvement of this initiative, over time. A capital-improvement budget is established each year to make necessary repairs and improvements, such as replacing wellheads and casings, to mitigate potential risk and keep the system operating efficiently.

Storage-specific Integrity programs include:

- Periodic well casing integrity inspections for internal and external corrosion;
- Regular inspections to verify well status and pressure, and to look for signs of atmospheric corrosion, vent gas or leaks;
- Remote monitoring; and
- Monitoring of third-party drilling activities in and around storage pools.

The company continues to pilot new technology to assess different aspects of the integrity of the well casing to identify any issues and address them before they become safety concerns. It has completed well casing inspections on more than 80% of our storage wells. It has plans to expand the program each year, and to complete the remainder of inspections within the PHMSA-specified period of 3-8 years. In 2018, PHMSA began its first audits of storage facilities in the U.S. Its audits of Dominion Energy’s program, and several of its storage facilities, produced no significant findings. Several more audits are scheduled for 2019.

**Pipeline Integrity Management**

Consistent with its Core Values of Ethics and Excellence, Dominion Energy strives to address both the letter and spirit of applicable regulations through integrity management programs. Similar to the initiatives applied to natural gas storage assets, the company engages in extensive integrity management programs that are tailored to the attributes of its natural gas transmission and distribution assets and operations.

Dominion Energy’s Transmission Integrity Management Program addresses the following components:

- High Consequence Areas,
- Threat Identification and Risk Assessment,
- Baseline Assessment Plan,
- Remediation/Prevention,
- Performance and Quality Assurance,
- Management of Change, and
- Communications.

Dominion Energy inspects and assesses its transmission pipelines in numerous ways, including patrols and continuous monitoring by 24/7 gas control centers. In addition to regular aerial observation and pipeline patrols, transmission pipelines also are inspected from the inside with internal inspection tools referred to as “smart pigs.” These devices use computerized sensors capable of detecting and reporting anomalies such as dents and corrosion, enabling the company to make appropriate repairs to ensure the integrity of the pipe. Dominion Energy uses smart pigs on more than half of our transmission and storage system—well beyond regulatory requirements.

Dominion Energy continuously monitors the pressure, temperature and flow of gas through remote sensors placed along the pipeline. Remote-controlled safety shutoff valves allow Gas Control operators to stop the flow of gas immediately and isolate individual sections of pipeline if needed.

To prevent external corrosion, the company operates cathodic protection systems on our underground steel assets. In addition to annual monitoring at key locations, it performs detailed corrosion surveys for an average of 1,000 miles of transmission pipeline each year to ensure these protection systems are functioning effectively. Internal corrosion is prevented through
vigilant monitoring of constituents in the gas stream, evaluating potential impact and applying targeted preventative and mitigation measures. The company also examines internal and external asset surfaces whenever operating and maintenance activities provide such opportunities, in order to validate the effectiveness of its programs.

The company has proactively committed to replace 50 miles of bare transmission pipeline across the Dominion Energy Transmission system by 2020.

Dominion Energy has partnered with the industry to improve overall emergency response times. To support this initiative, Dominion Energy has committed to install an additional 250 remote-controlled or automated valves across our footprint, by 2020.

Dominion Energy’s Distribution Integrity Management Program addresses the following elements:
- Knowledge of the Distribution System;
- Threat Identification;
- Evaluation and Ranking of Risk;
- Identification and Implementation of Measures to Address Risks;
- Measurement of Performance, Monitoring of Results, and Evaluating Effectiveness;
- Periodic Evaluation and Improvement;
- Reporting Results; and
- Document and Record Retention.

The company maintains a number of other programs to ensure distribution pipeline safety. These include:
- Enhanced Excavation Monitoring for high-risk excavation sites;
- Damage Investigation to conduct root-cause analysis of damage to pipes;
- Excavator Communications and Training to inform the public and excavators about the importance of safe excavation practices;
- Enhanced Leak Survey to accelerate leak surveys on higher-pressure distribution lines located outside of business districts; and
- Cross-Bore Verification to investigate pipeline projects that were directionally drilled prior to our current damage-prevention procedures.

Additional safety assessments for transmission and storage pipelines occur on both a cyclic and as-needed basis. This redundant system of vigilant monitoring enables Dominion Energy to detect and fix any problems in its system long before they present a hazard.

Going forward:
- Dominion Energy has committed to replace 50 miles of bare transmission pipeline by 2020 across the Dominion Energy Transmission, Inc., system and will continue to inspect and replace bare-steel distribution lines as needed.
- During that period it expects to install an additional 250 remote-controlled or automated valves across the Dominion Energy footprint.
- It has committed to install 20 additional mainline valves on critical areas of our natural gas pipeline systems.
- Its Western-state gas distribution operations plan to implement an enhanced pipeline excavation damage prevention program for safety and to reduce methane emissions.

Protecting the Public

It is critically important that our customers, contractors and employees know how to take safety precautions around gas infrastructure. Over the past 20 years, third–party damage has been the primary cause of incidents on natural gas pipelines. Dominion Energy conducts public awareness programs to educate landowners near company facilities, to reduce the likelihood of dig-ins or other harm that can cause a release of methane to the atmosphere.

Dominion Energy has long supported laws requiring use of the 811 “Know what’s below; call before you dig” one-call system. Anyone planning to do work that disturbs the soil beneath streets, sidewalks, yards, farms or other property is required to call the single designated number. Utilities, authorities and others mark their underground facilities before work begins. Excavators can call a state one-call system or the national number: 811. These one-call programs are a valuable component to protect our system and to ensure safe operations.

In Ohio, Dominion Energy teamed with the Cleveland Indians to promote the Call 811 safety message in 2017 through signage at Progressive Field. The venture built on similar promotions with the NBA’s Cleveland Cavaliers, the American Hockey League’s Cleveland Monsters and the Arena Football League’s Cleveland Gladiators at the Quicken Loans Arena.

In Utah, employees make roughly 100 safety presentations each year to community organizations, informing customers about earthquake preparedness, natural gas safety, the safety of high-pressure pipelines near their homes and businesses, ways to identify leaks, and what to do in the event of an incident.

The company conducts campaigns every fall in Utah to encourage customers to have a licensed heating expert check furnaces before winter. The company partners each year with Utah Poison Control, the Utah Health Department and the Utah Unified Fire Authority to educate the public about carbon
monoxide. It also sponsors the annual Utah Safety Council Safety Conference and Expo.

**Emergency Preparedness**

Thanks in part to extensive safety measures, natural gas emergencies occur very rarely. Those that do often result from external factors, such as excavations carried out near underground pipelines without adequate precautions. Because the potential for emergencies still exists, Dominion Energy also has developed rigorous and comprehensive programs and policies to mitigate them.

Dominion Energy conducts annual public-liaison meetings with emergency-response agencies. The company maintains and values positive, long-term relationships with fire departments, police departments, and sheriffs’ offices in the localities where our infrastructure is located. These sessions cover subjects such as the properties of natural gas, the roles of response agencies and natural gas companies in a potential incident, high level operating protocols and preferred channels of communication.

Dominion Energy has installed remotely-operated valves that can be closed when a pipeline leak or rupture occurs on a transmission pipeline. Such remote operation minimizes gas loss to the atmosphere, by quickly isolating the affected section of pipeline. Compressor stations have similar emergency shutdown systems activated through manual controls. Those systems are tested at least annually.

Dominion Energy has developed response plans for a variety of contingencies that could affect pipelines, compressor stations and storage wells. Those plans delineate specific roles, responsibilities and procedures. When there is an emergency call related to our distribution infrastructure, Dominion Energy personnel are on-site within one hour at least 98% of the time.

These efforts have produced a strong safety record that has received industry recognition. In August 2018, Dominion Energy Ohio received the American Gas Association’s Safety Achievement Award for excellence in employee safety for large local distribution companies, recognizing DEO’s 2017 performance. The company has won the award — the natural gas utility trade group’s highest employee safety honor — multiple times. Dominion Energy operations in Utah and West Virginia, as well as Dominion Energy Questar Pipeline and Dominion Energy Transmission, Inc., also received AGA Industry Leader in Accident Prevention awards for performance in 2017.¹⁰

¹⁰ Dominion Energy West Virginia, Dominion Energy South Carolina and Dominion Energy Transmission, Inc. have all earned 2018 AGA Safety Achievement Awards for excellence in employee safety. At the time of this Methane Emissions Reduction Report, Dominion Energy West Virginia has experienced over two years since its last federally-recordable employee safety incident.
Glossary of Terms

AVO  Audio, Visual, Olfactory inspections
BCF  Billion cubic feet
DECG  Dominion Energy Carolina Gas Transmission, LLC
DECP  Dominion Energy Cove Point LNG, LP
DEGP  Dominion Energy Gathering & Processing, Inc.
DEO  The East Ohio Gas Company, dba Dominion Energy Ohio
DEQP  Dominion Energy Questar Pipeline, LLC (including Dominion Energy Overthrust Pipeline, LLC)
DETI  Dominion Energy Transmission, Inc.
DEUWI  Questar Gas, dba Dominion Energy Utah, Dominion Energy Idaho, Dominion Energy Wyoming
DEWV  Hope Gas, Inc., dba Dominion Energy West Virginia
BMP  Best Management Practice
CH₄  Methane
CO₂e  Carbon Dioxide Equivalent
DI&M  Directed Inspection and Maintenance
Dth  Dekatherms
EPA  Environmental Protection Agency
G&B  Gathering and Boosting
GHGRP  Greenhouse Gas Reporting Program
GWP  Global Warming Potential
LDAR  Leak Detection and Repair
LNG  Liquefied Natural Gas
MCF  Thousand cubic feet
MT  Metric Tons
NgSTAR  Natural Gas STAR Program
RNG  Renewable Natural Gas
PHMSA  Pipeline and Hazardous Materials Safety Administration
T&S  Transmission and Storage
ZEVAC®  Zero Emissions Vacuum and Compression

Appendices

Appendix A:  Maps of Dominion Energy Storage Assets
Appendix B:  Dominion Energy NgSTAR reports for 2017
Appendix C:  EPA NgSTAR summary reports for 2017
Appendix D:  Dominion Energy Methane Challenge reports for 2017
This report contains statements concerning Dominion Energy, Inc.'s ("Dominion Energy") expectations, plans, objectives, future financial performance and other statements that are not historical facts. These statements are “forward-looking statements” within the meaning of the Private Securities Litigation Reform Act of 1995. In most cases, the reader can identify these forward-looking statements by such words as “anticipate,” “estimate,” “forecast,” “expect,” “believe,” “should,” “could,” “plan,” “may,” “continue,” “target” or other similar words.

Dominion Energy makes forward-looking statements with full knowledge that risks and uncertainties exist that may cause actual results to differ materially from predicted results. Factors that may cause actual results to differ are often presented with the forward-looking statements themselves. Additionally, other factors may cause actual results to differ materially from those indicated in any forward-looking statement. These factors include but are not limited to:

- Unusual weather conditions and their effect on energy sales to customers and energy commodity prices;
- Extreme weather events and other natural disasters that can cause outages and property damage to facilities;
- Federal, state and local legislative and regulatory developments, including changes in federal and state tax laws and regulations;
- Changes to federal, state and local environmental laws and regulations, including those related to climate change, the tightening of emission or discharge limits for greenhouse gasses and other substances, more extensive permitting requirements and the regulation of additional substances;
- Cost of environmental compliance, including those costs related to climate change;
- Changes in implementation and enforcement practices of regulators relating to environmental standards and litigation exposure for remedial activities;
- Difficulty in anticipating mitigation requirements associated with environmental and other regulatory approvals or related appeals;
- Risks associated with the operation of nuclear facilities, including costs associated with the disposal of spent nuclear fuel, decommissioning, plant maintenance and changes in existing regulations governing such facilities;
- Fluctuations in energy-related commodity prices;
- Global capital market conditions, including the availability of credit and the ability to obtain financing on reasonable terms;
- Changes in rating agency requirements or credit ratings and their effect on availability and cost of capital;
- Risks of operating businesses in regulated industries that are subject to changing regulatory structures;
- Impacts of acquisitions, divestitures, transfers of assets to joint ventures or Dominion Energy Midstream Partners, LP and retirements of assets based on asset portfolio reviews;
- Changes in demand for Dominion Energy's services, including industrial, commercial and residential growth or decline in Dominion Energy's service areas, changes in supplies of natural gas delivered to Dominion Energy's pipeline and processing systems, failure to maintain or replace customer contracts on favorable terms, changes in customer growth or usage patterns, including as a result of energy conservation programs, the availability of energy efficient devices and the use of distributed generation methods;
- Additional competition in industries in which Dominion Energy operates, including in electric markets in which Dominion Energy's merchant generation facilities operate, and potential competition from the development and deployment of alternative energy sources, such as self-generation and distributed generation technologies, and availability of market alternatives to large commercial and industrial customers;
- Changes in technology, particularly with respect to new, developing or alternative sources of generation and smart grid technologies;
- Changes to regulated electric rates and regulated gas distribution, transportation and storage rates, including LNG storage, collected by Dominion Energy;
- Changes in operating, maintenance and construction costs; and
- Timing and receipt of regulatory approvals necessary for planned construction or growth projects and compliance with conditions associated with such regulatory approvals.

Additionally, other risks that could cause actual results to differ from predicted results are set forth in Item 1A. Risk Factors in Dominion Energy's quarterly reports on Form 10-Q and most recent annual report on Form 10-K.

Dominion Energy's forward-looking statements are based on beliefs and assumptions using information available at the time the statements are made. Dominion Energy cautions the reader not to place undue reliance on their forward-looking statements because the assumptions, beliefs, expectations and projections about future events may, and often do, differ materially from actual results. Dominion Energy undertakes no obligation to update any forward-looking statement to reflect developments occurring after the statement is made.