# Table of Contents

- Introduction 3
- Overview 4
- Gas Consumption 7
- Consumer Data 9
- Economic Benefits 13
- Electricity Generation 15
- Energy Costs 16
- Infrastructure 18
- Energy Efficiency 23
- Community Impacts 25
- Environmental Benefits 27
- Energy Reliability 30
- Public Safety 32
- Conclusion and Acknowledgements 35
Dear Fellow Massachusetts Energy User:

Natural gas has been an energy, economic, and environmental success story for Massachusetts.

Every day, the Commonwealth gets more than half of its home heating and electric generation from natural gas. About 200,000 homeowners have chosen natural gas as their cost-effective fuel source in the last decade. And the natural gas industry has sharply reduced its emissions over the last 20 years, while driving deep reductions in emissions from electric generation.

In short, gas is good for Massachusetts. That's a message that needs to be reiterated and reinforced, especially as our state continues its robust discussion about the role expanded supplies of gas will and must play as part of an “all of the above” energy solution that includes wind, solar, and other renewables, distributed generation, energy storage, and a leading commitment to energy efficiency.

In this “State of the Industry Report,” the Northeast Gas Association and our supporters are collecting and presenting in one place a broad range of information about the benefits gas is delivering to Massachusetts day in and day out. Inside you will find not just numbers on the growth in the use of gas and the economic and environmental benefits that it is achieving, but information about:

• jobs, local taxes, and economic benefits delivered by local distribution companies (utilities) and other gas industry companies,
• the hundreds of organizations and charities the gas industry supports across Massachusetts,
• our robust commitment to promoting energy efficiency and what we’ve accomplished, and
• utilities’ constant commitment to the highest standards of safety and aggressive commitment to upgrading distribution networks to ensure safety and further reduce emissions.

Natural gas has an important role to play for many years to come within a balanced, diversified energy portfolio. That’s why we are working, with this report and throughout our Massachusetts Energy Reliability Awareness Campaign, to bring balance back into the discussion about Massachusetts’ energy needs. We hope you will find this report informative, and we hope you will make your voice heard with your elected officials to tell them: Continued, reliable access to adequate gas supplies, as part of an all-of-the-above energy strategy, is critical to ensure that Massachusetts has an affordable, reliable, and ever-cleaner energy supply.

Thomas M. Kiley
President and CEO, Northeast Gas Association
Overview

Massachusetts receives substantial, wide-ranging economic benefits from natural gas. This resource is a vital source of energy used for electric generation, home heating, industry, and transportation. Natural gas delivers significant value as a reliable and environmentally friendly fuel resource. It also strengthens the state’s economy by creating direct and indirect employment for thousands of residents, related direct and indirect economic activity, and numerous community benefits in cities and towns across the Commonwealth.

The Northeast Gas Association 2017 State of the Industry Report: “The Economic Benefits of Natural Gas in Massachusetts” is intended as a synopsis of the natural gas economy in Massachusetts. It is based on macroeconomic data derived from various consumer, infrastructure, environmental, and industry reports. The report summarizes publicly available information to highlight the role of natural gas within Massachusetts’ economy.
The findings of this report show that natural gas delivers key benefits in Massachusetts. These include energy affordability, which is an important economic factor in the Commonwealth. Perennial high energy costs in the Bay State result in difficult choices for many families and challenges for businesses looking to expand and grow jobs. Cost-efficient natural gas helps make home heating more affordable, especially for low-income households who struggle with the high cost of living in Massachusetts. In addition to the lower cost of natural gas compared to other fuels, every utility company in Massachusetts that delivers gas to homeowners provides assistance to low-income customers who require help with heating bill management.

By any measure, natural gas plays an essential and vital role in the Bay State. More than half of all Massachusetts homes and businesses count on natural gas for heating. Gas also serves as an abundant, reliable and affordable energy resource that continues to help deliver a cleaner future for Massachusetts.
Gas Consumption

Synopsis

Available public information shows the depth and reach of natural gas as a primary source of energy, electricity generation, and heating for homes and businesses in Massachusetts. Gas serves a full range of constituents in the Commonwealth, including homeowners, tenants, small businesses, commercial industry, institutions, and non-profits.

Natural gas is an essential part of the Massachusetts energy mix. It accounts for 46 percent of electric generation capacity and 51 percent of residential heating.

State Usage

Natural gas provides 30 percent of Massachusetts’ primary energy. It accounts for 46 percent of electric generation capacity, a large number that will rise even more as a new gas plant opens in Salem and a major coal plant has recently closed. In 2015, Massachusetts generated 64 percent of its electricity from natural gas. In addition, gas accounts for 51 percent of residential heating.

State Reach

Utility gas service is available in part or all of 275 of Massachusetts’ 351 cities and towns, or 78 percent of Bay State communities. Utility gas service is not available only on the Islands (Martha’s Vineyard and Nantucket); in rural communities in westernmost counties (Berkshire, Franklin, Hampden, Hampshire, Worcester); and on the lower Cape (Wellfleet, Truro, Provincetown). As can be seen in the map on page 5, the location of pipeline infrastructure largely determines the availability of local service.
State vs. Regional Consumption

Massachusetts
Gas consumption in MA by sector, according to the United States Energy Information Administration (U.S. EIA) “Natural Gas Annual 2015.”

<table>
<thead>
<tr>
<th>Electric generation</th>
<th>Residential heating and cooking</th>
<th>Commercial</th>
<th>Industrial</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>156 (Bcf)</td>
<td>127 (Bcf)</td>
<td>105 (Bcf)</td>
<td>46 (Bcf)</td>
<td>434 (Bcf)</td>
</tr>
<tr>
<td>35.9%</td>
<td>29.3%</td>
<td>24.2%</td>
<td>10.6%</td>
<td>100%</td>
</tr>
</tbody>
</table>

New England
Gas consumption in New England, according to U.S. EIA “Natural Gas Annual 2015.”

<table>
<thead>
<tr>
<th>Electric generation</th>
<th>Residential heating and cooking</th>
<th>Commercial</th>
<th>Industrial</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>385 (bfc)</td>
<td>213 (bfc)</td>
<td>195 (bfc)</td>
<td>111 (bfc)</td>
<td>904 (bfc)</td>
</tr>
<tr>
<td>42.5%</td>
<td>23.6%</td>
<td>21.6%</td>
<td>12.3%</td>
<td>100%</td>
</tr>
</tbody>
</table>

(Bcf) = billion cubic feet

Key fact: Massachusetts' natural gas consumption represents approximately 50 percent of the total six-state New England natural gas market.

State Ranking

Among all states, MA ranks:

<table>
<thead>
<tr>
<th>Overall Energy Consumption</th>
<th>Natural Gas Consumption</th>
<th>Petroleum Consumption</th>
<th>Electricity Consumption</th>
<th>Coal Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>44th</td>
<td>17th</td>
<td>20th</td>
<td>41st</td>
<td>26th</td>
</tr>
</tbody>
</table>

Source: U.S. EIA

Key fact: Massachusetts has achieved a more efficient use of energy than the national average during a period when the state’s share of natural gas consumption continues to rise.
Consumer Data

Synopsis

Massachusetts consumers increasingly prefer natural gas, relying on it as the most affordable home heating option.

Home Heating: Gas Is Leading Fuel Of Choice

<table>
<thead>
<tr>
<th>Natural Gas</th>
<th>Oil Heat</th>
<th>Electric Heat</th>
<th>Bottled Gas</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>51%</td>
<td>27%</td>
<td>16%</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: 2015 United States Census Bureau Data

Key fact: Natural gas use in homes in the Commonwealth has grown steadily over the past quarter century. Today, it is Massachusetts residential customers’ preferred heating and cooking fuel.

Natural gas is the most affordable energy choice for home heating in Massachusetts.

Massachusetts Residential Heating Usage Data (1990-2015)

<table>
<thead>
<tr>
<th>Percentage of Households</th>
<th>1990</th>
<th>2000</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>38%</td>
<td>43.9%</td>
<td>51%</td>
</tr>
<tr>
<td>Oil</td>
<td>44%</td>
<td>39.4%</td>
<td>27%</td>
</tr>
<tr>
<td>Electric</td>
<td>13.5%</td>
<td>12.4%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Key fact: Between 2000 and 2015, 200,000 homes in the Commonwealth selected natural gas as the primary home heating fuel, the majority through conversions from other heating fuels such as heating oil. This validates various consumer surveys that show a preference for gas as a reliable and more affordable fuel – and one with fewer environmental impacts.
Massachusetts Home Heating Affordability Data (2008-'16)

Key fact: Natural gas is a more affordable energy choice for home heating in Massachusetts, with gas heating consumers consistently paying less, often much less, than oil heat customers.

Source: U.S. EIA, MA Department of Energy Resources

Since 2000, 200,000 homes have chosen to add natural gas as their heating source in Massachusetts.
Massachusetts Winter Heating Cost Trends (2011-16)

Key Fact: Direct comparison of the Commonwealth's main home heating resources (natural gas, heating oil, propane, electricity) during winter months indicates that the average Massachusetts natural gas customer spent an average of 20 to 40% less for home heating during the winter months between Fiscal Year 2011 and 2016 compared with the average Massachusetts oil heat customer during the same period.

Note: Costs for average household usage that are tracked by fuel type do not reflect factors that affect fuel usage (e.g., number of household residents, square footage, etc.)

Natural Gas: Winter Data

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Volume (therms)</th>
<th>Avg. Customer Cost</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2016 (2015-16)</td>
<td>593</td>
<td>$646</td>
<td>-31%/-26%</td>
</tr>
<tr>
<td>FY 2014 (2013-14)</td>
<td>824</td>
<td>$1,212</td>
<td>7.1%/30.3%</td>
</tr>
<tr>
<td>FY 2013 (2012-13)</td>
<td>769</td>
<td>$930</td>
<td>13.6%/12.6%</td>
</tr>
<tr>
<td>FY 2012 (2011-12)</td>
<td>677</td>
<td>$826</td>
<td>NA</td>
</tr>
<tr>
<td>FY2012-16 (5-yr. avg.)</td>
<td>744</td>
<td>$897</td>
<td>NA</td>
</tr>
</tbody>
</table>

Source: MA Department of Energy Resources

Heating Oil: Winter Data

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Volume (gallons)</th>
<th>Avg. Customer Cost</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2016 (2015-16)</td>
<td>674</td>
<td>$1,508</td>
<td>-24.7%/-47%</td>
</tr>
<tr>
<td>FY 2015 (2014-15)</td>
<td>895</td>
<td>$2,847</td>
<td>-12%/-10%</td>
</tr>
<tr>
<td>FY 2014 (2013-14)</td>
<td>807</td>
<td>$3,237</td>
<td>7.1%/9.2%</td>
</tr>
<tr>
<td>FY 2013 (2012-13)</td>
<td>736</td>
<td>$2,965</td>
<td>17.4%/18.8%</td>
</tr>
<tr>
<td>FY 2012 (2011-12)</td>
<td>627</td>
<td>$2,495</td>
<td>NA</td>
</tr>
<tr>
<td>FY2012-16 (5-yr. avg.)</td>
<td>748</td>
<td>$2,610</td>
<td>NA</td>
</tr>
</tbody>
</table>

Source: MA Department of Energy Resources
Estimated Avg. Heating Bills

Winter Average Residential Heating Costs
($/MMBtu)

Based on energy produced in millions of British thermal units (MMBtu).

Source: MA Dept. of Energy Resources
Economic Benefits

Synopsis

The natural gas sector employs thousands of Massachusetts residents, generates substantial levels of secondary economic activity and employment, while producing over $100 million in local tax revenue.

Industry Employment Data

<table>
<thead>
<tr>
<th>2016</th>
<th>Full Time Employment (FTE)</th>
<th>Indirect Employment (vendors)</th>
<th>City and town local property tax payments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt; 4,000</td>
<td>&gt; $430 million</td>
<td>$101.5 million</td>
</tr>
</tbody>
</table>

The natural gas sector in Massachusetts is represented by the following labor unions:

<table>
<thead>
<tr>
<th>International Brotherhood of Electrical Workers</th>
<th>Utility Workers Union of America</th>
<th>United Steelworkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local 96</td>
<td>Local 56</td>
<td>Local 2285</td>
</tr>
<tr>
<td>Local 103</td>
<td>Local 273</td>
<td>Local 2936</td>
</tr>
<tr>
<td>Local 223</td>
<td>Local 318</td>
<td>Local 7912</td>
</tr>
<tr>
<td>Local 326</td>
<td>Local 340</td>
<td>Local 9158</td>
</tr>
<tr>
<td></td>
<td>Local 341</td>
<td>Local 9360</td>
</tr>
<tr>
<td></td>
<td>Local 369</td>
<td>Local 12003</td>
</tr>
<tr>
<td></td>
<td>Local 464</td>
<td>Local 12004</td>
</tr>
<tr>
<td></td>
<td>Local 475</td>
<td>Local 12012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local 12026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local 12325</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local 13507</td>
</tr>
</tbody>
</table>
Geographic Reach

<table>
<thead>
<tr>
<th>Local Distribution Company (LDC)</th>
<th>Berkshire</th>
<th>Columbia</th>
<th>Eversource</th>
<th>Liberty</th>
<th>National Grid</th>
<th>Unitil</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA CITIES/TOWNS</td>
<td>20</td>
<td>61</td>
<td>56</td>
<td>6</td>
<td>120</td>
<td>6</td>
<td>275</td>
</tr>
<tr>
<td>Total customers</td>
<td>39,700</td>
<td>317,600</td>
<td>295,200</td>
<td>55,300</td>
<td>902,000</td>
<td>15,900</td>
<td>1.625M</td>
</tr>
</tbody>
</table>

In addition, there are four municipal gas and electric light companies in the state and a single-community privately owned utility that also provide natural gas distribution service:

- Blackstone Gas Company (approximately 1,800 gas customers)
- Holyoke Gas & Electric (approximately 10,000 gas customers)
- Middleborough Gas & Electric (approximately 5,200 gas customers)
- Wakefield Municipal Gas & Light (approximately 6,500 gas customers)
- Westfield Municipal Gas & Light (approximately 10,000 gas customers).

Infrastructure Value

Massachusetts gas utilities’ collective “utility plant in service” exceeded $8.5 billion at the end of 2015. (Source: DPU Annual Returns.)
Electricity Generation

Synopsis

Natural gas is the predominant fuel resource in the electric generation sector, serving as the backbone of Massachusetts’ power sector. The increased use of natural gas for electricity generation since 1990 is widely credited with significant reductions in the state’s level of greenhouse gas emissions. During the period from 1990 to 2015, levels of greenhouse gases such as carbon dioxide fell by 21 percent. At the same time, the majority of coal- and oil-fired electricity generation in Massachusetts has been replaced by gas-fired power stations or renewable resources.

Capacity

In 2015, Massachusetts’ electricity generating stations represented a total of 14,659 MW of installed capacity, 6,799 MW (46 percent) of which was gas fired. Gas plants, however, produced close to two-thirds of all electricity generated within Massachusetts. The following chart breaks down the fuel sources used to generate power.

<table>
<thead>
<tr>
<th>Fuel Resource</th>
<th>Megawatt hours generated</th>
<th>Percentage of total MWh generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>21,007,411</td>
<td>65.4</td>
</tr>
<tr>
<td>Nuclear</td>
<td>4,994,806</td>
<td>15.5</td>
</tr>
<tr>
<td>Coal</td>
<td>2,252,664</td>
<td>7.0</td>
</tr>
<tr>
<td>Pumped-storage Hydro</td>
<td>827,184</td>
<td>2.5</td>
</tr>
<tr>
<td>Petroleum</td>
<td>774,074</td>
<td>2.4</td>
</tr>
<tr>
<td>Solar</td>
<td>451,366</td>
<td>1.4</td>
</tr>
<tr>
<td>Wind</td>
<td>214,666</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Source: US EIA

Several new natural gas-fired power plant projects are slated to open in Massachusetts by 2020:

- Salem Harbor Footprint, 674 MW power generating station (2017)
- Exelon Power West Medway Generation Station, Peaker Expansion, 195 MW power generating facility (June 2018)

As well, natural gas is the leading fuel type regionally in the list of power plants proposed before ISO New England.
Energy Costs

Synopsis

New England’s energy customers incur higher energy costs than the national average. As a result, Massachusetts remains a high-cost energy state, fourth among all US states for gas residential heating costs and for average residential electricity costs (source U.S. EIA, Dec. 2016). The state’s high-cost energy environment continues to pose challenges for economic growth and energy affordability. Massachusetts remains among the most price-sensitive natural gas markets in the nation due to limitations on its infrastructure capacity.

Utility Bill Components

Residential customer bills are based on several factors, including commodity costs of other supply sources, interstate pipeline capacity (or transportation) costs, utility transportation service charges, efficiency and other program costs. The gas utility, or LDC, passes on actual commodity cost to customers and does not make any margin on these costs, which are a direct pass-through, subject to regulatory oversight by the state Department of Public Utilities (DPU).
Pipeline Capacity

Price fluctuations within the natural gas wholesale market reflect the volatility of wholesale energy markets, which are based on a range of factors, including domestic and international demand, wholesale production and pipeline capacity.

Availability of natural gas in New England is constrained during winter months when cold weather results in increased consumption of gas for heating. As stated by the U.S. EIA, “pipeline constraints still exist in [New England and New York] and day-to-day price volatility is likely.”

During periods of extreme winter cold, available gas resources are prioritized for home heating over electric generation based on available maximum pipeline capacity, which impacts the cost of electricity. In New England, rising demand for natural gas within the region’s electric market has not been sufficiently matched by a commitment from the power market to secure adequate, reliable natural gas supplies and firm pipeline capacity.

Price Fluctuations

Increased availability of natural gas helps to stabilize utility rates for residential and business customers. At the same time, the reliance of the gas power generation sector on non-firm gas transportation contracts leaves that sector, and electric utility customers, subject to spot market price volatility and the potential for higher electric bills.

In 2016, mild winter weather in New England reduced demand for heating fuels like natural gas, which also was reflected by lower wholesale New England electricity market prices – reaching the lowest level since 1999. This reduced burden on electric utility customers reflected lower demand for natural gas during winter months and the resulting increased availability of natural gas for power plants. (Source: ISO New England 2017 State of the Grid.)

However, constraints on pipeline capacity can cause electric prices to spike. For example, during the winter of 2013-2014, extreme cold resulted in skyrocketing demand from home heat customers and higher spot gas prices. Subsequently, natural gas and wholesale electricity prices reached record highs over a three-month period, with the total wholesale cost of electricity in Massachusetts rising to nearly $5 billion, or more than all six New England states paid for wholesale electricity in 2016.

In Massachusetts, electricity and natural gas rates include fixed delivery costs, environmental efficiency fees, and a “cost of energy” rate tied to market price fluctuations of energy resources within the region.
Synopsis

Massachusetts' natural gas delivery infrastructure is part of an integrated New England system. Like the other states in the region, the Bay State relies entirely on external sources for gas supply. There is no natural gas produced in the state or region.
Supply

Massachusetts obtains its natural gas supplies from:

- Pipelines (U.S. and Canadian sources) over 90%
- Liquefied Natural Gas via marine shipping from 6-9%

Natural gas is imported into Massachusetts in vapor form via pipelines and as liquefied natural gas (LNG) by tankers. Currently, the majority of gas consumed in Massachusetts is produced from the Marcellus shale basin in Pennsylvania, the largest, most productive shale gas basin in the United States.
Interstate Pipelines

The interstate pipelines operating within Massachusetts are:

- Algonquin (Enbridge)
- Tennessee Gas (Kinder Morgan)
- The joint facilities of two separate systems: Portland Natural Gas Transmission System (PNGTS); and Maritimes & Northeast Pipeline.

The majority of Massachusetts’ gas supply is imported through the Algonquin and Tennessee pipelines. Both began operations in the early 1950s and were designed to transport gas from the Gulf Coast into New England. The PNGTS and Maritimes pipelines, which began operations in the late 1990s, were designed to transport gas from western Canada (PNGTS) and from offshore Nova Scotia (Maritimes).

Transmission pipeline and local distribution company main lines account for the following mileage within Massachusetts:

- 1,135 miles of gas transmission lines
- 21,631 miles of distribution mains

Interstate gas transmission lines are overseen by the U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration. Local distribution systems are regulated by the Massachusetts Department of Public Utilities.

Interconnection Pipelines

The Iroquois Gas Transmission does not physically operate within Massachusetts but interconnects with the Algonquin and Tennessee pipelines to support the supply of natural gas within the state. Other pipelines outside the region also interconnect with pipelines entering Massachusetts, providing both supply and reliability opportunities.
LNG

LNG import facilities operating in Massachusetts are:

• Distrigas (ENGIE) Terminal, Everett
• Excelerate, Northeast Gateway (offshore)

New England remains the most LNG-reliant region in the United States. LNG is used principally for peak day supply needs during cold winter months and to help support adequate system pressure.

The Distrigas Terminal, opened in 1971, has received more than 1,000 shipments of LNG via tanker ships. Today, gas delivered to Distrigas is sourced primarily from the island of Trinidad in the Caribbean Sea. The Northeast Gateway facility, located offshore from Cape Ann, began operations in 2008, and imports some spot cargoes during the winter months. In addition, many of the state’s (and region’s) gas utilities own and operate LNG peak-shaving or satellite facilities, which store natural gas in liquid form for winter peak day support. These LNG storage facilities are located across the Commonwealth within the communities of Acushnet, Dorchester, Easton, Fall River, Holyoke, Hopkinton, Lawrence, Ludlow, Lynn, Marshfield, Middleborough, Salem, South Yarmouth, Tewksbury, Wareham, Westminster, and Whately. These storage facilities are essential to gas utility winter system reliability.
Statewide Demand

Gas utilities in the Commonwealth continue to experience expanding consumer demand on a consistent basis, with annual growth between one and two percent. About 200,000 heating customers have selected natural gas since the year 2000.

To increase the availability and affordability of natural gas service, the Legislature enacted a new provision in 2014 to encourage gas utilities to design and offer programs for interested customers. Under state law, gas utilities are obligated to plan for and procure gas supplies for all their firm customers, including households and businesses. Every two years, LDCs are required to submit a five-year forecast and supply plan to the Department of Public Utilities for approval.

As demand for supply increases, utilities have the option of seeking additional interstate pipeline capacity as a means of ensuring reliable service for customers. An example of a recent pipeline project designed to meet increased gas utility demand was Spectra Energy’s (now Enbridge’s) Algonquin Incremental Market (AIM) project, which went into service in the region in late 2016 and added 342 million cubic feet per day of increased supply capacity – all contracted to gas utilities.

System Management

Gas utilities in the Commonwealth enter into both short-term and long-term contracts for supplies. As noted by the MA DPU: “The majority of gas supply (also referred to as commodity) contracts are short term with a duration of one to five years…. [Gas utilities] benefit from the availability of new supplies from areas such as the Marcellus Shale gas basin in the Appalachian region (Pennsylvania, West Virginia) and [are able] to diversify their supply portfolios and respond to the availability of new resources, thereby reducing the risk associated with potential production interruptions in a specific area.”
Energy Efficiency

Synopsis

Massachusetts is a leader in the United States in terms of energy efficiency programs. Massachusetts has ranked first-in-the-nation due in part to pioneering efforts on natural gas efficiency. According to the most recent state rankings released by the American Council for an Energy Efficient Economy (ACEEE), Massachusetts invested more dollars in natural gas efficiency programs per residential customer than any other state.

Massachusetts, which consumes 1.6 percent of natural gas used in the United States, accounts for 13.3 percent of all U.S. natural gas efficiency program spending.

The gas industry’s focus on efficiency measures that support energy savings includes free energy audits, as well as incentives and rebates for installation of energy efficient gas equipment. An August 2016 report from MassSAVE reported that, cumulatively, gas customers have saved 78.7 million annual therms of natural gas and 3.9 million annual megawatt-hours of electricity. The report indicated $4.69 in benefits for every $1 spent by the program.
Notable efficiency facts:

- Massachusetts, which consumes 1.6 percent of natural gas used in the United States, accounted for 13.3 percent of all U.S. natural gas efficiency program spending. (Source: ACEEE 9-16 Scorecard for Energy)

- Massachusetts customers invested $185.5 million in natural gas efficiency programs in 2015 out of a total of $1.4 billion invested in gas efficiency across the United States, or 13.25 percent of all gas efficiency investments. (Source: ACEEE 9-16 Scorecard for Energy)

- Between 2010 and 2015, Massachusetts invested $930 million in gas energy efficiency programs that saved consumers $2.8 billion, or a 201 percent return on investment. This achieved a reduction in annual Greenhouse Gas (GHG) emissions equivalent to discharges from 2.2 million homes. (Source: MassSAVEdata.com)
Community Impacts

Synopsis

The Massachusetts gas sector plays an important role in the civic, social, and cultural fabric of the Commonwealth and the communities they service.

Contributions

Massachusetts’ natural gas sector, represented by Local Distribution Companies (LDCs), deliver significant local benefits to civic organizations and non-profits across the state. Millions of dollars in direct and indirect support are provided to, among others, the following community groups:

- American Red Cross
- Animal Rescue League of Fall River
- Artists for Humanity
- Avangrid Foundation
- Boston Children’s Hospital
- Boston Children’s Museum
- Brockton Area NAACP
- Children’s Advocacy Center
- Citizens for Citizens
- City Year
- Community Development for Attleboro
- Dana Farber Cancer Institute
- Durfee Hilltopper Athletic Foundation
- Easton Children’s Museum
- Girls, Inc. (Lowell, Worcester)
- Greater Fall River Re-Creation
- Greater Lawrence Community Action Council
- Greater Lawrence Senior Center
- Habitat for Humanity
- Homeward Vets
- Jr. Tech
- Lazarus House
- Massachusetts Good Neighbor
- My Brothers Keeper
- Museum of Science (Boston)
- Neighbors Helping Neighbors
- New England Aquarium
- New England Veterans Liberty House
- Paulo Matos Memorial Revitalize CDC
- Revitalize CDC (Springfield)
- Science From Scientists
- Spirit of Springfield
- Stepping Stone Inc.
- Taunton Boys and Girls Club
- Thomas Chew Memorial Revitalize CDC
- US First
- USO Pioneer Valley
Low Income Assistance

Massachusetts’ LDCs offer a range of home heating assistance programs to qualified eligible participants. Discounted rate programs are available to residential customers who receive certain public assistance benefits. Qualified participants receive up to approximately 25% percent discounts on home heating.

Programs include the Low Income Home Energy Assistance Program (LIHEAP), which provides a maximum benefit based on available state and federal funding. Qualified eligible participants also may participate in other assistance programs, such as no cost energy efficiency improvements. The Residential Arrearage Management Program (RAMP), which was introduced in 2009, offers income eligible customers the opportunity to eliminate past due balances while retaining service for up to $3,600 per year.

The Good Neighbor Energy Fund (GNEF), which is administered in Massachusetts through The Salvation Army, is available each year to households that are impacted by a temporary financial distress. The GNEF provides assistance to low-income residents who do not qualify for other state assistance through a one-time $425 grant.

In addition, LDCs help eligible customers connect with available federally funded assistance such as the Residential Assistance to Families in Transition (RAFT), which offers short-term financial assistance to low income families at risk of becoming homeless or to families who are forced to move suddenly without adequate financial resources to cover utility startup costs.

Challenges: Delivery System Moratoria

The following Massachusetts communities are currently subject to a moratorium or other restrictions on natural gas connections for local residents and businesses because of constraints on the delivery system (mainly constrained laterals):

- Amherst
- Deerfield
- Easthampton
- Greenfield
- Hadley
- Hatfield
- Montague
- Northampton
- Sunderland
- Whately

Until infrastructure limitations are addressed, service in these communities will remain constricted. Some communities on Cape Cod are also temporarily restricted from system expansion pending the ongoing replacement of the mid-Cape main gas pipeline, which is scheduled to be completed in 2019.

Source: MA Department of Energy Resources
Environmental Benefits

Synopsis

Massachusetts’ natural gas sector has played a primary role in reducing GHG emissions and helping the Commonwealth attain climate change goals.

Key Facts

Increased use of natural gas for electricity generation in MA helped to reduce CO2 emissions from electrical generation by 23.8 percent between 1990-2014 due to reduced reliance on coal- and oil-fired generation. (Source: US EIA, November 2016.)

Natural gas systems have reported a steady decline in GHG emissions from 2.4 MMT of CO2 equivalent in 1990 to 0.8 in 2014, a 67 percent drop (Source: MA DEP, March 2017.)

Natural gas systems accounted for 1.1 percent of total statewide GHG emissions in 2014, down from 2.6 percent in 1990 (Source: MA DEP, 2016.)

Natural gas systems cut methane emissions by approximately 70 percent between 1990 and 2014 - principally through replacing and upgrading older system components (Source: MA DEP, 2017.)

Natural gas emits significantly less Greenhouse Gas (GHG) Emissions than coal and oil when used to generate electricity.

Greenhouse Gas (GHG) Emissions (in pounds) per MWH produced

<table>
<thead>
<tr>
<th></th>
<th>SO2 (sulfur dioxide)</th>
<th>NOX (nitrogen oxides)</th>
<th>CO2 (carbon dioxide)</th>
<th>Particulate Matter (PM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>0.1</td>
<td>1.7</td>
<td>1,135</td>
<td>.002</td>
</tr>
<tr>
<td>Oil</td>
<td>12</td>
<td>4</td>
<td>1,672</td>
<td>.003</td>
</tr>
<tr>
<td>Coal</td>
<td>13</td>
<td>6</td>
<td>2,249</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Differential</strong></td>
<td><strong>Oil = 120x more SO2 than gas per MWH</strong></td>
<td><strong>Oil = 2.4x more NOX than gas per MWH</strong></td>
<td><strong>Oil = 47% more CO2 than gas per MWH</strong></td>
<td><strong>Oil = 50% more PM than gas per MWH</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Coal = 130x more SO2 than gas per MWH</strong></td>
<td><strong>Coal = 3.5x more NOX than gas per MWH</strong></td>
<td><strong>Coal = 98% more CO2 than gas per MWH</strong></td>
<td><strong>Coal = 950x more PM than gas per MWH</strong></td>
</tr>
</tbody>
</table>

Source: US EIA
Methane emissions from natural gas systems in MA have declined by 67 percent since 1990, according to MA DEP’s recent GHG inventory report. The natural gas sector in MA accounted for just 1.1% of total state GHG emissions.
Distribution Line Upgrades

Between 2010 and 2015, Massachusetts’ distribution companies increased total footage of state-of-the-art plastic pipeline in service by 20 percent while reducing the extent of older cast iron and uncoated steel.

Methane Emissions Reduction

Methane emissions, which have declined substantially, remain a priority issue for Massachusetts. In 2014, the Legislature unanimously passed legislation that facilitated utilities’ ability to “accelerate” the replacement of older gas distribution system components that are more likely to be susceptible to leaks (cast-iron and bare steel), and that could result in methane emissions.

According to the U.S. EPA, the key factor in reducing methane emissions in gas distribution systems is “increased use of plastic piping (which has lower emissions than other pipe materials) and upgrades for metering and regulating (M&R) stations.” Massachusetts’ “Gas System Enhancement Plans” or GSEPs, which is overseen by the DPU, is utilized to replace older pipe with new plastic piping.
Energy Reliability

Synopsis

Natural gas is the backbone of the state and regional power system. Each day, natural gas accounts for 40 to 50 percent of the power generated in Massachusetts while allowing the Commonwealth to achieve significant GHG reductions over a 15-year period. However, the state’s reliance on natural gas does create reliability risks for the regional power grid during high-demand periods in the winter, since most gas generators rely on “non-firm” gas transportation.

During the coming decades of transition to a more renewables-based grid, gas-fired power plants will remain an essential aspect of Massachusetts’ electricity grid, providing reliable and affordable baseload and backup power supplies.

Reliability Challenges

The regional power grid and wholesale electric market administrator, Independent System Operator New England (ISO-NE), warned in its “2017 State of the Grid” report that “inadequate natural gas transportation and storage infrastructure create very challenging conditions” for the delivery of reliable electricity generation to the region, including Massachusetts. The report stated that “during extreme temperatures, fuel constraints can sideline thousands of megawatts of natural gas generation; aging generators can break down; imports can be cut by neighboring grids dealing with the same weather; and oil and LNG deliveries can be delayed. If a few of those problems coincided, ISO-NE system operators could be forced to use stronger measures to protect the grid. Those measures could include asking the public for voluntary conservation or, in extreme cases, ordering controlled power outages.”
Renewable Energy Reinforcement

The 2017 ISO-NE report stated “storage will be needed at a level that won’t be economically or technically feasible for many years … New England’s gas demand therefore will obviously continue to grow.”

Renewable energy technology continues to experience advances on an annual basis. And yet, even with future offshore wind development and importation of hydroelectric power from Canada planned for the early 2020s, the renewable energy sector remains decades away from fully supporting Massachusetts’ robust energy requirements. Further, planned renewable energy projects may be delayed by construction, regulatory, and financing issues and litigation. In addition, energy storage technologies currently remain unaffordable at utility scale.

Accordingly, ISO-NE has repeatedly stated that the successful integration of renewable energy resources such as offshore wind, imported hydro power, onshore wind, and solar power will require back up from natural gas power stations because this technology is both fast-start and highly-efficient. With remaining coal and oil units set for closure, gas-fired plants will become the only available utility-scale power resource that can cycle up and down rapidly enough to compensate for large swings in output from wind and solar energy.

During the coming decades of transition to a more renewables-based grid, gas-fired power plants will remain an essential component of Massachusetts’ electricity grid, providing reliable and affordable baseload and backup power supplies.
Public Safety

Synopsis

Safety remains the natural gas industry’s top priority. Both in Massachusetts and across the nation, the rate of incidents involving natural gas has decreased over the last decade during a period of time when consumer demand has substantionally increased – thanks to such programs as “Dig Safe” and efforts to increase public awareness of natural gas safety. Concurrently, the industry continues its efforts to mitigate and eliminate pipeline leaks, for both safety and environmental reasons.

Incident Rates

According to PHMSA, federal regulator of the natural gas system safety, Massachusetts’ gas distribution system has performed very well over the last two decades. The industry goal is always to have no incidents and to prepare and train and educate the workforce and the public on safety issues and on safe operations.

Training

Massachusetts’ gas utilities invest hundreds of hours per year in safety training for employees and for public safety officials. Northeast Gas Association member utilities also participate in “call before you dig” programs and numerous public awareness programs, which increase public perception of safety issues related to natural gas. In 2017, the Northeast Gas Association, working with member utilities, introduced a new online safety training programs for first responders: https://ngafirstresponder.com/. The individual gas utilities also conduct substantial training of personnel regarding safety.

Protocols

Natural gas utilities in Massachusetts utilize a series of procedures and protocols, which are overseen by federal and state agencies, to reduce the occurrence of system incidents. Development of new technologies in pipeline design, construction, inspections, and operations continue as part of the industry’s investment in pipeline integrity programs that ensure the safe and secure delivery of natural gas. Further, the industry works closely with emergency responders, state and local agencies to prevent and prepare for emergencies through training and periodic drills. Emergency plans and procedures are updated at least annually and made available to state authorities.

Massachusetts’ nearly 70 percent reduction in methane emissions over the last 25 years underscores the benefits of ongoing mitigation efforts within the industry.
Pipeline Leak Management and Remediation

PHMSA provides annual updates on key safety metrics including leak management. Leak management is measured by total number of leaks repaired per mile, total number of hazardous leaks repaired per mile, and total leaks scheduled for repair per mile for gas distribution systems in each state.

During 2016, Massachusetts enacted a law regarding “Grade 3” leaks in the natural gas system. Grade 3 leaks are defined as leaks that are “recognized as non-hazardous to persons or property at the time of detection and can be reasonably expected to remain non-hazardous.”

The legislation directed the DPU, working with DEP, to investigate the environmental impact of Grade 3 gas leaks and to establish a plan to repair leaks that are determined to have a significant environmental impact. The utilities are in discussions now with state regulators regarding the process and timeline for advancing the repair and/or replacement of environmentally significant leaks.

Researchers across the country continue to develop sophisticated sensing technology that is capable of locating leaks and accurately assessing the volume of escaping gas.

While the DPU finalizes regulations related to the new law, the natural gas sector continues its efforts to locate, evaluate, and repair and mitigate leaks within the state's gas distribution pipeline system. Massachusetts' nearly 70 percent reduction in methane emissions over the last 25 years underscores the benefits of ongoing mitigation efforts within the industry.
Some examples of successful mitigation initiatives include:

**Eversource**

Eversource replaced nearly 125 miles of older gas mains and 10,000 individual services in Massachusetts over the past five years. During 2016 alone, Eversource invested nearly $53 million on gas line improvement projects in Massachusetts to replace approximately 35 miles of main gas lines made of cast iron and steel, along with nearly 3,000 individual service lines. The company has announced plans to replace approximately 50 miles of older pipeline per year.

**National Grid**

National Grid replaced 140 miles of aging steel or cast iron gas pipes in Massachusetts during 2015 and about 165 miles in 2016. It has replaced more than 650 miles of pipes since 2010 and recently announced plans to spend more than $2.4 billion over the next five years throughout the Northeast and New England to mitigate pipeline leaks. It plans to replace nearly 500 miles of pipe in the next three years, from 2017 to 2019.

**Columbia Gas of Massachusetts**

Columbia Gas of Massachusetts has replaced 200 miles of cast iron and bare steel pipe in its gas line system over the past five years. It plans to retire approximately 53 miles of priority pipe and associated services in 2017. Over the next six years, the program is expected to grow to an annual priority pipe replacement rate of approximately 90 miles per year. The total overall cost of the infrastructure replacement program is currently estimated to be nearly $1 billion dollars.
Conclusion and Acknowledgments


Inadequate availability of gas infrastructure to support power generation demand will continue to be a significant area of concern for regulators, elected officials and other stakeholders given the primary role of natural gas in the regional system.

Every New England governor, including the current and prior governors of Massachusetts, has supported additional pipeline capacity to ease electric price instability and reliability concerns. Several pipeline projects have been proposed in Massachusetts that would help alleviate market-driven pressures on the electric power sector. Many environmental groups continue to oppose new pipeline capacity as part of a strategy to oppose any growth in natural gas consumption. As we have shown in this report, however, when it comes to natural gas and renewable energy, it’s not an “either/or” situation—it is a “both and.” Robust, reliable supplies of natural gas will be critical for decades to come to provide the affordable, dependable backstop to wind and solar and to help keep Massachusetts on track to meeting its 2050 Global Warming Solutions Act mandates.

The Northeast Gas Association would like to recognize and thank the following organizations for their assistance in the preparation of this report:

Massachusetts Gas Utilities/Service providers:

<table>
<thead>
<tr>
<th>Company</th>
<th>Local HQ</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berkshire Gas</td>
<td>Pittsfield</td>
<td><a href="http://www.berkshiregas.com">www.berkshiregas.com</a></td>
</tr>
<tr>
<td>Columbia Gas of MA</td>
<td>Westborough</td>
<td><a href="http://www.columbiagasma.com">www.columbiagasma.com</a></td>
</tr>
<tr>
<td>Eversource</td>
<td>Westwood</td>
<td><a href="http://www.eversource.com">www.eversource.com</a></td>
</tr>
<tr>
<td>Liberty Utilities of MA</td>
<td>Fall River</td>
<td><a href="http://www.libertyutilities.com/ma/">www.libertyutilities.com/ma/</a></td>
</tr>
<tr>
<td>Unilti</td>
<td>Fitchburg</td>
<td><a href="http://www.unitil.com">www.unitil.com</a></td>
</tr>
<tr>
<td>Westfield Gas &amp; Electric</td>
<td>Westfield</td>
<td><a href="https://www.wgeld.org/">https://www.wgeld.org/</a></td>
</tr>
</tbody>
</table>
About NGA

The Northeast Gas Association (NGA) is a regional trade association that focuses on education and training, technology research and development, operations, planning, and increasing public awareness of natural gas in the Northeast U.S.

NGA represents natural gas distribution companies, transmission companies, liquefied natural gas importers, and associate member companies. These companies provide natural gas to over 12 million customers in nine states (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont). NGA was established on January 1, 2003. Its predecessor organizations were The New England Gas Association (founded in 1926) and the New York Gas Group (founded in 1973).

Mission Statement

*The Northeast Gas Association's mission is to promote and enhance the safe, reliable, efficient, and environmentally responsible delivery of natural gas to customers in the region, and to advocate for the industry from production to delivery.*

For further information, contact NGA at:

Northeast Gas Association
75 Second Avenue, Suite 510
Needham, Massachusetts 02494-2859
Tel. 781-455-6800
www.northeastgas.org

Its NYSEARCH office is located at:

20 Waterview Boulevard, 4th Floor
Parsippany, NJ 07054
Tel. 973-265-1900
www.nysearch.org
75 Second Avenue, Suite 510
Needham, Massachusetts
02494-2859
Tel. (781) 455-6800

20 Waterview Boulevard, 4th floor
Parispany, New Jersey
07054
Tel. (978) 265-1900

www.northeastgas.org