

American Gas Association

# Uncovering the US Natural Gas Commercial Sector



American Gas Association  
January 2017



**Prepared by the American Gas Association**

400 North Capitol Street NW

Washington, DC 20001

(202)-824-7000

[www.aga.org](http://www.aga.org)

Notice: In issuing and making this publication available, AGA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is AGA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstance. The statements in this publication are for general information and represent an unaudited compilation of statistical information that could contain coding or processing errors. AGA makes no warranties—express or implied—or representations about the accuracy of the information in the publication or its appropriateness for any given purpose or situation.

This publication shall not be construed as including, advice, guidance, or recommendations to take, or not to take, any actions or decisions in relation to any matter, including without limitation relating to investments or the purchase or sale of any securities, shares or other assets of any kind. Should you take any such action or decision, you do so at your own risk.

Copyright & Distribution: Copyright © 2017 American Gas Association. All rights reserved. This work may not be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by information storage and retrieval system without permission in writing from the American Gas Association.

Cover Images: Pexels: <https://www.pexels.com/photo/food-chef-kitchen-soup-66639/> Free Images: <http://www.freeimages.com/photo/new-york-skyline-1-1193007> iStockPhoto: <http://www.istockphoto.com/photo/group-of-school-kids-writing-test-in-classroom-gm486541346-73710319>

Contents

- Introduction ..... 1
- Findings Summary..... 2
- 1. Commercial Sector Summary..... 4
  - 1.1. Commercial Sector Statistics and Trends..... 4
  - 1.2. Technologies ..... 8
  - 1.3. Rates and Regulations..... 11
- 2. Commercial Building Characteristics ..... 13
  - 2.1. Existing Commercial Building Stock and the Natural Gas Share ..... 13
  - 2.2. Types of Buildings ..... 15
  - 2.3. Regional Distribution of Commercial Buildings and Natural Gas Using Commercial Users ..... 20
  - 2.4. Main Heating Equipment Used for Primary Space Heating ..... 21
  - 2.5. Natural gas Used for Cooling ..... 22
  - 2.6. Onsite electricity generation..... 23
  - 2.7. Competitive Trends in the Natural Gas Commercial Sector ..... 23
- 3. Economic Contributions of the Commercial Natural Gas Market ..... 25
  - 3.1. Consumers Benefit from Lower Commodity Prices ..... 25
  - 3.2. Commercial Customers are Core to LDC Revenue..... 26
- 4. The Role of Codes and Standards ..... 29
  - 4.1. Model Fuel Gas Installation Codes..... 29
  - 4.2. Appliance Safety Standards ..... 30
  - 4.3. Appliance and Equipment Efficiency Standards ..... 30
  - 4.4. Commercial Building Efficiency Standards..... 31
- 5. A Look Ahead ..... 32
  - 5.1. Growing the Commercial Gas Market ..... 33
  - 5.2. Using Commercial Load to Aid in Natural Gas System Expansion ..... 34
  - 5.3. New Technologies to Bolster Growth ..... 35
  - 5.4. Opportunities to Lower Emissions ..... 36
  - 5.5. Energy efficiency programs..... 36
- Conclusion..... 38
- Appendix A - Changes in Commercial Customers and Consumption from 2010 Through 2015 ..... 39

This page left intentionally blank.

## Introduction

**L**ocal natural gas utilities deliver energy to many types of customers situated in homes, local businesses, and even power plants, vehicle fleets, and industrial manufacturing facilities. All are among the end users of natural gas in the United States. The commercial sector as a consuming category is broad and diverse, representing many parts of the nation's energy economy.

In fact, the *commercial sector* is typically defined by what it is not: residential, manufacturing, or agriculture. Instead, the commercial sector represents all the other businesses, services, and public activities within the US economy including education, health care, public order and safety, service facilities, offices, food sales and service, hotels, retail and public assembly.



---

Natural gas utilities support commercial businesses and public establishments that are America's economic engine.

---

More than 5.4 million commercial customers use natural gas for space and water heating. Smaller facilities may utilize natural gas similar to a typical household. Other commercial entities like hospitals tend to have larger and complex requirements. In total, the US commercial sector accounts for nearly one-fifth of all energy use in the United States, and natural gas is a critical source.

Serving all of these segments are the nation's natural gas utilities. Also referred in this paper as local distribution companies, natural gas utilities support commercial businesses and public establishments that are, ultimately, America's economic engine.

This report seeks to unveil the diversity within the commercial segment of the natural gas market and shed light on the range of customers, technologies, and end-uses that serve this important backbone of the US economy.

**Section one** looks at basic metrics such as volumes delivered, customers served, natural gas prices and expenditures. **Section two** looks at specific characteristics of the commercial sector using data from the *Commercial Building Energy Consumption Survey* published by the Energy Information Administration, a national survey that collects information on the stock of US commercial buildings including their energy-related characteristics. **Section three** of the paper examines the larger economic contributions of the commercial segment of the natural gas market. **Section four** that follows shares an examination of the importance of codes and standards in shaping the evolution of commercial buildings and energy efficiency over the past three decades. Finally, **section five** looks ahead at the market opportunities for growth in the commercial sector.

## Findings Summary

This report provides an analysis and evaluation of the commercial segment of the US economy. Principal sources include publically available data from the Energy Information Administration (EIA), surveys from the American Gas Association, and economic modeling from Regional Economic Modeling Incorporated (REMI). This report features an in-depth analysis of the EIA *Commercial Energy Building Consumption Survey* for 2012 (CBECS).

The following summarizes elements contained within the main sections of this report.

### Characteristics of Commercial Buildings

- Commercial buildings account for one-fifth of total US energy use, of which natural gas accounts for 18 percent. Retail space, offices, health care, and educational facilities constitute the majority of energy used within the commercial sector, and most of the commercial sector's energy is needed for lighting, space heating, ventilation, and cooling.
- Natural gas use in the commercial building sector has grown 10 percent (weather-adjusted) during the last decade, a result of growth in the overall commercial market. Natural gas consumption in the US commercial sector exceeded 3.5 trillion cubic feet in 2014.
- The amount that customers spend on energy has also declined. For example, the average real price commercial customers paid for natural gas in 2016 dropped to the lowest level since 1975, a result of low commodity prices for gas that have been driven downward by the growth in US natural gas production and increased levels of available and affordable domestic supplies.
- The share of buildings that use natural gas has remained relatively constant across the entire commercial building fleet. This suggests commercial natural gas growth has reflected an expansion of the entire market.
- Most commercial buildings are relatively small. There is more than 87 billion square feet of commercial floorspace in 5.6 million buildings in the United States (including vacant). Commercial floor space increased 23 percent overall from 2003 to 2012. The number of buildings increased by 14 percent.
- Half of all commercial buildings constitutes only 10 percent of all floorspace. The median size of a commercial building is 5,000 square feet, though the average is 15,700 square feet. The largest buildings are offices, warehouses and storage, mercantile establishments, and educational facilities.
- The US building stock is aging. Half of the commercial buildings were built before 1980 and 20 percent of buildings were constructed since 2000.

- There are many buildings that generate electricity on-site but that do not use natural gas, despite it being used for another application in the building. This represents a key growth opportunity for expanding natural gas use in buildings where service is already present.

### **Economic Implications**

- Natural gas utility commercial customers have benefited from a reliable lower cost of service. In 2015, commercial customers' utility bills reached a new low of \$405 on average, the lowest since AGA began collecting data in 2003.
- Commercial customers are a core part of local distribution company (LDC) revenue. In 2013, commercial customers accounted for approximately 22 percent of total revenues for natural gas utilities. Total natural gas utility revenue in 2013 was \$101.1 billion while commercial customers accounted for \$21.4 billion.

### **Appliance and Building Codes and Standards**

- Codes and Standards play a critical role helping ensure that natural gas applications in the commercial sector are installed and operated safely and reliably. Each state, and often local governments within each state, determine which C&S are applicable to their commercial occupancies.
- Building efficiency standards affect how a structure is designed and built, and its lifetime energy usage. While there are various state commercial building construction efficiency regulations in use around the country, ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, is the most widely adopted minimum.

### **The Look Ahead**

- EIA projects commercial floor space to continue a long-term increase while total energy consumption intensity declines. However, purchased natural gas for commercial consumption is projected to increase through 2040.
- In the near term, there are clear opportunities to expand natural gas service to commercial customers:
  - Leverage natural gas as a tool for economic growth.
  - Promote new technologies to improve energy services, lower costs, and reduce emissions.
  - Replace heating oil with natural gas, especially in the northeastern US.
  - Leverage existing efficiency programs to comply with broader economic or environmental policy goals.

# 1. Commercial Sector Summary

What is a natural gas commercial customer?

The commercial sector represents a broad range of end uses across a number of activities, building types, and number of customers served. While other segments of the natural gas market such as homes or vehicles are generally easily characterized, commercial customers are much more diverse. Their operations include wholesale or retail trade, communications, finance, fisheries, forestry, government, insurance, real estate, transportation, and others.

Many types of buildings may be characterized within the commercial sector. Broadly these categories include offices, retail, education, lodging, food sales, and others. By square feet, the largest building types are offices, warehouses and storage, mercantile establishments, and educational facilities. By the count of the number of buildings, offices are the most numerous building category followed by warehouses and storage, service buildings, and mercantile. More detailed treatment of the various categories and subtypes of commercial buildings can be found in Section 2.

Additional characteristics that help define commercial customers include:

- **Prices:** The average delivered price of natural gas to a commercial customer was 24 percent lower than that of the residential customer in 2015.
- **Energy Consumption:** Commercial gas customers generally consume about 6 times more gas compared to the typical residential customer, though this average volume includes significant variance.
- **End-Use:** Similar to the residential customers, the commercial sector uses natural gas primarily for space and water heating.
- **Size:** The average floor space per commercial building is 15,700 square feet, however, the median size is 5,000 square feet (half of all commercial buildings are bigger).

The US commercial building sector is as diverse as it is important to the makeup of the nation's economy. Accounting for 18 percent of all energy used in the US, most of the commercial sector's energy is needed for lighting, space heating, ventilation, and cooling. Natural gas is, of course, an important energy source that provides this important economic sector with reliable, affordable and safely delivered primary energy.

The remaining portions of Section 1 explore some of the statistics about natural gas volumes, customers, prices, and expenditures, as well as an overview of the types of technologies utilized.

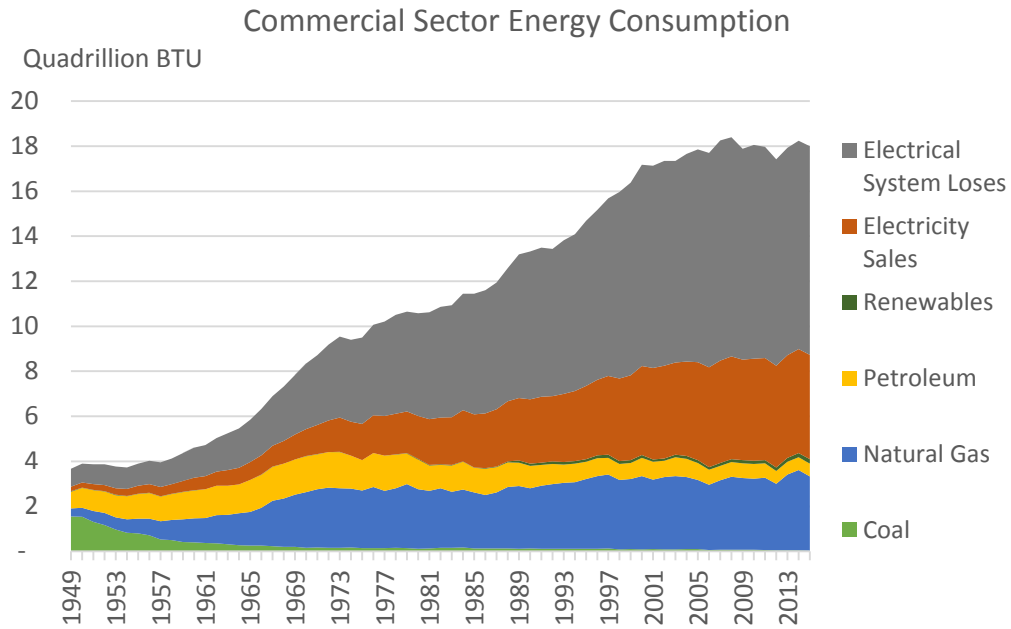
## 1.1. Commercial Sector Statistics and Trends

Measures of US energy consumption in the commercial sector show a steady growth in electricity usage during the past forty years, yet natural gas use has been relatively flat due in part to the inherent efficiency of direct use applications. Petroleum (mainly fuel oil and propane) has declined as a primary fuel, while renewables as an energy source have grown but still remain a tiny fraction of commercial sector energy consumption. Notably, electrical system losses—including energy lost due to generation,



transmission, and distribution of electricity—accounts for more than half of primary energy consumption in the sector (see Figure 1).

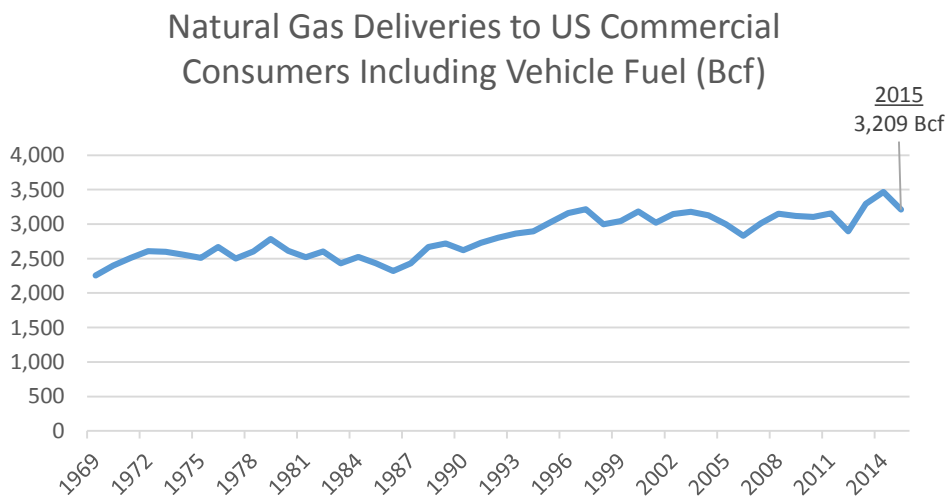
**Figure 1**



Source: Energy Information Administration

The total volume of US commercial natural gas consumed exceeded 3.5 Tcf in 2014 and grew 10 percent during the prior 10 years (non-weather adjusted). Milder weather resulted in less heating consumption during 2015, during which time commercial natural gas consumption totaled 3.2 Tcf.

**Figure 2**

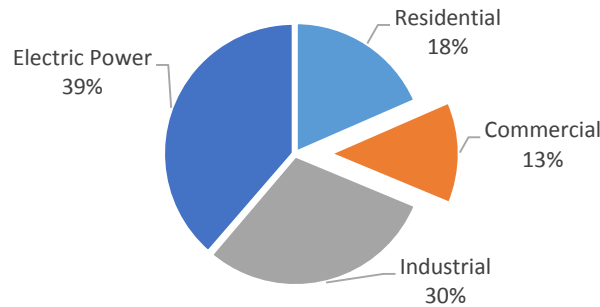


Source: Energy Information Administration

Thirteen percent of US natural gas consumption is utilized by commercial end users. The direct-use of natural gas within the commercial sector has grown slowly during the past 45 years. Between 1970 and 2015, commercial sector natural gas volumes grew at an average of 0.6 percent per year, noting there has more substantial variations in annual consumption due to weather-related heating demand.

**Figure 3**

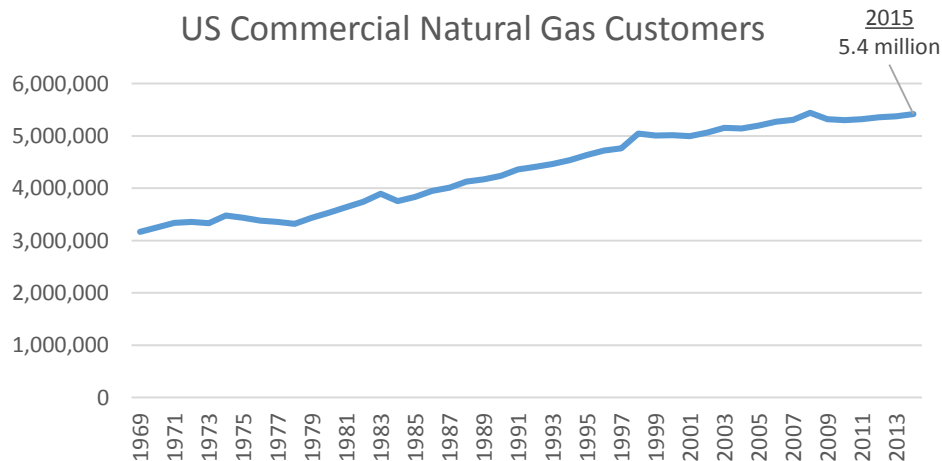
US Natural Gas Consumption  
by Customer Type



Source: Energy Information Administration

There are more than 5.3 million natural gas commercial customers, a number that has grown steadily for decades, a result of population growth, expanded use of gas applications, and the wide appeal of natural gas service. Based on data from AGA Gas Facts and EIA, the number of active commercial natural gas customers grew 71 percent during past 45 years, an average growth rate of 1.2 percent per year.<sup>1</sup>

**Figure 4**

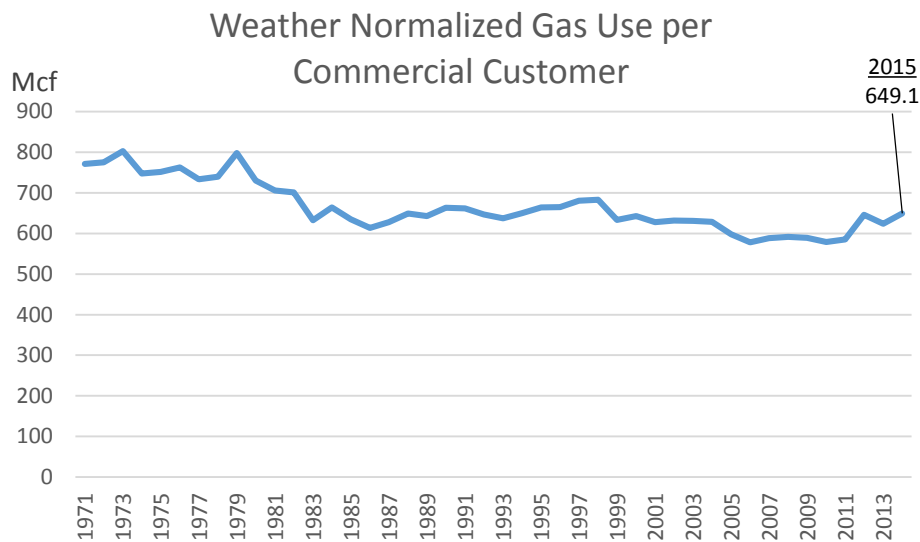


Source: Energy Information Administration

<sup>1</sup> American Gas Association. *Gas Facts: A Statistical Record of the Gas Industry, with 2014 data*. 2015.

Commercial floor space and primary energy consumption in total had grown by 58 percent and 69 percent, respectively, between 1980 and 2009.<sup>2</sup> By 2012, commercial floor space had grown to 87 billion square feet in more than 5.5 million buildings.

**Figure 5**



Source: US Energy Information Administration, AGA Gas Facts

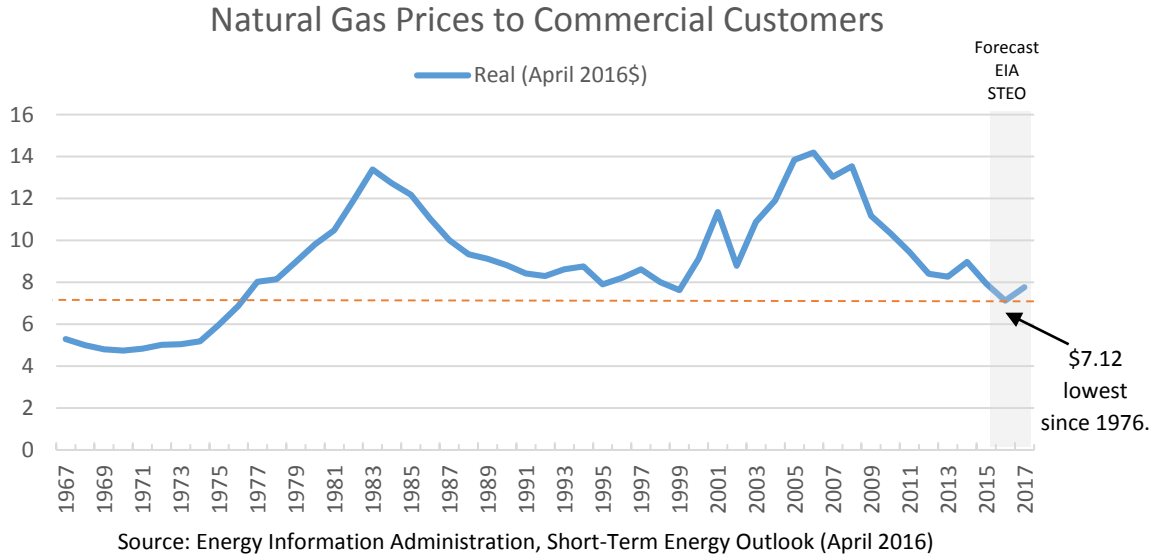
The long-term trend in efficiency and conservation is apparent in the declining gas use per customer. Adjusted for weather, the amount of gas consumed by the average commercial customer declined significantly and steadily during the past four decades. Weather-normalized commercial natural gas use has generally trended downward since 1969, the first year in which enough data were available to make this calculation. Use per commercial customer dropped 19 percent from 1977 to 2015, an average of - 0.3 percent per year.<sup>3</sup>

The steady decline in commercial gas use per customer is attributable both actions by industry and broader trends. These include the increased use of energy efficient appliances, improvements to building shell insulation, population migrations to warmer climates, conservation efforts, and the effectiveness of utility-sponsored efficiency programs. It is not easy to quantify the contribution of each individual element to the declining use per customer trend. However, each has made a contribution and it is likely these trends will continue. Variations from this downward trend may be explained by short-term weather or pricing trends.

<sup>2</sup> Department of Energy Commercial Building Databook <http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx>

<sup>3</sup> Until recently this decline was gradual. However, for 2012 and 2013 there was a departure from the steady decline. These later years could reflect greater economic volatility or may just be simply outliers. Once the aggregate effects of weather are removed (normalization), the remaining decline shows overall market energy efficiency and conservation gains, which is important to understanding the advantages of direct use and energy-related greenhouse gas emissions and customer value.

Figure 6



The dollar amount that customers spend on energy has also declined. For example, the average real price commercial customers paid for natural gas in 2016 dropped to the lowest level since the 1970s, a result of low commodity prices for gas that have been driven downward by the growth in US natural gas production and increased levels of available and affordable domestic supplies.

Commercial energy expenditures totaled nearly \$150 billion for the commercial sector in 2012. Electricity accounted for 80 percent of the sector’s total energy expenditures while natural gas accounted for 11 percent.<sup>4</sup> Expenditures had grown steadily through the 2000s then reversed and flattened as a result of the 2008-09 recession and subsequent drop in commodity prices for fuels.

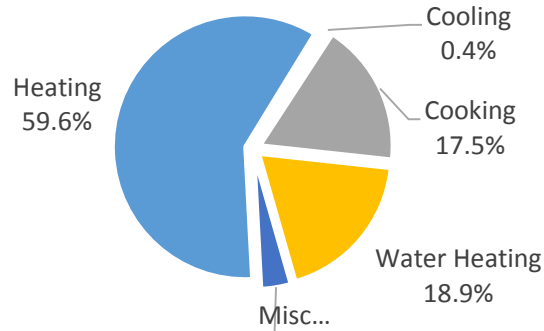
## 1.2. Technologies

Most natural gas used is for space heating, water heating, and cooking (see Figure 7). About 4 percent of commercial gas consumption is used for electricity generation (including combined heat and power applications), cooling, and manufacturing. More on how natural gas is utilized is explored in Section 2.

<sup>4</sup> CBECS Analysis <http://www.eia.gov/consumption/commercial/data/2012/c&e/cfm/c2.cfm>

**Figure 7**

### How Natural Gas is Consumed in Commercial Buildings (2012)



Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

There are many different technologies for use in a variety of market applications within the commercial sector. Different segments have specific requirements, which will shape the decisions of on-site energy or building managers, equipment purchasers, siting and design contractors, and even utility professionals consulting with their customers on their energy requirements. Consumers often consider many variables when evaluating long-term investments. Energy prices are always a chief concern and shape the economics of any investment decision. The stability, or perceived stability, of future energy prices is also a critical factor.

In addition to energy prices, the energy value of a particular energy technology will be shaped by other factors, some intangible:

- Equipment cost
- Overall seasonal efficiency
- Auxiliary electric costs
- Maintenance costs
- Onsite Storage needs
- Air quality
- Energy reliability
- Noise levels
- Comfort
- Ease of control
- Serviceability
- Environmental liability
- Equipment cleaning

A restaurant may look to natural gas technology solutions that are reliable and cost-effective, but they may also consider natural gas because a patio heater or fire pit sets a more pleasant dining experience. An office building energy manager may recognize that natural gas heat is simply more comfortable for the building tenants (which itself drives other economic considerations if a property with natural gas can be more highly valued).

**Table 1  
Natural Gas End-Use Technologies by Market Application via the Energy Solutions Center**

Technology / Market Application Summary Chart										
Market Segment										
Technology	Colleges & Universities	Elder Care	Food Service	Health Care	Lodging	Multi-Family	Niche Buildings	Office Buildings	Retail	Schools K-12
Boilers	●	●	●	●	●	●	●	●	●	●
PTAC's	●	●			●	●		●		●
Make Up Air		●	●	●	●		●	●	●	●
Infrared Heaters			●		●				●	
In-Suite Systems		●			●	●		●		
Water Heaters	●	●	●	●	●	●	●	●	●	●
Booster Heaters	●	●	●	●	●					●
Snow Melt Systems	●	●	●	●	●	●	●	●	●	●
Cooking Equipment	●	●	●	●	●	●				●
Absorption Cooling	●	●	●	●	●	●	●	●	●	●
Engine Drive Equipment	●	●	●	●	●	●	●	●	●	●
Thermal Storage	●			●	●			●		●
Desiccant s	●	●	●	●	●	●	●	●	●	●
Humidification	●	●	●	●	●	●	●	●	●	●
Emergency Generators	●	●	●	●	●	●	●	●	●	●
CHP	●	●	●	●	●	●	●	●	●	●
CSST		●	●		●	●			●	●
Outdoor Grills			●			●		●		
Patio Heaters			●		●	●		●		
Fireplace Log Sets			●		●	●		●		
Gas Lights / Torches			●		●	●		●		
Pool Heaters						●	●			
Laundry Equipment					●	●	●			
Thermal Fluid Heaters							●			

Courtesy of the Energy Solutions Center

To examine the variety of requirements and technologies, the *Energy Solutions Center* (ESC) developed a concise chart to summarize different applications for various market segments.<sup>5</sup> Technologies like boilers, infrared heaters, cooking equipment, humidifiers and desiccant dehumidifiers, combined heat and power, and other technologies may apply across a variety of market segments like colleges, health care, lodging, and such. Plotting the applicable technology for each market segment conveys the diversity of the commercial market and the importance of utilities working directly with customers to understand and serve specific energy needs.

Certain commercial natural gas technologies are found across all market segments. Boilers, water heaters, snow melt systems, engine drive equipment, desiccants, humidification, emergency generators, and combined heat and power have universal appeal across much of the commercial sector, noting that there may be geographic differences among market segments. Other natural gas technologies have more limited but still important applications. Patio heaters, infrared heaters, gas lights, laundry equipment, thermal fluid heaters would be appropriate for more niche customer segments.

### 1.3. Rates and Regulations

Rates are a key driver of customer utility bills. Commercial rates are established in the same manner as other natural gas market segments. Regulatory bodies determine a fair price for gas utility service using predominantly the cost of service to shape these rates. Many utilities classify customers by their operating characteristics (firm, interruptible, seasonal, etc.), and rates are adjusted depending on the costs to meet these requirements. Design principles can vary and may take into account other social, economic, regulatory, and political factors from a variety of stakeholder input. Some companies have promotional rates to encourage relatively new technologies, such as natural gas vehicles and distributed generation. In all cases, gas utilities are subject to comprehensive oversight by federal and state regulatory agencies.

Given the diverse differences in types of businesses requirements within the commercial sector, generally, commercial customer charges show wider variation because of the range of operating characteristics and size of the energy requirements. Commercial natural gas rates can be defined based on the type of business served or the amount of gas typically used. Typical commercial rate service categories include:

- General Service
- Large General Service
- Public Housing Service
- Transportation Service
- Technology-Based Service
  - Natural Gas Vehicle Service
  - Distributed Generation Service
  - Gas Cooling Service
  - Commercial Gas Outdoor Lighting Service

These are illustrative categories. States may organize similar service types into different categories.

---

<sup>5</sup> Energy Solutions Center, Commercial Buildings Consortium. "Natural Gas Solutions for Food Service Operations." PowerPoint presentation. 2009

To summarize broadly the typical charges a commercial customer might see, AGA conducted an analysis of 197 rate jurisdictions in all states and Washington DC providing small commercial rates. These produced a range of natural gas utility monthly charges to commercial customers, which is reported by quartile. Thus the median of the bottom half of the range of monthly charges represents the first quartile; similarly, the median of the upper half of the range is the third quartile. The median is the middle of the entire data. These are reported in Table 2.

**Table 2**  
**2015 Natural Gas Utility Monthly Charges to Commercial Customers**

First Quartile	\$	15.00
Median	\$	22.00
Third Quartile	\$	30.31

Source: AGA Survey 2015<sup>6</sup>

In addition to location-driven differences, variations in customer charges can be a function of the age of the system, numbers of customers served, employee wages and benefits, the local regulatory environment and philosophy, location-specific costs to install mains, and the frequency of rate cases.

**Table 3**  
**2015 Natural Gas Utility Monthly Charges by Census Region, Commercial Customers**

Census Region	Commercial Rates
New England	\$ 28.41
Middle Atlantic	\$ 23.60
East North Central	\$ 24.00
West North Central	\$ 24.40
South Atlantic	\$ 22.00
East South Central	\$ 16.96
West South Central	\$ 18.51
Mountain	\$ 20.00
Pacific	\$ 14.90

Source: AGA Survey 2015

The same analysis may be divided by geography. Table 3 shows the median natural gas utility monthly rate for commercial customers by census region in which the rate was reported. The median monthly charge on a commercial customer gas utility bill varies across the country. New England has the highest rates, followed by the Middle Atlantic and Central regions. The Pacific region has the lowest rates. Generally, these are proportional to temperature, where the coldest areas of the country have the highest rates. The survey noted median rates ranging from \$14.90 in the west to \$28.41 in New England.

---

<sup>6</sup> "Natural Gas Utility Rate Structure: The Customer Charge Component – 2015 Update." American Gas Association. 2015. [https://www.aga.org/sites/default/files/ea\\_2015-03\\_customercharge2015\\_0.pdf](https://www.aga.org/sites/default/files/ea_2015-03_customercharge2015_0.pdf)



## 2. Commercial Building Characteristics

The most comprehensive information available on the US commercial building stock is collected by the Energy Information Administration (EIA) through its semi-regular *Commercial Building Energy Consumption Survey* (CBECS). EIA data collection on building characteristics and energy consumption in the commercial sector initially surfaced with the first CBECS in 1979. In total, there have been nine CBECS releases—the most recent being 2012 and 2003 prior to that.<sup>7</sup>

CBECS defines *commercial* as “any building that is not residential (used as a dwelling for one or more households), manufacturing/industrial (used for processing or procurement of goods, merchandise, raw materials, or food), or agricultural (used for the production processing, sale, storage, or housing of agricultural products, including livestock). At least 50% of the floor space must be used for purposes other than residential, manufacturing/industrial, or agricultural for a building to be considered *commercial*.”<sup>8</sup>

The CBECS is conducted in two phases. The first is a building survey to collect building characteristics and energy usage data including consumption and costs. The second phase is a follow-up survey to energy providers for buildings without accurate energy data from the Buildings Survey. The CBECS administrators contact providers of natural gas, among other energy providers.

There are many potential ways to use CBECS. Generally, the data are utilized for commercial energy benchmarking by modelers and product developers, as well as in government regulatory proceedings and to determine threshold levels for ENERGY STAR compliance.

This chapter examines the most recent data released in the 2012 CBECS to understand the commercial building sector and natural gas use in particular. The types of buildings that use natural gas, types of equipment, consumption characteristics, and other interesting variables are examined. Due to the wealth of information collected and distributed through CBECS, any targeted analysis is incomplete. The goal of this section is to develop an understanding of the natural gas commercial sector trend—for example, where is the gas share of a commercial building type growing or declining?—as well as a snapshot of this sector in 2012. While not definitive, the CBECS analysis presented here a better understanding of natural gas use in the commercial sector.

### 2.1. Existing Commercial Building Stock and the Natural Gas Share

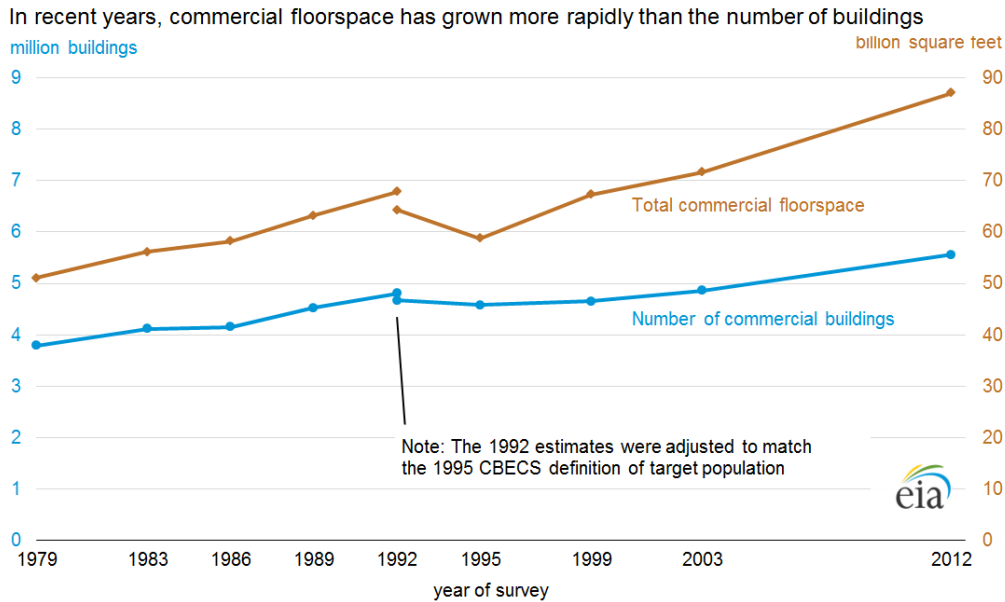
The comparison in this section uses data from the 2003 and 2012 surveys. Comparison between these two time periods is the predominant focus unless stated otherwise.

---

<sup>7</sup> CBECS was collected data for 2009. Problems with the survey and subsequent analysis rendered the data unusable and EIA never released the report or microdata.

<sup>8</sup> Energy Information Administration. “FAQs for CBECS.” Accessed August 4, 2016. <http://www.eia.gov/consumption/commercial/faq.cfm>

**Figure 8**



The commercial building stock grew between the years 2003 and 2012, both in the number of buildings and in total square footage, as shown in Figure 8. However, the growth in floor space has outpaced the number of commercial buildings. Buildings are getting bigger, a trend that mirrors data from the residential sector.

There is more than 87 billion square feet of commercial floor space in 5.6 million buildings. These range in sizes, from skyscrapers to mom-and-pop shops. Most buildings are small. About half of the commercial building stock makes up only less than 10 percent of all floor space.

The commercial building stock is aging. Half of the commercial stock was built before 1980, though 20 percent of buildings were constructed since 2000.

Generally, the newer the building, the larger the structure on average. The mean square footage of a commercial building was 11,000 square feet before 1920. By 2008 to 2012, the mean square footage climbed to nearly 19,000 per building.

Only a small share of buildings comprises a significant amount of the overall commercial floor space, as indicated by the difference between the average and mean size of buildings. The median size of a commercial building is 5,000 square feet, though the average is 15,700 square feet, suggesting a larger number of smaller buildings comprising the commercial stock.

In an analysis of its own survey, the EIA found four building types with a statistically significant increase in building size when comparing those constructed before 1960 and those after 1999. Their conclusions included:

- Health care buildings are getting larger, most likely to meet the needs of a population whose average life expectancy continues to increase.

- The size of lodging buildings increases substantially across vintages. Air travel became more affordable and accessible after 1978 when the industry was deregulated, and it follows that the growing numbers of both leisure and business travelers led to the construction of larger hotels.
- Retail (other than shopping mall) buildings—a subset of the mercantile category, which includes malls—have become larger, likely a result of the trend towards big box stores.
- Religious worship buildings are also larger, possibly an effect of megachurches, which have seen a rise in popularity in the United States in the past two decades.<sup>9</sup>

## 2.2. Types of Buildings

There are many different types of commercial buildings. Generally defined as inclusive of office buildings, venues retail or services, food establishments and stores, warehouses, places of worship, hospitals, schools, malls, and others. The various categories and subcategories include:

<b>Education</b>	<b>Nonrefrigerated warehouse</b>	<b>Public order and safety</b>
College/university	Distribution/shipping center	Fire station/police station
Elementary/middle school	Non-refrigerated warehouse	Other public order and safety
High school	Self-storage	Courthouse/probation office
Preschool/daycare	<b>Nursing</b>	<b>Refrigerated warehouse</b>
Other classroom education	Nursing home/assisted living	<b>Religious worship</b>
<b>Enclosed mall</b>	<b>Office</b>	Religious worship
<b>Food service</b>	Administrative/professional office	<b>Retail other than mall</b>
Fast food	Bank/other financial	Vehicle dealership/showroom
Restaurant/cafeteria	Government office	Retail store
Other food service	Medical office (non-diagnostic)	Other retail
Bar/pub/lounge	Mixed-use office	<b>Service</b>
<b>Food sales</b>	Other office	Post office/postal center
Convenience store	<b>Other</b>	Repair shop
Convenience store w/ gas station	<b>Outpatient Health Care</b>	Vehicle service/repair shop
Grocery store/food market	Medical office (diagnostic)	Vehicle storage/maintenance
Other food sales	Clinic/other outpatient health	Other service
<b>Inpatient health care</b>	<b>Public assembly</b>	<b>Strip shopping mall</b>
Hospital/inpatient health	Entertainment/culture	
<b>Laboratory</b>	Library	
<b>Lodging</b>	Recreation	
Dormitory/fraternity/sorority	Social/meeting	
Hotel	Other public assembly	
Model or inn		
Other lodging		

<sup>9</sup> <http://www.eia.gov/consumption/commercial/reports/2012/buildstock/index.cfm>

Ownership of all building types includes federal, state, and local governments, real estate investment trusts, individual owners, academic institutions, religious, non-profit, public or private corporation, and others.

Table 4 summarizes many changes to commercial building floor space between 2003 and 2012.

Total floor space square footage increased 23 percent overall from 2003 to 2012. Office buildings comprise the largest amount of floor space in the US, followed by non-refrigerated warehouses and educational buildings. In general, all of the major categories increased between 17 to 42 percent during the time period.

The slowest growing categories included strip shopping malls, lodging (dorms, hotels, motels), and food sales establishments (convenience & grocery stores). Enclosed malls declined a very significant 57 percent in terms of square footage. Refrigerated warehouses also declined 16 percent.

**Table 4**

**Commercial Building Square Footage by Type (Million Sq. Ft.)**

	2003	2012	Change	
<b>Grand Total</b>	<b>71,658</b>	<b>88,175</b>	<b>16,517</b>	<b>23%</b>
Office	12,208	16,115	3,907	32%
Nonrefrigerated warehouse	9,552	12,689	3,137	33%
Education	9,874	12,407	2,533	26%
Public assembly	3,939	5,531	1,592	40%
Retail other than mall	4,317	5,437	1,121	26%
Strip shopping mall	4,864	5,085	222	5%
Religious worship	3,754	4,760	1,005	27%
Service	4,050	4,743	692	17%
Lodging	4,113	4,447	334	8%
Vacant	2,567	3,257	690	27%
Inpatient health care	1,905	2,352	448	23%
Food service	1,654	1,927	274	17%
Outpatient Health Care	1,258	1,780	523	42%
Other	1,085	1,543	459	42%
Public order and safety	1,090	1,535	445	41%
Nursing	983	1,275	292	30%
Food sales	1,255	1,252	-4	0%
Enclosed mall	2,011	869	-1,143	-57%
Laboratory	654	729	76	12%
Refrigerated warehouse	526	441	-85	-16%

Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

Table 5 summarizes the change in the *number* of commercial buildings by type. Overall the total commercial stock of buildings increased by 698,000, a 14 percent jump. Offices and non-refrigerated warehouses are the most numerous types of buildings (and the largest by square footage). Buildings designated *services* (post office, repair & maintenance, etc.) are the third most numerous, even though the average square footage of these establishments tend to be much smaller. In total, the number of commercial buildings increased 23 percent by 2012.

All building categories by type increased in number from 2003 to 2012 with the exception of enclosed malls, food sales, retail, and refrigerated warehouses.

**Table 5**

**Commercial Buildings by Type (Thousands)**

	2003	2012	Change	
<b>Grand Total</b>	<b>4,859</b>	<b>5,557</b>	<b>698</b>	<b>14%</b>
Office	824	1,012	189	23%
Nonrefrigerated warehouse	582	787	205	35%
Service	622	619	-3	-1%
Retail other than mall	443	438	-5	-1%
Religious worship	370	412	41	11%
Education	386	389	3	1%
Food service	297	380	82	28%
Public assembly	277	352	75	27%
Vacant	182	296	114	63%
Food sales	226	177	-49	-22%
Strip shopping mall	209	163	-47	-22%
Outpatient Health Care	121	147	26	22%
Lodging	121	128	7	6%
Other	70	109	39	55%
Public order and safety	71	84	13	19%
Nursing	22	30	8	37%
Laboratory	9	16	7	72%
Inpatient health care	8	10	2	21%
Refrigerated warehouse	15	8	-7	-44%
Enclosed mall	4	1	-3	-65%

Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

The share of commercial buildings using natural gas increased slightly by 1 percent between 2003 and 2012. This suggests only modest change when viewing the sector in aggregate. In terms of types of buildings, the natural gas share increased in a number of categories including public order and safety, lodging, outpatient health care, education, and food sales. However, the natural gas shares of buildings declined in inpatient health care, malls, food service, laboratories, religious worship, and retail other than malls. Table 6 summarizes the change in natural gas share by type of commercial building.

**Table 6**

**Commercial Buildings, Natural Gas Share by Type**

	Share of Buildings			
	2003	2012	Change (% Points)	
<b>Grand Total</b>	<b>52%</b>	<b>53%</b>		<b>1%</b>
Inpatient health care	89%	84%		-5%
Enclosed mall	87%	81%		-6%
Nursing	79%	76%		-2%
Strip shopping mall	68%	75%		7%
Food service	76%	75%		-2%
Laboratory	78%	73%		-4%
Public order and safety	51%	63%		12%
Lodging	57%	60%		3%
Outpatient Health Care	54%	59%		6%
Office	59%	59%		-1%
Public assembly	53%	58%		5%
Religious worship	59%	56%		-4%
Service	45%	55%		10%
Education	55%	60%		5%
Retail other than mall	55%	53%		-2%
Food sales	43%	46%		3%
Other	54%	44%		-10%
Nonrefrigerated warehouse	31%	33%		2%
Refrigerated warehouse	28%	22%		-6%
Vacant	27%	15%		-12%

Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

The change in natural gas share of overall commercial floorspace changed little between 2003 and 2012, similar to the share of the number of buildings. Under the surface, different building types showed growth and declines in the share of floorspace between those years. Malls, public order and safety, food sales, and outpatient health care all increased in terms of the natural gas share of floorspace. Inpatient health care, nursing, food service, religious worship, and offices all declined. Table 7 summarizes the change in natural gas share by type of commercial building.

**Table 7**

**Commercial Floorspace, Natural Gas Share by Type**

	Share of Buildings			
	2003	2012	Change (% Points)	
<b>Grand Total</b>	<b>68%</b>	<b>68%</b>		<b>0%</b>
Enclosed mall	78%	92%		14%
Inpatient health care	95%	89%		-6%
Strip shopping mall	71%	86%		16%
Lodging	81%	84%		3%
Nursing	92%	83%		-9%
Education	71%	78%		7%
Food service	84%	78%		-6%
Public order and safety	58%	72%		14%
Public assembly	69%	70%		1%
Food sales	60%	68%		8%
Religious worship	70%	68%		-2%
Outpatient Health Care	59%	66%		7%
Office	67%	65%		-3%
Other	76%	63%		-13%
Service	62%	62%		0%
Retail other than mall	66%	62%		-4%
Refrigerated warehouse	76%	59%		-17%
Laboratory	65%	56%		-9%
Nonrefrigerated warehouse	53%	54%		0%
Vacant	46%	27%		-19%

Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

### 2.3. Regional Distribution of Commercial Buildings and Natural Gas Using Commercial Users

The commercial sector is spread relatively evenly across the United States, concentrated in more populous areas. The South Atlantic and Pacific areas of the country boast the largest numbers of commercial buildings, which also correlates to the largest amount of total floorspace.

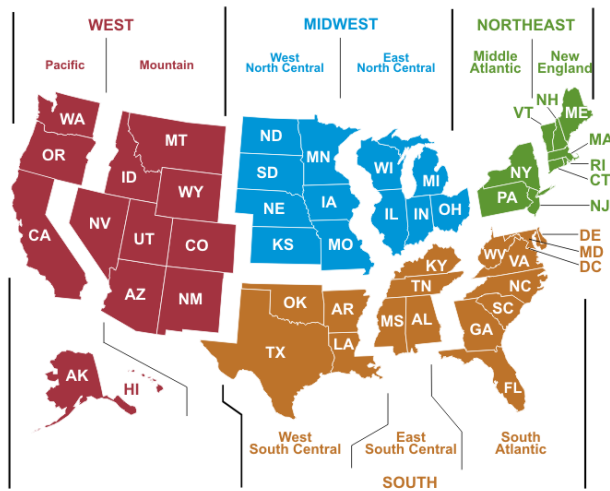
**Table 8**

**US Commercial Sector All Buildings & Floorspace, Natural Gas Share, by Region**

	Total Buildings (Thousands)	Natural Gas Used, Share of Total Buildings	Total Floorspace (Billion Sq. Ft.)	Natural Gas Used, Share of Floorspace
New England	302	32%	4.4	53%
Middle Atlantic	504	67%	11.7	78%
East North Central	735	78%	13.0	85%
West North Central	502	53%	6.4	70%
South Atlantic	1,091	35%	18.0	55%
East South Central	370	52%	4.9	70%
West South Central	786	47%	11.5	57%
Mountain	338	64%	4.9	75%
Pacific	929	53%	13.5	67%
<b>Grand Total</b>	<b>5,557</b>	<b>53%</b>	<b>88.2</b>	<b>68%</b>

Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

The largest shares of commercial buildings and floorspace that use natural gas are in the Middle Atlantic, East North Central, and Mountain states.

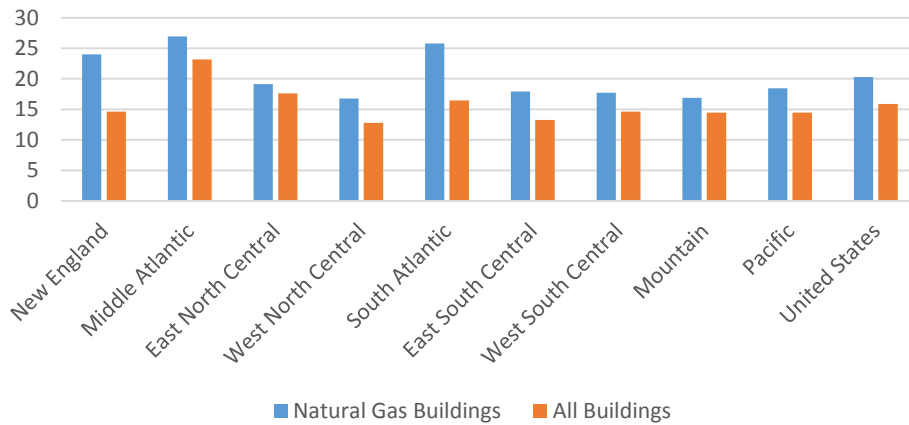


The larger the building, the more likely natural gas is used. In all regions, the share of floorspace as using natural gas is always larger than the share of total buildings using natural gas. This suggests that larger buildings, and thus more floorspace per building, tend to use natural gas.



**Figure 9**

**Average Size of Commercial Buildings  
(Thousand Square Feet)**



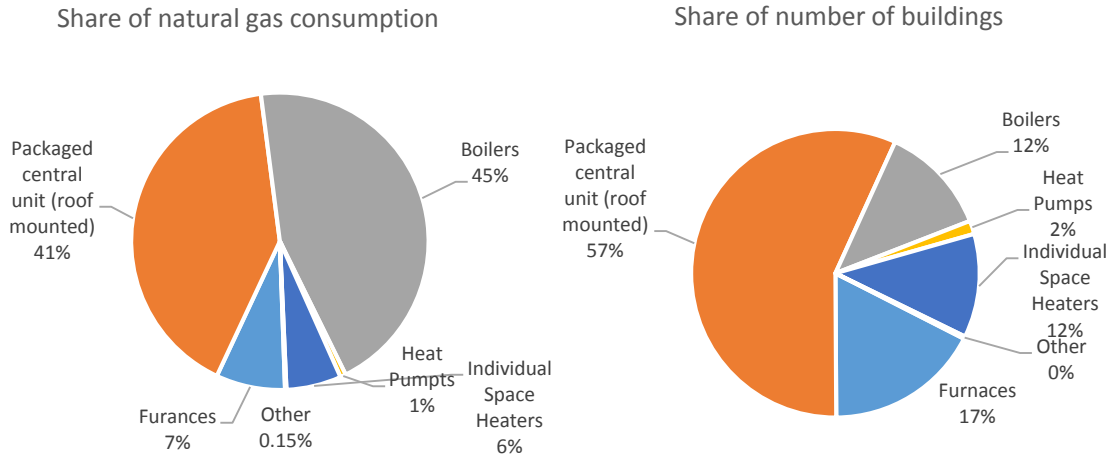
Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

Natural gas buildings are on average larger than the rest of the commercial building fleet. Commercial buildings with natural gas tend to be larger on the east coast (New England, Middle Atlantic, and the South Atlantic) than other places in the country. The Midwest and west have relatively smaller natural gas commercial space. The average commercial building with natural gas is 20,300 square feet. This compares to only 15,700 square feet for the commercial building fleet as a whole.

#### 2.4. Main Heating Equipment Used for Primary Space Heating

Figure 10 identifies the main equipment installed for primary heating in commercial space as a percent of commercial buildings with gas service. Packaged roof-mounted units represent more than half of all installations while building scale boilers, furnaces, and individual space heaters are also represented. In contrast, boilers consume 45 percent of the gas to commercial buildings and roof-mounted packages consume 41 percent.

**Figure 10**  
**Main Space Heating Equipment in Commercial Buildings**

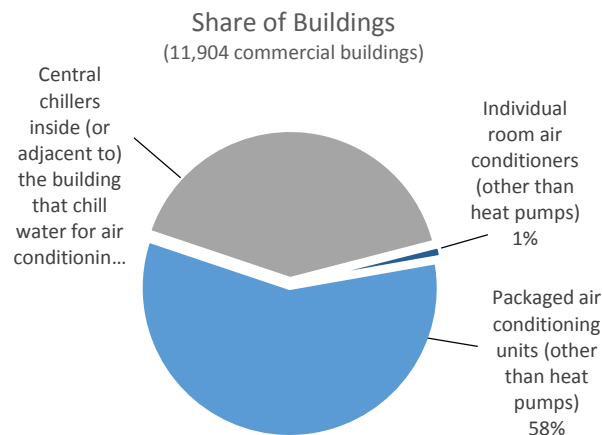


Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

### 2.5. Natural gas Used for Cooling

Very little natural gas is used for cooling in the commercial sector. As a proportion of total natural gas used it represents only 0.7 percent of commercial natural gas consumption in 2012, according to CBECS. Approximately 12,000 buildings reported using natural gas for cooling. The principal equipment types reported were packaged air conditioning units (other than heat pumps) or central chillers (see Figure 10). The most common building types were offices and non-refrigerated warehouses, along with some educational and medical facilities and shopping malls.

**Figure 11: Natural Gas Equipment Used for Cooling,**



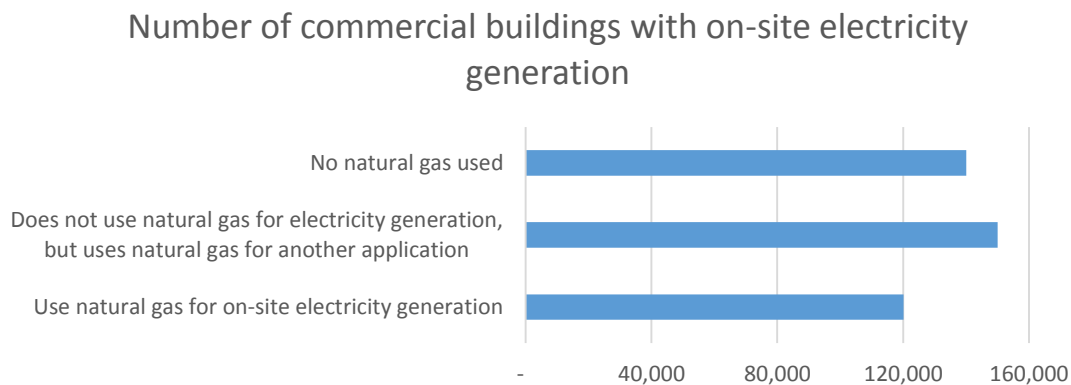
Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

## 2.6. Onsite electricity generation

Natural gas is used for electricity generation in approximately 120,000 buildings. Most of these buildings, 87 percent, utilize on-site generation primarily for emergency back-up or testing. The remainder—approximately 15,000 buildings—use on-site natural gas electricity generation during periods of high electricity demand or for baseload consumption (whenever electricity was used). Two percent of buildings with on-site natural gas-fired electric generation noted the use of a cogeneration system where thermal energy is generated simultaneously to on-site electrical energy.

There are many buildings that generate electricity on-site but that do not use natural gas, despite the fuel being present in the building and used for another application (Figure 8). Approximately 150,000 buildings report using natural gas but utilize a different fuel for on-site electric generation. This represents a key growth opportunity for expanding natural gas use in buildings where service is already present.

**Figure 12**

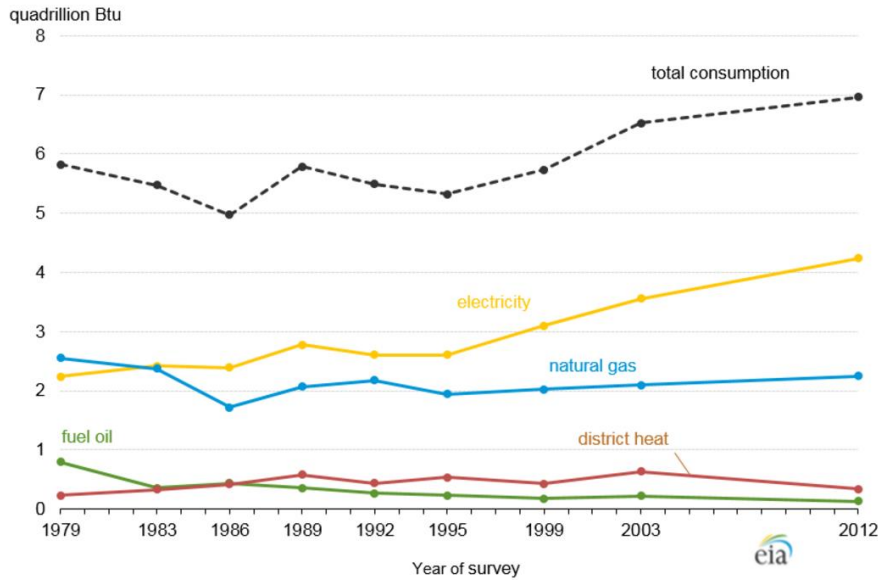


Source: US Energy Information Administration, Commercial Energy Buildings Consumption Survey 2012

## 2.7. Competitive Trends in the Natural Gas Commercial Sector

Overall, natural gas use per square foot has declined as buildings and appliances have become more efficient over time. Conversely, this energy intensity measure has increased for electricity, as more appliances have become standard. As such, electricity has been the principal driver of total energy growth in commercial buildings since 1995.

**Figure 13**  
**Electricity usage increased more than other energy sources since 2003**

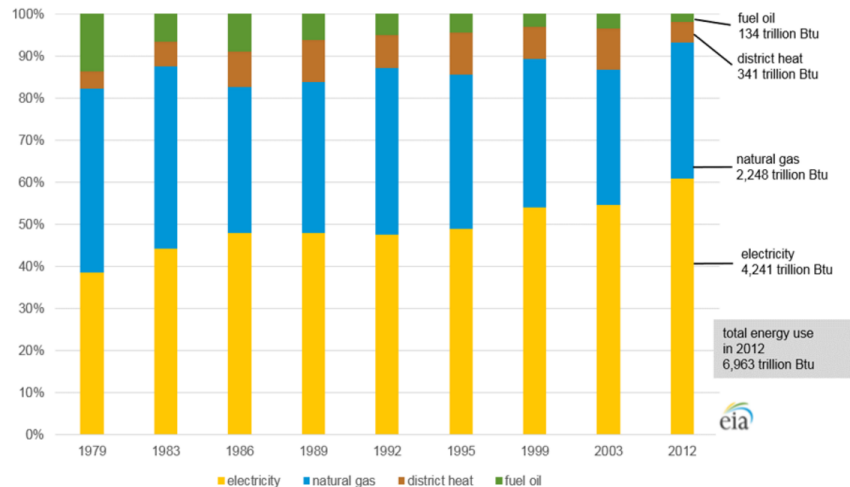


Source: U.S. Energy Information Administration, Commercial Buildings Energy Consumption Survey.

Electricity now accounts for 61 percent of total energy consumption in the commercial sector. This is up from approximately 50 percent in 1995.

The total amount of natural gas has remained relatively constant during the past two decades, exhibiting only growth since 2003. But as electricity’s share has grown, the relative gas share has shrunk to 32 percent.

**Figure 14: Electricity now accounts for 61 percent of all energy consumed in commercial buildings<sup>10</sup>**



Source: U.S. Energy Information Administration, Commercial Buildings Energy Consumption Survey.

<sup>10</sup> Values cited are for site energy consumption and thus exclude upstream losses, particularly at the electric power plant. If electrical system energy losses are taken into account, natural gas accounts for 18 percent of commercial sector primary energy consumption; electricity accounts for 79 percent.

### 3. Economic Contributions of the Commercial Natural Gas Market

Gas utilities serve many different customer groups, thus generating economic value-added from natural gas sales. Commercial customers benefit from lower commodity prices, which in turn generates further economic value. These contributions can be quantified by different segments of the economy that interconnect with natural gas utilities as a service provider. Revenue from natural gas utility sales alone numbers in the tens of billions of dollars and the commercial sector accounted for about one-fifth of revenue in 2013.

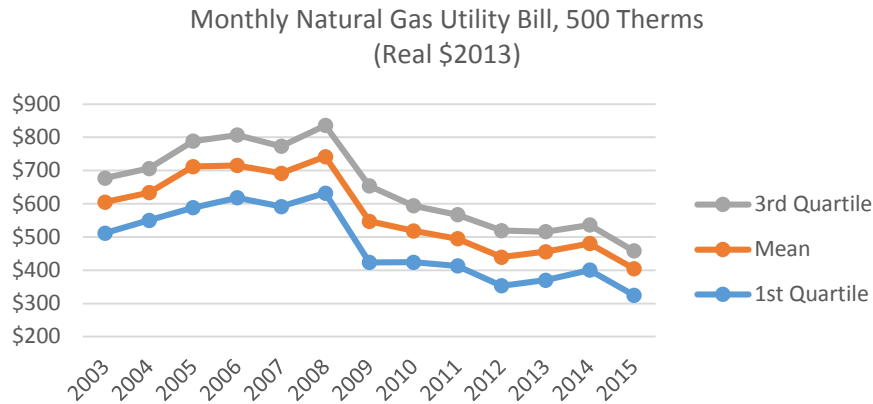
This section examines the larger economic contributions of the commercial segment of the natural gas market. The analysis relies on a few data sources, including the Regional Economic Modeling Incorporated (REMI) model, forecasting, and policy analysis tool built on publicly available data and allows for quantification of specific natural gas economic sectors. Also discussed are data from AGA surveys of natural gas utilities to quantify customer bills.

#### 3.1. Consumers Benefit from Lower Commodity Prices

For nearly a decade, natural gas utility commercial customers have benefited from a reliable lower cost of service. Commercial customers use about 500 therms (50 MMBtu) per month on average during an entire year, which is enough energy to fuel as many as ten or more homes (depending on location). Monthly commercial bills vary significantly given differences in customers, usage requirements, and facility size. Commercial natural gas use ranges from 300 to 20,000 therms or more (30 to 2,000 MMBtu). By comparison, residential bills typically show range from 40 to 1,000 therms or more (4 to 100 MMBtu) per meter. Residential units using volumes that rival those of commercial buildings are typically multifamily units that share a single meter.

To understand what commercial customers typically pay for their natural gas utility bill, and importantly how those bills change over time, AGA conducts a quarterly survey of natural gas utilities to determine average monthly bills for a range of customers.

**Figure 15**



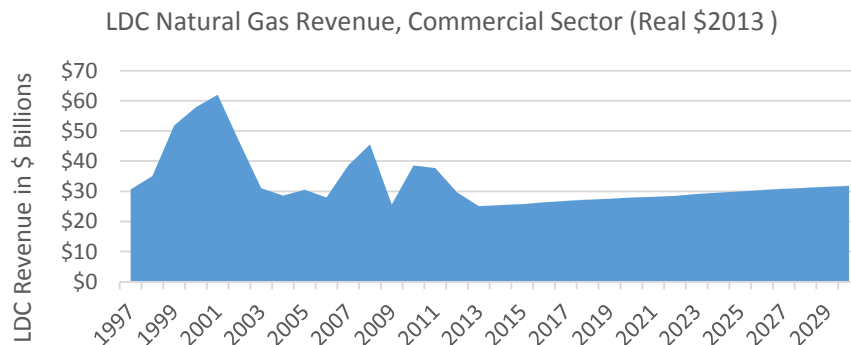
Source: AGA Quarterly Bill Comparison Report; Q1 2003 through Q4 2015

Based on the AGA survey, commercial gas utility bills arrived at a new low of \$405 for the average customer in 2015. In past years, the same 500 therms would have cost businesses less than \$500/month on average. Overall, the estimated monthly bill for commercial customers has dropped by nearly 50 percent compared with the recent peak year of 2008 when the customer bills averaged \$742 per month.

### 3.2. Commercial Customers are Core to LDC Revenue

In order to estimate both historical and future commercial revenue growth for natural gas utilities, AGA utilizes a nationally recognized macroeconomic regional modeling tool, REMI (Regional Economic Modeling Incorporated). REMI is a forecasting and policy analysis tool built on publicly available data from the US Federal Government and other sources. The model incorporates these sources to show how changes in any specific aspect of the economy such as consumption of natural gas can affect other inter-industry relationships.

**Figure 16**



Source: Regional Economic Modeling Incorporated, AGA

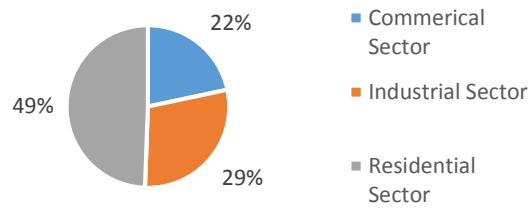
In 2013, commercial customers accounted for approximately 22 percent of total revenues for natural gas utilities; total natural gas utility revenue in 2013 was \$101.1 billion while commercial customers

accounted for \$21.4 billion. The total commercial revenue has been similar to total revenue from industrial customers for much of the past 10 years.

REMI projects that demand for natural gas from commercial customers will increase 26 percent by 2030. The primary drivers for this growth in commercial natural gas spending are the low price of natural gas and the projected 43 percent growth in sales by 2030 for the entire commercial sector.

**Figure 17**

Natural Gas Utility Revenue Breakdown  
by Industry, 2013



Source: Regional Economic Modeling Incorporated, AGA

REMI also reveals a nuanced picture of natural gas utility sales to the commercial sector and the subsectors of the economy to which natural gas is used as an input. REMI details a 61 industry breakout of the total commercial sector. Of the \$21.4 billion attributed to natural gas utility commercial customer related revenue in 2013, the top 10 industries accounted for \$16.6 billion or 78 percent of all commercial sales.

**Table 9**

LDC Revenue by Commercial User in 2013 (Real \$2013)

Commercial Sector	Revenue (\$ Billions)
Real estate	\$6.19
Educational services	\$2.54
Offices of health practitioners	\$2.38
Securities, commodity contracts, and other financial investments and related activities	\$1.27
Wholesale trade	\$1.17
Retail trade	\$0.93
Employment services	\$0.77
Newspaper, periodical, book, and directory publishers	\$0.53
Management of companies and enterprises	\$0.44
Amusement, gambling, and recreation industries	\$0.42
Other Commercial Users	\$4.74
<b>Total LDC Revenue from Commercial Customers in 2013</b>	<b>\$21.38</b>

Source: Regional Economic Modeling Incorporated, AGA

The top industry was real estate, a category which is comprised of companies that rent, manage, invest in and appraise properties. In 2013, real estate exceeded the second largest commercial industry by more than double and accounted for 29 percent of all natural gas utility sales.

REMI also allows for future projections based on current data. The greatest future growth in natural gas utility sales will come from the advertising and related services industry, which had only \$25 million in natural gas sales in 2013, according to the default REMI projections. By 2030, REMI projects this category's revenues to grow to more than \$330 million.

Only 4 of the 61 commercial industries in REMI are estimated to have a decline in total demand for natural gas utility service by 2030. These industries include legal service, automotive repair, family/community services and civil, social and professional organizations. In total, these four industries accounted for \$170 million in LDC sales in 2013. By 2030, these four industries are expected to only account for \$150 million in LDC sales (real \$2013) or a reduction in \$20 million.



## 4. The Role of Codes and Standards

The installation of appliances in commercial applications is diverse. Applications range from a 30-gallon water heater in a small retail shop to a large central boiler-chiller installation in an institutional facility.<sup>11</sup> As such, the role and applicability of codes and standards (C&S) in the commercial market will vary. Each state, and often the local government within each state, will determine which C&S are applicable to their commercial occupancies. For purposes of this paper the role that C&S play is described for:

- Appliance installations utilizing commercially available products and would exclude professionally engineered central plants and one-of-a-kind appliances.
- Building structures designed to meet minimum efficiency standards and would exclude buildings designed to meet higher performance standards such as green codes.

The basic role for C&S in the commercial market is similar to the role they play in the residential market in that they provide a basic level of safety, construction, performance, and efficiency. There are four primary C&S activities that influence the commercial market:

- Installation safety codes
- Appliance safety standards
- Federal appliance efficiency standards
- Building construction efficiency standards

### 4.1. Model Fuel Gas Installation Codes

Fuel gas installation safety codes are used by installers and local code officials to judge the acceptability of fuel gas piping, appliances, and vent installations in commercial facilities to help ensure a safe and reliable installation. There are three model fuel gas codes that can be directly adopted with or without local amendments or are used as the technical basis for state or locally written codes. All three are applicable to delivery pressures up to and including 125 psig and are applicable to most commercial occupancies.

- International Fuel Gas Code (IFGC): Developed and updated using the International Code Council (ICC) governmental consensus procedures. The IFGC is the most widely adopted fuel gas installation code. Approximately 60 percent of the IFGC is directly extracted from the National Fuel Gas Code including piping materials and sizing, venting types and sizing, combustion air, and clearances to combustibles.
- National Fuel Gas Code (NFGC): Developed jointly by the National Fire Protection Association (NFPA) and the Accredited Standard Committee (ASC) Z223 with the American Gas Association (AGA) as the Secretariat.
- Uniform Plumbing Code (UPC): Developed and maintained using the International Association of Plumbing and Mechanical Officials (IAPMO) ANSI-approved consensus procedures. The UPC is adopted by many western states and contains fuel gas piping, venting, combustion air, and water heating and boiler appliance installation requirements. The Uniform Mechanical Code (UMC),

---

<sup>11</sup> For brevity, the term appliance also includes equipment.

contains the same UPC fuel gas coverage but has additional requirements for a wider variety of typical gas appliances. The UMC is not widely adopted. Both the UPC and UMC extracts many of their fuel gas requirements directly from the NFGC.

The three model fuel gas installation codes have very similar installation requirements. All three codes are updated and published every three years. Model fuel gas codes will impact whether an appliance can be installed and how.

## 4.2. Appliance Safety Standards

Most commercial gas appliances are designed to meet specific national consensus standards that contain safety and performance criteria. CSA International is the leading developer of commercial fuel gas appliance standards and maintains a family of commercial appliance standards. CSA updates their standards using ANSI-approved consensus procedures. Underwriters Laboratories (UL) also develops some commercial gas appliance standards not covered by CSA standards. Commercial standards are periodically revised or reaffirmed to incorporate changes in technology and to address newly identified safety concerns.

Nationally recognized certification laboratories can design certify appliances to these product standards. CSA, UL, and Intertek Testing Services are three commonly utilized laboratories. Appliances are tested to the standards. When determined to be acceptable, they are listed by the laboratory and thereafter the appliance will carry the laboratories listing mark. Code officials typically consider listed appliances as acceptable for installation under their locally adopted fuel gas installation code. The installation of unlisted appliances may need additional technical justification from the manufacturer or design engineer prior to local acceptance.

Appliance standards affect both the types of appliances that are available and their features. Once a new standard is effective, manufacturers must comply with the new standard to maintain their appliance's listing.

## 4.3. Appliance and Equipment Efficiency Standards

As mandated by federal law, the United States Department of Energy (DOE) is responsible for setting national commercial appliance minimum efficiency standards. To accomplish this task, DOE maintains a family of efficiency testing methodologies and publishes regulations setting minimum efficiency levels. DOE methodologies and minimums cover a wide range commercial products including space heating, water heating, food service, cooling, and refrigeration. DOE is required, on a periodic schedule, to revisit and evaluate whether a new minimum should be set based on whether economic and technical feasibility. DOE is restricted from reducing minimums from currently published levels.

DOE minimums will affect the range of appliance types that are available and their installation requirements (e.g. types of venting systems). Once a new minimum is set, all appliances manufactured or imported to the US must meet the new standard typically within three years of final rule publication.

#### 4.4. Commercial Building Efficiency Standards

Building efficiency standards affect how a structure is designed and built, and its lifetime energy usage. While there are various commercial building construction efficiency regulations in use by the states, ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, is the most widely adopted minimum. ASHRAE 90.1 provides the minimum requirements for energy-efficient design of most buildings, except low-rise residential buildings. It offers, in detail, the minimum energy-efficient requirements for the design and construction of new buildings and their systems, new portions of buildings and their systems, and new systems and equipment in existing buildings, as well as criteria for determining compliance with these requirements. The continued development of ASHRAE 90.1 is undertaken using ASHRAE's ANSI-approved consensus procedures. A new edition is published every three to five years, with addenda published between editions.

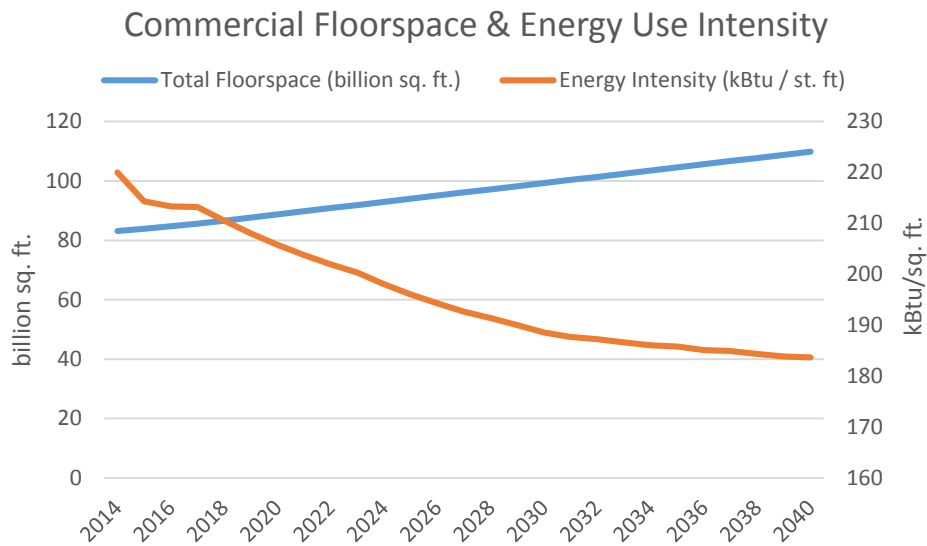
As required by federal law, DOE evaluates each new edition and make a determination as to whether the new edition would result in greater energy savings. Where an energy saving is determined, federal law requires each state to review ASHRAE 90.1 and their energy regulations for equivalency. While the states are not mandated to change their regulations, this federal review requirement has made ASHRAE 90.1 one of the two most influential building efficiency standard in the US. California's Title 24 regulations are the other influential building efficiency standard due to the State's population and construction activity.

## 5. Look-Ahead

The US commercial sector remains a stalwart of the economy and a principal user of energy. In this section, we look ahead at the macro trends of the commercial sector and identify where natural gas utilities are working to improve energy access and availability for this important segment.

To begin, we look at trends identified in the US Energy Information Administration's *Annual Energy Outlook 2016 with projections through 2040* (Figure 18). In short, EIA anticipates commercial floor space to continue to increase while total energy consumption intensity declines.

**Figure 18**



Source: EIA Annual Energy Outlook 2016, Reference Case

Commercial floor space is projected to continue to grow by 1.1 percent per year through 2040, according to AEO, but delivered energy consumption intensity will drop by 0.6 percent per year on average during that time.

The consequence of these largely offsetting trends is a relatively-flat-to-slowly-growing demand profile for commercial energy growth during the next few decades. EIA projections show total energy consumption for all end uses growing at 0.5 percent per year on average through 2040.

For context, total energy use in the commercial sector equaled 18.3 quadrillion BTUs (quads) in 2014.<sup>12</sup> The EIA Reference Case projects total commercial energy consumption in 2040 of 20.2 quads. A high economic growth case increases projected total commercial energy consumption to 20.8 quads, which is only a modest increase compared with the Reference Case. In other words, many of the growth trends in this sector are modest and moved by structural factors.

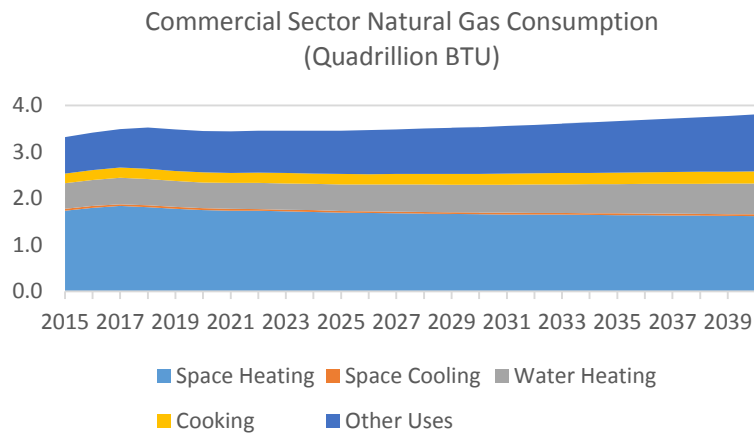
What about natural gas? EIA projects that purchased natural gas for consumption in the commercial sector will grow. Spacing heating and cooling becomes more efficient and total volumes decline over

<sup>12</sup> Includes electricity related losses.

time, but overall delivered energy increases, driven by growth in natural gas for water heating and cooling.

Generally, the growth in natural gas will track overall trends in commercial energy consumption. EIA projects total commercial sector natural gas consumption to grow from 3.6 quads in 2014 to 3.8 quads in 2040. More aggressive natural gas growth projections are relatively modest compared with the reference case. In its “High oil and Gas Resource and Technology” side case, in which EIA lowers the costs of developing new oil and gas resources by 50 percent, EIA projects commercial sector energy consumption of 4.2 quads by 2040.

Figure 19



Source: EIA Annual Energy Outlook 2016, Reference Case

While commercial demand may be relatively modest in the years ahead, the number commercial customers and the square footage of commercial facilities are expected grow steadily. This growth will require new investments into pipeline and other distribution infrastructure to meet these needs.

## 5.1. Growing the Commercial Gas Market

Commercial natural gas growth may also be measured in customers served, mileage of main and service pipe serving those customers, or even the range of energy services delivered. In the near term, there are clear opportunities to expand natural gas service to commercial customers, including:

- Leverage natural gas as a tool for economic growth.
- Promote new technologies to improve energy services, lower costs, and reduce emissions.
- Replace heating oil with natural gas, especially in the northeastern US.
- Leverage existing efficiency programs to comply with broader economic or environmental policy goals.

These goals will require new investment in natural gas distribution infrastructure to expand the network to serve a variety of customers, balance complementary load profiles, and optimize distribution costs across the customer base.<sup>13</sup>

## 5.2. Using Commercial Load to Aid in Natural Gas System Expansion

Many states have natural gas distribution infrastructure replacement and expansion activities underway or proposed. These include programs to extend mainlines to underserved or unserved customers through a number of mechanisms. These include helping customers bear the additional costs associated with new service; provide utilities incentives to enable new connections to customers, such as a supplemental return on equity to encourage new investments; programs to provide mechanisms to ensure timely cost recovery for companies, such as innovative rates or bill riders; statements of policy to support expansion of natural gas transmission, distribution, and storage infrastructure; or upfront

incentives to customers that can be replayed over an extended time period.

### EXPANDING THE REACH

38 STATES HAVE ADOPTED OR  
CONSIDERED INNOVATING EXPANSION  
PROPOSALS

Typically, the expansion of gas service by a utility into a new or a conversion market must pass an economic test to prove that such an investment will provide a net benefit to, and not require subsidies from, existing customers. While each project is unique, economics can be improved by

increasing the amount of gas throughput. The inclusion of commercial gas customers in these types of projects can improve profitability since the typical commercial gas customer uses almost six times as much gas as a home. Suburban areas are prime examples of such a customer mix, where homes are located near stores, schools, and restaurants. Rural areas are less likely to be able to take advantage of this strategy given the low population density of the area but are not immediately excluded.

As of November 2016, thirty-eight states have an innovative expansion programs or policies to connect new customers to natural gas service. Among these are states that have proposed or adopted policies to encourage economic development and job creating through the extension of gas service, in particular to major commercial, industrial, and manufacturing projects deemed otherwise economically infeasible.

The following states adopted varied approaches some companies and regulators have considered to address the economic opportunities to extend natural gas pipeline service. These should be viewed as illustrative examples and not as a comprehensive list:

- **Mississippi** features a number of programs designed to support economic development and growth through increased gas utility company investment. Gas utilities in this state have implemented *Supplemental Growth Riders* designed to encourage economic development and job creation by providing an incentive to extend gas service for major commercial, industrial, and manufacturing sites that are not otherwise economically feasible. Projects are selected based on the potential for economic growth after consultation with Mississippi Development

---

<sup>13</sup> American Gas Foundation. *Fueling the Future: Bringing it Home*. (2013)  
<https://www.fuelingthefuture.org/assets/content/AGF-Fueling-the-Future-Study.pdf>

Authority, the Mississippi Public Utility Commission, and Mississippi Public Utilities Staff.

- **New York** Public Service Commission approved the Partnership to Revitalize the Industrial Manufacturing Economy of Eastern New York (Prime-WNY) Program. The program utilizes shareholder funding to incentivize large commercial and industrial customers to install gas-fired equipment at existing facilities. One proposal currently under consideration would have the utility proactively identify commercial non-gas heating customers and evaluate the system impact of converting such customers based on estimated conversion loads and in particular those commercial and multi-family homes not using gas for heating purposes.
- **Tennessee** enacted legislation which provides for alternative regulatory methods to allow for public utility rate reviews and cost recovery for investments in infrastructure replacement and expansion in lieu of a general rate case. In particular, the bill allows the Tennessee Regulatory Authority (TRA) to authorize the recovery of costs related to infrastructure expansion for the purpose of economic development if such costs are found to be in the public interest. Expansion of economic development infrastructure may include that associated with alternative motor vehicle transportation fuel, combined heat and power installations in industrial or commercial sites, or that which will provide opportunities for economic development benefits in the area to be directly served by that infrastructure.

### 5.3. New Technologies to Bolster Growth

New natural gas technologies could further bolster growth in the commercial sector. Advanced heating or cooling systems using natural gas as the primary or secondary fuel source could deliver competitive economics and desirable environmental outcomes.

Examples of breakthrough technologies in the commercial sector include:

- Natural gas heat pumps
- Small-scale distributed generation applications
- Micro combined heat and power
- Advanced high-efficiency traditional applications (furnaces, boilers)
- Fueling facilities for natural gas vehicles

For example, breakthroughs in natural gas-fired heat pumps that heat and cool buildings with efficiencies above 100 percent could disrupt how energy is used in the commercial sector, and importantly how natural gas is perceived.

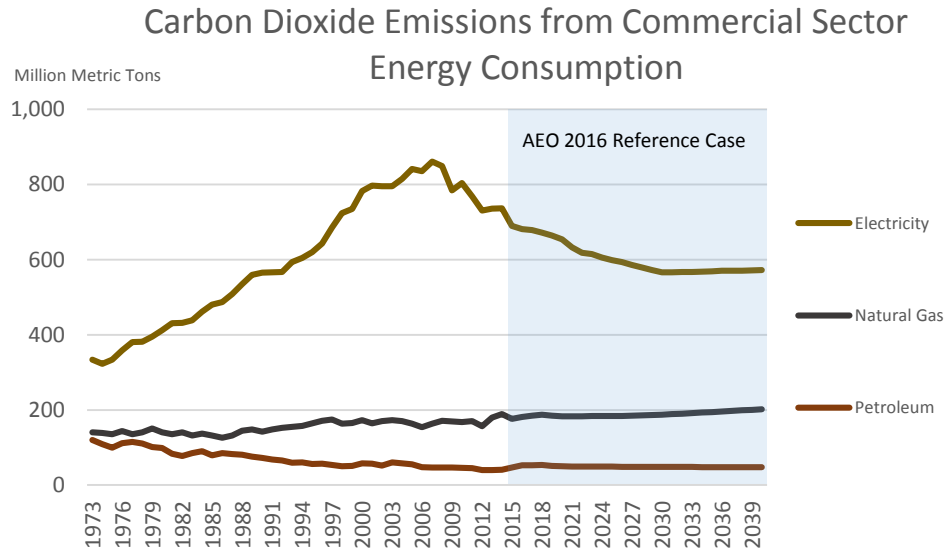
Different technologies reside at different points on the development pathway. Advancements in commercial gas technologies will require a combination of research and development investments (government and industry), technology demonstration, resources to facilitate commercialization, incentives to drive the market, and marketing efforts to accelerate adoption.

In order for commercial natural gas applications to remain competitive, it is incumbent on industry to work with government, regulators, manufacturers, builder and consumer groups, and other stakeholders to see continued advancement of commercial natural gas technology.

## 5.4. Opportunities to Lower Emissions

Natural gas is a low-cost, low emissions energy resource for consumers. Carbon dioxide (CO<sub>2</sub>) emissions from commercial energy consumption have grown only slightly in the past few decades during which data was collected. The Annual Energy Outlook 2016 sees this trend to continue, with largely flat CO<sub>2</sub> emissions from direct natural gas use in the commercial sector.

**Figure 18**



Source: EIA Monthly Energy Review, Annual Energy Outlook 2016

Yet competition remains stiff. Electric applications are advancing as well. With an ever-changing electric generation grid, one that has trended toward lower carbon resources for the past decade, it's plausible that electricity applications will be increasingly more competitive, not only economically but environmentally as well.

There is a growing body of research that demonstrates the low-cost, low emissions benefits of natural gas in the residential sector. Given the similarity of applications between residential and commercial end-uses, it is reasonable to assume these same benefits extend to larger-scale commercial and industrial applications.

But the variety of end uses and customers makes simple analysis for these applications sometimes difficult. Therefore, additional research is needed to demonstrate the low-carbon potential for commercial natural gas applications.

## 5.5. Energy efficiency programs

Energy efficiency has become increasingly important in recent years. Consumers are demanding new



energy services that save money and improve reliability, and companies offer services to help moderate consumer cost increases, reduce greenhouse gas emissions, and enhance energy security.

AGA tracks natural gas utility ratepayer-funded energy efficiency and conservation programs each year. It collects data from natural gas utility members. The characteristics of various utility-sponsored efficiency programs are diverse. Many types of incentives and programs target multiple customer groups. Many natural gas utilities have programs that target specifically commercial customers, though many group commercial & industrial customers for specific programs and activities.

Thirty-five states have at least one utility-sponsored energy efficiency program that targets commercial customers. In 2014, natural gas utilities logged \$203 million in energy efficiency expenditures targeting commercial end users.<sup>14</sup> This compares with a total programmatic expenditure for all sectors of \$1.27 billion dollars for 2014, thus commercial-specific programs account for about 16 percent of all gas utility ratepayer-funded program energy efficiency spending.

---

<sup>14</sup> For 2015, natural gas utilities budgeted \$241 million toward commercial programs. Final total expenditures for that year were not available by this report's publication.

## Conclusion

The natural gas commercial sector is a diverse mix energy users. It's comprised of many different types of technologies and end-uses. It is a critical part of the US energy economy and fundamental to the lives of everyone.

Efficiency and customer savings have been a core part of the natural gas story. Commercial consumption of natural gas in particular has been relatively flat during the past forty years as appliances and buildings have become more efficient. Consequently, consumer spending on energy has declined. Commercial customers today pay the same for natural gas in real terms as they did in the 1970s. Affordable natural gas supplies will only boost the value of natural gas.

Commercial natural gas prospects are strong. As the economy grows, so too will the commercial sector as a whole. During the past decade, the natural gas shares of the commercial market stayed relatively constant as a whole. If these trends persist then as the overall commercial sector grows, so will natural gas if it continues to capture a share of the growing commercial buildings market.

But natural gas growth is not a given. It will require concerted efforts of gas utility companies, working with their regulators, to continue to provide service for low-cost natural gas. Ensuring customer access will require new investments in natural gas distribution infrastructure to expand the network to serve a variety of customers, balance complementary load profiles, and optimize distribution costs across the customer base. Innovative rate approaches, tax considerations, removing regulatory barriers, and other mechanisms may all contribute.

Natural gas, as a low-cost reliable fuel will remain an essential ingredient in the energy mix of the nation's building sector. The use of efficient commercial natural gas applications helps lower costs to consumers, improve energy efficiency, and reduce the environmental footprint of energy consumption.

## Appendix A - Changes in Commercial Customers and Consumption from 2010 Through 2015

State	Average Number of Commercial Customers served by LDCs						5 Year	5 Year Average
	2010	2011	2012	2013	2014	2015	Average Change in Customers	Percent Change in Customers
Alabama	68,163	67,696	67,252	67,136	67,847	67,746	-417	-0.61%
Alaska	12,998	13,027	13,133	13,246	13,399	13,549	551	4.24%
Arizona	56,676	56,547	56,532	56,585	56,649	56,793	117	0.21%
Arkansas	67,987	67,815	68,765	68,791	69,011	69,265	1,278	1.88%
California	439,572	440,990	442,708	444,342	443,115	446,510	6,938	1.58%
Colorado	145,460	145,837	145,960	150,145	150,235	150,545	5,085	3.50%
Connecticut	54,842	55,028	55,407	55,500	56,591	57,403	2,561	4.67%
Delaware	12,861	12,931	12,997	13,163	13,352	13,430	569	4.42%
District of Columbia	9,879	10,050	9,771	9,963	10,049	9,975	96	0.97%
Florida	60,854	61,582	63,477	64,772	67,461	65,313	4,459	7.33%
Georgia	124,759	123,454	121,243	126,060	122,578	123,307	-1,452	-1.16%
Hawaii	2,551	2,560	2,545	2,627	2,789	2,815	264	10.35%
Idaho	38,506	38,912	39,202	39,722	40,229	40,744	2,238	5.81%
Illinois	291,395	293,213	297,523	282,743	294,391	295,869	4,474	1.54%
Indiana	156,557	161,293	158,213	158,965	159,596	160,051	3,494	2.23%
Iowa	98,396	98,541	99,113	99,017	99,186	99,662	1,266	1.29%
Kansas	84,446	84,874	84,673	84,969	85,654	86,034	1,588	1.88%
Kentucky	84,707	84,977	85,129	85,999	85,630	85,961	1,254	1.48%
Louisiana	58,562	58,749	63,381	59,147	58,996	57,873	-689	-1.18%
Maine	9,084	9,681	10,179	11,415	11,810	11,888	2,804	30.87%
Maryland	75,192	75,788	75,799	77,117	77,846	78,138	2,946	3.92%
Massachusetts	144,487	138,225	142,825	144,246	139,556	140,533	-3,954	-2.74%
Michigan	249,309	249,456	249,994	250,994	253,127	254,484	5,175	2.08%
Minnesota	132,163	132,938	134,394	135,557	136,380	138,871	6,708	5.08%
Mississippi	50,537	50,636	50,689	50,153	49,911	49,821	-716	-1.42%
Missouri	138,670	138,214	144,906	142,495	143,134	141,216	2,546	1.84%
Montana	34,002	34,305	34,504	34,909	35,205	35,777	1,775	5.22%
Nebraska	56,246	56,553	56,608	58,005	57,191	57,521	1,275	2.27%
Nevada	40,801	40,944	41,192	41,710	42,338	42,860	2,059	5.05%
New Hampshire	16,645	17,186	17,758	17,298	17,421	18,185	1,540	9.25%
New Jersey	234,158	234,721	237,602	236,746	240,083	241,417	7,259	3.10%
New Mexico	48,757	49,406	48,914	50,163	50,216	50,584	1,827	3.75%
New York	377,416	378,005	379,396	381,228	389,889	397,656	20,240	5.36%
North Carolina	113,900	115,609	117,155	118,257	120,111	121,842	7,942	6.97%

<b>North Dakota</b>	17,823	18,421	19,089	19,855	20,687	21,345	3,522	19.76%
<b>Ohio</b>	268,346	268,647	267,793	269,081	269,758	269,981	1,635	0.61%
<b>Oklahoma</b>	92,430	93,903	94,537	95,385	96,005	96,471	4,041	4.37%
<b>Oregon</b>	77,370	77,822	78,237	79,276	80,480	80,877	3,507	4.53%
<b>Pennsylvania</b>	233,751	233,588	235,049	237,922	239,681	241,682	7,931	3.39%
<b>Rhode Island</b>	23,049	23,177	23,359	23,742	23,934	24,088	1,039	4.51%
<b>South Carolina</b>	55,853	55,846	55,908	55,997	56,323	56,871	1,018	1.82%
<b>South Dakota</b>	22,267	22,570	22,955	23,214	23,591	24,040	1,773	7.96%
<b>Tennessee</b>	127,914	128,969	130,139	131,091	131,027	132,392	4,478	3.50%
<b>Texas</b>	312,277	314,041	314,811	314,036	316,756	319,512	7,235	2.32%
<b>Utah</b>	61,976	62,885	63,383	64,114	65,134	66,143	4,167	6.72%
<b>Vermont</b>	5,137	5,256	5,535	5,441	5,589	5,696	559	10.88%
<b>Virginia</b>	95,401	96,086	96,503	97,499	98,741	99,643	4,242	4.45%
<b>Washington</b>	99,231	99,674	100,038	100,939	101,730	102,266	3,035	3.06%
<b>West Virginia</b>	34,063	34,041	34,078	34,283	34,339	34,448	385	1.13%
<b>Wisconsin</b>	164,173	165,002	165,657	166,845	167,901	169,271	5,098	3.11%
<b>Wyoming</b>	19,977	20,146	20,387	20,617	20,894	20,816	839	4.20%
<b>US Total</b>	<b>5,301,576</b>	<b>5,319,817</b>	<b>5,356,397</b>	<b>5,372,522</b>	<b>5,413,546</b>	<b>5,449,180</b>	<b>147,604</b>	<b>2.78%</b>

\*Source: Energy Information Administration, 176 Annual Report of Natural and Supplemental Gas Supply and Disposition