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Winter Fuels Outlook 2017-2018

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December 5, 2017

Congressional Research Service
7-....
www.crs.gov
R45042

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

The Energy Information Administration (EIA), in its *Short-Term Energy and Winter Fuels Outlook* (STEWFO) for the 2017-2018 winter heating season, projects that American consumers should expect to see heating expenditures that will be higher than last winter. However, the winter of 2016-2017 was relatively warm. Average expenditures for those heating with natural gas are projected to increase by 12%, while those heating with electricity are projected to see an increase of about 8%. These two fuels serve as the heating source for about 87% of all U.S. household heating. Propane and home heating oil consumers are also projected to see increased costs.

Within the United States, average expenditures projections differences exist with respect to region of the country. Differences in weather conditions and fuel prices contribute to differing regional expenditures.

Economic conditions of relatively high growth and low unemployment suggest that higher consumption levels of all fuels may occur. Increased consumption could lead to higher prices for all winter fuels. The STEWFO provides analysis of scenarios covering a warmer, or colder, winter than the base case forecast.

The key federal program designed to assist low-income households is the Low Income Home Energy Assistance Program (LIHEAP). LIHEAP funding beyond the expiration of the Continuing Appropriations Resolution (P.L. 115-56) is uncertain and if reduced could put an additional burden on families qualified for benefits. If the weather in the winter of 2017-2018 is severe, or if energy prices are volatile, the fixed amount of LIHEAP funding will likely result in smaller assistance payments to families, or fewer families receiving payments.

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Introduction

Each year, in October, the Energy Information Administration (EIA) publishes the *Short-Term Energy and Winter Fuels Outlook* (STEWFO).[1] The purpose of the STEWFO is to provide fuel-specific estimates of expected average annual heating expenditures in comparison to previous years. While the STEWFO provides estimates of average annual heating expenses, individual expenses may vary regionally: by energy source utilized, home size, energy efficiency, individual temperature preference, market size, and local weather conditions.

Average annual heating fuels expenditures depend on the price of the fuel used, with natural gas, heating oil, propane, electricity, and wood products constituting the main heating fuels in the United States. Expenditures also depend on the quantity of fuel used, which is partially based on a variety of individual consumer decisions. Weather conditions, measured by heating degree-days, are the other key factor in determining expenditure levels.[2] The National Oceanic and Atmospheric Administration (NOAA) provides winter heating degree-day estimates to the EIA for the STEWFO.

The STEWFO is not a forecast in the statistical sense; it is a projection based on assumed values of key variables. If, for example, the underlying fuel price estimates prove to be incorrect, or weather conditions vary from forecast trends, actual average heating expenditures will reflect those differences.

Average Annual Heating Fuels Expenditures

NOAA forecasts a 10.6% increase in heating degree-days for the 2017-2018 heating season compared to 2016-2017 for the United States as a whole. However, the 2016-2017 winter fuel season was warmer than normal. Regional differences in weather, along with regional fuel usage patterns, can cause regional expenditure projections to vary from the U.S. average.

In the Northeast, heating degree-days are expected to increase by 3.5%, while in the West they are expected to increase by 2.9%. Estimated heating degree-days are expected to increase by 23.6% in the South, and increase by 13% in the Midwest.[3]

On average, the EIA projects that U.S. household expenditures on heating fuel for the 2017-2018 heating season will increase for all households irrespective of the heating fuel utilized. The projected increase in expenditures reflects generally higher prices for all fuels, as well as the increased quantity consumed in light of the forecast of colder weather. **Table 1** provides a summary of the percentage changes in the key components of the U.S. average annual heating fuel expenditures by fuel.

[1] The winter heating season runs from October 1 through March 31.

[2] Heating degree-days are defined as the day's average temperature, calculated as the high plus the low temperatures of the day divided by two. If the resulting number is less than 65, subtract the average temperature from 65. The result is the number of heating degree-days on a particular calendar day.

[3] All percentage changes in the STEWFO and this report are calculated on a yearly heating season basis, not on a calendar year basis. The estimated 2017-2018 values are compared to the 2016-2017 values.

Table 1. U.S. Average Winter Fuels Projections, Winter 2017-2018

(percentage change)

	Natural Gas	Heating Oil	Propane	Electricity
Consumption	7.7	3.9	N/A	5.1
Price	1.9	12.4	N/A	1.6
Number of Households	0.0	-3.5	-1.3	2.0
Expenditure	9.7	16.8	N/A	6.7

Source: Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* Table WFO1, October 2017.

Notes: Percentage change compares projected changes for the 2017-2018 heating season to 2016-2017 data. The EIA does not provide U.S. average propane data, except number of households.

Regionally, the EIA expects expenditures on natural gas to increase most in the Midwest at 16.9%, and to increase by 12.1% in the South, 6.9% in the Northeast, and 2.4% in the West. Expenditures on heating oil, used primarily in the Northeast, are expected to increase by 16.8%. Expenditures on propane are expected to increase by 10.6% in the Northeast and by 23.5% in the Midwest.[4] Electricity expenditures are expected to increase by 3.4% in the Northeast, 7.7% in the Midwest, 8.6% in the South, and 3.8% in the West.

Due to changing market conditions for primary fuels, the prices assumed in the STEWFO can differ from actual prices. Price volatility in the world oil market can have direct effects on the cost of heating oil and propane. Variations in natural gas prices can directly affect those households heating with that fuel, while indirectly affecting electricity prices. Projected consumption levels are likely to be affected by variations in the weather. If the observed weather is colder, or warmer, than forecast by NOAA, or if consumers change their consumption habits at any given price level, or at any given number of heating degree-days, consumption levels would differ from those projected in the STEWFO.

Natural Gas

While the United States is largely self-sufficient in natural gas, it remains part of a North American regional market and participates in international trade. Most U.S. imports of natural gas come from Canada. Small quantities of liquefied natural gas arrive in the United States from Trinidad. The United States exports natural gas by pipeline to Mexico and Canada, and exports liquefied natural gas to about a dozen nations, with South Korea, Jordan, and Mexico among the largest customers.

Domestic consumers of natural gas include households and commercial customers that largely use natural gas for space heating. Electric power generators, especially those that satisfy peak load demand, use natural gas as a primary fuel to power generators. Industrial consumers use natural gas as a raw material, for example in fertilizer production, and as a heat source in industrial processes. Households, commercial customers, and electric power generators are those consumers whose consumption is most likely to be affected by winter weather conditions.

[4] The 2017-2018 *Short-Term Energy and Winter Fuels Outlook* does not include complete data broken down by region for heating oil and propane.

Table 2 presents average residential consumer natural gas consumption and price data for the winter heating seasons 2013-2014 through projected values for the winter 2017-2018.

Table 2. Average Household Winter Natural Gas Consumption and Price

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Consumption (Mcf)	68.0	64.8	55.8	56.9	61.3
Price ($/Mcf)	$9.97	$9.91	$9.30	$10.11	$10.30

Source: Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* Table WFO1, October 2017.

Notes: Data for winter 2017-2018 are projected, other years are actual values. Mcf is thousand cubic feet.

On a per-household basis, as presented in **Table 2**, winter consumption shows the effects of the last two relatively warm winters compared to the colder two previous winters. The winter of 2017-2018, although projected to generate 10.6% more heating degree-days than last winter, is only an increase compared to the last two warm winters. Approximately 48% of U.S. households heat with natural gas.

Natural gas prices are expected to increase somewhat, an increase of about 2% compared to last year. The observed price-consumption relationship suggests that natural gas demand may be price inelastic in the range presented in **Table 2**. Price inelasticity implies that consumption might not be expected to respond proportionally to changes in price.[5] An inelastic demand relationship is likely because home heating is typically considered to be a necessity by consumers. In addition, existing metering systems do not provide consumers with easy access to real-time price and quantity data. Lack of real-time information could result in consumers making ill-informed decisions with regard to heating usage and expenditures. Income levels and the unemployment rate might also be important in determining natural gas consumption.

The EIA projects a 9.7% average increase in expenditures in households heating with natural gas, driven by a 1.9% increase in natural gas prices, coupled with a 7.7% increase in fuel consumption. Compared to last winter, natural gas heating expenditures are expected to rise by 6.9% in the Northeast, 16.9% in the Midwest, 12.1% in the South, and 2.4% in the West. Average expenditures during the winter of 2017-2018 are expected to be $631 per household, compared to $575 for the winter of 2016-2017. The STEWFO projects, on average, natural gas to be the lowest-cost heating source for the winter of 2017-2018.

On the national level, including all consumer groups, total natural gas consumption rose by about 12% from 2011 through 2016. Over the period, the electric power generating sector's consumption rose by about 40%. Residential and commercial usage showed losses, about -9% and -1% respectively. Industrial demand increased by about 10%, while natural gas consumption in vehicles increased by about 40%, albeit from a small base.[6] The STEWFO projects an increase in total natural gas consumption of about 2% over the period 2016 through 2018.

The STEWFO projects an increase in U.S. natural gas production of about 9% over the period 2016 through 2018. While during the winter of 2016-2017 the United States was a net importer of natural gas, the EIA expects the United States to become a net exporter of natural gas during the

[5] Price elasticity of demand is calculated as the percentage change in quantity demanded divided by a given percentage change in price. Demand is considered to be inelastic if the price elasticity calculation yields a value less than one.

[6] Data available at https://www.eia.doe.gov.

winter of 2017-2018. This shift is due to increased pipeline capacity to Mexico and increased liquefied natural gas export capacity on the Gulf Coast.

Storage levels of natural gas at the beginning of the winter heating season are important because while production is relatively constant over a 12-month period, consumption is subject to seasonal fluctuations. Natural gas in storage is used to smooth out production and consumption differences. The STEWFO projects adequate natural gas in storage for the 2017-2018 heating season. Projected inventories in October 2017, of about 3.8 trillion cubic feet, were above the five-year average.

Heating Oil

Home heating oil is a middle distillate, derived from the same part of the oil refining process as diesel fuel. As a result, the price of home heating oil is closely related to the price of crude oil as well as the price of diesel fuel. Approximately 4.5% of households in the United States heat with oil, and most of these consumers are in the Northeast, where about 90% of U.S. heating oil consumption takes place.[7]

Table 3. Average Household Heating Oil Consumption and Price

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Consumption (gallons)	607.3	608.1	481.7	517.9	538.1
Price ($/gallon)	$3.88	$3.04	$2.06	$2.41	$2.71

Source: Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* Table WFO1, October 2017.

Notes: Data for 2017-2018 are projected.

The EIA expects average home heating oil expenditures per household to increase by $209, or 16.8%, for the winter of 2017-2018. These dollar and percentage increases are relatively large compared to the cost of heating with other fuels identified in the STEWFO. Heating oil accounts for the highest average total expenditure for any winter fuel, $1,457 per household. The projected heating oil expenditure for winter 2017-2018 is more than double the total expenditure for a household heating with natural gas ($631), and two-thirds higher than a household heating with electricity, $967.

Diesel fuel, a product similar to home heating oil, has been more expensive than gasoline in 2017, averaging about $0.33 per gallon higher. Home heating oil has averaged about the same premium over gasoline during 2017. These price differentials likely result from U.S. refiners' emphasis on gasoline production for the U.S. market, coupled with the relatively high level of world demand for diesel fuel. The United States has exported about 1.4 million barrels per day of diesel fuel over the first eight months of 2017. The costs of gasoline, diesel fuel, and home heating oil are all directly related to the price of crude oil on the world market. The EIA projects the refiner's acquisition cost of crude oil to average $48.75 per barrel in 2017, compared to $40.69 per barrel in 2016.[8]

Two risk factors are key in assessing the heating oil component of the winter fuels outlook. Brent crude oil, the crude oil price most relevant to setting U.S. petroleum product prices, was projected

[7] Data available at https://www.eia.doe.gov.

[8] Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* Table 2, October 2017.

to be $54 per barrel during the winter heating season. However, the spot price of Brent averaged over $62 per barrel during November 2017. Crude oil prices are volatile, and changes in crude oil prices are likely to proportionally affect home heating oil prices.

The second risk factor is the level of inventories in the Northeast. At the beginning of October 2017, distillate inventories in the Northeast totaled 35.5 million barrels, 16.8 million barrels less than at the same time last year. In addition, these inventories were 1.9 million barrels lower than the previous five-year average for the time period. The lower inventory levels are due to high global demand and the disruptive effects of Hurricane Harvey. Prices for home heating oil in the Northeast could rise rapidly if colder-than-expected weather occurs. In that case, the Northeast market might have to turn to more expensive imports. Simultaneous cold weather in Europe could cause additional upward pressure on price and perhaps compound pressure on low inventories.

Propane

Propane provides primary home heating for approximately 5.7 million households in the United States, about 5% of the total households. Propane consumers are projected to experience an increased expenditure of about $211, or 10.6% in the Northeast, while consumers in the Midwest are projected to experience an increase of $276, or 23.5%. These cost increases make propane the second most expensive fuel among those covered in the STEWFO. The number of households heating with propane has remained roughly constant over the past three years. The EIA expects a decline of 1.3% in the number of households using propane in 2017-2018.

Table 4. Average Household Propane Consumption and Price, Northeast

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Consumption (gallons)	745.4	751.5	607.7	651.1	667.6
Price ($/gallon)	$3.56	$3.00	$2.71	$3.06	$3.30

Source: Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* Table WFO1, October 2017.

Notes: Data for 2017-2018 are projected.

Table 5. Average Household Propane Consumption and Price, Midwest

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Consumption (gallons)	868.7	813.2	667.7	679.1	751.7
Price ($/gallon)	$2.61	$1.91	$1.47	$1.73	$1.93

Source: Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* Table WFO1, October 2017.

Notes: Data for 2017-2018 are projected.

For the Northeast in 2016-2017, propane prices were $3.06 per gallon, while they were $1.73 in the Midwest, a differential of over 55%. While the consumption levels in the two areas are expected to be, on average, within 90 gallons of each other, the difference in propane prices leads to heating season expenditures of $1,451 in the Midwest compared to $2,203 in the Northeast.

Propane is unique compared to other fuels covered in this report in the sense that it is a by-product, and not directly produced itself. The production of gasoline and natural gas both

contribute to the supply of propane. As a result, when the supply of those fuels is high, so is the supply of propane.

Many of the same factors that affect natural gas and home heating oil prices also influence expected propane prices. However, in the case of propane, the relationship is indirect because propane is a by-product. Propane prices, unlike the other fuels covered in this report, are affected by distance and dispersion of consumers. Because the distribution process usually requires delivery by truck, of relatively small quantities, it tends to be high cost.

Electricity

Electricity prices are related to natural gas and coal prices as well as the availability of nuclear, hydro, and alternative fuel generating capacity. In addition to natural gas being an input in electricity generation, it is also a direct competitor to electricity as a home heating source. Approximately 40% of U.S. households use electricity as their primary heating source. In the Northeast, electricity use is lowest, at about 15%, while in the South it is highest, at about 63%. Overall growth in the number of households using electricity for space heating is expected to be 2% year-on-year, driven by expansion in the Midwest of over 3%. In comparison, the numbers of propane and heating oil customers are expected to decline, by 1.3% and 3.5%, respectively. The number of households using natural gas for space heating is expected to remain the same for the 2017-2018 heating season.

Table 6. Average Household Electricity Consumption and Price

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Consumption (kwh)	7,981	7,801	7,242	7,227	7,593
Price ($/kwh)	$0.120	$0.123	$0.124	$0.125	$0.127

Source: Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* Table WFO1, October 2017.

Notes: Data for 2017-2018 are projected. Kilowatt hours are kwh.

The EIA projects increasing heating expenditures for households heating with electricity. In the Northeast, expenditures of $1,145, an increase of 3.4%, are projected, and in the Midwest, expenditures of $1,072, an increase of 7.7%, are projected. In the South expenditures of $889 are projected, an increase of 8.6%, while in the West expenditures of $961 are projected, an increase of 3.8%. **Table 6** shows that, while rising, electricity prices have shown less year-on-year volatility than other heating source prices.

Wood

Wood and wood pellets are projected to provide primary home heating for approximately 2.3 million U.S. households in 2017-2018. The EIA also estimates that wood provided a secondary heating source for about 9.3 million households in 2015. Data in the STEWFO show that the number of homes heating primarily with wood and wood products has declined since the winter of 2013-2014, with a year-on-year decline of 1.7% expected during 2017-2018.

The EIA does not track wood prices, and therefore cannot calculate expected expenditure levels for the winter heating season. Wood prices are likely to be highly localized, with relatively large urban/rural differentials, as well as regional differences.

Risk Factors

The primary risk factors with respect to STEWFO projections are the weather and energy prices. Total household expenditures on home heating are equal to the price of the fuel times the quantity of fuel consumed. The weather, measured by the number of heating degree-days, largely determines the quantity of fuel used. Conservation, in the form of reduced temperatures inside the home, also can reduce the quantity of fuel consumed, but for a given desired temperature inside the home, heating degree-days are the key factor. The 2017-2018 winter heating season is expected to be colder in all regions of the United States, ranging from 2.9% colder in the West to 23.6% colder in the South. As a result of this key dependence on the weather, the STEWFO includes heating expenditure scenarios estimates based on weather which is 10% warmer, or 10% colder, than the NOAA forecast, identified as the base case, as shown in **Table 7**.

Table 7. Percentage Change in Home Heating Expenditures

(percent)

	Base Case	10% Warmer	10% Colder
Heating Oil	17	5	32
Natural Gas	12	3	19
Propane	18	2	41
Electricity	8	4	12

Source: Energy Information Administration, *Short-Term Energy and Winter Fuels Outlook,* October 2017.

Notes: The base case compares projected heating expenditures for the 2017-2018 winter heating season to the 2016-2017 winter heating season. The 10% warmer and 10% colder data replace the base case data for 10% fewer, and 10% more heating degree-days.

It should be noted that in interpreting **Table 7**, when the weather is warmer, or colder, this affects the quantity demanded of heating fuel, which can translate into a change in the price of the fuel. These "secondary effects" are included in **Table 7**.

The other independent risk factor in determining the expenditure on home heating is the price of the various fuels. These prices are determined by a complex web of related prices, market conditions, exports, expectations, and other economic variables. In a period of relatively strong economic growth, with low unemployment, the key relationship may be that between the level of economic activity, measured by the real growth rate of gross domestic product, and the prices of oil and natural gas.

A higher price of crude oil directly increases the price of home heating oil and propane. Electricity prices are directly affected by natural gas and coal prices. Even in the face of a growing reserve base and increased production, U.S. natural gas prices are expected to increase as shown in **Table 2.**

While crude oil prices are determined in the world market and are also thought to be non-forecastable, the STEWFO includes an assumption of higher oil prices affecting heating oil and propane expenditures as shown in **Table 3** and **Table 4**.

Heating Expenditure Assistance

The Low Income Home Energy Assistance Program (LIHEAP) is the primary federal government program to supplement home heating expenditures. LIHEAP is composed of two parts: funding

for block grants to states, and emergency contingency funds. LIHEAP funding for FY2018 has been set at $3.39 billion (Continuing Appropriations Resolution, 2018, P.L. 115-56). Prior to the approval of the Continuing Appropriations Resolution, the President's budget request proposed to eliminate funding for the program. Emergency contingency funds have not been appropriated since 2011.[9]

LIHEAP's ability to provide heating assistance depends upon the level of funding, but also on the cost of energy, which depends upon the prices of the various energy sources; the total consumption of energy for heating, which depends on the severity of the weather and energy efficiency; and the number of eligible households.[10]

If the weather in the winter of 2017-2018 is severe, or if energy prices are volatile, the fixed amount of LIHEAP funding will likely result in smaller assistance payments to families, or fewer families receiving payments.

Conclusion

The STEWFO projects that U.S. households will generally face increased heating costs during the winter of 2017-2018. Fuel costs are generally expected to be higher than last year and the weather is expected to be colder. Any change in the level of economic activity, or changes in the prices of fuels, coupled with the natural variability in the actual weather experienced during the winter heating season, could change the expenditure projections as shown in **Table 7**.

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[9] More detailed analysis of the provisions and funding of LIHEAP can be found in CRS Report RL31865, *LIHEAP: Program and Funding*, by (name redacted)

[10] Ibid., p. 7.