

Heating Oil Conservation and Fuel Switching

Summary:

Demand Side Management for Heating Oil

Demand side management (DSM) is the modification of consumer demand for energy through various methods such as financial incentives, education, conservation and fuel switching to name a few. The goal of DSM is to encourage the consumer to use less energy. This initiative aims to replace or upgrade inefficient household appliances that utilize fuel oil with more energy-efficient models, thereby decreasing energy consumption and reducing emissions.

DSM for Heating Oil

Residential sector: Achieve 37 percent reductions from reference case oil consumption in 2030.

Commercial sector: Achieve 26 percent reductions from reference case oil consumption in 2030.

Fuel Switching - Natural Gas

This initiative recognizes the potential for additional greenhouse gas (GHG) reductions through fuel switching from heating oil to natural gas. Please note that the work plan is a simple analysis of combustion and does not include an analysis of methane leakage. This analysis only evaluated residential sector greenhouse gas savings. In the future, the commercial sector should be examined, as it may have the potential for cost effective greenhouse gas savings.

Natural Gas

Fuel switching to natural gas can also yield reductions in GHG emissions. Fuel switching to natural gas has increased with the decrease in natural gas prices and is expected to continue. According to the U.S. Energy Information Administration (EIA), the average Pennsylvania home fueled by heating oil uses approximately 516 gallons per year, whereas the average home fueled by natural gas uses approximately 53,000 cubic feet per year. The mid-Atlantic region EIA data for 2015 predicts that the average delivered cost of natural gas to the residential sector was \$11.55 per MMBtu¹. The average price of heating oil in the mid-Atlantic region for the same time period was \$25.10 per MMBtu¹. At these prices the average family could save approximately \$1,126 per year in heating fuel costs by switching to natural gas. In addition, every household that switches from oil to natural gas could contribute a GHG emission reduction of 28 metric tons annually, not accounting for any future additional natural gas projections. UGI expects to increase their customer base by almost 10,000 new customers and Columbia Gas expects an increase of 3,500 new customers in 2015. However, large geographical areas of the Commonwealth still do not have access to natural gas, including urbanized areas of the southeast. Additionally, there are numerous neighborhoods where natural gas is only partially available.

With the onset of two pilot programs in 2014 by Pennsylvania natural gas distributions companies, UGI's GET Program and Columbia Gas's NAS Program, the addition of another 2,350 households switching to natural gas is possible. These new acquisitions are in addition to their normal annual new customers. This work plan assumes a total of 4,500 homes converting each year from fuel oil to natural gas for home heating (approximately .5% of the homes in the commonwealth using fuel oil). The cost of conversion is assumed to be \$5,600- the estimated cost of a furnace conversion and a gas connection to a home.

Fuel switching to natural gas should be encouraged by first ascertaining what may be the barriers to greater deployment and providing incentives to hasten the transition to this cleaner-burning, domestically produced fuel.

Implementation Steps for Conservation:

Encourage:

1. Air Sealing and Insulation (10 percent–40 percent annual energy savings)
 - Seal air leaks in homes or businesses; duct sealing increases efficiency and reduces energy usage.
 - Adding insulation to buildings can slow heating and cooling in extreme temperatures.
 - By air sealing & insulation, consumers could probably save up to 25 percent of this.
 - Install multi-pane windows to provide extra layers of protection from heat entering or escaping, reducing energy consumption.

2. Increased furnace and boiler efficiency to >95

- Nationwide and in PA, more than 10 percent of homes use oil for heating.³
- Continue Programs like the “Keystone Help” program to provide low interest loans to Pennsylvania residents who wish to upgrade their present heating system and building envelope.

3. Domestic hot water heaters

- Encourage purchase of high efficiency water heaters.

Implementation Steps for Fuel Switching:

- Encourage the PUC to approve more programs such as UGI’s Growth Extension Tariff (GET) program and Columbia Gas’s New Area Service (NAS) program, which allows customers to pay a monthly surcharge, avoiding significant up-front costs, when connecting to a new natural gas main extension.
- Encourage other natural gas distribution companies to develop pilot programs to expand natural gas service areas.
- Encourage the use of on-bill financing and other creative financing options to assist with the payment of new and conversion gas appliance installations and hook-up fees.
- Recommend the PUC and DCED create map(s) showing the areas likely underserved by natural gas based on analysis of population density and number of natural gas customers.
- Heating water accounts for 14 percent–25 percent of total household energy consumption. Solar water heaters can provide 85 percent of domestic hot water needs.
- Tankless water heaters heat the water as it runs through a coil in the appliance. These are more efficient than high efficiency heaters, given that they only use fuel to heat water when flowing (rather than heating the tank). They can save 45 percent to 60 percent over standard water heaters.
- For homes that use 41 gallons or less of hot water daily, demand water heaters can be 24 percent–34 percent more energy efficient than conventional storage tank water heaters.
- Instantaneous hot water heaters can be 8 percent–14 percent more energy efficient for homes that use a lot of hot water—around 86 gallons per day. You can achieve even greater energy savings of 27 percent—50 percent if you install a demand water heater at each hot water outlet.

Key Data and Assumptions	2015	2030	Units
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First Year Results Accrue

2015

Savings Targets

Heating Oil DSM

Achievable cost-effective savings in heating oil use as a fraction of total oil demand:

Residential

37%

Commercial

26%

Fraction of achievable savings reached under program

100%

Year in which target fraction reached

2030

Year in which programs fully "ramped in"

2030

Fraction of full program savings by year

0%

100%

Implied fractional new annual oil demand savings, residential

0.0%

4.6%

Implied fractional new annual oil demand savings, commercial

0.0%

3.3%

Residential

\$0.63

\$/gal

Commercial

\$0.98

\$/gal

Value from Pennsylvania: Energy Efficiency, Demand Response and On-Site Solar Potential. ACEEE 2009.

Assumed average measure lifetime

16

years

Avoided Delivered Heating Oil Cost

\$29.97

\$/MMBtu

Avoided Delivered Heating Oil Cost

\$3.9	\$/gal
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Avoided Heating Oil Emissions Rate

0.07	tCO ₂ e/ MMBtu
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Additional Data and Analyses	2015	2030	Units
DSM Heating Oil Analyses			
Reduction in Oil Use (Cumulative)	4,465	98,095	Billion Btu
Reduction in Oil Use (Cumulative)	32	490	Million Gal
Reduction as % of overall projected sales in that year	2.14%	32.51%	
Incremental GHG Emission Savings, Heating Oil	0.3	4.9	MMtCO ₂ e
GHG Emission Savings (2015-2030)		41.9	
Net Present Value (2015-2030) (DSM)		-\$137	\$million
Cost (2030) (DSM)		-\$14	\$million
Cost effectiveness (2030) (DSM)		-\$3	\$/tCO ₂ e
Cost effectiveness (2015-2030) (DSM)		-\$3.27	\$/tCO ₂ e
Total Fuel Consumption after DSM	204,490	141,333	Billion Btu
Total Heating Oil Consumption after DSM	1,397	966	Million Gal

Fuel Switching from Heating Oil to Natural Gas
2015
2030

Year	2015		2030	
	NG	Fuel Oil	NG	Fuel Oil
% of Homes (2013 data)	50.9%	17.6%		
PA Homes	4900000	4900000		
Homes using fuel	2,494,100	862,400		
Total BTU's consumed (2012 data)	2.06E+14	7.15E+13		
BTU's per household	8.26E+07	8.29E+07	8.26E+07	8.29E+07
BTU content of fuel	1,030	138,500	1,030	138,500
Total amount of fuel	199,991,262	516,194,946		
Units	MCF	gallon		
fuel per home	53,457	516	53,457	516
2015 cost per MMBtu (EIA est.)	11.554	25.101	15.208	29.266
2015 yearly cost per home	954	2,081	1,256	2,426
CO2 emission Rate	.12/scf	22.58/gallon	.12/scf	22.58/gallon
Emission per home (lb CO2e)	6,415	11,657	6,415	11,657
fuel savings (\$) per home		1,126.61		1,170.10
Emission savings (tons) per home		2.62		2.62
# of homes switching		4500		4500
Cost of switching per home		5600		5600
Gross cost of switching (\$ million)		25.20		25.2
Fuel savings (\$ million)		5.07		82.78
Net Cost of switching (\$ million)		20.13		-57.58
GHG Reductions by switching (MMtCO2e)		0.01		0.19
Cost effectiveness		1881.69		-306.88

Potential GHG Reduction:
Table 1. Estimated GHG Reductions and Cost-effectiveness for Heating Oil Conservation

Annual Results (2030)			Cumulative Results (2015-2030)		
GHG Reductions (MMtCO ₂ e)	Costs (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	GHG Reductions (MMtCO ₂ e)	Costs (NPV, Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
4.93	-\$14	-\$2.83	41.9	-\$151	-\$3.62

Table 2. Estimated GHG Reductions and Cost-effectiveness for Fuel Switching

Annual Results (2030)			Cumulative Results (2015-2030)		
GHG Reductions (MMtCO ₂ e)	Costs (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	GHG Reductions (MMtCO ₂ e)	Costs (NPV, Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
0.19	-\$57.58	-\$306.88	1.59	-\$138.54	-\$87.32

Potential Overlap:

- High Performance Buildings