Present and Future Energy Efficiency Upgrade and Conservation Opportunities for Residential Oil Heating in New York State

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Introduction

Recently, gas utility companies and proponents of increased natural gas usage have initiated efforts to expand the use of gas in residences through conversion from heating oil to gas. However, many of these programs are based on assumptions related to future oil and gas prices based on the past several years, and the supposition that these price differentials will continue indefinitely. This is clearly not supported by a review of residential oil and gas prices over the past 30 years as recorded and published by the US Department of Energy. In addition, fuel switching programs do not present alternative investments in oil heating equipment efficiency improvement that frequently offer a better return on investment for homeowners in New York State.

The purpose of this report is to supply well-documented information from highly reputable sources that clearly demonstrates the efficiency advances that have occurred with oil heat equipment over the past 20 to 30 years. In many cases, upgrading the efficiency of existing oil heating systems is a far better investment, i.e. lower cost and better resource conservation and emissions reductions than switching to natural gas.

The author of this report, John Batey, is President of the Energy Research Center, Inc (ERC) and a professional engineer with more than 35 years of experience in oil and gas energy conservation and air emissions studies and applications. He started the Oil Heat Research Program at Brookhaven National Laboratory (BNL) that was funded by the US Department of Energy in the mid-1970s. This program has evaluated the efficiency and emissions of oil heating equipment, and evaluated a full range of energy conservation options and conducted oil heat conservation research for more than three decades. Mr. Batey continues to supply engineering consulting services to BNL on fuel combustion projects including demonstrations of low sulfur and ultralow sulfur heating oil, biofuel blend combustion, and residential heating equipment performance funded by the New York State Energy Research and Development Authority, National Biodiesel Board, and other agencies. He has also supplied expert testimony at administrative hearings and trials related to combustion equipment performance.

Executive Summary

Oil heating equipment efficiency has increased dramatically over the past three decades, and many low- to moderate-cost conservation measures are now readily available that permanently lower heating costs and reduce air emissions, with good to excellent paybacks to homeowners. These oil heat conservation options are proven and well-documented by laboratory testing and field demonstrations including research at Brookhaven National Laboratory (BNL). This work includes the Oil Heat Research Program at BNL that has operated for more than 25 years through funding from the US Department of Energy (USDOE). (See References 8 to 16). This program assisted with development and market acceptance of many advances in oil heating equipment efficiency improvements. These include energy efficiency upgrade options ranging from low cost adjustments to replacements of oil burners, boilers, and furnaces, with good to excellent payback periods for homeowners. In older houses with original heating equipment, these upgrades can reduce energy use and costs by as much as 40 percent, and lower air emissions by a comparable amount.

The laboratory testing at BNL was fully supported by field studies that quantified the savings produced by a range of oil heat conservation improvements including high efficiency boilers and furnaces and combinations of options. A 2009 field study conducted by BNL and funded by the New York State Energy Research and Development Authority (NYSERDA) measured the energy savings in the lab and in the field by installing high efficiency oil boilers which fully substantiated earlier BNL research (See reference 1). The results demonstrate the efficiency improvements, energy savings, and air emissions reductions that are possible by installing new high efficiency oil heating equipment.

A 2006 pilot study funded by the USDOE accurately measured the energy savings for low income housing in Bridgeport Connecticut and demonstrated the economic viability of oil heat equipment upgrades with energy savings that exceed 50 percent in some cases with very attractive payback periods (see reference 3). It quantified the opportunity that now exists for using high efficiency oil heating equipment to substantially lower fuel use in a cost-effective way.

The Consumer Energy Council of America (CECA) was one of the oldest public interest and energy policy organizations, and they conducted a number of studies over the years, some of which addressed the issue of fuel switching. CECA reviewed past oil heat conservation studies and performed economic analyses including rates of return for a range of options in oil heated houses. They published several guides for oil heat conservation and related technical support documents. CECA concluded that, given long-term price parity between oil and natural gas, it is better to conserve a BTU of oil than to replace it with a BTU of gas. They further concluded that from an environmental perspective it is better to conserve a BTU of oil than to replace it with a BTU of gas.

The cost of switching from home heating oil to natural gas is substantially higher than the installed cost of the new gas fired boiler or furnace. It requires many costly modifications that include vent system and chimney upgrades, gas service extensions, removal of existing fuel storage tank, installing a gas fired water heater, and other changes. When the cost of extending the gas supply piping to the house is added, the payback can be longer than the expected lifetime of the new gas equipment - the investment may never pay back the homeowner's initial investment.

It is important to note that the projected savings and payback from fuel switching is based on current price differentials between oil and gas. History proves that residential energy prices vary from year to year, but over the long term, price parity between oil and gas is the norm. Basing long-term investments on short-term price differences is very risky for homeowners. It is not in the best interest of New York state homeowners and residents to base fuel selection choices which are twenty year investments on recent fuel price differentials since they are not guaranteed to exist in the long-term.

Utility-based marketing programs that promote switching from other fuels to natural gas do not include adequate information on energy conservation options with the existing fuel as a viable option for homeowners and residents. It is vitally important that homeowners who currently use oil for heating are informed about oil heat energy savings measures as an alternative to fuel switching. Energy conservation using the existing energy source can be the lowest cost and best option for New York State homeowners to lower energy use and costs and reduce air emissions in the most cost effective way.

Oil Heat Energy Efficiency Upgrade and Conservation Opportunities

Oil heat energy-saving projects using known and proven oil heat options including retrofits and new highly efficient oil boilers and furnaces substantially and permanently reduce fuel use and air emissions. Research over the past 30 years has definitively proven that oil heat conservation options are far more cost-effective than fuel switching and better investments for homeowners. This information and conclusions are available from a variety of exceptionally reliable sources including the US Department of Energy and Brookhaven National Laboratory, and must be incorporated into any analysis of cost savings and potential paybacks to offer homeowners the option of oil heat conservation instead of switching fuels. The economics of both available alternatives, including all costs, must then be fully evaluated to produce more reliable findings based on the best available information. Once completed, it is very likely if not certain that many homeowners will select oil heat energy efficiency upgrade and conservation programs in place of fuel switching. It is clearly in the best interest of all New York State homeowners and residents to produce maximum energy use savings, energy cost savings, and air emissions reductions in the most cost-effective manner.

Well-documented Information on oil heat conservation is available from decades of research at Brookhaven National Laboratory (BNL) , the New York State Energy Research and Development Authority (NYSERDA) and other groups. This includes recent field demonstrations including a USDOE-funded study of the Oil Heat Equipment Replacement Program at Action for Bridgeport Community Development (ABCD) in Connecticut. (A comprehensive list of all pertinent reference studies is included at the end of this document.)

These studies clearly demonstrate that Oil Heat conservation options can reduce fuel use from 25% to more than 40% , and often have very favorable payback periods to homeowners in the range of 1 to 5 years. Oil heat energy efficiency improvements are frequently far more cost-effective than fuel switching while achieving the same goals - energy conservation, lower heating costs, and reduced air emissions.

The Oil Heat Research Program at BNL was funded by the USDOE and directly measured savings for many oil heat options ranging from new Flame Retention Oil Burners to new High Efficiency Oil Boilers and Furnaces. Various studies over many years have shown that simply replacing outdated oil burners with the newer flame retention units can produce 16% fuel savings with excellent payback periods of only 1 to 2 years (see references 8, 11, 12, 13, and 14). This is one of the most cost-effective options for reducing fuel consumption and heating costs with minimal initial cost. Lower income households in particular can benefit from this highly effective and low cost option. Brookhaven found that replacing

outdated oil boilers and furnaces with new higher efficiency units produces, on average, 24% savings and 6 to 8 year paybacks.

BNL oil heat research identified and quantified energy and cost savings and payback periods for a range of oil heat energy efficiency improvements virtually all of which are still equally valid and applicable today. The table that follows summarizes some of the key findings and recommended oil heat equipment upgrades, many of which have excellent payback periods that are far superior to fuel switching.

Energy-Saving Action	Savings %	Payback Period (Yrs)
Reduced Burner Nozzle Size	8	0 to 0.4
Boiler Water Temp Reduction	5	0 to 0.5
Automatic Setback Thermostat	8	1.3
Burner Efficiency Adjustment	3	0 to 1.3
Retention Head Oil Burner	16	2.1
New High Efficiency Boiler	24	8.3

Source: References 8, 11, 13, 14, and 16.

The conservation options identified and evaluated by the BNL Oil Heat Research Program include low cost options with excellent payback periods, especially for older heating equipment. Reducing the fuel firing rate by installing a smaller nozzle can lower fuel use by 8 percent for older boilers. Lowering the boiler water temperature reduces off-cycle heat losses from the boiler and lowers annual fuel use by 5 percent. These are both no-cost actions if included as part of an annual tune-up. Automatic setback thermostats are very effective in reducing annual fuel use and were found to save about 8 percent by BNL. These savings are considerably higher if the setback period is extended. Burner efficiency adjustments lower fuels use and are now typically a part of annual burner service and tune-up. Regrettably, lower-income households tend not to purchase their heating oil from full-service companies, and their heating equipment is not covered by an annual service agreement. The lack of an annual tune-up thus results in higher than average fuel use.

Equipment upgrade options evaluated by BNL include installing flame retention oil burners and replacing outdated boilers with new, high efficiency models. New burners reduce fuel use by 16 percent, lower air emissions, and produce an excellent payback on the order of 1 to 2 years. While all new boilers have included flame retention oil burners for many years, this is still an option for older heating equipment that is most commonly found in low income

households. Replacement high efficiency boilers can permanently reduce fuel use and related air emissions by 24 to 26 percent, on average, while offering a lower cost and better payback than fuel switching. Depending on the age and operating efficiency of the boiler being replaced, the energy savings and emissions reductions can be much higher.

The energy use/cost savings of the various oil heat conservation options have been proven repeatedly by both laboratory and field testing. Combinations of options including new oil burners, setback thermostats, and attic insulation can produce optimum savings at low cost with paybacks that are often on the order of 3 years. The low initial cost of these combinations are much lower than fuel switching and are especially valuable in lower income households where initial costs are critical.

For older houses with outdated oil boilers, the savings can be on the order of 40% to 50% with very good payback periods of 4 or 5 years at a cost much lower than other options. The table that follows shows four example case studies based on field studies by the Energy Research Center funded by the US Department of Energy and NYSERDA, (See references 3 & 4). The new oil burner shown in Case 2 produced 16.9 percent savings, with a payback of only 1.2 years. In Case 4, a new boiler reduced annual energy use by more than 50 percent and produced a payback in about one year partly due to the initially high energy use of 2018 gallons a year before the boiler replacement.

Payback Analysis Based upon Energy Saving Measurements

Ref: USDOE / ERC

	Case 1	**Case 2**	**Case 3**	**Case 4**
	Furnace	**Oil Burner**	**Boiler**	**Boiler**
Fuel Use - Gal/yr	856	1045	980	2018
Fuel Price - $/Gal	4.00	4.00	4.00	4.00
Savings - %	31.4	16.9	35.1	52.5
Savings - $/Year	1,075	706	1,375	4,240
Installed Cost - $	3,680	850	4,600	4,500
Payback: Years	**3.4**	**1.2**	**3.3**	**1.06**

Note: Installed costs vary widely and are included for illustrative purposes only.

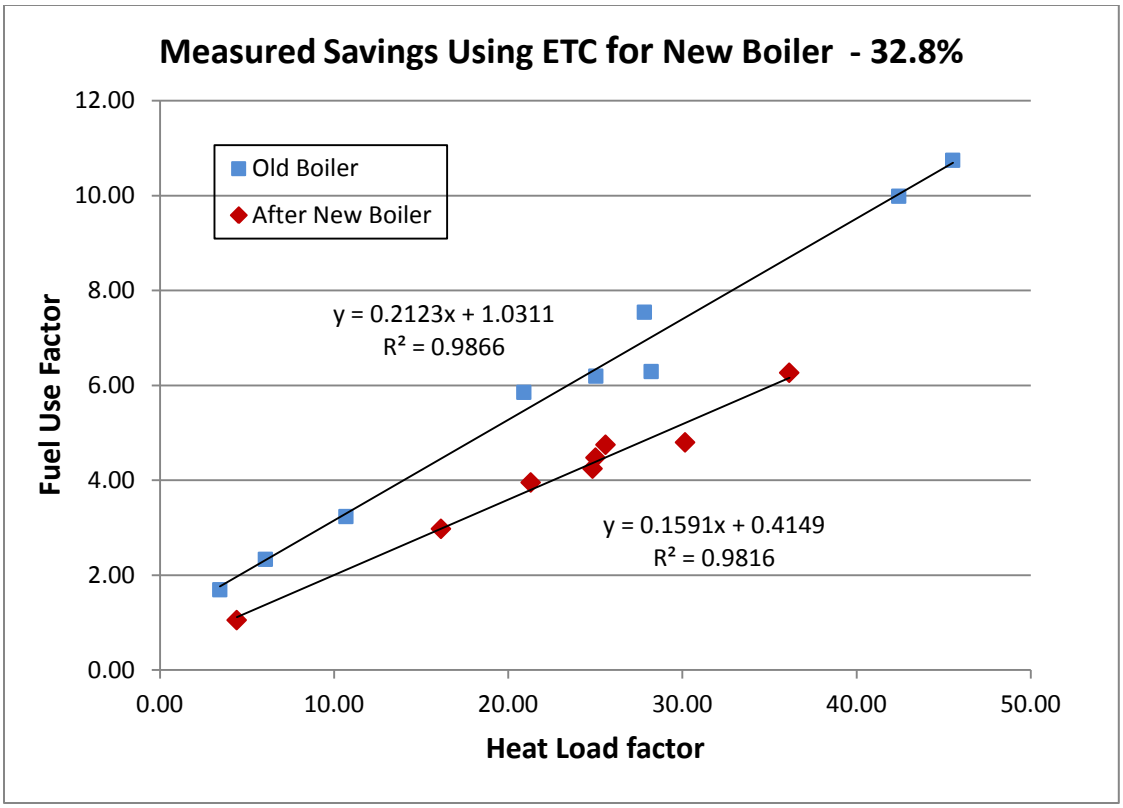
A study of energy savings from the installation of replacement high efficiency oil boilers was completed by BNL and ERC in 2009 supported by funding from NYSERDA. (See Reference 1). This study included both laboratory-based measurement of energy savings and field studies using a highly accurate fuel tracking system to measure actual savings. Measured energy savings averaged 25.9 percent, and in one case was 48.3 percent.

The table below from this 2009 study summarizes the results from actual field measurement of savings using the Energy Tracking and Control (ETC) method to measure pre- and post-replacement energy use. Results for the 10 houses are as follows:

	% Saved
Test house 1	27.3
Test house 2	34.4
Test house 3	22.6
Test house 4	14.7
Test house 5	32.8
Test house 6	18.3
Test house 7	17.8
Test house 8	48.3
Test house 9	30.0
Test house 10	13.1
AVERAGE	**25.9**

The plot that follows from the same study shows the ETC test results for a High Efficiency/ Low Mass Steel Boiler installed in a house on Long Island, New York. An example plot for Test House Number 5 follows.

The new oil burner was installed in October 2005. The upper plot is for the **older oil boiler** before the upgrade. The fuel use data fit before the new boiler was installed is excellent with an R-Square value for this profile is 0.9866. The bottom line is the fuel use profile based on actual fuel deliveries for the **new high efficiency oil boiler**. It also had an excellent data fit with a R-Square value of 0.9816. By comparing the two plots over the entire range of heat load factors, the energy savings achieved by installing the new boiler was determined to be 32.8 percent with an uncertainty factor of less than two percent.



These field-measured fuel savings are higher than savings measured in the laboratory at Brookhaven National Laboratory for a baseline boiler; but this is to be expected given that the boiler that was replaced was an older and less efficient design with higher off-cycle and jacket heat losses.

An important finding of these laboratory and field efficiency tests is that combustion efficiency tests and Annual Fuel Utilization Efficiency (AFUE) ratings cannot be used to accurately predict actual fuel savings in the field when installing new boilers. AFUE comparisons severely under-estimate the savings that are produced by new high efficiency boilers. This was first reported by BNL in the late 1970s, and current studies further substantiate this conclusion. AFUE ratings are primarily based on combustion efficiency tests which do not adequately account for burner and boiler off-cycle heat losses, jacket heat losses, and heat losses related to infiltration of cold outdoor air which is exhausted by the heating equipment. Field tests using the ETC method takes all of these losses into account and accurately measures actual fuel savings when new high efficiency boilers and furnaces replace outdated equipment including high mass and coal-converted boilers with high off-cycle flue and jacket heat loss rates.

A pilot field study was conducted by the US Department of Energy in 2006 to measure oil heat savings by the Weatherization and Heating Equipment Replacement Programs

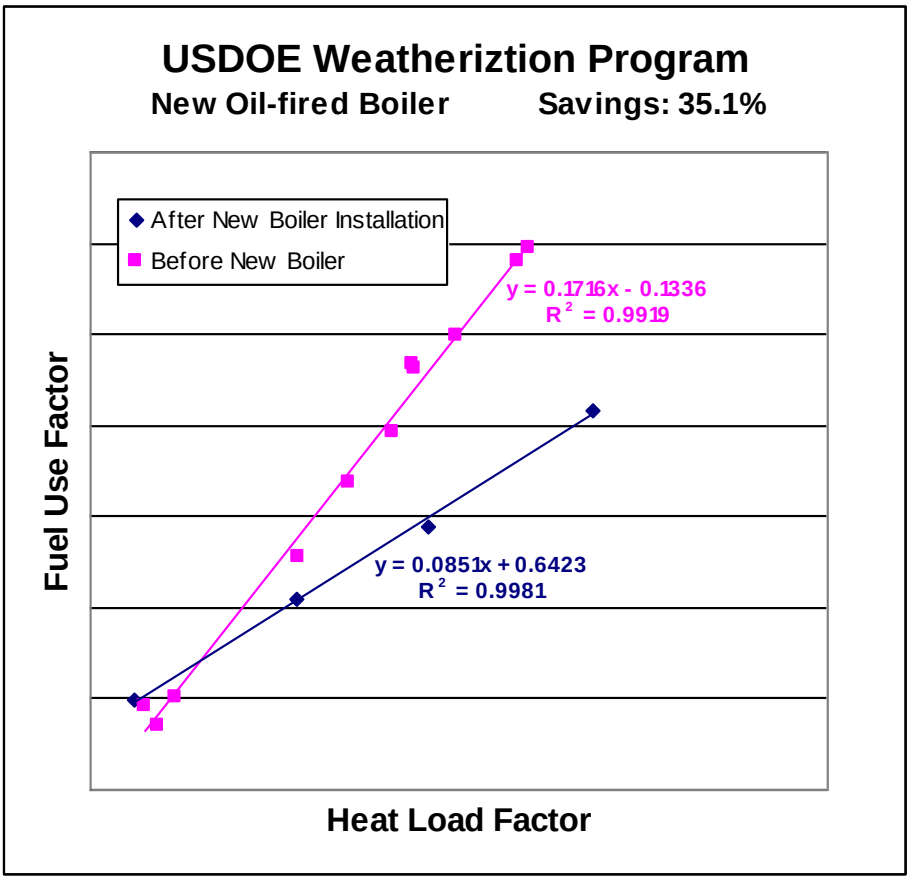
operated by Action for Bridgeport Community Development (ABCD) in Connecticut. (See reference 3). Fuel use data were collected for each house before and after conservation options were installed and actual fuel savings were measured. The average savings measured for boiler and furnace replacement was 26.0 percent, with one-third of these oil heating systems upgrades saving more than 30 percent. Payback periods were as low as 1.9 years for the ABCD oil heat conservation program. These excellent savings clearly demonstrate the cost effectiveness of the energy conservation and heating equipment replacement programs and the substantial benefits available to homeowners.

The table below shows the savings that were measured for eight houses. This includes houses that were insulated and houses with new heating equipment (Heating System Replacement Program – HSRP).

ABCD Weatherization and HSRP Measured Savings

Test Case	Savings %
1	31.4
2	35.1
3	22.0
4	19.8
5	27.8
6	36.1
7	22.5
8	13.3
Average	**26.0**

Case 2 of the 2006 pilot field study shows the fuel savings for a house with a new high efficiency oil boiler. The original boiler was an old and inefficient coal-converted unit. The upper plot is the measured fuel use profile with the old coal-converted boiler and the lower plot is the ETC fuel use profile for the new boiler. The measured savings is 35.1 percent with an uncertainty of less than one percent. This field test case again demonstrates the savings potential by replacing older oil fired boilers in the field with new higher efficiency boilers.



Older outdated boilers are most often found in lower income households, and new high efficiency boilers and furnaces can produce fuel savings of 45% and 50% in some cases with payback periods of 1 to 4 years. Conservation is clearly the most important and most cost-effective energy saving option for homeowners in New York State who currently heat with oil.

The **Consumer Energy Council of America** (CECA) was founded in 1973 and prior to ceasing operation in 2007 was one of the nation's foremost public interest energy policy organizations. CECA's Research Foundation provided information, analysis, and technical expertise on a wide range of energy-related issues. Their goal was to ensure reliable and affordable energy for all sectors of the nation. CECA placed a strong emphasis on conservation and energy efficiency programs as the cornerstone of a sound economy.

Over the years, CECA-RF conducted several studies comparing the relative merits and economics of homeowner investments in conservation compared to fuel switching. These studies concluded that : "It is financially unwise for consumers to convert from oil to gas heat. In 95 out of 100 cases, where consumers do not need a new heating system, it makes economic sense to stick with oil and invest in conservation." (See references 6 & 7).

The CECA reports and brochures listed both singular efficiency upgrade options as well as combinations of options that offer better paybacks than switching fuels. These are summarized as follows.

		Energy	Rate of Return	
Conservation Measure	**Cost $**	**Savings %**	**Avg Use %**	**Low Use %**
House Doctor	570	13	32.8	17.5
Ceiling Insulation	650	16	39.4	24.7
Wall Insulation	1,360	15	13.1	7.3
Flame Retention Burner	580	16	46.5	28.8
Setback Thermostat	350	9.5	45.4	28.2
Burner & House Doctor	1,190	27	35.2	22.2
Burner & Ceiling Insul'n	1,540	29	27.4	17.3

The highest energy savings of the options evaluated are for the combined measures *Burner & Ceiling Insulation* and *Burner and House Doctor*, which are moderate cost measures with excellent rates of return for the average use house. The highest rates of return are for the *Flame Retention Burner* and *Setback Thermostat* based on the costs and savings used in this study. *Ceiling Insulation* and *House Doctor* produce sizable energy savings, are relatively low in cost, and also yield excellent rates of return. *Wall Insulation* has the lowest rate of return at 13.1 percent.

While the installed costs and payback periods ..(which are based on fuel prices)... vary from year to year, these oil heat energy efficiency upgrade measures are clearly far better investments for most homeowners than switching fuels.

CECA studies which investigated the relative benefits of oil heat energy conservation versus switching to natural gas over the past two decades concluded that: In the long-term price parity is likely for the two fuels, and from an economic perspective it is better to conserve a BTU of oil than to replace it with a BTU of gas. Energy conservation extends available resources and helps to offset future price spikes.

CECA also concluded that from an environmental perspective, it is much better to conserve a BTU of oil than to replace it with a BTU of gas. (See references 6 & 7).

Fuel Switching Costs and Benefits

Many of the oil heat efficiency improvement options that are summarized in this report are of low to moderate cost with excellent energy savings and very favorable payback periods for homeowners. They have been proven by many years of laboratory and field-based research by the US Department of Energy and National Laboratories. In contrast, the costs and benefits of switching fuels, are often not as favorable with much higher costs, and often with less favorable economic benefits and paybacks.

The cost of converting to natural gas is much higher than that of a heating system replacement in that it not only requires complete replacement of the boiler or furnace, but also necessitates many other high cost modifications including: new exhaust pipes, chimney replacement or relining, gas main and service line extension, new gas water heater, gas line and meter, removal of the existing fuel storage tank, and some other hidden costs. These added costs can dramatically increase the payback period to a point which it is greater than the 20 year expected lifetime of the new gas heating equipment.

The added installation requirements and costs for conversion to natural gas heat contribute to longer paybacks compared to other options including oil heating system upgrade measures. Homeowners must be made aware of all conversion costs so that they can make an informed decision regarding fuel switching and other energy-saving options. In addition, these fuel switching costs can vary widely from house to house, and so an accurate estimate of all costs must be presented to each homeowner in order that a decision on whether to switch to natural gas is made based on the best available information. Presenting costs estimates for fuel switching for "typical houses" is not in the best interest of homeowners, and conversion costs must be determined on a case-by-case basis before the financial investment is made.

The discussion that follows offers an overview of the these total costs, many of which are often overlooked, and how much they can vary.

The price of both new gas and oil-fired boilers and furnaces varies depending on size and operating efficiency, and the higher efficiency condensing units are substantially higher in cost. New oil boilers and furnaces which have rated efficiencies in the 85 to 89 percent range, cost approximately $4,500 to $6,000 installed. Past research indicates that the total installed cost of comparable efficiency gas boilers average approximately $7,500 including installation (See references 7, 9, 29, Consumer Price Index corrected).

When an existing oil-fired heating system is switched to natural gas, a number of additional and costly modifications are required that appreciably impact the overall cost and economic payback of the fuel conversion. These include the following:

Chimney upgrades are frequently required due to the increased moisture content of natural gas exhaust and increased condensation within the chimney that can cause chimney blockages to occur which have resulted in fatal carbon monoxide incidents. In addition, some older chimneys in oil heat installations are oversized for the new gas boiler or furnace. Chimney relining with a metal liner is often required which can vary in cost depending on the chimney height and ease of installation. An alternative is to install a sidewall venting system that includes a powered vent fan, vent piping, draft control device, and controls. Chimney relining and power vents are costly modifications that add approximately $1,600 to $3,000 to the new gas heater installation (See references 7, 9, 29,Consumer Price Index corrected).

A new gas powered hot water heater is also required when the oil heating system is replaced. Many existing oil boilers include tankless coils installed through the side of the boiler to produce domestic hot water. When a house is converted from oil to gas, a new gas fired water heater is needed. The installed cost of the new gas water heat is on the order of $1,300.

Removal of the fuel oil tank is another added cost of conversion that can range from $600 to $700 for an above ground or basement fuel tank to $2,500 for a larger in-ground storage tank. In addition, loss of the value of the remaining fuel oil can be $300 or more.

Other added costs of conversion include new vent piping and draft control devices, and related piping from the meter to the burner that total approximately $500, including installation.

These added costs of fuel switching are often overlooked but increase the cost of conversion from home heating oil to natural gas by $4,000 to $7,500 or more which can double the cost of the equipment installation and the payback period for homeowners. When these costs are added to the installed gas equipment, the full cost for fuel switching can be as high as $11,500 to $15,000 per house.

The most costly of all the modifications needed to switch to natural gas is connection of the new gas heating equipment to the existing gas mains. It is conservatively estimated to cost approximately $100 per linear foot of gas main installed and $25 to $30 per foot of service lines from the street to the house. For the purposes of this economic analysis, the $100 per foot of gas main extension was used. If the first 100 feet of main or service line needed to connect to a prospective customer are paid by the existing utility ratepayers, an added distance of only 100 feet costs $10,000, and an added distance of 200 feet costs $20,000. The table that follows summarizes the cost of fuel switching for each house including extending the fuel main for a range of distances from the house to the main, and omitting the service line costs.

Costs of Switching to Natural Gas

Distance to Gas Main (ft)	Connection Cost ($)	Installed Cost of Gas Heater ($)	Total Cost of Fuel Switching ($)
0 - 100	0	11,500	11,500
		15,000	15,000
200	10,000	11,500	21,500
		15,000	25,000
300	20,000	11,500	31,500
		15,000	35,000

The total cost of switching to natural gas increases to $21,500 to $25,000 for a gas service extension of 200 feet. This has a substantial impact on the economics of the fuel conversion and requires high initial investment by homeowners. It also increases the investment payback period which can extend beyond the lifetime of the new gas fired heating equipment. As the distance from the house to the gas main increases to 300 feet and further, the cost of interconnection becomes prohibitively expensive. This analysis clearly demonstrates that the total cost of fuel switching is much higher than the cost of the new gas boiler or furnace, and can vary widely from house to house.

The goal of switching to natural gas from other fuels is to lower heating costs for homeowners, and it is not based on efficiency improvement but on the current price advantage of natural gas. New gas boilers and furnaces used in fuel switching are generally not high efficiency condensing units because of their higher equipment and installation cost. Therefore, the economic benefit is based solely on fuel price differentials that have occurred over the past several years. The decision to change fuels, however, is a costly, long-term investment as boilers and furnaces have effective lifetimes only on the order of 20 years. Therefore, the economic analyses proposed by proponents of fuel switching implicitly assumes that this price differential will exist, unchanged into the indefinite future, so that the homeowner will recover their initial investment costs.

History indicates that this is most likely not a good assumption. Over the past thirty years both oil and gas prices in New York State have varied but on average have been nearly equal. The US Department of Energy's Energy Information Administration publishes average statewide residential fuel prices. These data were tabulated and reviewed, and show that from 1983 through 2012 the average price of natural gas was only 2 percent lower than home heating oil in New York State, (See references 25, 26, 27, and 28). Furthermore, for 16 out those 30 years, oil prices were actually lower than natural gas prices by more than 30 percent for some years. Clearly, oil and gas prices and price differentials vary from year to year, but price parity has prevailed in the long term.

The payback on the investment for homeowners who convert from home heating oil to natural gas has be evaluated based on projected fuel cost savings. The expected payback is evaluated for projected future home heating oil and natural gas prices linearly extrapolated for the next 20 years from USDOE/EIA prices for 1983 through 2012 (see references 25 and 26). The linear regression approach applies actual past fuel prices over a 30 year period and projects them forward. It is not based on an assumption of extending the current fuel price differential twenty years into the future.

The USDOE/EIA regression analysis yields cost savings averaging $1000 a year projected for 20 years. This cost savings projection is used to estimate payback periods for homeowners switching from home heating oil to natural gas. The table below summarizes these calculated payback periods.

Payback Periods by Switching to Natural Gas

Distance to Gas Main (ft)	Total Cost of Fuel Switching ($)	Payback Period (Years) ref: USDOE/EIA
0 - 100	11,500	11
	15,000	15
200	21,500	21
	25,000	25
300	31,500	31
	35,000	35

The payback periods are strongly impacted by the installed equipment costs including the cost of interconnection to the gas main. The best case for fuel switching is the lower conversion cost case with no cost to connect to the main. However, this produces paybacks on the investments of 11 to 15 years. When the distance to the gas main is 200 feet or longer, the payback period increases to 21 years or more, which is actually longer than the expected lifetime of the new gas heating equipment.

The real financial cost to a homeowner switching from another fuel to natural gas is often substantially understated by gas marketing and fuel conversion programs which do not offer homeowners the best and most complete available information, or totally omit some of the key cost factors discussed in this report.

We may conclude that basing long-term decisions (20 years equipment lifetimes) on short-term price differences is very risky and, in many cases, is not in the best interest of homeowners in New York State. Furthermore, heating oil is the fuel that backs up interruptible natural gas at times of maximum demand in the winter. Fuel switching programs that convert large numbers of residences to gas will undoubtedly stress the already strained gas supply and distribution system and can lead to non-residential gas shortages and rationing in the future. From an energy policy standpoint, it is an unacceptable choice to expand firm residential gas load at the expense of making gas interruptions to the utility company's non-residential base more frequent and for longer durations.

Oil Heat Conservation Summary

It is suggested that all utility-based fuel switching programs being considered in New York State revisit fuel switching costs and dependable future fuel price comparisons. The benefits of a comprehensive program for oil heat energy efficiency upgrades versus fuel switching can then be compared fairly, based on well-documented energy savings for a full range of options. In addition, the costs of fuel switching vary widely from installation to installation, and each homeowner must be presented with accurate conversion cost estimates that reflect all the modifications that are needed before converting from oil and other fuels to natural gas.

It is important that homeowners who currently use oil for heating be informed of oil heat conservation options using well-established research findings related to oil heat energy conservation, savings, and paybacks as presented in this report. Conservation is often the lowest cost and best option for homeowners to lower energy costs and reduce air emissions in the most cost-effective way.

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