

The Global Warming Benefits of Oil Heated Homes

Global Climate Change in Maine - The Risks and Opportunities

Conference

**Presented By: John Batey, PE, President, Energy Research Center, Inc.
(203)459-0353**

This report was prepared on behalf of the Maine Oil Dealers Association and summarizes many years of research. The author was former head of the Oil Heat Research Program at Brookhaven National Laboratory which is funded by the US Department of Energy. This program has contributed to the substantial increase in the efficiency of oil heating equipment over the past 25 years, and it has helped lower greenhouse gas emissions by oil heating equipment by 40%.

Negligible Greenhouse Gas Reductions By Replacing Residential Oil Burning Equipment with Natural Gas

Home heating oil releases more carbon dioxide than natural gas burners, but does not produce more global warming. The primary component of Natural Gas is methane (CH₄) which is a powerful greenhouse gas that is between 20 and 70 times more powerful than carbon dioxide in producing global warming (ref 1,2). Leakage of natural gas into the atmosphere is known to occur during its production, distribution, and transmission to end users. Recent research by the Gas Research Institute and others indicates that these methane leaks are large enough to negate the greenhouse benefits from switching from oil to natural gas, because the decreased Carbon Dioxide emissions are counteracted by the global warming impact of spilled methane (ref 1,3, 6).

Converting Electrically Heated Homes to Oil Lowers Greenhouse Gas Emissions by More Than 50%

Homes that are now heated by electricity can lower their emissions of carbon dioxide into the atmosphere by **more than 50% by switching to oil heating equipment**. Carbon Dioxide is the most prevalent gas believed to contribute to undesired global warming. The reduction of Carbon Dioxide with oil equipment equals 16 tons per year for each house that is converted from electric heat and hot water for the average energy use in the Northeast. Simply replacing an electric water heater with an oil powered unit can lower carbon dioxide release by more than 2 tons per year. Additional benefits of switching from electric to oil heat include: (1) much lower heating cost (less than one-half to one-third of electric heating cost), (2) excellent paybacks for homeowners that are typically between 2 to 3 years, and (3) lower emissions of other air pollutants including nitrogen oxides (an ozone precursor) and particulate matter.

Electric power plant emissions are much higher than oil burners. The total CO₂ emission in the US in 1995 from electric power plants was 3.94 trillion pounds, and the total energy generated was 2,994 billion Kwh (ref 8). This corresponds to **385 pounds of Carbon Dioxide per million BTU** of electric energy in the power plant (excluding energy losses during power transmission and distribution, and in the home). Home oil burner emissions are much lower based on the USEPA emission factor of 22,300 pounds of CO₂ per thousand gallons of oil (ref 7). This is equivalent to **161 pounds per million BTU of fuel consumed**. This is 58% less than electric heat emissions.

Electric heating produces much higher emissions of carbon dioxide than oil heat because electric power plants burn fuels that produce more carbon than home oil burners. Also, only about one-third of the energy entering the power plant is converted to useful heat in your home. In Maine the overall efficiency of electricity generation in 1995 was only 32% (ref 9). Therefore, more fuel must be burned

in the electric power plant to produce the same useful heat which increases the emissions of all air pollutants including carbon dioxide.

Based on typical energy usage rates and heating equipment and water heater efficiencies (ref 10), the average reduction in carbon dioxide emissions by switching from electric to oil space heating and hot water can be determined. **Electric** heating releases **50,000** pounds of carbon dioxide a year when transmission, distribution, and in-house energy losses of 10% are included. Modern **oil** heating equipment produces only **22,400** pounds per year (per house) on average in the Northeast at an efficiency of 85%. Similarly, for home water heaters, electric powered units produce 11,100 pounds of carbon dioxide per year based on an average electric water heater efficiency of 90% (ref 10), and transmission and distribution losses at 8%. Oil powered water heaters produce only 6,300 pounds a year with an average efficiency of 61% (ref 10). Therefore, replacing electric space and water heating with oil powered equipment reduces total emissions from 61,100 to 28,700 pounds, which equals **32,400 pounds of carbon dioxide each year**. This is a reduction of **16 tons a year** for each home that switches to oil. If only the electric hot water heater is converted to oil, this reduces carbon dioxide emissions into the atmosphere by more than **2 tons per year** (for each heater). Clearly, oil powered space and water heaters offer an important opportunity for lowering emissions of greenhouse gases that can have a positive impact both in Maine and nationally.

Homeowners realize other important benefits by switching from electric to oil heating equipment. Energy cost savings by converting a typical home in Maine from electric to oil heat and hot water can exceed **\$3,500 a year** based on average electric rates and oil prices. This produces a 20-year cost savings of more than \$70,000 for Maine homeowners. Short paybacks are often produced, and the new oil equipment, on average, pays for itself in about 1.8 years based on December 1998 energy prices (ref: US Department of Energy). Payback periods less one year are possible for some larger homes and with low conversion costs (eg. electric furnaces).

Switching from electric to oil heat is an excellent investment which allows homeowners to permanently reduce their energy use and heating costs, while also lowering greenhouse gas emissions. The 20-year reduction in greenhouse gas emissions is approximately 320 tons of carbon dioxide for each home that is converted to oil.

Another important benefit of conversion from electric to oil heating is reduced emissions of other air pollutants. These include: Nitrogen Oxides, Particulate Matter, Carbon Monoxide, Hydrocarbons, and Sulfur Oxides.

Converting Electrically Heated Homes to Oil Lowers Ozone and Particulates

In addition to reducing greenhouse gas emissions, switching homes from electric heat to oil substantially lowers the emissions of Nitrogen Oxides (an ozone precursor) and Particulate Matter. The total **Nitrogen Oxide** release (a primary pollutant that produces ozone) from electric utilities in the US in 1995 was 7,135 thousand short tons, while the total electric energy generated was 2,994 billion kilowatt-hours (ref 8), and slightly lower emissions were shown in a USEPA report (ref 14). The average value is 1.32 pounds of NOx per million BTU of electric energy. If 10% is added for transmission, distribution, and in-home energy losses, this becomes **1.45 Lbs/MMBTU** of energy delivered to the home. Nitrogen Oxides from oil heating equipment in homes is 0.13 Lbs/MMBTU based on recent USEPA emission factors (ref 7). When typical heating equipment efficiency of 85% is included, this becomes **0.15 Lbs/MMBTU**. This is almost ten times less than the NOx emissions per BTU of heat delivered with electricity - a 90% reduction

The total release of **particulates** (PM-10) from electric utilities in the US in 1995 was 258 thousand short tons, while the total electric energy generated was 2,994 billion kilowatt-hours (ref 8,14). This

equals 0.051 pounds of PM per million BTU of electric energy. When 10% is added for transmission, distribution, and in-home energy losses, this becomes **0.056 Lbs/MMBTU** of energy delivered to the home. Particulates from modern oil heating equipment in homes is only 0.003 Lbs/MMBTU based on recent USEPA emission factors (AP-42). This is much lower than older residential oil burners and reflects decreases that were recently acknowledged by the USEPA (ref 7). When typical heating equipment efficiency for new oil heating equipment is included, the particulate emission factor becomes **0.0035 Lbs/MMBTU**, which is 16 times less than the PM emissions per BTU of heat delivered with electricity - a 94% reduction.

Major Reductions in Greenhouse Gas Emissions by Oil Heating Equipment

The Maine Oil Dealers Association is contributing to lowering greenhouse gases and global warming by supporting an active and successful program to convert homes from electric heat to oil.

Brookhaven National Laboratory's oil heat research program has also helped to substantially reduce emissions of carbon dioxide gas, by more than 470 million tons over the past 15 years. Brookhaven's oil heat research program is credited with efficiency improvements that have reduced fuel oil use in homes by more than 40 percent. This is a remarkable record of accomplishment unmatched by other energy use sectors in the US. The improved efficiency and lower fuel use facilitated by this research program also continues to reduce air emissions including carbon dioxide gas. If all energy use sectors reduced fuel consumption by 40%, as accomplished to date by residential oil heat, the global warming reduction targets for greenhouse gases that have recently been proposed worldwide could be reached easily.

Homeowners with older oil heating systems can also improve their equipment's efficiency, lower heating costs, and reduce greenhouse emissions by implementing a range of proven energy conservation measures. These include: installing a new flame retention oil burner (15% savings), a new boiler or furnace (20% to 40% savings), setback thermostats, efficiency tune-ups, and a many other options. Contact Maine oil dealers for assistance.

Summary

The oil heat industry in general, and the Maine Oil Dealers Association specifically, has produced a substantial reduction in greenhouse gas emissions over the past 20 years. Home heating oil has a global warming impact comparable to natural gas when both carbon dioxide and methane leaks are included. Replacing electric heat in homes with oil equipment lowers greenhouse gas emissions by more than 50% - or 16 tons of greenhouse gases per year for each house that is converted to oil. Other benefits of conversion from electric to oil heat include: an 80% reduction in heating costs, and lower air pollutant emissions. Nitrogen oxides (which form ground level ozone) and particulate emissions are lowered by 90% and 94% respectively by converting to oil. The oil heat industry, working with Brookhaven National Laboratory and the US Department of Energy, has reduced greenhouse gas emissions from oil heated homes by more than 40% - a remarkable achievement that is unmatched by other energy sectors.