Getting Off Oil

Maine & New Hampshire have more than 750,000 homes that are heated with oil. The two states combined import more than 2.5 billion gallons of fossil fuel per year and export more than $3 billion out of their local economies to pay for it—much of this money flows to countries that do not care much for America. Despite the region's pristine environmental reputation, ME & NH have the highest per capita CO2 emissions of all New England states. ReVision Energy's goal is to transition people away from unsustainable dependence on fossil fuels.

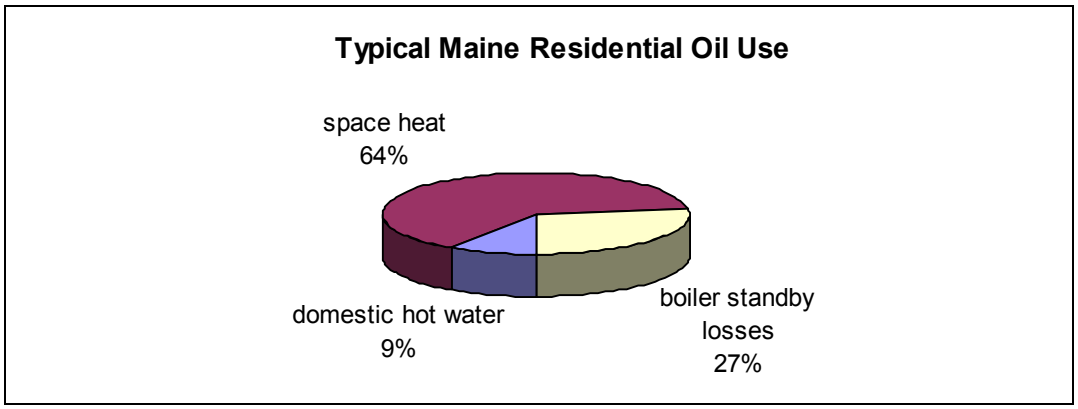
If the planet is to avoid the most serious consequences of global warming, we will have to reduce our carbon footprint by 50% over the next two decades. That means every house in Maine and New Hampshire needs to drastically shrink its carbon footprint. For most of us, that means weaning our homes from oil. Here's how:

First, we need to understand where our oil goes. The heat energy from every gallon of oil you burn goes to one of three places:
1. up the chimney or into the basement (known as 'standby' losses)
2. heating domestic hot water
3. heating your living space

To find out where your oil heat energy is going, take a look at a year's worth of oil bills with delivery dates and gallons. Now look at the first fill up in the fall, after summer. If this fill up happens before the middle of October, the fuel consumption likely includes very little, if any, space heating load, and most of the oil heat energy is being used to heat domestic hot water and the rest is being wasted through boiler 'standby' losses (heat which goes up the chimney and into the basement). Divide the number of gallons delivered in the first fall fill up by the number of days since the previous delivery in late winter/spring. That result is your non-heating season daily oil usage, which consists of two parts: domestic hot water heating and boiler standby losses.

For example, lets assume that your home consumed 1,000 gallons of oil during a calendar year and that the October fill up was 160 gallons and that it had been 160 days since your last oil delivery. This means your non-heating season daily oil usage is 1 Gallon per day (which is about average). The average American family uses roughly 64 gallons a day of domestic hot water for showering, dishwashing and laundering. The energy required to heat that water is equivalent to roughly the energy that exists in ¼ gallon of oil, burned at 80% efficiency, so the other ¾ G/day is attributable to boiler standby losses. Here is how the oil consumption breaks down:

Domestic Hot Water:	.25 gal. oil/day	91 gal per year
Boiler Standby Losses:	1-.25=.75 gal. oil/ day	273 gal per year
Space Heating:	1.74 gal. oil/day	635 gal per year



OK, now we know where our oil is going—wow, 273 gallons up the chimney and into the basement! Now let's figure out how to reduce it. You've got about 5 options that, when combined, can drastically reduce or even eliminate the fossil fuels you consume to heat your house and hot water. Which one you do first will vary from house to house, but most houses will need to do most or all of the options over time to make significant, cost-effective oil reductions. This is a process. You don't need to do all of them at once, but you need to develop a plan and to start reducing oil consumption, CO2 emissions and fuel costs.

Solar Hot Water

This is a great option for most homes with a decent southern exposure. A properly sized solar hot water system will eliminate 80% of the domestic hot water loads, or about 75 gallons of oil per year. However, if you have an oil boiler that is or can be cold started, the savings can be much more substantial. Because the solar caries nearly 100% of the domestic hot water load during the non heating season, you can eliminate the boiler standby losses entirely for that half of the year. In our example above, where boiler losses plus domestic hot water equals a gallon a day, a well sized solar hot water system will eliminate 180 gallons of fuel oil in the summer alone, plus another 50 or so gallons during the heating season. Tax credits and State rebates make this a very cost effective measure to reduce oil consumption.

Oil Boiler Upgrades

Most oil boilers can be upgraded to a "cold start' mode, which means changing the control settings such that the boiler is off unless specifically called to produce space heat or hot water. As discussed above, converting a boiler to cold start mode in conjunction with a solar hot water installation is a no-brainer because it almost completely eliminates boiler standby losses in the summer months, thus dramatically improving the savings from the solar system. Adding some other boiler control upgrades is more low hanging fruit. Either outdoor reset control or a boiler firing manager accomplish the same thing; they make the boiler run cooler and for longer run times, which increases overall boiler efficiency by between 10 to 15%. Many products promise

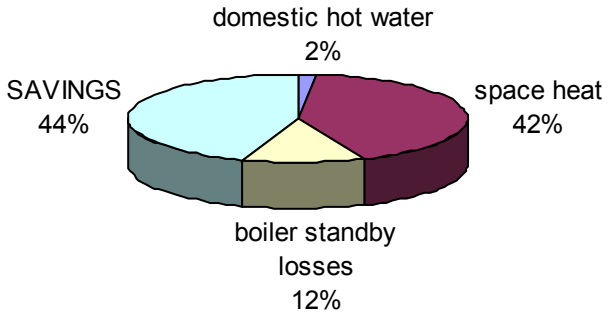
a 10% reduction in oil consumption. Consider the example 1,000 gal per year house. After the installation of the solar hot water system and cold starting the boiler, that house will be burning 770 gallons of oil a year. 10% of that is 77 additional gallons saved per year. At only about $600 for boiler upgrades, that is some low hanging fruit.

Air Sealing and Insulation Upgrades

If you have a leaky house, you may benefit greatly from air sealing and insulating. For information about do it yourself projects that can save you up to 20 percent on your heating bill, see: http://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_sealing

To find a local professional to guide you through the process, go to the Maine home performance web site at: www.mainehomeperformance.org. In the example case, if insulation and air sealing saves you 20 percent of the remaining heating bill, that's another 139 gallons a year. This can take a few weekends or a few thousand dollars, whichever you've got more of, for a quick pay-back. As a side benefit, your house will be less drafty and feel more comfortable.

Typical Maine Residential Oil Use after Solar hot water, boiler controls, air sealing and insulating



Solid Fuels: wood and wood pellet boilers

Now you've pretty much plucked all of the low hanging fruit. Let's assume you put in a solar hot water system (along with boiler controls) and performed some air sealing measures. You've saved 307 gallons a year with solar hot water and boiler controls and an additional 139 gallons a year with air sealing and insulation upgrades.

You've taken your 1,000 gallon-a-year habit down to 554 gallons. Of your remaining 554 gallons, it breaks down like this

Boiler Losses……120 gallons (every day the boiler is on ¾ of a gallon goes up the chimney)

Domestic hot water……..16 gallons (now that solar is doing 80% of the load)

Space heating……418 gallons

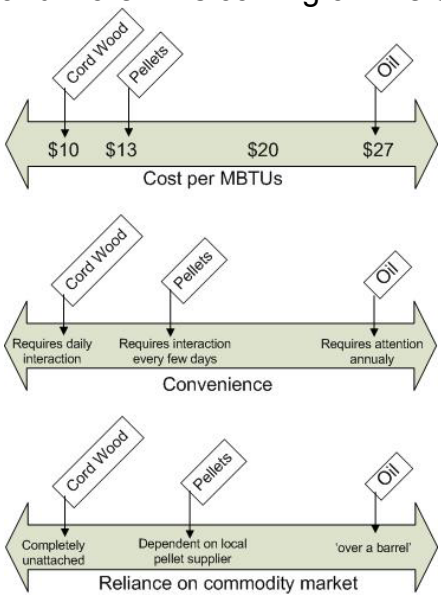
As you can see, the biggest remaining chunk is space heating. If you want to reduce your oil consumption further, or eliminate it all together, you'll have to come up with an alternative for space heat. What can we use to heat our buildings in a cost-effective manner? A propane heating system might be a step in the right direction because propane is cleaner and burns more efficiently than oil, but it also tends to be somewhat more expensive and like oil, it is a non renewable fossil fuel. Geothermal and other cold climate heat pumps promise fossil fuel free heating, but they also tend to be very expensive to install and in most cases are only marginally cleaner than oil because the compressors required to run geothermal systems require large amounts of electricity, which tends to be generated by filthy fossil fuel burning power plants (the exception, of course, is if your electricity comes from a renewable source, like a grid tied photovoltaic system).

What about solar? Our solar hot water system works great for the domestic hot water load, but realistically, in most cases not enough sun lands on the roof during the heating season to heat the space. If only there were some magical solar storage medium that could store the energy from the sun all year long, and we could use it when the sun isn't shining. Trees actually do this!

Trees are wonderful solar energy storage systems and we also happen to have them in abundance here in Maine. In our northern climate, we believe there is no better way for us to heat our homes today in an environmentally friendly manner than efficiently burned wood and wood pellets. Sustainable wood harvesting helps promote healthier forests and helps the local economy at the same time. If harvested responsibly, wood is a local fuel source that we can depend on for generations. Although burning wood does create some emissions, it's important to note that the remaining trees in a sustainably harvested forest will easily absorb the CO_2 emissions from burning the harvested wood.

Pellets vs. Cord Wood

Wood fuel comes in a variety of forms ranging from pellets, to wood bricks to cord wood. You can think of oil, pellets, and cord wood on a continuum in terms of price, convenience, and attachment to the commodity market . Wood is very inexpensive; coming in at $10 per Million BTU's compared to $13 for pellets and $27 for oil at current prices. On the other hand, wood burning requires daily interaction, compared to once every few days for pellets and almost no interaction at all for oil. In terms of attachment to a broader commodity market, if it came to it, most of us could go out and get wood, not true of pellets and certainly not true of oil. Pellets are produced locally, with more and more mills coming on line every year.



Fuel Supply

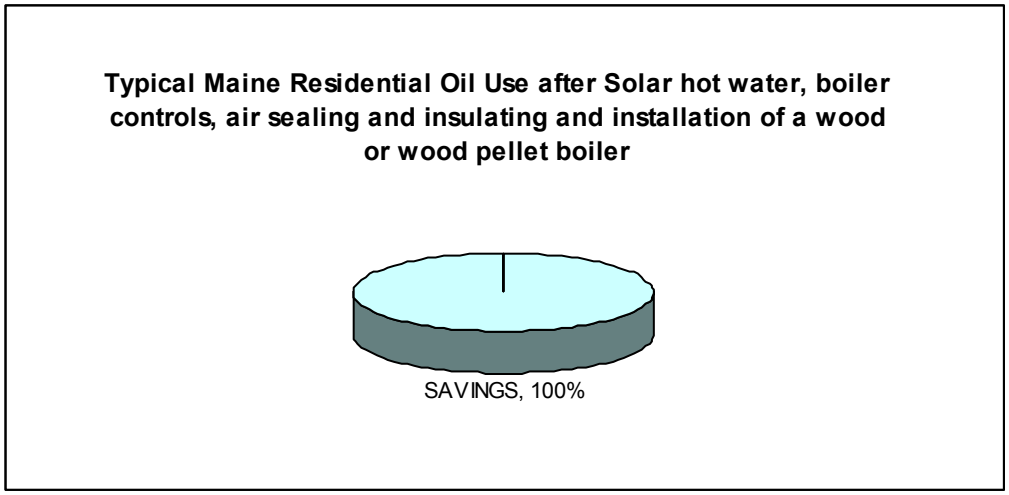
Most folks know who to call to get oil and how to get a cord of firewood. Pellets are currently purchased in bags from local hardware stores and stove shops. In many areas in Maine, you can also arrange for home delivery of palletized pellets (say that 5 times fast), usually by the ton. In the next year or so, we expect to have bulk delivery into parts of Maine as well.

Stoves vs. Boilers

Pellet and wood stoves are less expensive to install than boilers and are a good solution in some cases, especially smaller homes with open floor plans. In most homes, a stove will not heat the whole house, but it will heat some central part of it. Stoves are nice in that they provide ambience, but, on the down side, they dry the air and create indoor air pollution and a mess. Stoves are also inherently less efficient and less safe than boilers. The larger and more spread-out a house is, the more a boiler makes sense because the boiler uses the existing heat distribution system to move heat to the far corners of the house. Boilers are inherently safer than stoves because they are surrounded by water, which is another plus because they can also heat your hot water (that 20% that your solar hot water system isn't doing).

The Numbers

Now that you've gotten the heating bill down to 418 gallons of oil, how much wood or pellets are required to match that? Each ton of pellets contains the same fuel as 116 gallons of oil. Each cord of well seasoned hardwood contains the same fuel as 150 gallons of oil. Assume your wood or pellet boiler gets the same efficiency as an oil boiler and a wood or pellet stove 10% less. That means, in rough terms, it would take just about 3 cords of wood to heat our example home.



The Flue, Propane and Boiler losses

As mentioned above, propane is a somewhat cleaner and more efficient fuel than oil, and amongst the fossil fuel choices, propane is definitely a lesser evil. Propane can play a strong role in moving us off of oil for a number of reasons. First, due to the physics of the design of low mass, direct vent propane boilers, they tend to have much lower boiler standby losses than an average oil boiler. As a result, very little heat is lost up a propane boiler's chimney and through its walls. In a conventionally built Maine home, the reduction in these stack losses is more than offset by the higher cost per BTU of propane, which is why most homes in Maine are still heated with oil not propane. However, as houses burn less fuel (because of better insulation or because the heating load is partially offset with solar and a wood stove or boiler), the stack losses become a bigger share of the whole. In our example, if you burn 3 cords of wood in a wood stove, and you have solar hot water, you'd still be burning 120 gallons of oil a year, just to keep the boiler hot in the winter months. A propane boiler would require no energy if not used.

The other huge benefit of a propane boiler is the fact that it doesn't require a flue. You can vent out the side of the house and free up your flue for a wood or pellet stove or boiler.

Making a Plan

The process of eliminating oil from our houses is a daunting one and can feel overwhelming. For most of us it is an ongoing process. What you do first depends on the house: If the oil boiler is nearing the end of its useful life, make the switch to propane to free up your chimney and reduce your boiler losses. If you have a leaky house, you might want to start with air sealing. If you've got a nice south facing roof, solar hot water might be first on the list. What is important is that you do your research, and talk to enough knowledgeable people to develop an action plan.

When you are ready to put that plan into action, the renewable energy professionals at ReVision Energy stand ready to help you achieve your goals.

A Success Story

"We hoped adding attic insulation, a solar domestic hot water system, and a more efficient boiler would save on energy costs. In fact, our oil consumption dropped from about 900 gallons previously to 464 gallons in 2007. During the late spring, summer and well into the fall, almost all of our domestic hot water comes from the solar system we installed"—*Tom Gillen, ReVision Energy solar hot water customer.*