Choosing A Source Of Heat For Your Home

During the Sustainability Committee's natural gas survey in spring 2016, we were asked for more information on alternative ways to heat a home. For a general overview of space heating options, see the U.S. Department of Energy's web pages at http://energy.gov/public-services/homes/heating-cooling/home-heating and http://energy.gov/energysaver/home-heating-systems or New York City's home heating site at https://www.nyccleanheat.org/content/alternatives.

Information specific to home space heating in our area follows below.

For options to heat domestic hot water (DHW) for washing and bathing, click here.

Information in this posting came from a variety of reliable sources: recent contractor quotes, discussions with heating and other energy practitioners, real estate brokers, various government-sponsored web pages, and experience of members of the Sustainability Committee, several of which are professionally involved in energy services. Its content was reviewed by all members of the Committee and the Energy Coach of the New York State EnergizeNY program. All pictures were taken at homes in Croton.

Basic Heating Options And Lingo In Three Minutes

Most of our homes are heated by boilers (which heat or boil water) or furnaces (which heat air). When heated water is circulated through pipes in a home, we call it a "hydronic" system. When heat is distributed as steam, we call it a "steam" system. When air is heated and sent through ductwork, we call it a "forced air" system. A home equipped with electric baseboards has an "electric resistance" heating system. This posting looks only at options for heating sources, and not distribution systems. In this analysis, we assume all rooms are heated to the same temperature by the same source.

A heating system has two major costs: fuel and installation. When choosing a heating source, it's important to consider both costs over the lifetime of the system. If a fuel is cheap, but installation of equipment needed to use it is expensive, then lifetime and/or monthly cost may still be high, especially if financed via a long-term loan.

Since early 2014, oil prices have fluctuated from a high of about $110 a barrel, settling (in early 2017) to $54 a barrel. That's a range of about $3.80 to $2.40 a gallon. Due to the vagaries of the international oil and currency markets, oil prices may again rise suddenly. Natural gas and electric pricing also vary, but most of what we pay for them remains regulated, so their costs are more stable.

Unless a homeowner has access to a large and continuous source of free wood, the cheapest fuel source for space heating in our area is natural gas. Our survey found that about two-thirds of Croton's homes use it. In rising order of approximate cost (with the exception stated below), are: propane, wood pellets (when used in a boiler or furnace designed for them), fuel oil (about one-third of Croton homes heat with it), followed by electricity (used either directly or through a heat pump). None who responded to our survey heated a home with coal, and that source is not discussed here.

An exception to the above is solar energy, the fuel cost of which is zero, while its installation cost may be quite significant. While solar heating may be cost-effectively incorporated into the design of a new home, this posting deals only with ways to change heating sources in existing homes. As discussed below, the cost to convert an existing home so it is heated solely by solar energy may be beyond the means of many homeowners.

A heating system is a major source of a home's carbon emissions, and thus a contributor to climate change. Below we discuss each source's emissions relative to fuel oil and ways to mitigate it.

To jump to a discussion of a specific heating source, click on its name (order represents commonality of sources, as used in our area):

[natural gas]

[fuel oil]

[propane]

[electric resistance]

[wood]

[electric heat pumps]

[solar thermal]

[solar electric]

Frequently Asked Questions (FAQ) on choosing a heating source

Why change your present heating source?

A homeowner may wish to pursue one or more of these goals:

- cut the annual heating bill
- replace an aging system that is past its useful life
- secure financial incentives to cover part of the cost to upgrade your heating system
- renovate a home to increase its sale value

- use a more environmentally sustainable option, i.e., one that reduces or avoids emissions.

Information in this posting may help clarify your approach.

[Back to FAQ]

Can I cut my heating bill without changing my boiler or furnace?

Before investing in new heating equipment, look for other ways to save on heating costs. A home energy assessment (also called an energy audit) may reveal ways to do so while keeping your home comfortable. Some low-cost options (such as a night setback thermostat, pipe insulation, and/or sealing air leaks) may pay for themselves faster than a new boiler or furnace. Others, such as additional roof insulation, may cut total fuel use, regardless of its source. To see which options may work best for you, have an assessment done on your home. Depending on your income, it may be free. For details, go to:

http://croton.energizeny.org/how_it_works

The assessment will list both the quick payback options (e.g., night setback thermostat) and those taking longer to pay for themselves, such as a more efficient boiler or furnace.

To view some short videos about energy assessments, go to:

http://energizeny.org/ask_the_energy_coach

[Back to FAQ]

How may we compare heating source options?

To do so consistently, we assume that all rooms in a home are being heated to the same temperature, and that one fuel does most of the job. We focus on options for existing homes.

Sources may be compared based on installation cost, operating cost, and environmental impact. Where appropriate, we also mention issues specific to each source. We consider an option to be financially viable if it may be installed at a reasonable cost in an existing home, with available financial incentives, and pay for itself, relative to using fuel oil. The installation cost for such options vary between about $6,000 and $30,000 (sometimes more), depending on the type of equipment installed and conditions specific a home.

[Back to FAQ]

When should I replace my boiler or furnace?

If it's more than 40 years old, you've already gotten your money's worth. If only 10 or 20 years old, it may be more economical to instead replace only its burner (contractors often call this the "gun"). Overall efficiency may improve, and doing so may allow switching to a cheaper fuel source (e.g., natural gas to replace oil). While not as efficient as a new boiler or furnace, a new burner may cost much less and pay for itself more quickly out of fuel cost savings.

When buying an existing (as versus newly built) home with an old boiler or furnace, it may make sense to replace it before moving in. Doing so may avoid nasty winter "surprises" such as heating failures and/or stunningly high fuel bills. Depending on the location of the boiler or furnace, its size, and other factors, the job may be more easily done before the home is occupied.

If already occupied, the best time for replacement is in spring or summer when a day or two without heat may be tolerable.

[Back to FAQ]

Typical oil-fired hot water boiler

Is financial help available to pay for new heating equipment?

Rebate programs come and go. Depending on family income and the type of new heating equipment, some incentives (also called "rebates") may be available. In the past, a New York State agency (called NYSERDA) offered incentives to all homeowners but (as of October 2016) only the local utility (i.e., Con Edison) does so. Low-income families (e.g., earning less than $62,000 for a family of four) may, however, be still be eligible for State assistance. For details, go to: http://www.nyserda.ny.gov/All-Programs/Programs/Assisted-Home-Performance-with-ENERGY-STAR/Income-Guidelines .

Con Edison may offer rebates for certain types of gas-fired boiler or furnaces. Details on rebates are found in the discussions for each fuel type. In some cases (e.g., a new burner), no rebates are available. A heating contractor may be helpful in securing financial incentives.

Via income tax credits, the U.S. government may offer financial assistance for certain upgrades, (including for solar PV and solar hot water, but not including fossil-fueled boilers). A 30% credit is available for systems placed in service by 12/31/2019. Thereafter the percent drops until 2022.

To finance the cost of new heating equipment, several options exist. On-bill financing through the utility allows you do so via a fixed monthly charge appearing on your electric or natural gas bill. In

essence, the utility pays the contractor and you pay back the utility through such a loan. NYSERDA may also offer loans at a moderate interest rate. A heating contractor may also help with that process.

[Back to FAQ]

Could new heating equipment increase my home's value?

Home buyers often have a professional engineer examine a home before making an offer to buy it. An old heating system with an underground fuel oil tank may be seen as less desirable than a modern system using a different heat source. As discussed below, underground tanks present a potentially costly hazard if they leak, and buyers (or their agents) may reduce their offer to account for it. Switching to an efficient and trouble-free heating system may eliminate that problem and help clinch a sale at your asking price.

[Back to FAQ]

Is new heating equipment the only way to reduce my carbon footprint?

Heating a home is one way we cause climate-related emissions, also called a "carbon footprint." Improving a heating system's efficiency or switching to a cleaner fuel will reduce emissions, and we encourage you to do so. Insulating a home will reduce fuel use and thus the carbon it produces.

But if none of that is affordable, it may be possible to cut emissions elsewhere at a more manageable cost. As long as climate-related emissions are reduced somewhere, the impact is the same as if they were reduced at your home: it's all the same atmosphere.

"Carbon offsets" may be purchased that counter emissions coming from a home boiler or furnace, a car, or any other source, regardless of fuel type. Offsets will not, however, reduce the actual emissions from your heating system. Money paid for offsets pays to plant trees (which absorb carbon), seal landfills (which otherwise leak methane), or pursue other projects that reduce climate-related emissions outside of your property.

At 2016 offset pricing, the cost to cancel out annual emissions from a home boiler or furnace may be just a few percent of the annual fuel bill, possibly less than $100 a year. That cost is in addition to your fuel bill, and offsets need to be purchased each year that a heating system is used.

Offsets may be purchased through several agencies, all of which are certified by an independent non-profit organization. Some fuel suppliers will package offsets with their fuel sales so that the net carbon impact from using their product is zero. To learn more and how to purchase them, go to http://apps3.eere.energy.gov/greenpower/markets/carbon.shtml?page=0

[Back to FAQ]

For quick comparisons of heating source options, see the chart below. Note that the numbers are approximate. Actual costs may vary based on home size, age, and other conditions. Relative fuel costs assume no improvement in fuel use efficiency.

heating source	financially viable	renewable energy?	local carbon emissions	fuel cost relative to #2 fuel oil	financial incentives
passive solar	in new homes	yes	zero (if 100% solar)	zero	tax credit
active solar	in new homes	yes	zero (if 100% solar)	almost zero	tax credit
solar (PV) panels	not for heating	yes	zero (if 100% solar)	zero (if 100% PV)	yes
electric resistance	expensive	very little	greater than oil	double to triple that of oil	no
heat pump	yes	mostly	same as or 40% less than oil, depending on heat pump type	slightly more or slightly less, depending on heat pump type	yes
wood pellets	yes	yes	~85% less than oil	slightly less than oil	yes
propane	yes	no	~15% less than oil	comparable or slightly more than oil	for new boiler or furnace
natural gas	yes	no	~30% less than oil	~30+% less than oil	for new boiler or furnace
B20 (Bioheat)	yes	slightly	~15% less than oil	About same as oil, if tax credit is taken	$.20/gal NYS tax credit

[Back to FAQ]

How may I use the sun's thermal energy to heat my home?

Some new homes have been designed so they can absorb and store heat from the sun for later use. A supplementary heating system (using a fossil fuel or electricity) may also be needed on very cold nights. Solar energy is renewable and has no negative climate impact.

Passive solar house

Two types of solar space heating have been successful when integrated into a home's design:

- Passive systems take advantage of architectural designs and materials that capture and store solar energy through windows sized and oriented to maximize solar input. No mechanical systems are involved, though some systems use small fans to circulate passively-heated air. Learn more at:

http://energy.gov/energysaver/passive-solar-home-design

- Active systems use roof or ground-mounted solar collectors (also called "thermal panels") which heat air and/or water that circulates through a home using fans or pumps. Solar collectors that make domestic hot water are on the rooftop of the Umami Restaurant on South Riverside Drive in Croton. Do not confuse solar collectors (which gather heat from the sun) with photovoltaic (PV) panels that instead use solar energy to produce electricity. PV panels may be seen atop the Gulf station at the corner of South Riverside Drive and Croton Point Avenue. Learn more at:

http://energy.gov/energysaver/active-solar-heating

The extra cost to build solar heating into a new home will vary based on design, size, etc. Federal tax incentives may be available to cover part of that cost. Before proceeding, homeowners are cautioned to verify their tax opportunities with an accountant. Utility incentives for passive or active solar space heating are not available at this time. Financial incentives (in the form of tax credits) are discussed at:

http://programs.dsireusa.org/system/program/detail/1274

http://programs.dsireusa.org/system/program/detail/80

Please note that such programs may expire or change without notice.

[Back to FAQ]

May I use solar electricity to heat my home?

Solar power from PV panels is renewable and may be used to heat a home in either of two ways:

- via electric resistance baseboards or an electric boiler or furnace

- or through a heat pump that pulls heat from the air or ground.

In both cases, however, the total cost to switch to such a system that is not also supplemented by a fossil fuel or wood may be out of reach of many homeowners. Many homes are also not oriented properly, or do not receive sufficient sunlight, to allow solar PV as an option.

The economics of a system using PV panels is assisted by a government policy called “net metering.” It allows a homeowner to use its utility to “bank” PV power that a home doesn’t use at the time it is generated. Under net metering, a homeowner’s PV panels could (for example) produce 10,000 kilowatt-hours (kWh) during months when the sun shines long and brightly, while consuming only 6,000 kWh of it at that time. The utility credits the homeowner for the other 4,000 kWh, applying them against the homeowner’s later electric bills.

For general uses of power (e.g., appliances, lighting), a typical residential rooftop PV system may be sufficient in our area – across a year – to produce those 10,000 kWh. But the energy needed to heat a home with electricity may be much greater. For example, to replace 500 gallons of fuel oil could require another 15,000 kWh of banked power. To generate it with PV panels during one year (because the utility may not allow it to be carried over for a longer period), could require many more PV panels and extra power conditioning equipment. Total 2016 cost could range from $25,000 to $40,000, unless solar subsidies are greatly increased.

Rooftop photovoltaic (PV) system

Depending on the type of system for converting that power into heat (e.g., electric resistance or heat pumps), such conversion equipment could drive the total cost even higher (e.g., roughly $10,000 for an electric boiler, $20,000 to $30,000 for heat pumps), making the solar PV heating option financially out of reach for many homeowners. A larger electric service (i.e., new breaker panels, and wiring to and within a home) may be needed to accommodate such equipment, costing several thousand more dollars.

If net metering policies were to change (as has already occurred in several states), solar PV’s operating cost may also rise. Some utilities, for example, now credit banked power at its wholesale

(not retail) value. That may cut its dollar value in half. Such a loss could add another $1,000 a year (or more) to a homeowner's electric bill.

If net metering were to end, some solar enthusiasts have suggested that excess PV power could instead be stored in lithium-ion batteries. While their pricing continues to fall, the present cost for enough of them to store the power needed to heat a home on a cold winter's day could approach (or exceed) $40,000. Due to the relatively low output of PV panels during short and dark winter days, a larger PV system would be needed to create enough electricity on such days. Total cost (solar PV + electric boiler + batteries) could approach $100,000.

[Back to FAQ]

Is electric resistance heating a good choice in our area?

Some homes built between 1950 and 1980 use electric resistance heating to convert power into space heat. They use either electric baseboard radiators or an electric boiler or furnace (which acts like a standard boiler or furnace). This method costs relatively little to install as part of a new home. In parts of the US where power is cheap (e.g., the Northwest) and winter weather is moderate, the operating cost for electricity for resistance heating may be lower than that of fossil fuels.

At our local electric rates, however, it may be quite expensive unless very tightly controlled, e.g., by keeping some rooms much colder than others. Otherwise, the annual cost for utility electricity to heat a home could be several times that of a fossil-fueled system. Converting an existing home to use it may also require an electric service upgrade (e.g., new breaker panels, heavier wiring to the house). In a new super-efficient home with triple-glazed windows and double the code level of insulation, much less heat is needed, and the annual heating cost when using electricity may approximate that of an oil-fired system in a typical home.

While not producing emissions at a home, electric resistance heating may have a bigger local environmental impact than using a fossil-fueled boiler or furnace. Due to the way fossil fuel is used at power plants to generate electricity, most of the fuel's heating value is lost in the process. Additional losses occur when power is transmitted and distributed. When utility electricity is used to heat a home in our area, those inefficiencies may result in more climate-related emissions at the power plant than an efficient fossil-fueled system producing the same amount of heat at a home.

[Back to FAQ]

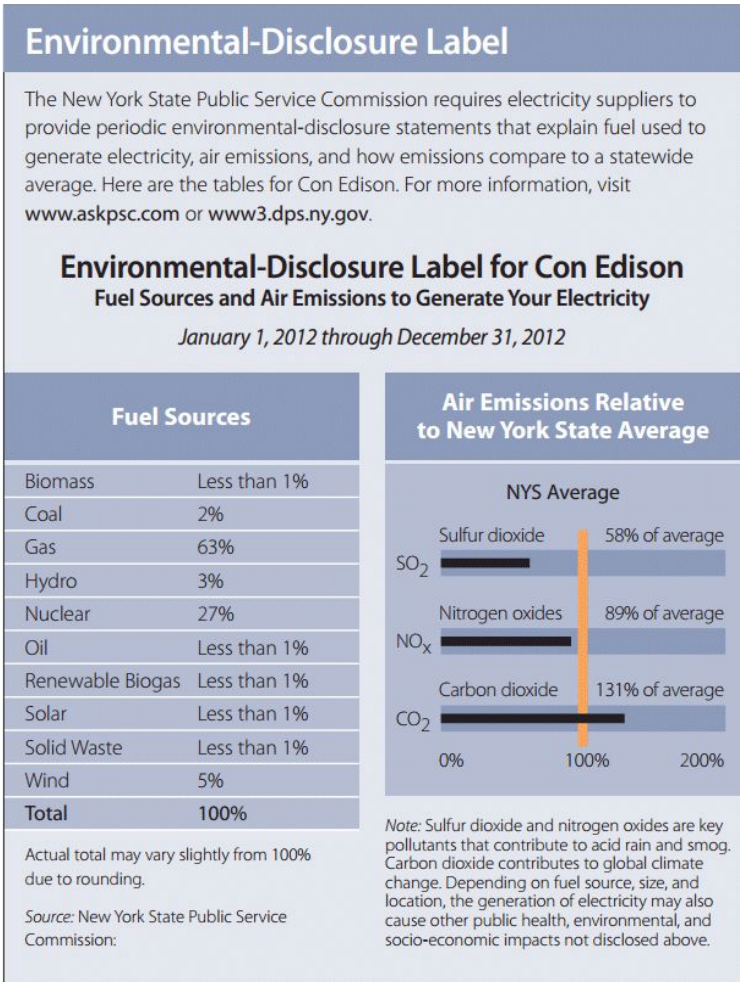
If I buy my electric supply as renewable power, doesn't that eliminate my home's emissions?

We encourage the purchase of renewable electricity (e.g., from wind turbines) but - due to local power transmission constraints - doing so reduces carbon emissions near where that power is used (e.g., upstate New York), not at your home. In reality, the power actually being used to electrically

heat a home is only as renewable as that provided by the local utility. Buying renewable power is much like buying carbon offsets, addressed above in "Is new heating equipment the only way to reduce my carbon footprint?"

At present, about 10% of our local electricity comes from renewable sources (primarily wind and hydropower). While all New York State power suppliers are at this time required to secure 25% of their electricity from renewable sources, the difference (about 15% for us) is made up by the utility instead buying Renewable Energy Certificates (RECs), which are analogous to [carbon offsets]. Only power generated either on-site by PV panels or at a local community solar power facility (none of which presently exist in our area) will physically displace power supplied by the local utility.

Most (about 63%) of the electricity delivered in our area comes from burning natural gas in nearby power plants. Another 27% comes from nuclear power (which, while not emitting local carbon emissions, is also not renewable). For more detail, see Con Ed's Environmental Disclosure Label:



Environmental-Disclosure Label

The New York State Public Service Commission requires electricity suppliers to provide periodic environmental-disclosure statements that explain fuel used to generate electricity, air emissions, and how emissions compare to a statewide average. Here are the tables for Con Edison. For more information, visit **www.askpsc.com** or **www3.dps.ny.gov**.

Environmental-Disclosure Label for Con Edison

Fuel Sources and Air Emissions to Generate Your Electricity

January 1, 2012 through December 31, 2012

Fuel Sources

Biomass	Less than 1%
Coal	2%
Gas	63%
Hydro	3%
Nuclear	27%
Oil	Less than 1%
Renewable Biogas	Less than 1%
Solar	Less than 1%
Solid Waste	Less than 1%
Wind	5%
Total	**100%**

Actual total may vary slightly from 100% due to rounding.

Source: New York State Public Service Commission:

Air Emissions Relative to New York State Average

Note: Sulfur dioxide and nitrogen oxides are key pollutants that contribute to acid rain and smog. Carbon dioxide contributes to global climate change. Depending on fuel source, size, and location, the generation of electricity may also cause other public health, environmental, and socio-economic impacts not disclosed above.

As a result, emissions in our area are not physically avoided by using electricity for space heating, even though no emissions occur at a home's location.

[Back to FAQ]

What about using an electric heat pump?

Acting like reverse air conditioners, heat pumps pull heat from the air or ground into a home. In doing so, they produce as much heat as an electric resistance system while consuming only half or a third as much electricity. They may also provide air conditioning to cool a home.

As discussed above, some of the electricity to run a heat pump may come directly from on-site PV panels. Otherwise, all power to run them must come through the local utility.

Two types of heat pumps are available to heat a home:

- Air-source heat pumps (ASHP) pull heat from outdoor air and send it into a home. A typical installation in an existing home involves a separate ductless unit for each room. ASHP are designed to heat forced air (like a furnace) so they cannot

distribute heat where done so using circulating hot water or steam. One local vendor estimated an ASHP installed cost of $4,500-$5,500 per room, with a range of $18,000 to $23,000 for an average home. Depending on the age and condition of a home's electric service, it may be necessary to upgrade it to handle the extra load created by heat pumps. In very cold weather, heat from an ASHP may need to be supplemented by another heat source (e.g., a propane-fired boiler or furnace). When using local utility power, running an ASHP may create about the same emissions at the local power plant as occurs at a home using a high-efficiency gas boiler or furnace. At local electric rates, the heat produced by an ASHP will cost about the same as an equivalent amount of fuel oil.

Ground source heat pump and piping

- Ground-source heat pumps (GSHP) may be more economical for homes in our area. They take advantage of the fact that - below a few feet - the ground stays at a constant temperature of about 50 ° F. GSHP pull heat from the ground via buried piping or wells drilled for that purpose.

A GSHP concentrates that energy to provide circulating hot water at a temperature up to about 130° F. In new homes, baseboard radiators or radiant floor panels may be installed to work with water at that temperature. Radiators in existing homes may, however, require water heated between 150° F and 180° F to work properly. A supplementary or backup heating system (e.g., propane) may therefore be needed. Some older homes distribute heat using steam, but heat pumps cannot produce steam.

Determining economic and technical feasibility for a heat pump involves an analysis specific to your home. A large open yard area with no underground utilities (e.g., septic, sewer, or water systems) may be needed to accommodate GHSP wells and piping. A local vendor estimated that a GSHP for an average sized home would cost at least $30,000. As with an ASHP, the capacity of the existing electric service may also need to be upgraded, adding to the total installation cost.

While annually using only a third of the kilowatt-hours consumed by electric resistance heating systems, power used by a GSHP will (unless generated by on-site or nearby PV panels) come from the local utility. At local electric rates, a GSHP may provide heat at an annual cost slightly less than fuel oil. Taking into account utility power production and delivery inefficiencies, using a GSHP may reduce climate-related emissions (relative to an oil-fired boiler or furnace) by about 40%.

Financial incentive programs for heat pumps have recently changed. For details, see:

www.coned.com/energyefficiency/residential_HVAC_program.asp?utm_source=residential-hvac-program&utm_medium=boxes&utm_campaign=EEHomepage

[Back to FAQ]

How may I use wood to heat my home?

While many homes have fireplaces or stoves for burning chopped wood, they are - for several reasons - not good ways to heat a home. Most heat is lost up the chimney, incomplete combustion creates both soot and other forms of air pollution, continuously tending a fire is not practical for many people, etc. The preferred way to heat a home with wood is through a boiler or furnace designed to automatically consume standardized wood pellets.

Depending on size, type, accessories, and a home's plumbing, installing a wood pellet boiler or furnace may cost $7,000 to $10,000 (maybe more). Pellets cost between $200 and $300 a ton, equivalent to oil between $1.70 and $2.60 per gallon, though pellet heat output and seasonal pricing varies.

Many homes having hydronic or forced air systems may replace their boilers or furnaces with wood pellet-fired units. Such systems have combustion efficiencies and emissions comparable to efficient oil or gas-fired boilers or furnaces. Wood pellets are considered a renewable fuel because the trees from which they were made pulled carbon dioxide from the atmosphere to create the wood. To be sure that a net reduction in emissions occurs, however, the pellets should be "sustainably sourced," meaning that the vendor ensures that the wood came from forest debris rather than deforestation.

To create the pellets, some energy is used (e.g., natural gas to dry them, electricity to compress them), so some emissions occur during production. Taking such inputs into consideration, burning wood pellets in a pellet boiler or furnace releases about 15% of the emissions from an equivalent amount of heat from burning fuel oil.

When considering a switch to wood pellets, consider how you would obtain, handle, and store them, and dispose of the resulting ash. In our area, 40-pound bags of pellets are available at several outlets (e.g., Home Depot) or online. To heat a typical existing home, a 40-pound bag of pellets may last a few mild days, or one very cold day. The boiler or furnace's hopper may hold enough pellets for several cold days, depending on weather, before needing to be replenished. Burning 40 pounds of pellets produces about half a pound of fine ash, which is captured in a drawer at the bottom of the boiler or furnace. A homeowner will need to dispose of it several times a week (more often in very cold weather) as trash or into compost.

At least one local company (in Newburgh) will deliver a truckload of pellets (i.e., about a ton) to a home, sufficient for several winter months. An appropriate storage facility, e.g., an indoor storeroom

or enclosed exterior building, is needed. While few local heating contractors presently maintain or repair pellet-fired units at this time, that may change if pellet boiler or furnaces become popular.

NYSERDA incentives are available for wood pellet-fired equipment at:

http://www.nyserda.ny.gov/All-Programs/Programs/Renewable-Heat-NY

[Back to FAQ]

May propane be used as a heating fuel?

Also called “liquefied petroleum (LP) gas,” propane is a byproduct of producing oil and natural gas. Like all fossil fuels, it is not renewable. Using tanker trucks, several suppliers deliver propane in our area. While it burns cleaner than oil, a gallon of it produces about 33% less energy than a gallon of fuel oil, so a larger storage tank may be needed. Per unit of heat, burning propane releases fewer emissions than fuel oil but more than natural gas. On that same basis, its cost is comparable or slightly higher than oil, and more than natural gas. One of its other benefits is that it may be used (with appropriate appliances) for cooking, clothes drying, and domestic hot water heating. If replacing electricity for those tasks, propane costs significantly less.

To convert from oil to propane typically requires replacement of a burner or boiler or furnace, plus installation of appropriate indoor gas piping. The propane supplier will lease the outdoor storage tank to the homeowner. While not required in Croton, adding a metal liner to the boiler’s chimney (to preserve internal brickwork) may also be prudent when switching from oil to propane. Have your chimney cleaned and inspected to make that determination. Some high-efficiency “condensing” boilers or furnaces may instead exhaust from the side of a home, thus avoiding that issue.

Financial incentives for propane-firing equipment are not presently available.

[Back to FAQ]

How is natural gas used as a heating fuel?

Unlike propane, natural gas is delivered by the local utility through its underground pipes. Like propane, natural gas is not a renewable fuel. Converting to it requires replacement of a boiler or furnace or its burner, plus installation of appropriate indoor gas piping. Like propane, it may (with appropriate appliances) be used for cooking, clothes drying, and domestic hot water heating. If replacing electricity for those tasks, natural gas costs significantly less. As previously mentioned, most homes in Croton presently heat with natural gas.

Natural gas offers the lowest operating cost for home heating in our area. Its emissions are higher than burning wood pellets, electricity used in ground-source heat pumps, or solar (thermal or electric), but lower than that of oil, propane, or electric resistance heating. Adding a metal liner to a boiler’s

chimney (to preserve internal brickwork) may be required by the utility. Have your chimney cleaned and inspected to make that determination. Some high-efficiency “condensing” boilers or furnaces may instead exhaust from the side of a home, thus avoiding that issue.

Unlike other options listed above, natural gas service is limited to homes near an existing utility gas line. To determine if gas service is available on your street, enter your address at http://www.coned.com/gasconversions/gas_locator_page.asp , or have a heating contractor submit a gas service request on your behalf, or contact the Croton Sustainability Committee at info@sustain-croton.org.

As a result of our 2016 survey, we found that many homes presently using oil may be close enough to a gas line to secure service. If a gas line exists on your street, the utility does not charge to install its underground line to your home unless it is more than 100 feet from the road. Respondents to our survey that expressed interest in securing gas service have been notified regarding their proximity to existing gas lines.

Con Edison offers incentives to switch to natural gas, but only for installation of a new boiler or furnace. No incentives are available for replacing only a burner.

High-efficiency condensing gas boiler. Hand shown for relative size.

Con Ed rebates for new gas boilers or furnaces at homes not presently using gas: http://www.coned.com/energyefficiency/residential_HVAC_program.asp

For homes already having gas service for cooking, additional incentives may be available:

http://www.coned.com/gasconversions/pdf/2016_Gas_Conversion_Incentive_Program(1-4).pdf

[Back to FAQ]

If I must continue using oil, are there any options for reducing its environmental impact?

Many homes were built with heating systems using #2 fuel oil (essentially the same as diesel fuel). While fuel oil has gotten cleaner (e.g., sulfur content has been greatly reduced), oil still produces more carbon dioxide, nitrous oxide, and soot per unit of heat than other fossil fuels. Storing oil in an underground tank may also create a significant environmental and financial risk if it leaks. Based on our survey, about 20% of respondents who use oil store it in underground tanks.

Those who must continue to use oil may, however, reduce its environmental impact at little or no extra cost by switching to a blend of fuel oil and renewable fuels called B20. B20 displaces 20% of fuel oil with renewable oils such as deglycerized soybean oil and/or used vegetable oils recovered from restaurants and food processing. It works well in fuel oil boilers or furnaces and may be stored in underground or indoor tanks, but should not be stored in above-ground outdoor tanks. Several local fuel oil vendors offer B20.

While growing soybeans and processing oils requires energy, B20 burns cleaner than fuel oil and results in a 15% net carbon reduction. In our area, B20 costs slightly more per gallon. To encourage its use, New York State offers a $.20/gallon credit off a homeowner's State income tax.

B20's emissions per unit of heat are lower than standard fuel oil and resistance heating, but higher than propane, natural gas, solar, or heat pumps. No incentives, beyond the tax credit, are available. For details on securing the tax credit, go to:

www.tax.ny.gov/pdf/current_forms/it/it241i.pdf?_ga=1.268937841.140824554.1440614058

[Back to FAQ]

What should I do if I have an underground oil tank?

Unless you can see your tank inside your home (e.g., basement or garage) or outside your house, it's underground. If installed before about 1980, an underground tank may be past its useful life. Under State and County regulations, leaking tanks and soil contaminated by oil must be excavated and removed to a licensed burial site. The cost for that process may be very high, and typical homeowner insurance does not cover it.

Eliminating an underground tank may improve the sale value of a home, though by how much is difficult to quantify. Smart home buyers will require a tank leak test before buying a home, and may use the existence of an underground tank as a reason to cut their offer price.

In Croton, underground tanks may either be removed, or emptied and filled with sand or plastic foam. When switching to a new heating source, it would be prudent to address the tank issue as part of the job.

NYSERDA had offered a low-interest loan program to cover part of the cost of removing an underground tank before it leaked, but that program is not presently available. Ask your oil supplier for an update.

[Back to FAQ]

What are my options for making domestic hot water (DHW)?

Some homes use their boiler or furnace to also heat their DHW, while others use a separate device. There are two ways to use an existing boiler or furnace to also heat DHW:

- a tankless DHW coil built into the boiler or furnace

- a separate hot water tank that is piped to the boiler or furnace, known as an “indirect-fired” DHW heater.

Many boilers and furnaces may be used with either choice. While the first option costs little (many boilers or furnaces either come with a tankless coil, or could have one inserted), it may consume more fuel in non-winter months than other options.

Indirect DHW heater piped to a boiler

Installing an indirect-fired unit costs more than other options, but is the most efficient way to make DHW using an existing boiler or furnace. It may provide a more consistent water temperature, and be added (with appropriate plumbing) to an existing boiler or furnace. A new condensing gas boiler may, however, save even more.

To make DHW without using a home’s boiler or furnace, many homes do so with heaters that consist of a large water tank equipped with a separate burner fueled by oil, propane, or natural gas. Such units must be vented like a boiler, and thus lose heat when the burner is not running. Such units may consume more fuel than other options, but may provide a more consistent water temperature than a tankless coil. If a DHW heater with a separate oil burner exists, it may be replaced when the boiler is converted to gas, or allowed to remain and continue using oil. Once it is time to replace it, the new unit may be either a separate gas-fired DHW heater or an indirect-fired unit that is heated off of the main boiler.

Two types of electric DHW heaters (with tanks) are available:

- electric resistance (which uses an electric heating coil)

- air-source heat pump (ASHP DHW).

The first has been common for 50+ years, costs less to install, but potentially much more to run than the second. ASHP DHW heaters are relatively new, are priced higher, but cost much less to run. They use electricity to pull heat from surrounding air (e.g., in a basement), making it a partially renewable source of heat. When more heat is required than available from that process, it works like a resistance DHW heater. Neither type need be vented, so standby losses may be quite low.

Some homes now use separate DHW heaters (with small tanks) in their laundry rooms, kitchens, and bathrooms. Called “on-demand” heaters, they run on electricity, natural gas, or propane. While costing more to install, they may offer the most energy-efficient way to provide a home’s DHW needs. Installation costs are minimized if installed during construction of a new home: running the electric lines or gas pipelines to the units is cheaper if done before walls are enclosed. Doing so also eliminates the need to run separate hot water piping throughout a new home, and may allow a smaller central boiler or furnace to be installed.

For some types of DHW heating equipment, Con Edison may offer rebates. For details, go to:

https://www.conedhvacrebates.com/hvac

Solar thermal collectors (not PV panels) have been used for decades to heat DHW. For homes with sufficient solar exposure, such collectors may (when feeding a hot water storage tank) supply half or more of the heating energy needed to make DHW. An electric resistance coil or other heat source is used to make up the rest. At present, utility rebates for solar DHW systems are not available, though federal and/or State tax credits may be available. Check status at:

http://programs.dsireusa.org/system/program/detail/80

Solar Domestic Hot Water collectors

[Back to FAQ]

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