Chapter 4 *Reduction of fuel use with proper maintenance and reduction of emissions with fuel switching*

There are three ways that a building owner could potentially reduce the air pollution produced by a building's heating system. For those buildings that currently burn No. 6 or No. 4 heating oil, the most significant reductions would come from a change to a cleaner burning fuel, such as No. 2 oil or natural gas. Even those buildings that currently burn No. 2 oil could benefit from a number of heating system upgrades. Any heating system, regardless of the fuel it burns, will work more efficiently and produce lower air emissions if properly maintained.

The cost figures cited in this chapter cover only the cost of new or modified equipment required to switch a boiler to a new fuel or to perform the specific efficiency upgrades discussed. Many in-use heating systems may suffer from deferred maintenance issues that might need to be addressed in the context of an upgrade project. The cost of any deferred maintenance items, while potentially real and significant, are not included in this discussion for two reasons: 1) they would be unique to a specific boiler or building; and 2) they are unrelated to the upgrade or fuel switch and would likely need to be addressed regardless.

Heating system maintenance

Proper boiler maintenance is very important to sustain system efficiency and to minimize harmful air emissions. A poorly maintained boiler will emit excess pollutants and will use more fuel than a properly maintained system. Regular maintenance, cleaning and tuning of the boiler will both reduce pollution and save the building owner money.

Picture showing dirty boiler fire tubes

Picture showing clean boiler fire tubes

Boilers that burn residual and heavy-distillate fuel oils (No. 6 and No. 4) have the greatest maintenance requirements, including daily soot blowing during the heating season to remove soot from the heat exchanger surfaces and quarterly or more frequent tuning of the boiler to optimize excess combustion air. This maintenance will ensure that boiler efficiency does not degrade over time.

Boilers that burn distillate (No. 2) heating oil should, at a minimum, have an annual maintenance service performed. Basic maintenance for fuel oil boilers should include:

- Burner tip and heat exchanger cleaning
- Ash and soot removal
- Flue gas analysis/carbon monoxide test
- Air intake filter replacement
- Oil filter replacement

Residential boilers that burn natural gas normally need less maintenance, with normal service required only every other year. This service should at a minimum include:

- Air intake filter replacement
- Flue gas analysis/carbon monoxide test

If regular maintenance and boiler tuning is performed, exhaust emissions and efficiency should be within manufacturer specifications. To reduce emissions even further, switching fuels will be necessary.

Fuel switching

Fuel switching is an effective way to reduce boiler emissions, particularly for those units that burn residual fuels (No. 6 oil) or heavy distillate fuel (No. 4 fuel oil). The greatest emissions benefits will come from a switch to natural gas, but a switch to No. 2 fuel oil will also provide significant reductions. Such a fuel switch will also significantly reduce required boiler maintenance. As discussed later in the chapter, reducing the maintenance and fuel heating required when burning heavy fuels (No. 4, No. 5 and No. 6) can save approximately $1,000 to $4,000 annually. Actual maintenance savings from fuel switching will depend on the fuel used, annual total fuel use, the condition of the equipment, etc. It may also be both economically and environmentally beneficial to convert to dual fuel operation.

Summary of Potential Conversion Costs

- Conversions incur no incremental costs if the conversion happens at end of the useful life of the boiler/burner (25-35 yrs. for boilers (up to 60 if maintained and overhauled) and 20 years for burners);
- $15,000-30,000 (2 men, 3 days) for basic conversion from No. 6 oil to No. 2 heating oil

  - $5,000-10,000 to remove pre-heater and electric heater, repipe;
  - $5,000-10,000 to clean tank, steam lines;
  - $5,000-10,000 for burner “set up” to burn with proper air mix (improves efficiency by 15-20%, from 65-70% burn to 85% burn);
  - Burners less than 20 yrs. old can be adjusted to burn all fuels; specs for dual fuel burners are somewhat different, cost $4,000;
- $40,000-60,000 for complete burner replacement, including electrical and filings
- Extras
  - $1,000-2,000 for low NOx burner (not available for No. 6 oil);
  - $6,000 for optional closed loop oxygen system, boosts efficiency 2-10%;
  - $50,000 for economizer (heat exchanger in flue), boosts efficiency 5%, but these are bulky and unwieldy and are vulnerable to sulfur;
- Tank removal costs can be significant but may be inevitable under LUST regulations.

Gas line extensions can be a major capital expense. Inquire with National Grid or ConEdison if they will pay for the gas line extensions. According to National Grid or ConEdison, they will pay for the line if a buildings burns natural gas only or if several buildings switch at the same time, they will also pay for the line and let the buildings go dual fuel and burn the cheaper natural gas rate (interruptible rate).

Considerations for all boilers

The average boiler/burner have an optimal useful life of about 20 years.[1] With that said, many boilers/burners are used for much longer. If the boiler/burner are older than 15 years, a comprehensive boiler/burner inspection will give insight as to the boiler/burner’s expected remaining useful life. If this evaluation concludes that the boiler/burner have less than five years of life left, then a building owner should consider buying a new, more efficient boiler/burner. If the inspection determines that the boiler/burner have a long life ahead, a cost analysis should be performed to weigh the benefits of replacing versus fuel switching or upgrading.

If the boiler was installed before the 1970s, its insulation or pipes could possibly contain asbestos. A qualified inspector can sample suspect materials to verify whether asbestos is present or not so that asbestos abatement can be done according to the law. We recommend replacing such old boilers and burners for increased efficiency and less emissions.

Asbestos abatement costs vary widely and depend on individual situations; no general cost approximation can be given. If asbestos is removed from boiler or pipe insulation, new insulation will be required. Fiberglass insulation is the preferred material for pipes and costs approximately $1.35 per linear foot.[2]

Residual fuel to distillate fuel conversion

For boilers running on residual fuel, the first option that could be considered is a switch to distillate (No. 2) fuel. Switching from residual fuel oil to distillate fuel provides emissions as well as operational benefits.

Changing from residual to distillate fuel will reduce PM emissions by approximately 94%, NO_x by 65% and SO_2 by 68%. From an operational standpoint, distillate fuel does not need to be stored in a heated tank because it is much less viscous than residual fuels and remains a liquid even at temperatures below 0°F. Also, combustion of distillate fuel does not create as much ash or contaminants, so that fuel burners and combustion areas require less frequent maintenance and cleaning.

Although distillate fuel is cleaner burning and provides maintenance benefits, upgrading a residual fuel boiler to burn distillate fuel might require a capital investment. The main component required is a distillate fuel burner. Often, burners that were installed in the last 15 years already have a burner that is readily convertible to No. 2 heating oil or even natural gas so check with your heating system engineer whether a new burner is needed when switching fuel.

The cost of these burners can range from $5,500 to $8,000, depending on boiler size.[3]

If the existing residual fuel storage tank will be retained, certain steps must also be taken to ensure proper operation with distillate fuel; alternately a new tank could be installed.

Heating fuel sulfur level

Local and State law limits the sulfur content of heating fuel sold in New York City to levels lower than typically seen in other parts of the country. No. 2 distillate heating fuel sold in New York City can have no more than 2,000 ppm sulfur, while this type of fuel typically has 3,000 ppm sulfur in other locations. No. 4 and No. 6 heating fuel is limited to no more than 3,000 ppm sulfur in New York City—in other parts of the country these heavier fuels typically have 5,000 ppm sulfur or more.

Further reductions in heating fuel sulfur content will have little effect on direct PM and NO_x emissions from heating boilers, but will reduce SO_2 emissions, which will reduce the amount of indirect PM formed in the atmosphere.

The use of lower-sulfur heating oil (less than 500 ppm) would also allow the use of secondary condensing heat exchangers on oil-fired boilers. This could boost system efficiency by up to 20%, reducing fuel use and indirectly reducing emissions from equipped boilers (see below).

First, the existing tank must be properly cleaned of all residual oil. This can cost approximately $500 to $2,000 for an average size tank and costs also vary depending on the tank location.[4] Next, the fuel heating equipment that was required to heat the residual oil must be secured or removed. This equipment can include fuel immersion heaters, steam lines, heat exchangers, etc. The costs for securing/removing this equipment can vary widely, therefore no estimate is provided here.

Distillate fuel has lower energy content per gallon than residual fuel, so a greater number of gallons will be required even though the overall efficiency of the system remains the same. One gallon of No. 6 residual fuel contains 150,000 Btu of energy, while No. 2 distillate fuel contains 140,000 Btu per gallon (approximately a 7% reduction in heating potential per gallon of fuel).

This means that if a building normally burns 10,000 gallons of No. 6 residual fuel, it would burn 10,700 gallons of No. 2 distillate fuel.

No. 2 distillate fuel is also more expensive than No. 6 fuel. Over the next ten years, the average price of No. 2 heating oil is projected to be $2.87 per gallon compared to $2.27 per gallon for No. 6 oil. The switch to No. 2 from No. 6 fuel would therefore increase average annual fuel costs by approximately $8,000 for a building that currently burns 10,000 gallons of No. 6 fuel.

This increase in fuel costs would be at least partially offset by a reduction in boiler maintenance costs, through elimination of the energy costs required to keep No. 6 fuel heated year-round and by a small increase in boiler system efficiency (1–2%) because the heat exchanger surfaces would be cleaner.

The maintenance cost savings for a 5 mmBtu/hr-sized boiler could be as high as $3,000 per year, and elimination of fuel heating could save another $1,000 per year.[5] Boiler efficiency could increase by 1–2%, saving an additional $300 for every 10,000 gallons of fuel burned.

Residual fuel to natural gas/dual fuel boilers

Switching a boiler from residual fuel to a natural gas or natural gas dual fuel system is straightforward. The main component that must be modified is the fuel burner. For a dual fuel boiler, this requires that a natural gas burner ring be installed around the existing oil burner. Depending on the size of the boiler, the cost of these burner rings can range from $8,500 to $11,500.[6]

If the boiler will retain its capability to burn residual fuel (dual fuel), all of the existing oil storage and supply equipment will stay in place, but additional natural gas fueling equipment will need to be installed. If converting just to natural gas the existing oil storage and supply equipment can be disconnected and left in place, or removed.

The required fueling equipment usually includes a natural gas meter[7], regulator and a metering or flow valve. This equipment can range in cost from approximately $2,000 to $12,000[8], depending on the distance of the boiler from the utility connection and the boiler configuration. In some cases, natural gas suppliers will subsidize the cost of the equipment (in highly competitive markets) or amortize the cost over several years by adding a surcharge to the monthly fuel bill rather than requiring an up-front payment.

Another cost that must be considered is chimney relining. According to New York State Uniform Fire Prevention and Building Codes, boilers found without a chimney liner must be lined with an approved lining system to prevent the leakage of flue gases into the building.[9] Chimney lining cost approximately $1,000 for one or two family homes and can cost much more for larger buildings depending on the size of the chimney.[10]

Also, buildings will need to check with the natural gas provider whether the buildings is located in a low pressure gas area. If this is a case, the building will need to buy a natural gas booster which can cost around $25,000.

Generally, the intent of a dual fuel conversion is to use natural gas as the primary fuel, while retaining the existing residual fuel capability as a backup, in order to take advantage of a lower interruptible rate for natural gas (see chapter 3). We recommend using No. 2 heating oil as a back up fuel because it is the cleaner oil.

To illustrate the annual cost implications of dual fuel conversion, we will assume that 25% (but typically it's only a few days out of the year where a building needs to switch to oil so this is a conservative estimate) of the annual heat requirement will come from No. 2 heating oil and 75% from natural gas. For a boiler that burned 10,000 gallons of No. 6 residual oil annually prior to conversion, the post-conversion fuel use would be 2,500 gallons of No. 2 heating oil and 1,125 mmBtu of natural gas per year.[11]

If the natural gas provider offers an interruptible natural gas rate of $8.49 per 1,000 cubic feet ($8.26/mmBtu)[12], the total average annual fuel cost after conversion would be $17,982, which is $6,200 less than the cost of burning No. 6 oil exclusively. The above interruptible rate is calculated using Energy Information Administration ten-year-average projected data, and an assumed 23% savings over the standard commercial natural gas rate.

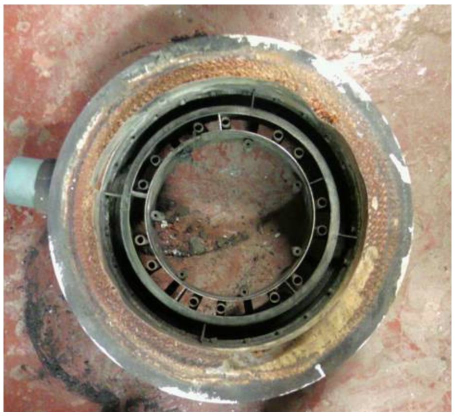
Primary use of natural gas after dual fuel conversion will reduce annual boiler maintenance and cleaning costs, for an annual cost savings of as much as $1,000 per year[13], which would further reduce total heating system operating costs. Dual fuel conversion will not significantly reduce annual costs for residual fuel heating— a sizable supply of backup residual fuel must still be kept heated year-round in case of natural gas supply interruption.[14]

These numbers are illustrative—actual annual costs will vary depending on annual fuel usage and the percentage of time using backup residual fuel.

Distillate fuel to natural gas/dual fuel boilers

The process of converting a boiler that burns distillate fuel to natural gas or dual fuel operation is similar to the process for a residual fuel boiler. The modifications required are to the burner (but check if the existing burner is already a dual fuel burner), the addition of a gas supply train and possibly a gas booster (in case of low pressure gas). Also check with an engineer and the utility company if an external extension of the gas line is necessary. If the burner needs modifications, this can usually be accomplished by adding a natural gas burner ring assembly to the existing distillate fuel burner. Prices for the required burner equipment usually range from $8,500 to $11,500[15], depending on the size of the boiler. A low pressure gas booster can cost approx. $25,000 and is a one time capital expense. As discussed above, the cost of the required gas supply equipment will generally range from $2,000 to $12,000 depending on building and boiler configuration.[16]

25 mmBtu/hr boiler gas ring



Source: Newton Wellsley Hospital

Given current fuel pricing, conversion of a distillate boiler to dual fuel natural gas operation will produce much greater annual fuel cost savings than conversion of a residual fuel boiler.

Assuming a baseline annual energy use of 1,500 mmBtu (equivalent to 10,700 gallons of No. 2 distillate fuel) and post-conversion operation with 25% oil and 75% interruptible natural gas, average annual fuel costs after conversion would be $17,000 using projected ten-year-average prices. This would be $13,700 less than the cost of operating the boiler exclusively on No. 2 distillate fuel.[17]

Primary use of natural gas after dual fuel conversion will also reduce annual boiler maintenance and cleaning costs, for an annual cost savings of as much as $1,000 per year.[18]

These numbers are illustrative—actual annual costs will vary depending on annual fuel usage and the percentage of time using backup residual fuel.

Boiler upgrade/replacement

Existing heating boilers, particularly older ones, can often be upgraded with modern technology to reduce their emissions directly and indirectly by increasing efficiency and reducing fuel use. The reduction in fuel use from efficiency improvements will also save money. Some of the more common upgrades available are discussed below.

Time delay relay (hot water boilers only)

Usually, when the thermostat calls for heat, the boiler will light off and circulate hot water to the radiators or baseboard heaters. Since boilers are insulated, they retain a significant amount of heat even if the burner has been off for some time.

A time delay relay delays burner ignition and circulates the hot water that was already in the boiler to the radiators. After a set amount of time, the boiler will fire up and increase boiler water temperature. Time delay relays usually cost about $100 and can save up to 5% in annual fuel costs.[19]

Stack O_2 closed loop control

Fuel is mixed with air in the combustion chamber of a boiler—the air provides the oxygen required for the fuel to burn. In a perfect world, only enough air would be provided to completely burn the fuel and there would be virtually no oxygen in the exhaust.

In the real world, some amount of additional or excess air is always provided to make certain that all fuel is burned inside the boiler. This ensures that both particulate and carbon monoxide emissions are as low as practical.

If too much excess air is provided to the burner, overall boiler efficiency will be reduced because the unused excess air is heated in the combustion chamber and carries energy out of the exhaust stack. Reducing burner excess air to the minimum practical level will therefore increase system efficiency and reduce fuel costs.

Many boilers operate with significantly more excess air than required because of burner/control imperfections, variations in boiler room temperature, lack of burner maintenance and changes in fuel composition. A stack O_2 closed loop control system monitors the oxygen content of the exhaust and adjusts the amount of air provided to the burner in order to maintain optimal combustion conditions with minimal excess air.

Levels of excess air possible with a well-tuned heating system

Fuel	Minimum Excess Air, %
Natural Gas	10%
#2 Oil	12%
#6 Oil	15%

Source: Energy Management Handbook

As a rule of thumb, boiler efficiency can be increased by 1% for each 15% reduction in excess air, or 40°F reduction in stack gas temperature. An annual fuel savings of up to 5% can be obtained with tighter control of excess combustion air.

Typically, only boilers 10 mmBtu/hr in size or larger can benefit from this technology. The closed loop O_2 system requires a mechanical linkage between the blower fan louvers and the burner to adjust air fuel ratio.

Smaller boilers (less than 10 mmBtu) typically use an "all-in-one" unit for their burner, blower fan, louvers and fuel pump, and the required control linkage is not feasible.

For a 10-mmBtu/hr boiler, a closed loop O_2 system will typically cost between $10,000 and $20,000.[20] A boiler of this size will typically use approximately 10,800 mmBtu of fuel annually, so that a 5% fuel savings would result in an annual fuel cost savings of approximately $8,000 (assuming No. 6 residual fuel). The payback period for installation of a closed loop O_2 system could be less than two years for this sized boiler. Larger boilers might have an even shorter payback period, depending on current efficiency.

These systems should be installed and tuned by a boiler professional, and proper training should be given to all boiler operators.

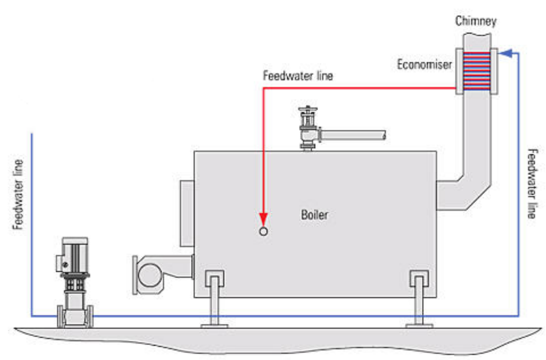
Condensing heat exchanger

Another way to increase heating system efficiency is to add a condensing heat exchanger (CHX), which is a second heat exchanger installed in the exhaust stack of the boiler. These systems are sometimes referred to as "economizers."

Combustion gases always contain water (H_2O) because the hydrogen in hydrocarbon fuels is oxidized during combustion. This water is usually in vapor form (steam) and retains significant energy—which is typically lost when the vapor exits the exhaust stack.

When using a CHX, feed water returning from the baseboard heaters/radiators to the boiler is first directed through the CHX heat exchanger in the exhaust stack. As the exhaust gases flow over the outside of the CHX heat exchanger, exhaust heat is transferred to the feed water, which then enters the boiler. Because the boiler feed water is now warmer than it would be without this recovered energy, less fuel input energy is required, thus increasing the efficiency of the boiler system.

Hot water boiler with flue gas heat exchanger (economizer)



Source: Boiler Burner Consortium

Because the CHX heat exchanger removes so much heat, the exhaust stack temperature drops below 212°F (boiling point of water), causing the water vapor in the exhaust to condense.

This condensed water must be removed—a condensate pump and drain need to be installed. Drains are usually made with PVC pipe because of its resistance to chemicals and acids.

The savings potential of a secondary CHX heat exchanger is a function of how much heat can be absorbed or recovered. A general guideline is that about 10% of boiler heat input can be recovered with a properly designed and sized CHX.

In practical terms, a CHX can only be used on boilers that burn natural gas or special low-sulfur distillate fuel. During combustion some portion of fuel-borne sulfur is converted to sulfuric acid, which collects in the condensate water of a CHX. When using fuels with sulfur content greater than approximately 500 ppm, so much acid will be present in the condensate that it will quickly corrode the heat exchanger pipes, even when made from stainless steel. In New York City, No. 2 distillate heating oil has approximately 2,000 ppm sulfur, while the sulfur content is even higher in other parts of the State and country. To utilize a secondary CHX, a distillate boiler in New York City would need to burn ultralow-sulfur diesel fuel (ULSD) instead of standard heating oil. By law, this fuel, which is used in all on-road trucks and buses, can have no more than 15 ppm sulfur. It is readily available for bulk delivery from fuel suppliers, but not necessarily from heating fuel dealers. It will likely cost more than higher-sulfur heating oil as well.

For a 10-mmBtu/hr boiler, the cost of a condensing heat exchanger is approximately $5,000 to $15,000[21], and will require professional installation.

A boiler of this size will typically use approximately 10,800 mmBtu of fuel annually, so that a 10% fuel savings would result in an annual fuel cost savings of $11,500 (assuming natural gas fuel). The payback period for installation of a CHX on a natural gas boiler could be less than one year.

Condensing Boiler for Domestic Hot Water (DHW) and Hydronic Heat.

There is now a large international market in true condensing boilers, which incorporate the condensing heat exchanger of the previous section directly into the design of the boiler. Widely used in Europe (required in some countries) and common in other parts of the US, these devices can produce domestic hot water from gas with efficiency in excess of 95% and provide hydronic space heat with efficiency ("AFUE", an official DOE test procedure) greater than 90% with properly sized radiators or fan-coil units. They are available in all sizes, from wall-hung units suitable for single-family homes to 1.5-2.5 mmBtu commercial scale units that can be arrayed to meet any practical load.

Condensing boilers are not as common as they should be in New York City. There is no doubt that this situation will change, and it is changing now, as demand for higher efficiency forces the service industry to learn the (fairly simple but different) techniques needed.

Any residential building with 100 units or more and steam heat should consider getting a gas-fired condensing boiler and storage tank to meet their DHW needs. The system will be far more efficient than the steam boiler in the summer, and depending on the fuel used in the steam boiler, may also provide less expensive hot water in heating season. Based only on summer usage, payback periods of 5-10 years are common. Optimally, if the heating system is based on oil or is dual fuel, and can provide back-up hot water, the condensing boiler can operate on interruptible gas and enjoy the lower price structure much of the year.

Proper Maintenance

The importance of proper maintenance of the boiler and distribution system to efficient operation and low emissions cannot be over-emphasized, and should be the first area to which attention and effort are applied. More often than not, the same company that is selling fuel to the building carries out the maintenance on the boiler and system. This is convenient, but it means the company has an intrinsic lack of interest in having the equipment operate at peak efficiency. If a building operator is reluctant to move to separate suppliers of maintenance and fuel, he or she should at least bring in an independent boiler firm to provide a combustion efficiency test and review other aspects of operation. Many boilers in New York City, even large ones, do not receive annual combustion efficiency tests and are operating well below their potential as a result. The NYC Dept. of Buildings requires safety inspections for carbon monoxide every year. The NYC Dept. of Environmental Protection performs combustion tests on all large NYC boilers every three years, but their goal is to ensure that emissions are within prescribed limits, and they offer no advice to owners other than "you passed".

In addition to the combustion efficiency tests, all other aspects of boiler and distribution system operation should be checked annually, including operation of all pumps and motors, steam traps, air valves, and all aspects of whatever control system is in use. It is very easy to let these items slide, since usually the heating system will continue to function, but the cost-effectiveness of proper maintenance is well established, and should be pursued before any add-ons or improvements are considered. Dan Holohan's web site, www.heatinghelp.com, is an excellent source of detailed information on best-practice techniques and solutions to common problems, and his book, "the Lost Art of Steam Heating", should be on the shelf of anyone charged with operating a large steam heating system.

Flame retention burner (oil-fired boiler only)

If a boiler has an old, inefficient burner, it may be cost effective to replace the burner with a flame retention burner. A flame retention burner blocks the flow of air up the chimney when the burner is not in use. Other advantages over a conventional burner include: reduced emissions, higher efficiency, hotter flame and more complete mixing of fuel and air. Flame retention burners usually have 5–15% higher fuel utilization efficiency over conventional burners.[22] The price for a new flame retention oil burner assembly is approximately $500–2,000 depending on boiler size, and will require a professional to install and tune.[23]

Annual cost savings for a 5-mmBtu boiler would be approximately $5,000 (assuming No. 2 oil and a 5% efficiency increase). The payback period for installing a flame retention burner would likely be less than one year.

Boiler re-rating

Many older water and steam heating systems were designed with burners that could deliver more heat than the heat exchanger could really absorb. This was done to make them more responsive to changes in demand for heat (i.e., they could heat up faster), but it is inefficient most of the time since the excess heat put out by the burner goes up the exhaust stack and is wasted.

Some older systems may be able to be "re-rated" by installing a smaller burner. In some cases, net system efficiency could be increased by 20% or more.

The current system design should be evaluated by a boiler professional prior to investing in the new burner required for a fuel conversion. This approach might also be cost effective even if staying with the same fuel, as annual fuel savings might outweigh the cost of the new, smaller burner.

Cogeneration

Also called "combined heat and power" or CHP, cogeneration has been around as long as regular generation has. It is based on the fact that burning fuel to produce electricity is limited to a conversion efficiency to electric power of 25-35%, with the remainder of the energy in the fuel being released as heat in the engine. In most large scale utility generation this heat is discarded either in cooling towers or to a convenient river, since shipping it in pipes to where it could be used is too expensive to be practical. Con Edison's steam system is an exception to this, made possible by the density of buildings in Manhattan.

Another exception is the use of small-scale generators in buildings, with the reject heat being captured and used to heat domestic hot water, eliminating the need for the gas or oil that would otherwise have been needed. If both the heat and electricity can be used, cogeneration can lower fuel bills and carbon footprints, but at the price of adding a somewhat complex piece of equipment to the building's infrastructure. There are several factors to keep in mind when considering cogeneration:

- The building must have sufficient hot water usage to make use of the reject heat. Otherwise the system will make no sense economically. Even for small cogenerators (30-50 kW), this normally means a residential building of at least 100 apartments.
- The building must be master metered for electricity. If the apartments have individual accounts with Con Edison, there will be no way to use the electrical output within the building, and Con Edison will not pay a useful amount of money for the power. Converting a building to a master meter is a good idea (more information is available at www.submeteronline.com), since it will save considerable money, but should only be done in conjunction with submeters. Simply including a fixed electricity fee in rent or maintenance payments is a terrible policy that encourages wasteful behavior.
- The building must either have an informed and enthusiastic member of its staff to manage the cogenerator, or must work with one of several companies that will install and operate the equipment as a "hands off" operation for the building.
- Since cogeneration supplies domestic hot water, a building currently using a steam boiler for heat and hot water should choose between cogeneration and a gas-fired condensing boiler as discussed earlier in this section. It would make no sense to install both.
- The decision as to whether and how to pursue cogeneration is technically complex and should only be undertaken with the advice of an expert other than the company that will install the equipment. Since the installer can charge in proportion to the scale of the equipment, there is an unfortunate tendency to oversize, resulting in poor economic performance. A program such as those offered by NYSERDA (discussed below) can provide this assessment as part of

their technical assistance, and some financial assistance may also be available, depending on how program participation is carried out.

In short, cogeneration can be an attractive option for larger multifamily buildings, but is one that should be carried out carefully and with objective, expert advice.

References

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[2] State Supply Company, "Steam Pipe Insulation," http://www.statesupply.com/displayItem.do?sku=IF1010X (accessed November 13, 2008).
[3] Conversations with Barry Allen and Robert Mucci from National Grid discussing boiler upgrades, May 7, 2008.
[4] Consumer Energy Council of America (CECA), "Smart Choices for Consumers: Analysis of the Best Ways to Reduce High Heating Costs, Section D: Upgrading Existing Equipment," p. 12, November 2005.
[5] Switching to distillate fuel will reduce sootblowing requirements (~$1,000–2,000) as well as reduce the need for boiler efficiency tune-ups (~ $1,000).
Removing the heated residual fuel storage tank would result in a savings of $1,000 annually, assuming a 2kW heater operating for 7,000 kWh annually.
[6] Conversations with Barry Allen and Robert Mucci from National Grid discussing boiler upgrades, May 7, 2008.
[7] We recommend that all natural gas users consider having their gas meters calibrated annually for accuracy in therm usage, especially for large systems.
[8] Conversations with Barry Allen and Robert Mucci from National Grid discussing boiler upgrades, May 7, 2008.
[9] New York State Uniform Fire Prevention and Building Code, §F603 Fuel Fired Appliances - §F603.6.1 Masonry chimneys, http://www.cortland.org/CITY/fire/statecode-fuelfired.htm (accessed September 26, 2008).
[10] Consumer Energy Council of America (CECA), "Smart Choices for Consumers: Analysis of the Best Ways to Reduce High Heating Costs, Section D: Upgrading Existing Equipment," p. 12, November 2005.
[11] 75% x 10,000 gallons x 150,000 Btu/gal = 1,125,000,000 Btu, or 1,125 mmBtu.
[12] Assumes that interruptible gas rate will be 23% lower than standard commercial rate, per current pricing structure in New York City.
[13] Conversations with Barry Allen and Robert Mucci from National Grid discussing boiler upgrades, May 7, 2008.
[14] Using natural gas will reduce the need for sootblowing (~$500) and the need for boiler efficiency tune-ups (~$500). Maintenance practices when using the backup fuel will be normal No. 6 procedures.
[15] Conversations with Barry Allen and Robert Mucci from National Grid discussing boiler upgrades, May 7, 2008.
[16] Conversations with Barry Allen and Robert Mucci from National Grid discussing boiler upgrades, May 7, 2008.
[17] Assuming $2.60/gallon for No. 2 fuel oil and $11.11/mmBtu interruptible rate for natural gas.
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[22] Oil Heat America, "Oil Heat Equipment—Burners," http://www.oilheatamerica.com/index.mv?screen=burners (accessed August 28, 2008)

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