Appendix A:
Case studies of costs and savings of heating fuel conversions

All fuel prices are average projected prices between 2010 and 2020 in accordance with the Energy Information Administration Annual Energy Outlook 2009. The interruptible natural gas rate is assumed to be 23% lower than the standard commercial natural gas rate.

Case study 1: Single-family home

Fuel switch from No. 2 heating oil to natural gas

For this study, we assume that the existing boiler is a 100,000 Btu/hr boiler[1] in good working condition and does not require replacement of standard components to operate correctly.

Capital cost

Natural gas burner	$1,000
Chimney relined	$ 500
Removal of oil tank	$ 500
Natural gas piping *	$1,500
Condensate pump	$ 100
Total	$3,600 **

Operating cost

We assume that a single-family home uses 87 mmBtu (621 gallons No. 2 fuel)[2] annually for heating. U.S. average projected prices (2010–2020) are used.

Annual No. 2 oil cost: 621 gallons x $2.87 =	$1,782
Annual natural gas cost: 87 mmBtu x $10.73/mmBtu =	$ 934
Savings	**($ 848)**

Payback period: $3,600 / $848 = 4.25 years **

Emission savings (lbs/year): NO_x: 3.2 lbs, PM: 0.1 lbs, SO_x: 17.6 lbs.

* *Assuming no previous natural gas service.*

** *The natural gas utility may provide incentives to reduce installation costs (see chapter 6). The payback period would generally be shorter if more fuel was used annually. For 1,000 gallons of annual fuel oil use, the annual savings after switching to natural gas would be $1,350 and the payback period would be less than three years.*

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[1] Building Green.com, Environmental Building News, Energy Metrics: Btu's, Watts, and Kilowatt-Hours, accessed on September 26, 2008, http://www.buildinggreen.com/auth/article.cfm?fileName=161220a.xml.

[2] U.S. Department of Energy, Energy Information Administration, 2001 Residential Energy Consumption Survey: Household Energy Consumption and Expenditure Tables, Table 2. Fuel Oil Consumption and Expenditures in U.S. Households by End Use and Census Region, 2001; Average for Northeast Region; this is 630 gallons of fuel oil.

Case study 2: 200-unit apartment building

Fuel switch from No. 6 residual oil to natural gas (2% efficiency increase); Add a condensing heat exchanger (10% savings)

For this study, we assume that the boiler is a 5-mmBtu/hr hot water unit in good working condition and does not require replacement of standard components to operate correctly.

Capital cost

Natural gas burner	$10,000
Chimney relined	$ 5,000
Secure oil tank	$ 3,000
Natural gas piping	$ 6,500
Condensate pumps	$ 500
Condensing heat exchanger	$10,000
Total	$35,000

Operating cost

We assume that the building currently uses 5,400 mmBtu (36,000 gallon No. 6 oil) annually for heating

Current

Annual No. 6 oil purchase: 36,000 gallons x $2.27 =	$81,720
Annual No. 6 oil tank heating (2kW heater @ 7,000kWh) =	$ 980
Annual soot blowing and maintenance	$ 3,000
	$85,700

Proposed

Annual natural gas cost: 4,900 mmBtu x $10.73/mmBtu =	$52,577
Annual No. 6 oil tank heating (2kW heater @ 7,000kWh) =	$ 0
Annual soot blowing and maintenance	$ 0
	$52,577
Savings	**($33,123)**

Payback period: $35,000/$33,123 = 1.1 years

Emission savings (tons/year)

NO_x	0.80 tons
PM	0.14 tons
SO_x	1.41 tons

Case study 3: 500-unit apartment building

Fuel switch from No. 6 residual oil to natural gas/No. 2 oil dual fuel (1% efficiency increase);Add closed-loop O_2 control (5% fuel savings)

For this study, we assume that the boiler is a 10-mmBtu/hr boiler in good working condition and does not require replacement of standard components to operate correctly.

Capital cost

Dual fuel burner	$20,000
Clean residual fuel tank	$ 3,000
Secure/remove residual fuel heating equipment	$ 2,000
Chimney relined	$ 8,000
Natural gas piping	$ 8,500
Condensate pumps	$ 1,000
Closed-loop O_2 control	$15,000
Total	$57,500

Operating cost

We assume that the building currently uses 10,800 mmBtu (72,000 gallon No. 6 oil) annually for heating

Current	
Annual No. 6 oil purchase: 72,000 gallons x $2.27 =	$163,440
Annual No. 6 oil tank heating (4kW heater @ 14,000kW) =	$ 1,960
Annual soot blowing and maintenance	$ 5,000
	$170,400
Proposed	
Annual No. 2 oil purchase: 18,128 gallons x $2.87 =	$ 52,027
Annual natural gas purchase: 7,614 mmBTU x $8.26/mmBTU =	$ 62,892
Annual maintenance	$ 1,000
	$115,919
Savings	**($54,481)**

Payback period $57,500 / $54,481 = 1.1 years

Emission savings (tons/year)

NO_x	1.16 tons
PM	0.21 tons
SO_x	2.16 tons

Cost and savings analysis:
Switching from No. 6 oil to No. 2 heating oil

An 86-unit building burns approximately 50,000 gallons of No. 6 oil. Two years ago, the building was equipped with a new dual fuel burner and a new boiler.

The costs of removing preheater equipment and technical changes to accommodate burning of No. 2 heating oil including cleaning of tank:

One-time expense: $8,500

Yearly additional heating costs if No. 2 heating oil costs 35 cents more than No. 6 oil plus 4% taxes (price per June 16, 2009):

Annual increase in oil costs: $18,200*

Yearly cost savings due to less maintenance costs, less electricity use and less operational costs for No. 2 heating oil:

Annual savings: approx. **($1,500)**

To offset the additional heating oil costs, building owners should consider implementing efficiency measures (proper maintenance and fine tuning of boiler system, insulating pipes as well as system upgrades) to reduce the number of gallons of oil burned. Such efficiency measures are described in chapter 5 of this report.

Potential annual savings with 10% fuel savings: **approx. ($9,000)**

An energy management system (EMS)** could reduce heating oil consumption by about 20%, which would translate into 10,000 fewer gallons burned annually. With No. 2 heating oil prices of June 16, 2009, this would reduce fuel costs annually as follows (including taxes):

Annual fuel savings: approx. **($20,000)**

* EIA predicts that No. 2 heating oil will be approximately 60 cents/gallon more expensive than No. 6 oil.
** An EMS costs approximately $20,000.

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