



Heating Oil's Role in the Housing Market

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Executive Summary

This memorandum profiles oil heat's use in housing and the factors that affect it: heating fuel choice in new home construction, availability of alternative heating fuels and relative prices. Its principal findings:

- Oil heat's market is the Northeast, where two-thirds of the nation's 11.2 million oil-heated homes are located and where it heats half of the housing units in New England and about one-third of the units in the Mid-Atlantic. (Figure 1 and Table 1, pp. 2-3.)
- The average consumption in single family homes totals about 900 gallons per year in New England and 950 gallons in the Mid-Atlantic, according to Energy Information Administration (EIA) data. For space heating alone, these homes use about 800 gallons annually in New England and 850 gallons in the Mid-Atlantic. (Profile, p. 3.)
- Oil heat's use in new homes is dependent on new home building in the Northeast, where almost 90% of new oil-heated homes are built. It continues to show its greatest market strength where homeowners (as opposed to builders) have chosen the heating fuel. (Figures 2-5, pp. 4-5.)
- Although gas availability in the Northeast has increased in the last several years, the loss of oil-heated homes through conversions to gas heat has decelerated in the last several years. In spite of the slowdown, and in spite of a relatively recent trend of converting electric heated homes to oil heat, the net number of oil-heated homes declines annually. (Figure 6 and Table 2, pp. 6-7.)
- About 55% of the oil-heated housing units in the Northeast have access to piped gas, and 2/3 of these use it for some non-heating purpose. While these homes appear to be candidates for conversion, the combination of aggressive oil marketing and the lower price of oil have kept them in the oil heat market. In addition, more than a million housing units in large apartment buildings in the Mid-Atlantic region have nearly full access to gas, but with residual fuel oil prices low and the housing stock old, they are unlikely conversion markets. (Table 3 and Figure 7, pp. 8-9.)
- Oil heat is cheaper than gas in the Northeast, especially in New England. According to EIA data for 1993, the average single family homeowner in New England paid \$8.52 per million BTU for gas heat, or 30% more than the homeowner with oil heat. In the Mid-Atlantic, the difference is smaller: \$7.18 per MMBTU for gas heat and \$6.69 for oil heat. (Table 4, p. 10.)

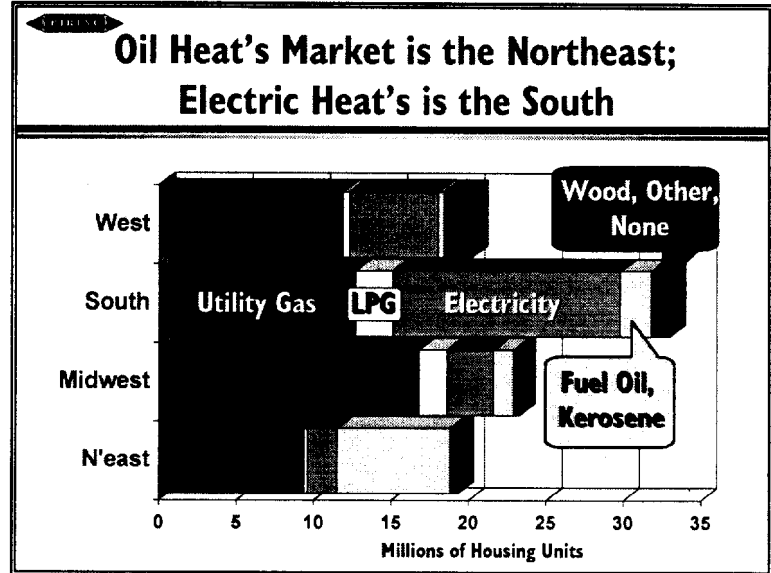
Space heating requirements for buildings other than housing units (churches, schools, hospitals, stores, etc.) are not discussed in this memorandum, although they do represent additional markets for oil heat.

Existing Housing: Oil Heat's Market is the Northeast

Nationwide

The U.S. Department of Energy's Energy Information Administration (EIA) conducts a triennial *Residential Energy Consumption Survey*, gathering information on the housing stock and the energy use of its inhabitants. As shown in Figure 1, utility gas is the most popular heating fuel for the existing housing inventory in three of the four Census regions. Including LPG with utility gas, as many data sources do, "gas" takes the largest fuel share in the South as well. Electric heat's popularity, by contrast, is regionally concentrated; its importance in the South, the largest regional housing market, gives electric heat its national second-place position.

Figure 1



Approximately 11.2 million housing units were heated with oil (including 1 million heated with kerosene) in 1993, 7.3 million or two-thirds of them in the Northeast. Oil is the main heating fuel for 12% of the housing units nationwide, and 37% of the housing units in the Northeast.

Oil Heat in the Northeast

Even in the Northeast, the popularity of heating oil varies substantially by region. In New England, just over half of the housing units use oil heat.¹ Its greatest popularity is in the detached single family homes market, where oil is the heating fuel for two-thirds of the homes, a substantially higher share than it gets in other types of housing units. The Mid-Atlantic region provides a strong contrast: one-third of all housing units heat with oil, and the strongest popularity -- by a small margin -- is in buildings with five or more units. As noted in later sections of this memorandum, these larger buildings likely use residual fuel oil, and are a nearly unique regional phenomenon: 98% of all units in buildings with 5 or more units are in the Northeast; 82% in the Mid-Atlantic alone.

¹ In this section and throughout this memorandum, we have relied on the Energy Information Administration's comprehensive *Residential Energy Consumption Survey*. The EIA surveyed more than 7,000 householders and their rental agents and fuel suppliers in all regions of the country. EIA applies a scaling multiplier to each household record. It publishes summary data and has made its database available (excluding, for confidentiality reasons, the small number of households sampled in Alaska and Hawaii, and including the assigned scaling multipliers). The data presented in this memorandum are primarily based on PIRINC's own extraction and tabulation of the database details.

Table I: Oil-Heated Housing in the Northeast, 1993

	Fuel Oil		Kerosene	
	000 Units	% of All Fuels	000 Units	% of All Fuels
New England	2,552.2	50.4	142.6	2.8
Mobile Homes	109.9	48.7	99.1	44.0
One-Family, Detached	1,754.7	64.8	43.5	1.6
One-Family, Attached	112.9	29.3	0	0
Bldgs. w/ 2-4 Units	334.7	37.2	0	0
Bldgs. w/ 5 Units or More	240.0	28.4	0	0
Mid Atlantic	4,470.7	31.0	215.5	1.5
Mobile Homes	81.5	25.7	111.0	35.0
One-Family, Detached	2,307.0	33.7	24.7	0.4
One-Family, Attached	404.0	20.5	9.3	0.5
Bldgs. w/ 2-4 Units	477.0	23.6	26.7	1.3
Bldgs. w/ 5 Units or More	1,201.2	36.9	43.8	1.3

Snapshot of Distillate-Heated Homes in 1993

Making the assumption that distillate fuel oil is used in the mobile homes, single family homes (both attached and detached) and in the garden-type apartments with 2-4 units in the building, No. 2 oil heats some 2.3 million housing units in New England and 3.3 million in the Mid-Atlantic. Consumption characteristics are shown in the shaded box.

According to the Energy Information Administration's data, single family homes used about 900 gallons annually on average in New England and about 950 gallons in the Mid-Atlantic. The figures include oil consumed for heating water, as about 60% of the oil-heated housing units in New England and 50% of the units in the Mid-Atlantic do. According to

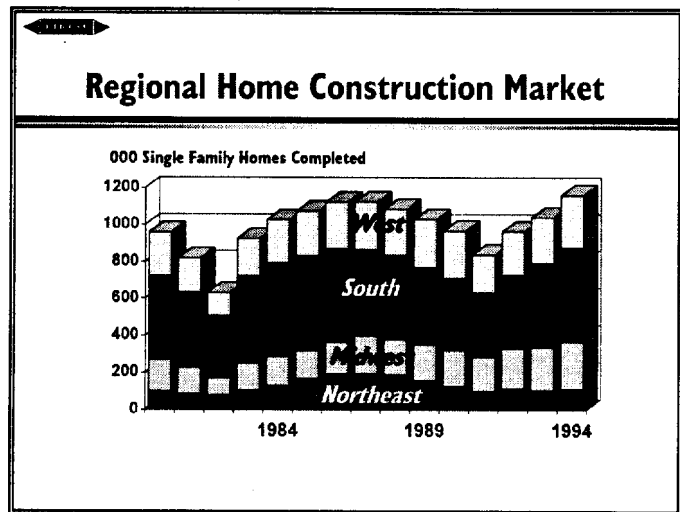
Profile of Distillate-Heated Housing Units, 1993			
		One-Family	All Units
New England			
	Built before 1960	67.6%	68.0%
	Avg. Heated Area	2,280 sq. ft.	2,114 sq. ft.
	Avg. Consumption	908 gal.	880 gal.
	Avg. Consumption for Space Heating	790 gal.	767 gal.
	Avg. Space Heating Use per Degree Day	0.120 gal.	0.117 gal.
Mid Atlantic			
	Built before 1960	60.2%	64.2%
	Avg. Heated Area	2,387 sq. ft.	2,119 sq. ft.
	Avg. Consumption	958 gal.	872 gal.
	Avg. Consumption for Space Heating	848 gal.	765 gal.
	Avg. Space Heating Use per Degree Day	0.145 gal.	0.132 gal.
Note: "One-Family" limited to detached one-family units. Source: Extracted from <i>Residential Energy Consumption Survey, 1993</i> .			

the survey, these homes use about 100 gallons more per year than the average. As shown in the table, single family houses tend to be larger in the Mid-Atlantic. Isolating consumption for space heating, we can see that the larger square footage seems to explain most of the difference in the two regions' average consumption. However, because the Mid-Atlantic experiences fewer degree days, the region's oil consumption per degree day is about 20% higher than New England's. The numbers imply that Mid-Atlantic homes are kept at higher temperatures, and in fact, EIA's survey confirms that they are, especially at night and when no one is at home. Heat loss could also be a factor, but is harder to confirm.

New Homes: Oil Heat Depends on the Northeast

Oil heat's new home additions are dependent on the small Northeast single family home construction market.² In 1994, for instance, of the 39,000 new oil-heated homes constructed nationwide, 34,000 were in the Northeast. (The construction of units in multi-family buildings represents a small fraction of overall housing construction. Oil heat -- residual fuel oil -- no longer gets a measurable share of this smaller market, even in the Northeast.) As shown in the following figure, the Northeast currently accounts for the smallest regional share of home construction, about 10% of the single family homes completed in the U.S. in 1994. The Northeast's recent peak share of the new home market, coincident with its strong economic performance, was in the late 1980's. The peak in the Northeast's construction also coincides with the recent 1988 peak in oil-heated home completions -- 58,000 nationwide, all but 1,000 of which were in the Northeast. In fact, if the Northeast's construction in 1994 had been as robust as in the late 1980's, oil heat's share of the bigger pie would have resulted in the construction of some 25,000 additional oil-heated homes. With low population growth expected to continue, the Northeast is likely to remain a relatively low share of the home-building market.

Figure 2

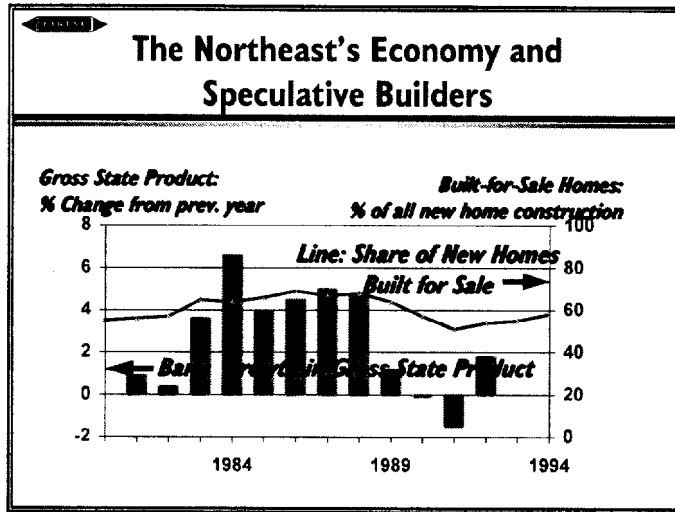


The Bureau of the Census divides its single family home construction data by category of builder:

- *Built-for-sale*: a builder pays to construct a home with the intention of selling it. In this memorandum, we assume that the *builder* makes the heating fuel choice for such a home.
- *Owner-built*: Clearly, the *homeowner* makes the heating fuel choice.
- *Contractor-built*: a builder constructs a home for, and is paid by, a specific homeowner. The *homeowner* makes the fuel choice.

² The term "oil heat" as used in this section generally refers to distillate and residual fuel oils and kerosene, because the source data on new home construction from the Bureau of the Census aggregate the three types of oil.

Figure 3



In this memorandum, “owner-built” plus “contractor-built” equals the total number of homes where the homeowner has chosen the heating fuel.

The number of homes built for sale exceeds the number of owner-built and contractor-built homes. In 1994, for instance, homes built for sale were equal to about 60% of all single family home completions. As illustrated in Figure 3, builders respond sharply to the overall health of the regional economy. The high growth period in the mid-1980's brought a high share of homes built for sale. The declining share of builder activity during the economic slowdown is a given.

Builders v. Homeowners: The Gap Narrows in Heating Fuel Choices

Builders and homeowners have historically chosen differently when installing home heating fuels: Gas has generally been more popular with builders, who can enjoy economies of scale in development-wide hook-ups, while electricity, and in the Northeast, oil, have been more popular with homeowners. Gas heat's share of new construction, however, has grown sharply in all regions, and in both the builder and the homeowner markets, absorbing electric heat's plummeting share.

Oil heat is an important factor in new home construction only in the Northeast, as noted above. In the region's builder market, oil heat's share has remained relatively steady at 20% or so over the last decade and a half, in contrast to the other two major fuels. Gas heat's share of new homes built for sale has soared from 44% in 1980 to 65% by 1994, mirroring electric heat's decline from a 36% share to a 12% share, as

Figure 4

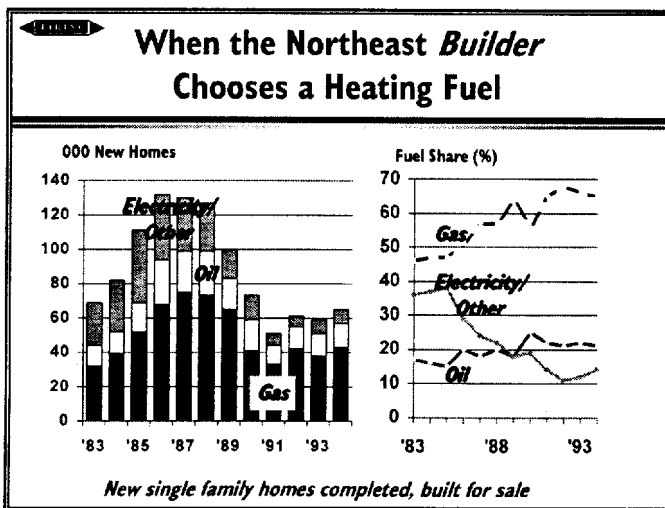
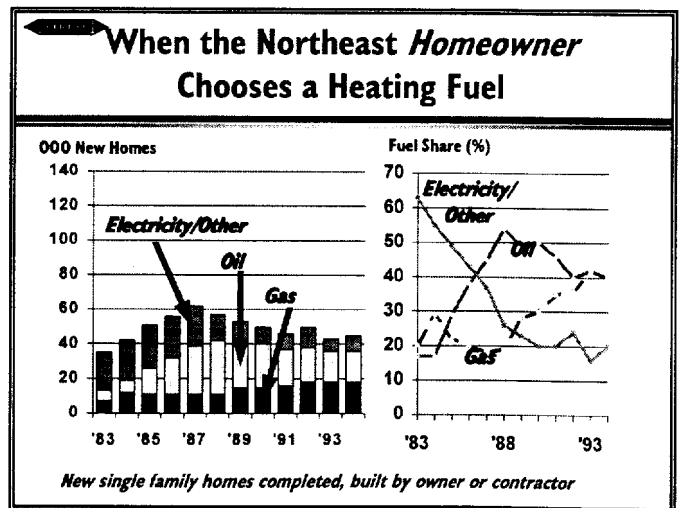


Figure 5



shown in Figure 4. Increased gas availability has allowed the use of gas in new markets and the low installation cost for electricity has been overcome by the uncompetitive operating (fuel) cost, as discussed in a later section.

Of particular note in recent years has been gas heat's strength in the homeowner market, those homes built by owners or their contractors. (Figure 5.) While oil heat's share has fallen somewhat, from more than 50% in the late 1980's to 40% in recent years, the real trade-off has been between gas heat and electric heat, as in the builder market. The gas heat share of new homes built by owners or their contractors rose from about 20% in the late 1980's to 40% in the last few years. Thus, approximately the same number of homeowners choose oil heat and gas heat. The share of homeowners choosing electric heat for their new homes has fallen so low that the sample is no longer statistically reliable. By difference, we can calculate the combined share of electric heat with the "Other Fuel" catchall. This combined share fell from more than 60% in the early 1980's, to less than 30% by the late 1980's, to about 20% now.

As noted in the previous discussions, the new availability of gas and the high operating cost of electricity are both factors in these recent trends.

Conversions to Gas Heat: The Pace Hesitates

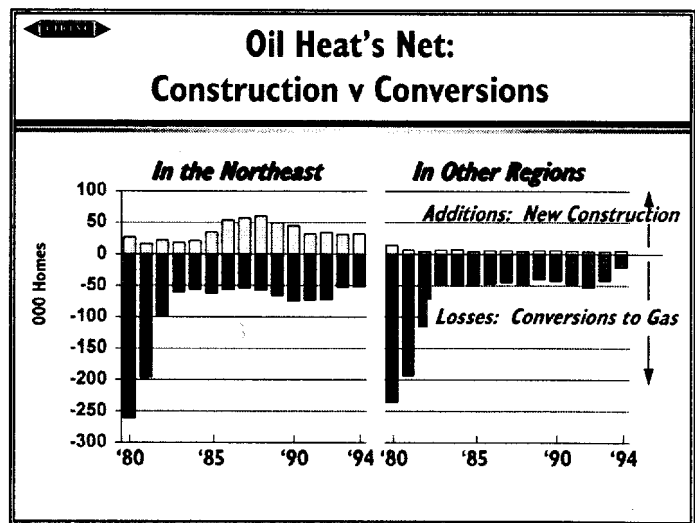
As shown in Figure 6, conversions from oil to gas heat exceed the construction of new oil-heated houses, even in the Northeast. In recent years, however, even with greater gas availability in the Northeast, conversions have not increased, and in 1994, according to data available from the American Gas Association, conversions from oil to gas heat, at 52,000 homes, were about at the 1993 level and 20,000 lower than in each of the three previous years (1990-92).

The "Net" change in oil-heated homes illustrated in the figure excludes the additions of oil-heated units from conversions of other fuels to oil heat. While firm data are unavailable, conversions from electric heat to oil by all reports have been increasing; high electric rates make the economics clear. In

some areas, in addition, dealers report conversions from gas heat to oil. Some of these, particularly re-conversions, have occurred in non-residential accounts such as schools and churches.

The data on conversions to gas also show that oil's role in the total number of conversions to gas heat is in fact declining. Nationwide, conversions from oil to gas accounted for as much as 87% of all conversions to gas heat in the early 1980's. In contrast, by 1994, the oil heat conversions accounted for only 36%. The decline has run across all regions. The American Gas Association cautions that conversions from "Other" fuels to gas took a suspicious and pronounced increase in 1993 and 1994, and thus may be overstated at the expense of the more common fuels like oil, electricity, and propane. The decline in the oil share, however,

Figure 6



preceded this possible data anomaly, as shown below. Conversions from electric heat to gas have been a key element.

Table 2: Conversions of Oil-Heated Housing Units to Gas Heat, 1980-94

	U.S.		Northeast		Midwest		South		West	
	No. (000)	Oil % of Total	No. (000)	Oil % of Total	No. (000)	Oil % of Total	No. (000)	Oil % of Total	No. (000)	Oil % of Total
1980	498	85	262	95	135	70	82	89	19	55
1985	113	76	63	91	25	64	20	66	6	51
1990	118	54	75	85	21	42	11	25	11	31
1993	73	36	52	70	6	13	8	15	7	22

Source: American Gas Association

Since the early 1970's, a total of about five million homes have been converted from oil to gas heat. The Northeast, over the two decade period, has had the greatest number of conversions from oil to gas heat, about half of the national total. Cumulatively, however, only about one-quarter of the oil-heated homes in the region have been converted. In the Midwest and West, where gas is available to about 80% of all homes, about half have been converted (52% in the Midwest, 46% in the West). Gas availability to the remaining Midwestern oil-heated homes, however, is now markedly lower than the regional norm. Thus, the slowing pace of oil conversions is unsurprising.

The pace of conversions in the Northeast has hesitated due to a mixture of factors, including, importantly, the price advantage of oil over gas. (See the discussion in a later section). The most likely time for a conversion decision is when the homeowner is facing a new equipment purchase, whether an oil burner or an oil storage tank. Dealers market aggressively to such customers, and the data reflect their success in retaining them.

The regulatory treatment of underground oil storage tanks has been the subject of some degree of controversy and negative publicity. While actual cases of leaks have been scarce, the fear of a leak that would require expensive remediation and affect the marketability of the home has moved banks in some areas to require testing (and, if necessary, remediation) as a condition of issuing a mortgage at the time of sale. Some homeowners have chosen to take the tank out of service voluntarily, with the basement a preferred location for the replacement in Northern climates. Replacing the tank, of course, requires a new expenditure, one that some heating oil dealers have developed programs to mitigate.

Gas Availability: Oil Heat Endures

Natural gas supply capacity to the Northeast has increased by about 40% in the early 1990's, with increases both in import capacity from Canada and in transmission capability from the U.S. Gulf Coast producing areas. The distribution network enhancements in the region to take advantage of the augmented supply have made natural gas a new option for many areas. While the availability of gas is one early question to ask with respect to heating fuel possibilities, it is clearly not the only determinant. As shown

below, many homes with gas available still heat with oil. According to the EIA's *Residential Energy Consumption Survey* data, some 5.2 million oil-heated housing units nationwide -- 51% of the oil-heated total -- have piped gas available in the neighborhood, and 2.7 million (53%) of these use gas in the home for non-heating purposes. See Table 3. (The data in this section exclude kerosene in the "oil-heated" total. Kerosene-heated housing units have considerably lower gas availability, as would be expected from its characteristically rural use; only about 30% of the kerosene-heated units have piped gas available.)

Table 3: Availability of Piped Gas to Oil-Heated Homes, by Region, 1993

Region	Gas Not Available	Gas Available			Total
		Not Used	Used	Total Avail	
000 Units	Available	Not Used	Used	Total Avail	
Northeast	3,179	1,371	2,473	3,843	7,023
Midwest	721	439	136	575	1,296
South	1,022	322	109	431	1,453
West	99	294	20	314	413
Total	5,021	2,426	2,739	5,164	10,185
Percent	As % of Total	As % of Avail	As % of Avail	As % of Total	Total
Northeast	45	36	64	55	100
Midwest	56	76	24	44	100
South	70	75	25	30	100
West	24	94	6	76	100
Total	49	47	53	51	100

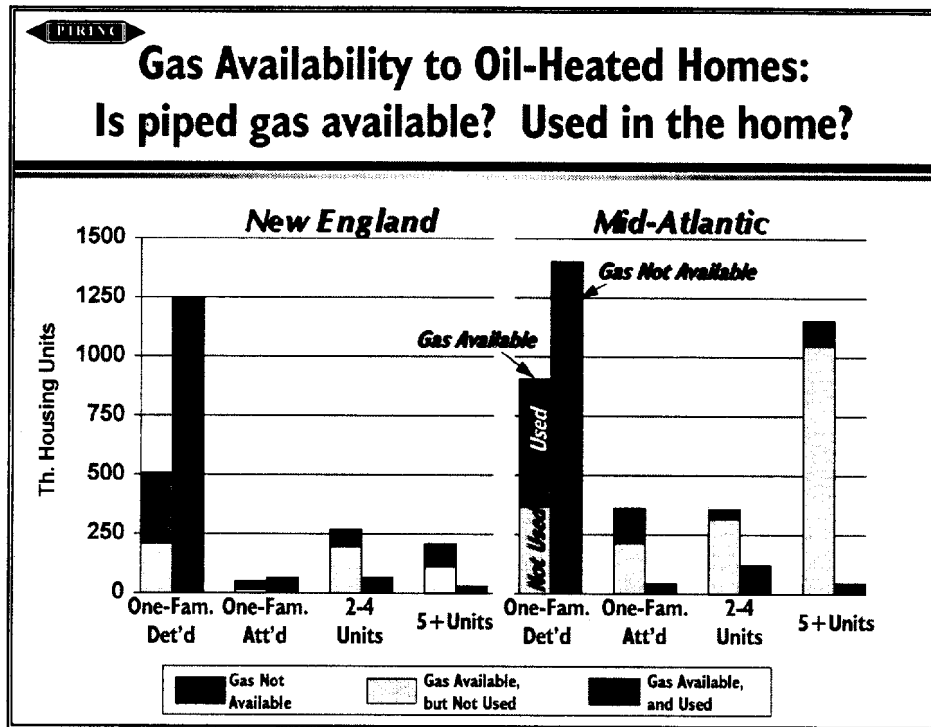
Source: Extracted from Energy Information Administration's *Residential Energy Consumption Survey, 1993* database. Excludes mobile homes and units heated with kerosene.

Gas Availability in the Northeast

Some 70% of the homes heated with distillate or residual fuel oil are located in the Northeast, where 55% of them have access to piped gas, and in fact 2/3 of these use gas for some purpose. As shown in Figure 7, the urban, denser population of the Mid-Atlantic dictates its housing stock and is reflected in the gas access patterns, providing a marked and predictable difference in the gas availability pattern in New England versus the Mid-Atlantic region.

- Gas is *unavailable* to about 70% of the one-family (*detached*) homes in New England, and about 60% of them in the Mid-Atlantic region. Given the weight of these "traditional" single family homes in the oil-heated housing stock, half of New England's oil-heated housing and about 30% of the Middle Atlantic's housing did not have conversion to gas heat as a possibility in 1993.
- Gas is *unavailable* to about 55% of New England's small number of one-family (*attached*) homes. By contrast, this type of home is almost twice as prevalent in the Mid-Atlantic's oil-heated housing stock, and as expected, they have an extraordinarily high level of gas availability: almost 90% have access to piped gas.

Figure 7



- In sum, there are about 5.4 million housing units in the Northeast likely heated with distillate heating oil, including 800,000 units in buildings with 2-4 units. Piped gas is *un*available to about 55% of these (63% of New England's distillate-heated units and 49% of the Mid-Atlantic's). Of the 2.4 million units that have access to gas, gas is actually used for some purpose in 1.3 million of them.
- The Mid-Atlantic's 1.2 million oil-heated housing units in multi-family buildings, the last remaining housing units dependent on low-priced residual fuel oil, have nearly full access to gas: 96% of the units. (In this case, "Mid-Atlantic" is virtually synonymous with "New York," the location of all but a handful of the regional total.) Gas, however, is not used for any purpose in more than 90% of them. These units are older: 43% are pre-war; two-thirds built before 1950; 85% built before 1960. With the price of residual fuel oil to the commercial sector significantly lower than the gas price, they are unlikely candidates for conversion. As a more sophisticated BTU energy market develops, some limited number of these buildings may become dual-fueled, using interruptible gas in the Summer and fuel oil as necessary in the Winter. If demolished, these units are overwhelmingly likely to be replaced by gas-heated ones. Oil heat no longer gets a measurable share of the multi-family construction market.

Price: Oil Heat is Cheaper than Gas in the Northeast

Oil heat's lagging share of the new home market and its loss to gas via conversions cannot be explained by the relative fuel prices. The EIA's data in the *Residential Energy Consumption Survey* demonstrate that

average heating oil prices are lower than average utility gas prices in both New England and the Mid-Atlantic. The differential, however, is wider in New England, where the average single family (detached) gas-heated home paid \$8.52 per MMBTU for heating fuel, 30% more than its oil-heated counterpart. The data presented exclude any expenditures or fuel volumes used for purposes other than heating.

Table 4: Heating Fuel Prices to Residences in the Northeast, 1993

Type of Building	New England			Mid-Atlantic		
	Piped Gas	Fuel Oil	Electricity	Piped Gas	Fuel Oil	Electricity
Mobile Homes	NA	7.26	NA	7.69	6.81	NA
One-Family Detached	8.52	6.54	30.80	7.18	6.69	26.23
One-Family Attached	7.78	6.59	30.41	7.68	6.66	28.56
Bldgs. w/ 2-4 Units	8.81	6.48	34.43	7.78	6.56	31.74
Bldgs. w/5 or more Units	7.97	5.23	32.57	8.03	4.42	29.87
Avg., All Units	8.40	6.45	31.94	7.54	6.07	28.40

Note: Expenditures for heat in dollars per MMBTU. Extracted from Energy Information Administration's *Residential Energy Consumption Survey, 1993*.

The difference between the fuel prices is structural. At the end of the distribution network, gas prices in the Northeast have high transmission costs, and in the urban areas, particularly high distribution costs. Utility rates in the region are the nation's highest. The transmission and distribution costs present an add-on which is a multiple of the wellhead cost. These add-ons to the cost of gas have been treated as fixed. As new marketing mechanisms develop, utilities as well as independent gas marketers are finding ways to price gas more flexibly for large users. But for the residential market, which represents a permanent seasonal peak in demand, rates will remain subject to regulatory control, and rate-setting will continue to reflect the high fixed cost of transmission and distribution. In contrast, the price of heating oil responds continuously to market factors for each of its components, from the underlying cost of crude oil, to the refiner's margin, to the cost of moving and storing the oil, to the marketer's margin. The cost of electricity, of course, is another story altogether. High regional fixed costs, even high regional fuel costs for generation are overshadowed by the fundamental efficiency loss in electric generation: it takes approximately three BTU's of energy input to produce and transmit one usable BTU of electricity to a home. Although electric heat is considered 100% efficient at the point of use, the generation loss far outweighs the efficiency loss in even the oldest residential oil or gas burner. Note that the heating fuel prices shown above are based on expenditures for heating divided by fuel use for heating; hence, they account for point-of-use efficiency differences.

The data also clearly demonstrate the economic sense of using fuel oil in the Mid-Atlantic's multi-family units that have access to gas. The price of fuel oil (again, likely residual fuel oil) is only 55% of the gas price. As noted above, these units are virtually all located in New York, where local, state and federal rules mandate the use of residual fuel oil with only very low sulfur content. Again, because of the construction of the EIA's survey, the numbers reflect the required fuel quality.