UNIT HEATERS DESERVE ATTENTION FOR COMMERCIAL PROGRAMS

Harvey M. Sachs

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1001 Connecticut Avenue, NW, Suite 801, Washington, D.C. 20036
Phone: 202-429-8873, Fax: 202-429-2248, website: http://aceee.org

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SUMMARY

The goal of this report is to draw the attention of program planners and the policy community to the savings potential of commercial and industrial unit heaters. Although annual shipments are less than one-tenth of those for residential furnaces (roughly 200,000 and 3,000,000, respectively), the median size of unit heaters is several times larger, so the aggregate potential for savings from greater efficiency is relatively large.

Unducted, ceiling-hung, gas *unit heaters*[1] warm factories, warehouses, repair shops, and similar structures. These buildings typically have high ceilings and open floor plans. The unit heater includes a burner, a propeller fan, and some guide vanes (louvers) to direct air in the preferred direction. It is generally controlled with simple thermostats. In 2000, 216,000 units were shipped (GAMA, undated). The Gas Research Institute (GRI) reported that unit heaters account for 38% of the commercial gas heating load (Manix, McElhattan, and McGreevy 1997, p. 5), but this is considered too high as a current estimate by other industry sources (Street 2002[2]).

Unit heaters are rated by thermal efficiency, a steady-state output measure. By this measure, gravity- and power-vented equipment have similar efficiency (typically about 80%). However, they differ greatly in off-cycle losses. When the gravity-vented heater is not running, warm air continuously leaves the building through the heater's flue, entering the flue via the draft hood or barometric damper. In contrast, power-vented units have a sealed flue. When the fan is off, little air can escape to the outdoors. The seasonal efficiency of gravity-vented units is estimated at 62–64%, while that of power-vented units is estimated about 80–83% (Krauss, Hewett, and Lobenstein 1992).

Historically, gravity-vented unit heaters with pilot lights dominated the market. Recently, sales of power-vented units with intermittent ignition devices (IID) have grown greatly, and probably account for about half of sales today. Power-vented units formerly cost about 35% more than gravity-vented units, but the price gap has narrowed as market share has increased (Sachs 2002, 2003). Their seasonal efficiency is so much better (about 80% compared to about 63%) that buyers generally can expect payback in months, not years. One major manufacturer also offers a condensing unit heater, but its sales are not yet a major factor in the market. These units, with seasonal efficiency greater than 90%, are currently expensive, but cost-effective in some applications. The major barriers to universal adoption of power-vented and condensing technologies seem to be the first cost penalty, and split incentives between purchasers (building owners) and users (tenants).

In this report, we evaluate alternative strategies for improving efficiency in the unit heater market. Available options include incentive programs for power-vented and condensing unit heaters, and elimination of gravity-vented unit heaters by banning pilot lights and gravity vents, through federal or state regulations.

[1] The term *unit heater* includes unducted heaters hung from ceilings or high on walls, whether the heat energy is natural gas, propane, fuel oil, hot water, steam, or electricity. CBECS (1998) seems to use the term "Packaged Heating Unit" to include unit heaters and rooftop packaged units (e.g., CBECS 1998, BC-33).

[2] Mr. Street noted that the GRI data date to 1989, and that radiant heaters, rooftop packaged units, and other equipment have replaced some unit heater applications.

In terms of developing a market transformation strategy, the major challenge is that one target technology (power-vented units) probably has over half of the market now. This implies that rebate programs would have very high “free rider” levels—that is, incentives paid to customers who would have bought power-vented units even without the incentive. As an alternative to rebates, ACEEE recommends targeted intervention with mechanical contractors and equipment distributors to encourage stocking and additional sales of power-vented units. Options to consider include salesperson incentives (“spifs”), inducements to only stock power-vented units, and incentives for incremental sales above 50%. At the same time and for the longer term, in order to develop the market for condensing unit heaters, we recommend that a technology procurement and/or incentives program be considered, with enough lead-time to encourage additional firms to enter the market.

ACKNOWLEDGMENTS

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INTRODUCTION

Warehouses, factories, and automotive and machinery repair shops typically have high ceilings and open floor plans. Wider temperature variations are tolerated than in office or school spaces; frequently there is no air conditioning, and sometimes there is only enough heating service to prevent freezing. Many of these buildings are prefabricated, and minimizing first costs is an overwhelming concern of owners.

GRI claimed that unit heaters accounted for 38% of the commercial sector gas heating energy used in 1989 and were the most important way to heat commercial buildings (GRI 1992). At that time, the inventory of approximately three million units used over 0.5 quads of gas (GRI 1992). This high market penetration was despite the virtual absence of unit heaters in offices, schools, and other major commercial applications. Some in the industry suggest that unit heater market share is declining, with infrared heaters increasing in the light industrial and warehouse sectors, and rooftop-packaged units in some other sectors. Still, as discussed in the next section, there are significant opportunities to cost-effectively improve unit heater performance.

Unit heaters are rated on steady-state (operating) thermal efficiency rather than seasonal efficiency. The seasonal efficiency of a baseline unit is estimated as 62–64% (GRI 1992), whereas better systems, which have roughly half the market, typically have seasonal efficiencies of about 80% (GRI 1992). Although standing pilot lights (which may burn year-around) are giving way to electronic or electric intermittent ignition devices (IID) in gravity-vented units, they still suffer major standby losses from the draft hood and gravity-vent. All power-vented and condensing units include an IID and a draft inducer motor with sealed exhaust. Although steady-state thermal efficiency does not necessarily rise much, these furnaces almost eliminate standby losses. On a seasonal basis, this reduces energy use by an average of 21% [(80-.63)/.80]. Payback may be faster than one year for the average unit in an average climate.

The market for unit heaters is dominated by three manufacturers. Modine, Sterling, and Reznor provide an estimated 90% of all units shipped. Several other manufacturers account for the remaining 10% (Manix, McElhattan, and McGreevy 1997).

TECHNOLOGY DESCRIPTION

The unit heater is a relatively simple but carefully made box.[3] It contains a burner assembly, an air-to-air heat exchanger isolating the combustion gases from the room air, and an exhaust for the combustion gases. There is also a propeller-type fan[4] (to push room air through the heat exchanger and blow it into the room) and a thermostat for control. In its most basic

[3] For our purposes, *duct furnaces* or *duct heaters* are similar products. As the name implies, duct furnaces are installed in a duct, to warm the air passing through it. Sales of duct furnaces are less than 6% of unit heater sales.

[4] About 5% of unit heaters are equipped with centrifugal blowers (Manix, McElhattan, and McGreevy 1997), instead of axial fans, to allow connection to ductwork. The static pressure losses (air friction) of the ducts require the blower instead of an axial (propeller) fan.

form, the gravity-vented unit heater draws combustion air from the heated space, and buoyancy forces (gravity) pull the hot exhaust gases through the flue. This heater uses a draft hood or a barometric damper to provide pressure equalization during operation. The result is a simple, robust heater that blows warm air around the facility. Several variations on this theme offer better efficiency. These include:

- **Vent dampers** have been offered as an option for gravity-vented units. In vent damper units, an electric motor closes a stack valve above the draft diverter to prevent flow through the stack during the off cycle. An interlock assures that the damper is in its open position before the ignition sequence begins. Market share is inconsequential, and availability today is uncertain.
- **Energy-efficient, power-vented,** or **power exhaust** units use a fan to pull combustion air through the unit. This requires a sealed exhaust stack, without draft diverter, and cuts off-cycle losses to a very low level.[5] Because the stack is blocked during the off cycle, these units require an intermittent ignition device instead of a standing pilot. Most models draw inside air for combustion instead of outside air. In 1989, power-vented units accounted for no more than about 20% of the market (Krauss, Hewett, and Lobenstein 1992; Manix, McElhattan, and McGreevy 1997). Reports from the three major manufacturers suggest that power-vented units are 45% or more of the market now.
- **Separated combustion** units draw in outside air for combustion and thus can have higher efficiency than power-vented units. Separated combustion units are relatively expensive. Market fraction was extremely small in 1992, but units were listed by the three major manufacturers in 2002.
- **Condensing furnaces** employ a secondary heat exchanger to capture the latent heat of the water vapor in the exhaust stream, and have seasonal efficiencies estimated at 90% or better. In general, condensing furnaces use outside air (separated combustion). Condensing unit heaters have a tiny market share in the United States, but apparently are more established in northern European markets. Condensing furnaces are listed by only one of the three major manufacturers in 2002 literature.

Currently, unit heaters are rated by their steady-state performance while firing, called *thermal efficiency.* Thermal efficiency ignores the relatively modest losses during start-up and shut-down and the much larger potential losses while the unit is off. In particular, the barometric damper or draft hood of the gravity-vented unit heater allows a continual loss of heated air from the interior of the space to the outside, through the open exhaust flue, during the off cycle. Major improvements in seasonal efficiency can come from limiting these off-cycle losses.

Efficiencies are only published at steady-state (thermal efficiency) and cluster at 80–83% thermal efficiency (ASHRAE 1999[6]). As with all gas-fired combustion equipment, raising

[5] Since the unit heater is located in the heated space, standby losses from the shell contribute to heating the building. Thus, the heat stored in the furnace at the end of the operation cycle is made available for heating the space.

[6] The ASHRAE 1999 building code standard specifies a minimum thermal efficiency of 80%. This is essentially no change from the ASHRAE 1989 standard that specified 78% combustion efficiency. Thermal efficiency is the percent of fuel energy available as work, while combustion energy is the fraction of fuel energy that does

thermal efficiency much higher increases the likelihood of flue gas condensation (and ensuing corrosion) in the stack. Thus, the most attractive route to improved energy efficiency for unit heaters appears to be limiting off-cycle losses.

Table 1 gives the thermal (steady-state) efficiencies and ACEEE estimates of seasonal efficiencies for these alternatives. It also includes ACEEE-estimated market shares. The table strongly suggests that great efficiency improvements are possible. Further, the first step, eliminating gravity-vented units, is already underway, since power-vented units seem to have had approximately a 45% share in 2002.

Table 1. Efficiency Estimates and Market Share for Unit Heaters in 2002

Technology	Efficiency Estimates		Market Share
	Thermal	Seasonal	
Gravity-vent, pilot	78–82%	63%	~50%
Power-vent	80–83%	80%	~45%
Separated Combustion	80–83%	80%	~4%*
Condensing	>90%	>90%	niche

Source: Sachs estimates, except * is from Manix, McElhattan, and McGreevy (1997), p. 27

In addition to burning natural gas (or propane), unit heaters use electricity for the propeller fan that circulates the air, and for the thermostatic controls. In contrast with the centrifugal fans on residential HVAC equipment, unit heaters typically have relatively low-power propeller fans that would not work against the pressure head associated with ducted systems. Power-vented units also have a flue fan that pulls gases through the heat exchanger and pushes them out the vent, and use some power for their IIDs. In some installations, condensing furnaces will require a small condensate pump, too. We found no public information on the actual electricity use of unit heaters, but can draw some inferences from posted electricity requirements and their variation with unit gas capacity. Table 2 shows nominal air handler efficiencies in the range of 200–250 watts/1,000 cfm for one manufacturer's line of products. For context, this is much better than the residential default value (365 watt/1,000 cfm), but the latter value is based on testing against a higher external static pressure, to attempt to account for the duct system. Indeed, the electricity used by these mid-sized unit heaters is no more than about 1.5% of site energy (4.5% of source energy). These values are roughly one-half the comparable numbers for residential furnaces, according to the test methods used (Kendall 2002). Since the unit heater is not used as part of an air-conditioning system, motor inefficiency is not amplified as a parasitic load on the compressor. Thus, ACEEE does not find that electricity use by unit heaters is likely to be a fruitful candidate for initial attempts to improve efficiency.

not go up the flue. Thus, because combustion efficiency does not take jacket losses, etc. into account, it is typically about 2% higher than combustion efficiency.

Table 2. Maximum Electricity Use per Unit Gas Use for Mid-Sized Unit Heaters from One Product Line

	Input Capacity	Full Load Amps, 115 v	Watts	cfm	Watts/1,000 cfm
	150,000	5.8	667	2,765	241
	200,000	5.8	667	3,275	204
	250,000	8	920	3,685	250
	300,000	8	920	4,020	229
Average	225,000	7	794	3,436	231
Btu to building	180,000		2,707 Btu		
Electricity raction			1.5%		

Note: The published "Full Load Amps" data probably overestimate actual electricity use, since the data are primarily published to establish field wiring sizes required.

MARKET DESCRIPTION

In 1989, gravity-vented unit heaters represented about 75–80% of unit heater sales (Krauss, Hewett, and Lobenstein 1992, p. 10). In contrast, in 2002 power-vented units (including separated combustion) are about 45% of the market (Sachs YEAR?). Condensing unit heaters are only offered by one of these three principal manufacturers, and apparently have not yet achieved substantial market penetration. Eighty percent of unit heaters burn gas (Manix, McElhattan, and McGreevy 1997). Oil (1% market share) is largely restricted to the Northeast, and electricity (18% share) is primarily used in units less than 100,000 Btuh.

BARRIERS

ACEEE believes that the principal barriers to greater deployment of higher-efficiency unit heaters are the typical ones encountered by technologies that promise life-cycle savings but have higher purchase prices: incremental cost and split incentives. We discuss each of these in the following sections.

Incremental Cost

Manix, McElhattan, and McGreevy (1997) provided data on the *installed costs* of unit heaters, in $/1,000 Btuh, based on interviews with market participants. Table 3 summarizes their results for "Northern" and "Southern" installations. The table suggests that the Northern market may be more competitive than that in the South (lower incremental costs in the North).

The work to install gravity- and power-vented unit heaters is similar. Each requires gas and electrical service, each needs to be suspended from the ceiling or attached to the wall, and each needs a penetration for the vent.[7] Prices without shipping and installation costs are now available on the World Wide Web from firms that provide equipment for specific industry segments, such as greenhouses. Table 4 looks at prices for medium-sized (175,000–300,000 Btuh) unit heaters from a single manufacturer, as posted by one distributor.

[7] It is possible, of course, that contractors charge more for installing a premium product such as the power-vented unit heater.

Table 3. Estimated Incremental Cost (1997) and Efficiency Gains for Power-Vented and Pulse Combustion Unit Heaters

	Base, Gravity-Vented	Power-Vented	% Change	Pulse	% Change re: Base
Northern	$11	$13	18%	$25	127%
Southern	$10	$13	30%	$25	150%
Estimated annual efficiency	63%	80%		90%	
Cost (Northern) per % efficiency improvement		$0.12		$1.20	

Note: Pulse combustion unit heaters are taken as comparable in complexity and market share to condensing furnaces. Cost is expressed as the dollars (per 1,000 Btuh capacity) required to lift estimated annual efficiency by 1%.

Like most gas-heating appliances, unit heaters are conventionally classified and labeled by input capacity. However, for examining installation economics, the relevant efficiency metric is a measure of seasonal efficiency rather than the rated steady-state efficiency. The seasonal efficiencies of gravity- and power-vented unit heaters are estimated as 62–64%, and about 80%, respectively (Krauss, Hewett, and Lobenstein 1992). For an average climate, Table 4 uses these values to estimate gas use per season, and an unsophisticated payback estimate.[8]

Table 4. Prices, Incremental Prices, and Paybacks for Mid-Sized Gravity- and Power-Vented Unit Heaters, Without Shipping or Installation.

Input, 1,000s Btuh	Model	Purchase Price	Therms for 2,080 FLH	Therms Saved/ Year	Annual Saving, at $0.60/therm	Simple Payback/ Year
175	Base	$638	2,293			
	Power-Vented	$867	1,806	487	$292	0.8
200	Base	$708	2,621			
	Power-Vented	$889	2,064	557	$334	0.5
250	Base	$818	3,276			
	Power-Vented	$1,118	2,580	696	$418	0.7
300	Base	$938	3,931			
	Power-Vented	$1,334	3,096	835	$501	0.8

Source: web survey by author

Notes: Payback assumes seasonal efficiency of 0.63 for base unit, and 0.8 for the power-vented one, and fuel prices of $6/MMBtu (*e.g.*. 2002–2003 winter prices of about $10/MMBtu). FLH = full-load heating hours.

Tables 3 and 4 differ in two ways: the data for Table 3 are five years older, and Table 3 shows system installation costs, while Table 4 shows only the incremental price of the power-vented unit heater. Because the installation activities are very similar, this report uses the incremental purchase price of the "bare" unit, in dollars, as the basis for examining cost-

[8] This approach was suggested by S. Jones of CEE, and is gratefully acknowledged.

effectiveness. With the assumptions of Table 4, payback for power-vented unit heaters is a matter of months, not years.[9]

Split Incentives

Both when the building is constructed and when replacement units are required, the person paying the utility bills may not be the one responsible for specifying the equipment. Unless the architect or design engineer specifies an "upgraded" power-vented or condensing furnace, the mechanical contractor preparing a bid has every incentive to choose the least expensive equipment available, in this case the gravity-vented unit. In many cases, typified by the sprawling light industrial complexes in subdivisions, the landlord buys the heating equipment, but the tenant pays the bills. Again, there is little incentive for the landlord to specify better-than-baseline equipment. These examples show that there is frequently a split between the needs of the bill-payer and the needs of owner or other party that controls the specification.

ENERGY SAVINGS POTENTIAL

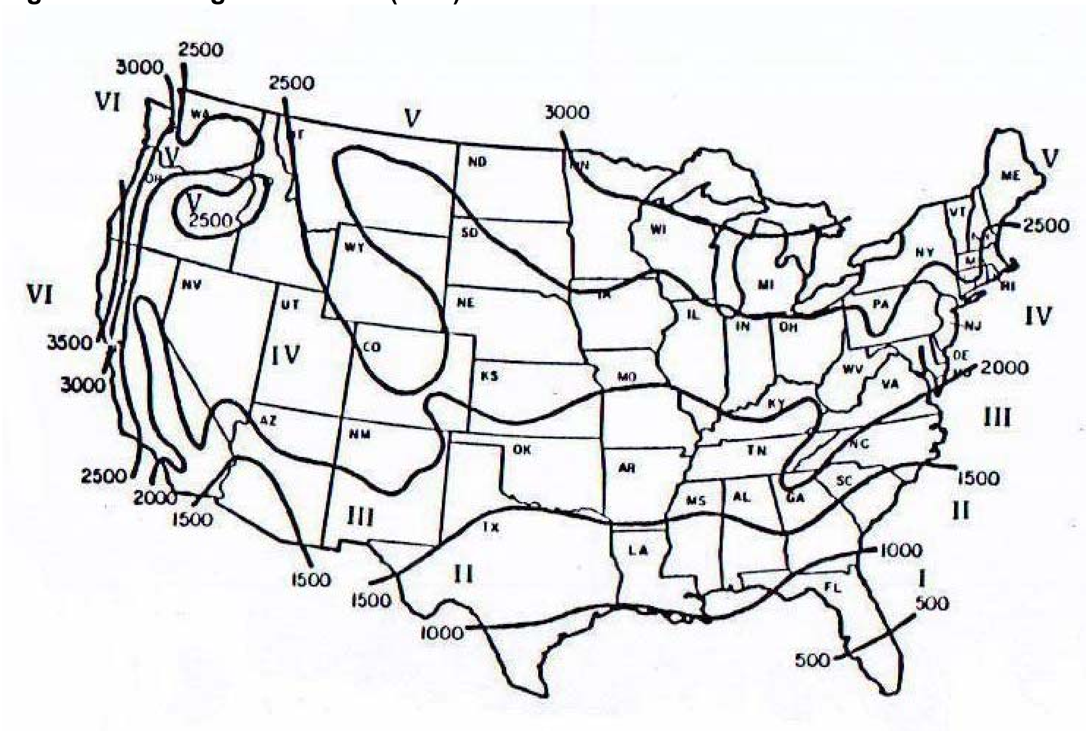
Incremental Costs

Figure 1 is a representation of climate severity in terms of (residential) heating load hours, which range from less than 500 hr/yr in South Florida to more than 3,500 hr/yr in mountainous areas and portions of the Pacific Northwest. This provides context for Tables 3 and 4, which estimate the incremental cost for installing power-vented equipment instead of gravity-vented units. As noted above, we assume that the base gravity-vented unit heater costs $3.40/1,000 Btuh, and that the incremental cost for power-venting is $1.18/1,000 Btuh. Thus, our incremental cost for a median-sized 220,000 Btuh unit heater[10] is about $260, which is much less than the $425 incremental cost estimate of Krauss, Hewett, and Lobenstein (1992). Table 5 presents a less unsophisticated savings calculation method. With it, we calculate a 11-month payback for an average installation. Our number is based on the incremental cost of the heater, not allowing additional mark-up on installation, and is based on comparison of prices posted on vendor websites.

[9] This statement is not quite as conservative as it might be, because it assumes that the installation cost of the power- and gravity-vented units is the same, and that the contractor does not mark up the price of the power-vented unit more than the gravity-vented one. In addition, the average full-load heating hours number (2,080) is for residential applications (ARI 1994, Figure A6.2.5), and for many commercial areas a cooler interior temperature will be maintained. On the other hand, the typical building using unit heaters may be less well insulated and may have higher infiltration (open shipping dock doors, etc.) than the average residence.

[10] 220,000 is approximately the median size, based on data in Manix, McElhattan, and McGreevy (1997).

Figure 1. Heating Load Hours (HLH) in the United States



Note: Contours are approximate, with local variance not shown.
Source: ARI (1994)

Table 5. An Approximate Energy Savings Calculation Method.

Median input capacity	220,000	Btu/h
Typical oversizing	0.50	
Actual peak demand	110,000	Btu/h
Average heating load hours, U.S.	2,080	HLH
Annual use	228,800,000	Btu/yr
Annual use	2,288	therm/yr
Typical cost	0.6	$/therm
Annual gas cost	$1,400	
Estimated annual efficiency, gravity-vented unit	$0.63	
Heat delivered to space	$1,441	therms
Estimated annual efficiency, power-vented unit	80%	
Therms required for power vented unit	1,802	
Therms saved, per year	486	therms
$ saved, per year	$292	
Incremental cost, power-vented unit	$260	
Approximate payback, months	11	

Note: We assume median unit heater (220,000 Btuh) twice the necessary capacity; average U.S. heating load hours; gas valued at $0.60/therm; and an incremental cost of $118/1,000 Btuh for purchasing a power-vented furnace.

In regions with higher heating load hours, the return is more rapid, as shown in Table 6. In more moderate climates, the payback is still generally two years or less. Because the power-vented unit has very low standby losses, it has higher seasonal efficiency. Thus, installing power-vented unit heaters is very cost-effective compared to the baseline gravity-vented unit.

Table 6. Payback Variation with Winter Intensity, As Represented by Heating Load Hours

Typical Areas	HLH	Annual Savings	Payback, months
FL, S. TX	1,000	$140	22 (1.8 years)
SC, GA, AL, MS, LA, TX coastal plain	1,500	$210	15 (1.25 years)
NC, TN, AR, OK, N. TX, NM	2,000	$281	11
S. NY, PA, VA, WV, OH, IN, IL, IA, NE, KS, UT, NV	2,500	$351	9

Note: Assumes conditions as in Table 5 (220,000 Btu input, 2x oversizing, $0.60/therm gas). See also Figure 1 as key to the geography of heating load hours.

Along these lines, it is also interesting to consider the economics of condensing unit heaters, with power-vented heaters as the base case (Table 7).

Table 7. Economics of Upgrading from Power-Vented to Condensing for Unit Heaters.

Condensing Unit Heater, 220,000 Btuh vs. Power-Vented Unit			
$/therm	Annual Savings	HLH	Payback, years
0.6	$594	3,000	4.8
0.6	$396	2,000	7.3
0.9	$891	3,000	3.2
0.9	$594	2,000	4.8

Note: The table gives four cases, two at 3,000 HLH and two at 2,000 HLH, with higher and lower gas prices for each. The incremental cost used in calculation is $2,860 for a 220,000 Btuh unit.[11]

Except in the case of both low heating load and low natural gas prices, estimated paybacks today are less than five years, but there is only one major vendor with a condensing unit heater now. This suggests that payback will improve as competitors enter the market. Competitors not only create price discipline, but also help spread the word and validate the technology. Thus, condensing unit heaters may become attractive for market transformation programs as competitive vendors learn of opportunities for incentives.

EFFORTS FOR CHANGE

Unit heaters do not command much attention, despite their prevalence. ACEEE knows of no current incentive programs for unit heaters. At this time, the U.S. Department of Energy does not plan to undertake a rulemaking to set standards for unit heaters (DOE 2002, Table 6-4).

[11] Based on data from GRI (1997), with the assumption that costs of pulse combustion units roughly comparable to those of condensing furnaces. The incremental installation cost for the water drain and pump required by the condensing unit heater is not explicitly considered.

MEASURE SCREENING DATA

Measure Life

For both gravity- and power-vented unit heaters, Manix, McElhattan, and McGreevy (1997) estimated approximately a 19-year service life in the North, and 25 years in the South for mid-sized units. The service life estimates for smaller units tend to be somewhat shorter.

Current Equipment Stock

The stock of equipment in use today is somewhat uncertain. Krauss, Hewett, and Lobenstein (1992) gave the inventory as approximately 3 million units in 1989. If "Service Life" is roughly the median life-time, then 3 million units divided by a 22.5-year median life gives 135,000 units per year, much less than the shipment total from the Gas Appliance Manufacturers Association of 216,000 units for 2000 (GAMA, undated?) Given the uncertainties about actual service life, the Krauss estimate of 3 million units in the field is probably the best available.

Overall Energy Savings Possible

With some conservative assumptions, it is feasible to estimate the national impact if all unit heaters were power-vented or better. Table 8 illustrates that complete turnover of the stock (but no sales growth) leads to annual savings of 0.1 Quad/yr. This remarkably large number is the result of the large heating capacity of the units and the large annual savings that result from virtually eliminating standby (off-cycle) losses.

Table 8. Savings If All Unit Heaters Sold Were Power-Vented, with Intermittent Ignition, Instead of the Estimated 45% Market Share Today

Sales, 2000 (= 1 "cohort")	216,141	units
Power-vented units sold, 2000 (estimated)	45%	
Sales of gravity-vented units, 2000	119,000	units
Avoided by power vent, each unit heater	486	therms
Avoided by power vent, each unit heater	49	MMBtu
Avoided by 100% power vent, per cohort	5,786,000	MMBtu
Per cohort savings	5.79	TBtu
Expected service life of units	20	Years
Annual savings after 20 years	116	TBtu

Note: Table assumes 220,000 Btuh median unit, 50% oversizing, 2,080 heating load hours (U.S. average).

RECOMMENDED STRATEGIES

Voluntary Programs for Mid-Efficiency Unit Heaters

In all areas with at least average winter intensity (around 2,000 heating load hours/yr), the payback for power-vented unit heaters is expected to be under a year (see Tables 4–6).[12] Under these circumstances, a nominal coupon incentive might increase sales dramatically. However, since about half the purchases are already power-vented units, this would lead to substantial costs for "free riders"—customers who take the rebate but would have bought a power-vented unit even without the incentive. If the coupon incentive is small, the program still might be cost-effective, even though it may lead to vendors raising the prices of power-vented units to benefit from the induced demand. In these circumstances, ACEEE recommends giving incentives to other actors in the distribution chain. Programs could be tailored either to the contractors who sell and install the equipment, or the distributors who stock and sell the equipment to the contractors. To be effective, such incentives must be based on verifiable actions. Ideas include:

- If a way can be developed for the distributor or contractor to verify sales totals, then an incentive based on fraction of sales of power-vented units beyond the present average (50%) could be used at either contractor or distributor level.
- Experience with furnaces in Oregon suggests that distributors can be persuaded to stock only the upgraded (power-vented) units, making gravity-vented units a special-order option, if the distributors have incentives to do so. It may be feasible to pay distributors to keep only power-vented unit heaters in stock.
- Per unit "spifs" to sales personnel may be very effective, too.

Any of these approaches could be used to build a low-cost sustained program that could consolidate the market at near saturation of power-vented units.

Why Not Use a Standards Approach for Mid-Efficiency Units?

Although the U.S. Department of Energy has listed unit heaters as a product class for which standards could be developed, it presently does not have the legal authority to do so. Legislation requiring a rulemaking for unit heaters was passed by the U.S. Senate in May 2002, but the 2002 Energy Bill died in Conference Committee. There is a reasonable chance that this legislation will pass in 2003. Under the schedule established in the 2002 bill, a federal unit heater standard would take effect on or about January 1, 2010.

Several states are now considering adopting state efficiency standards on a variety of products, including unit heaters. State discussions thus far have generally focused on a requirement that "unit heaters shall not have pilot lights and shall have either power venting or an automatic flue damper." To our knowledge, all of these proposals are still at the formulation stage and no state has taken formal action.

[12] Exclusive of shipping and installation

Thus, voluntary programs offer the promise of essentially completing market transformation to power-vented and better unit heaters before wide-scale regulatory standards would be likely to have much effect.

Market Transformation and the Condensing Furnace

At present, only one of the three major manufacturers offers a condensing unit heater, and there is no evidence that this product line has made significant market penetration yet. The technology is available, and there are no obvious barriers to market entry by other manufacturers. Thus, it would be possible for an organization such as the Consortium for Energy Efficiency (CEE) to announce a future incentive program for condensing unit heaters. With enough lead-time, this would allow multiple manufacturers to participate by designing their own products, or by importing and relabeling products from abroad. This would expand market share. It would, however, be more costly (per therm of gas saved) than a program for power-vented products. First, the incremental costs for condensing units are so much greater, and second, the efficiency gains beyond power-vented units are lower.

CONCLUSIONS

Power-vented unit heaters have relatively high market share (estimated as 45%) and are cost-effective in almost all applications. ACEEE recommends targeted intervention with mechanical contractors and equipment distributors to encourage stocking and sales of power-vented units. Options to consider include salesperson incentives (spifs), inducements to only stock power-vented units, and incentives for incremental sales above 50%.

ACEEE does not recommend substantial rebates for power-vented unit heaters, unless the market penetration in specific regions or market segments is very low. Because power-venting already has about one half of the market, rebate programs would have very high “free rider” levels. On the other hand, modest coupons could pique customer interest.

For condensing unit heaters, there is only one supplier among the three major manufacturers. However, the savings from these units are likely to be cost-effective for many customers. Therefore, ACEEE recommends considering a technology procurement program, with long advance time, to encourage other actors to enter this market. After competing vendors emerge, a direct incentive program may be appropriate.

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