CenterPoint Energy

FACTS ON AIR-SOURCE HEAT PUMPS AT YOUR FINGERTIPS

When it comes to home heating, it's important to know the facts – about cost, efficiency, comfort, environmental impact and return on investment. At CenterPoint Energy, we want to be sure you have the information you need to keep your customers informed about their home heating options. The wrong choice could cost your customers more in the long run and result in complaints and callbacks for you. Information in this brochure will help you get the facts.

Heat pump basics

An air-source heat pump heating/cooling system is a residential whole-house system containing an air-source electric heat pump combined with a supplemental source of heat (usually natural gas). The system, being marketed as a "hybrid," uses supplemental natural gas heating.

A heat pump's mechanical refrigeration device operates much like a conventional central air conditioner, with additional components and controls allowing it to be operated in reverse during the heating season – extracting heat from outdoor air and delivering it to the interior. Heat pumps do not burn fuel like a natural gas furnace, but they do consume large amounts of electricity by using an electric motor to drive the mechanical refrigeration cycle to transfer heat from one area to another.

This brochure is designed to help you sort out the myths from the facts and to help your customers realize the true cost and payback period of a heat pump purchase.

Get the facts on air-source heat pumps

This heat pump fact sheet includes information to consider before recommending a heat pump system for your customers, including:

- **Effectiveness in cold weather**
- **Comfort factor**
- **Return on investment**
- **Maintenance, installation and technical data**
- **Cost comparison**
- **Environmental impact**
- **Natural gas - your best energy value**

Effectiveness in cold weather

Air-source heat pumps are designed for, and can be effective in, mild winter climates. In Minnesota and other states with winter temperatures frequently below 35 F, however, heat pumps are much less efficient. As the outdoor temperature decreases, a heat pump's efficiency decreases and it cannot maintain the home thermostat's set-point of 68-70 F without a supplemental heat source.

In climates like Minnesota, customers using a heat pump will need a supplemental heating system such as a natural gas furnace. In addition:

- Heat pumps require a substantial amount of electricity to operate.
- Heat pumps also require longer operating hours to produce the same heat output as a natural gas furnace – in some cases up to six times longer.

Comfort factor

Consider your customers' comfort before recommending a heat pump. Many heating contractors have learned first-hand that customers often are unhappy with heat pumps because of their lower comfort level.

- Heat pumps deliver air lower than body temperature, at a cool 90-100 F. The air feels drafty or cool – a problem that cannot be resolved by simply turning up the thermostat, as one would do with a natural gas furnace.
- A natural gas furnace delivers air at a comfortable 120-125 F.
- It can take several hours for a heat pump to move from a set-back temperature of 65 F to a 70 F room temperature. A natural gas furnace quickly delivers comfortable heat when you want it, because the heat delivered begins at a higher temperature.

Return on investment

Over the long-term (30 years or more) a heat pump can potentially save on energy costs, provided the homeowner has access to discounted electric rates. However, factors such as initial equipment purchase cost, installation issues, the actual cost of electricity, potential increased maintenance costs, and most importantly, comfort, all need to be considered when making a decision about what type of home heating system to purchase.

The payback period

While buyers may realize some small operating savings when using a heat pump system compared to a standard air conditioning system (with high efficiency furnace), the savings do not compensate for the higher overall costs.

- Purchasing a heat pump adds an average of $1,300 to the final equipment cost.
- Manufacturers claim the payback for heat pump systems could be two to three years because they can offset natural gas costs. However, manufacturers fail to fully explain how they arrived at the savings figures. Often, the savings promoted are simply from an increased overall efficiency factor upgrade (which can also be accomplished by upgrading to a higher efficiency natural gas furnace and electric air conditioner), not specifically from the heat pump.

For example, if a customer replaced an existing 8 Seasonal Energy Efficiency Rate (SEER) standard air conditioner unit with either a new 16 SEER air conditioner unit or a heat pump, they would save about half the cooling cost on their electric bill, simply by the increased unit efficiency. The increased efficiency provides the energy savings, not the type of system used.

When making a recommendation to a customer, be certain they understand that an overall increase in efficiency is what provides savings.

- Substantially more electricity is required to operate a heat pump system during the heating season because the system operates longer hours to satisfy the home thermostat set point.
- In addition, energy-saving measures a customer may have made – such as installing a programmable thermostat – are not typically compatible with a heat pump.

Maintenance, installation and technical data

Maintenance matters

Customers also can expect to spend more on maintenance and repairs with a heat pump.

An air conditioner/natural gas furnace combination only uses the air conditioning during the hottest weeks of the year. A heat pump will operate as much as six times longer, resulting in more wear. And, heat pump warranties are typically only five to 10 years, versus 20 years for a natural gas furnace.

Other important decisions when installing a heat pump include unit sizing and location, including wind protection, and snowfall.

Unit sizing

- Heat pump sizing should be based on the application cooling requirements using a method such as Air Conditioning Contractors of America's (ACA) Manual J and State of Minnesota codes for design. In Minnesota, heating loads are larger than cooling loads. If the heat pump is sized to match the heating load, it will be too large for the cooling requirement.
- In Minnesota, the total cooling capacity of a heat pump should not exceed 125 percent. Over-sizing of cooling can lead to losses of 2 percent to 10 percent in efficiency, higher equipment costs, and minimal humidity control due to short cycling, according to U.S. EPA Energy Star and the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE).

Here's what the Energy Information Agency (EIA) – Department of Energy has to say:

All heat pumps are rated and tested to ARI (Air Conditioning Refrigeration Institute) standards, but are labeled with a Heating Season Performance Factor (HSPF) for a more temperate area than Minnesota. The EIA, however, notes that the actual heating efficiency and seasonal performance of an air-source heat pump will vary significantly from ARI test results. In fact, the **EIA recommends that heat pumps with an HSPF rating of 9.0 be revised to a HSPF rating of 5.0 for the Twin Cities area.**

Location

Heat pump placement must comply with manufacturers' recommendations.

- Units must be given protection from strong prevailing winds and installed outside the roof drip line, which can affect the number and length of defrost cycles. Under the right air conditions, frost can begin building on the outdoor coil at temperatures of 45 F or less, decreasing efficiency by increasing the number of defrost cycles.
- Heat pumps should be installed with frost controls calibrated to defrost only when absolutely necessary. Time/temperature defrost controls cause unnecessary defrost cycles, resulting in increased energy use, unacceptable and uncomfortable indoor air supply temperatures, shortened equipment life, and nuisance service calls.
- A heat pump outdoor-lockout thermostat should be located so that it senses the true ambient temperature at the outdoor unit. This thermostat prevents the heating system from operating when the outdoor temperature is above the design balance point (30 F to 40 F).
- In addition, the unit must be placed above the snowline, requiring unusual placement. The Consortium of Energy Efficiency recommends heat pumps be installed at least 16-24 inches above grade. Given Minnesota's average annual snowfall of 48 inches, the overall installed height could be more than 4'6", making the unit aesthetically unpleasing to many homeowners.
- Regardless of where the unit is located, heat pump customers must frequently remove snow, leaves and debris from the condensation and defrost drain hole, or risk the unit not working and invalidate the warranty.

Cost comparison

Natural gas remains your best energy value

Even with a discounted electric rate, it would take approximately 30 years for a heat pump to payback. Even if the heat pump and the furnace are similar or equal efficiency (see Option 2 below).

In fact, purchasing an air-source heat pump may never show a return on investment (see Option 2).***

Overall, using a natural gas furnace and traditional air conditioner is the most economical choice for customers for the variety of reasons covered in this brochure. Cost savings become even more substantial by installing a high efficiency natural gas furnace.

When considering replacing old HVAC equipment with high efficiency equipment, a customer has the following options:

OPTION 1: Replacing an old A/C and furnace with a high efficiency A/C and furnace.

Old air conditioning versus high efficiency A/C	Old A/C	High efficiency A/C
SEER rating	**8**	**16**
Design size (Btu)	30,000	30,000
Annual energy use (Btu)	19,860,000	19,860,000
Annual electric use (kWh)	2,482	1,241
Electric cost ($/kWh)	$.087	$.087
Total cost	**$215.93**	**$107.97**
Net savings		**$107.96**

Old furnace vs high efficiency furnace	Old furnace	High efficiency furnace
Furnace efficiency	**78%**	**94%**
Annual therms	**820.5**	**680.9**
Cost of natural gas*	$1.05	$1.05
Annual cost of natural gas	$853.32	$708.14
Cost of electricity (blower fan)	$30.00	$28.99
Total cost	**$883.32**	**$737.13**
Net savings		**$146.20**

Total HVAC net savings ***$254.16***

Remember:

A heat pump adds an average of $1,300 in equipment purchase costs.** However, in order to conduct a true cost comparison for the additional cost incurred to buy the heat pump, the comparison needs to be made to a high efficiency furnace, because the additional cost to purchase the heat pump only is a factor for the payback, not the entire HVAC replacement cost.

OPTION 2: Replacing a high efficiency furnace with an air-source heat pump and supplemental natural gas furnace.

High efficiency (HE) furnace versus heat pump with supplemental HE furnace	High efficiency furnace	Heat pump and HE furnace regular electric rate	Heat pump and HE furnace discounted electric rate
Furnace efficiency	**94%**	**94%**	**94%**
Annual therms	**680.9**	**323**	**323**
Cost of natural gas $/therm	$1.04	$1.04	$1.04
Annual natural gas cost	$708.14	$335.92	$335.92
Blower fan– electricity cost	$28.99	$13.70	$13.70
Total cost	**$737.13**	**$349.62**	**$349.62**
Heat pump name plate HSPF	N/A	9.0	9.0
Annual kWh – heating to 30 F	N/A	6893	6893
Cost of electricity – $/kWh	N/A	$0.087	$0.05
Annual cost of electricity	N/A	$599.61	$344.65
Net heating cost	**$737.13**	**$949.23**	**$694.27**
Net savings		***-$212.10***	***$42.86***
Additional cost to purchase heat pump		**$1,300****	**$1,300****
Payback		**No payback**	**30 years*****

* *Using three-year average residential natural gas price of $1.04 per therm and a three-year average retail residential electricity price in Minnesota of $0.087/kWh as of December 2007, and discounted electricity price of $0.05/kWh and using a 94 percent efficient furnace and a 9.0 Heating Seasonal Performance Factor (HSPF) for the air source heat pump.*

** *The average additional cost to purchase the heat pump is based on dealer quotes ranging from $1,000 to $1,600.*

*** *If the cost of capital for the heat pump is considered, no payback is seen with this option.*

Environmental impact

Environmental effects

While marketed as "hybrids," heat pumps are actually less environmentally friendly than natural gas furnaces because they require substantial electricity to operate. Electricity is a secondary fuel that must be produced from another energy source such as coal, uranium, natural gas or oil – further increasing the impact on the environment.

In Minnesota specifically, a significant share of electricity is produce by coal, the biggest source of pollutants in this area. The chart below details the levels of various pollution-causing emissions released by heat pumps versus natural gas furnaces. Clean-burning natural gas releases far fewer harmful emissions into the environment.

Natural gas is clean-burning and efficient

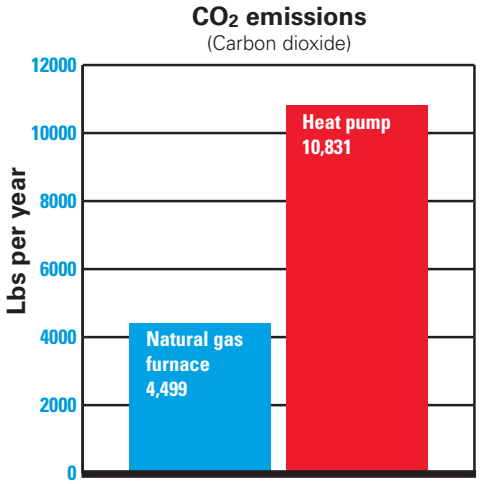
As the environmental impact of daily life becomes ever more important in the decision-making process – from what vehicles we drive to how we heat our homes – the decision to use natural gas for home heating is an easy, comfortable one. Compared to electricity, natural gas:

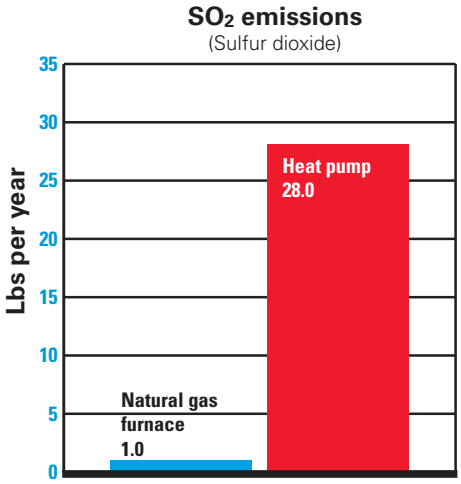
- **Produces less than half the amount of greenhouse gas emissions.** Carbon dioxide (CO_2) is the principle greenhouse gas linked to global warming.
- **Contributes almost zero sulfur dioxide emissions.** Sulfur dioxide (SO_2) emissions contribute to acid rain and the formation of fine particulates, which pose major public health problems and are the major cause of reduced visibility or "haze."
- **Emit three times less nitrogen oxides emissions.** Nitrogen oxides (NO_X) are linked to the formation of ozone smog. Ground level ozone can cause increased frequency and severity of asthma attacks, respiratory infections and other health problems.
- **Does not emit mercury.** Mercury accumulates in some fish at levels exceeding current health department guidelines. Burning natural gas produces no natural emissions. However, coal-fired electric power plants have been called the United States' largest source of mercury air emissions.

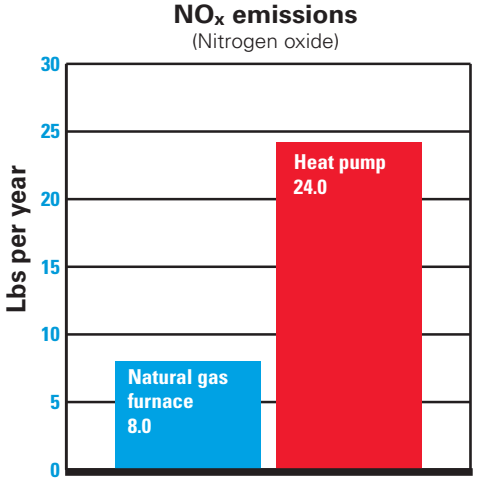
Environmental impact: heat pump versus natural gas furnace

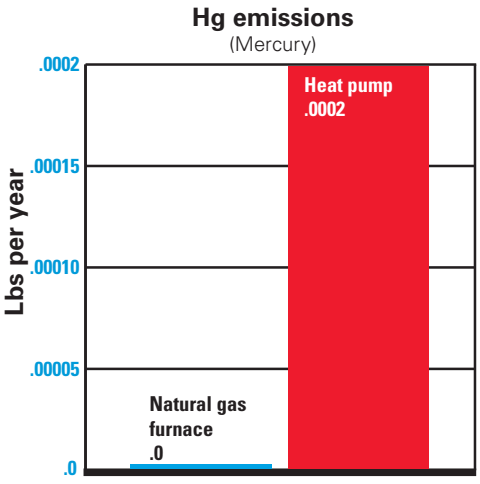
At a glance, it's easy to see that a heat pump system is less environmentally friendly than a standard furnace.

The substantial amount of electricity needed to operate a heat pump contributes to more emissions released into the environment.*









*Based on equivalent heating hours for natural gas furnace and air source heat pump.

Emissions rates: Minnesota 2004 State Average Emissions: eGRID-April 2007
Gas Emissions: AGA report: Source Energy and Emissions Factors for Residential Energy Consumption, August 2000.

Natural gas - your best energy value

Whether you're considering a home heating system, water heater, clothes dryer or other appliance, natural gas is your best energy value.

The cost difference

Because electricity is billed in kilowatt hours (kWh) and natural gas in therms, it can be challenging to compare costs. Delivery and other charges make it even more difficult to accurately assess cost differences. Even when a range of electric prices are considered, natural gas prices are consistently two to three times lower than electric prices.

In fact, when all charges are considered, for a $0.06 per kilowatt hour (kWh) electricity rate to be competitive, natural gas would need to cost $1.77 per therm. Historically and currently, natural gas costs are well below that price. Even the highest residential natural gas firm rate on record is only $1.39 per therm. The higher cost was, in fact, the result of 2005's unusually active and destructive hurricane season.

Another consideration is that electric utilities nationwide are projecting significantly increased costs as they update aging infrastructure to accommodate increased demand. Those costs will be passed along to the consumer and could even widen the gap between natural gas and electric costs.

CenterPoint Energy has been providing for the energy needs of Minnesotans for more than 135 years. With rebate programs for purchasing high efficiency natural gas heating and water heater equipment, Home Energy Audits and a wide variety of money-saving ideas, CenterPoint Energy provides the comfort, safety and efficiency Minnesotans have come to expect.

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