AIRPLUS HEATING & COOLING

# KEEP COZY AND COMFORTABLE

## With Northern Virginia's Heating Experts

# The Ultimate **HEATING SYSTEM** Buyer's Guide

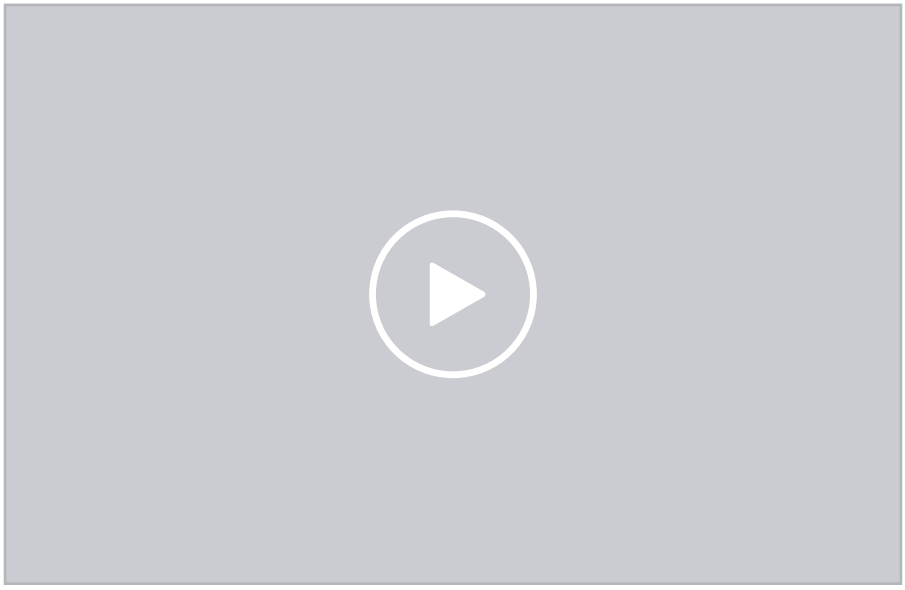
AIRPLUS HEATING & COOLING

If your heating system struggled to keep up with the demands of the season's cold last winter or if you've moved into a new house with an outdated system, keeping your family warm and comfortable through the coming months may be on your mind.

Replacing your home's heating system, either on its own or as part of a complete HVAC upgrade, can seem a daunting task.

Where do you start? What questions should you ask? How can you know what you really need and that you're choosing the right system for your home and pocketbook?

At AirPlus Heating & Cooling we know that the best decision is an informed decision. That's why we put together this guide to answer your questions and perhaps even answer questions you may not have considered.



DID YOU KNOW

All heating systems regardless of type have three components:

1. **A HEAT SOURCE** (usually a furnace, boiler or heat pump) to provide the heat that warms the air or water used heat the home;
2. **A DISTRIBUTION SYSTEM** (such as forced air or radiators) which moves the heated air, water or steam through the home;
3. **A CONTROL SYSTEM** (usually a thermostat) to control heat generation and distribution.

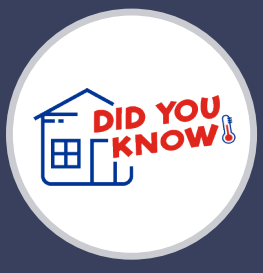
# FIRST THINGS FIRST: WHAT IS AN HVAC SYSTEM?

Most everyone has heard the term "HVAC system". But what is it, really?

The technologies that make-up your HVAC system - Heating, Ventilation and Air Conditioning - are the systems that ensure the quality and comfort of our home's indoor environment.

Each component has its role to play: Your heating and air conditioning systems each regulate your home's temperature to keep it within a comfortable range of warmth in the winter and cool in the summer. Nowadays, in most residences, both systems work through a centralized system.

Ventilation's role is to both keep your interior air circulating throughout the space and to replace indoor air with fresh, outdoor air. By both circulating air throughout your house and replacing it with fresh air from the outside, ventilation works to increase oxygen levels, remove carbon dioxide and other noxious gases, remove excess moisture, dust, smoke, and odors, and, to a degree, modify internal air temperatures.




**Space heating & cooling accounts for 46% of energy bills and is the biggest energy expense in the average U.S. home.**

# EFFICIENCY: WHAT IS IT, REALLY?

HVAC isn't the only acronym you'll run into when shopping for a new heating system. AFUE, SEER, EER, HSPF are all terms that refer to various ways to measure how efficient they are at getting heat (or cold) from fuel.

So, let's start with the basics: "efficiency" is simply how much heat is extracted from a quantity of fuel. In other words, efficiency= energy out divided by energy in.

Heat is measured in "Btu" or "British thermal units". 1 Btu is equal to how much energy you need to raise the temperature of 1 pound of water by 1 degree fahrenheit.

1 KWh of electric power, for example, yields 3413 Btu.

Because electric space heaters radiate all their heat out into the room they are heating, they are 100% efficient: you'll get exactly 3413 Btu of warmth for that 1 KWh.

On the other hand, 1 cubic foot of natural gas is equal to 1000 Btu.

If a manufacturer tells you their furnace is 90% efficient, they are really telling you that for every 1 cubic foot of gas their furnace burns, it will extract 900 Btu of heat from that cubic foot of fuel to warm your home. 100 Btu will be lost up your chimney as exhaust heat.

So why not make all furnaces electric or heat your home with electric space heaters?

Because every Btu from electricity costs you  more than a Btu from natural gas.  Electricity is more expensive than gas.

So while electric heaters use energy more efficiently, it would cost you much more to heat your entire home electrically than it would using gas, even if your gas furnace isn't 100% efficient.

DID YOU KNOW

**You can save an estimated 10% per year on your heating and cooling bills by using a programmable thermostat.**

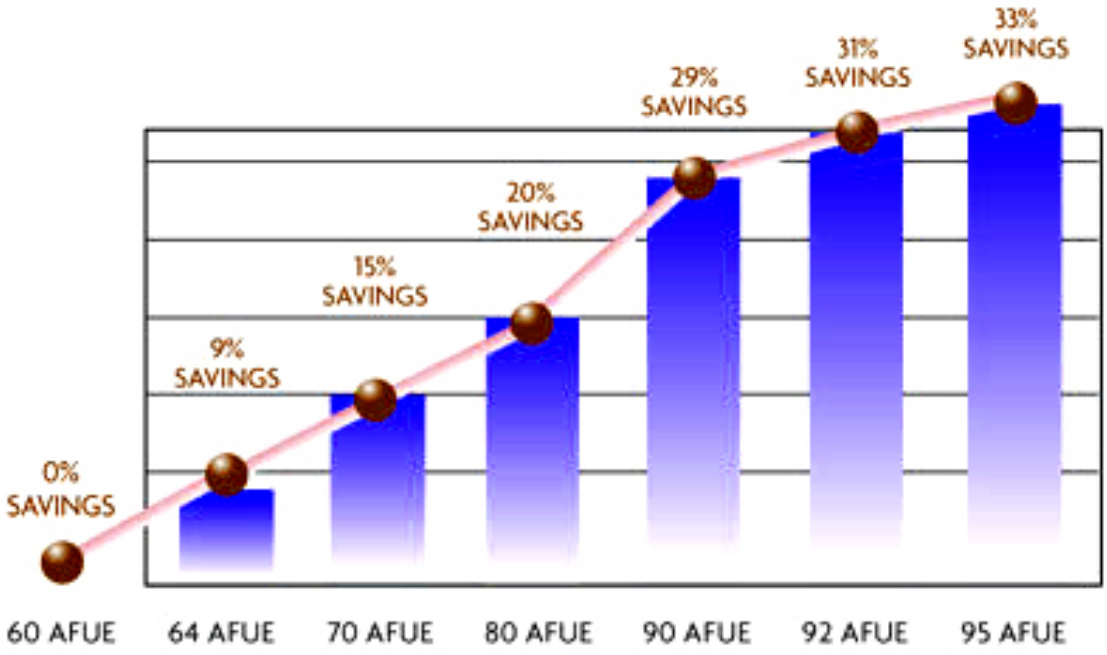
# ALPHABET SOUP: UNDERSTANDING EFFICIENCY RATINGS

## AFUE

Annual Fuel Utilization Efficiency (AFUE) measures how efficient a furnace or boiler is over an entire heating season.

Because colder the weather puts higher demands on equipment than less extreme temperatures, AFUE tells you your furnace or boiler's average efficiency over the course of a typical winter.

Higher Afue Equals Greater Energy Savings



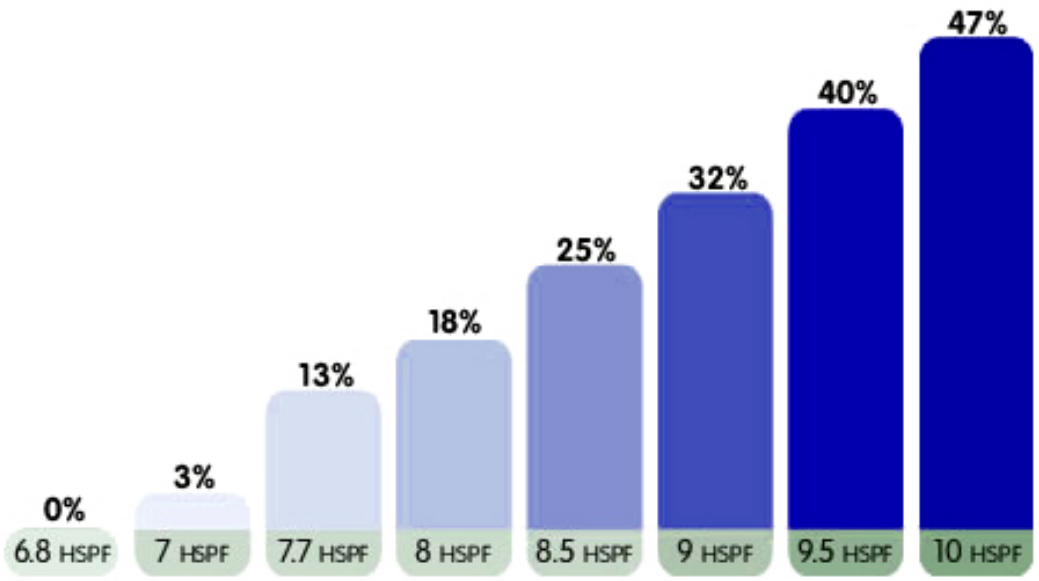
## HSPF

Heat Seasonal Performance Factor (HSPF) is most commonly used to rate efficiency of air heat pumps.

A heat pump's HSPF number is its total heat output in Btu (including supplementary electric heat) over the course of a normal heating season divided by the total mount of electricity used (in watt-hours) over that same period.

The higher the HSPF, the more efficient the heat pump.

### Annual Savings for Heating Your Home Based on HSPF Rating

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## SEER & EER

refer to how efficient a heat pump or air conditioner is at cooling or, in other words, removing heat. Because cooling is the removal of heat, SEER & EER are expressed in Btu.

The SEER number is the total cooling capacity produced over an entire cooling season measured in Btu divided by the total electric energy (in watt-hours) consumed by the heat pump or AC unit to produce it.

SEER is specific to efficiency in temperate climates in the middle of the U.S.

Energy Efficiency Ratio (EER) is a measure of cooling system efficiency when operating at an outdoor temperature of at 95 degrees F.

In technical terms, EER is the steady-state rate of heat energy removal (i.e. cooling capacity) per hour divided by the steady-state rate of energy input to the product measured in watts.

So, the SEER rating more accurately reflects overall system efficiency on a seasonal basis while EER reflects the system's energy efficiency at peak day operations.

Like with HSPF, the higher the number for SEER & EER, the more efficient the system. Both ratings are important when choosing a product.

## Home Heating & Cooling System Packages

Energy Efficiency: Saves Money On Utilities

Lower Equipment Cost

Staying In Home Less Than 5 Years

Staying In Home 5+ More Years

### 14 SEER

$3,999

### 16 SEER

$4,999

### 18 SEER

$5,999

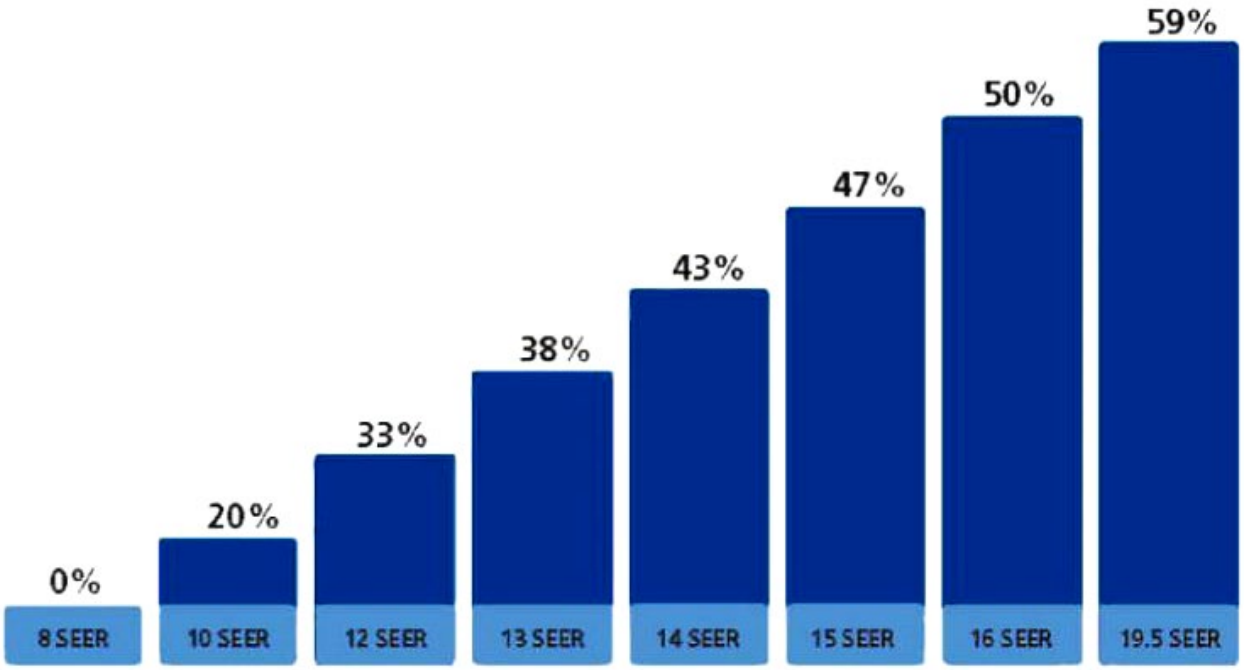
### 20+ SEER

$7,999

# EFFICIENCY = SAVINGS

Bottomline? The average U.S. household spends 46% of its total annual on space heating and cooling. Speaking with a professional HVAC contractor to help you determine the best balance between cost and efficiency for your home and situation is well worth it.

## Annual Savings for Cooling Your Home Based on SEER Rating

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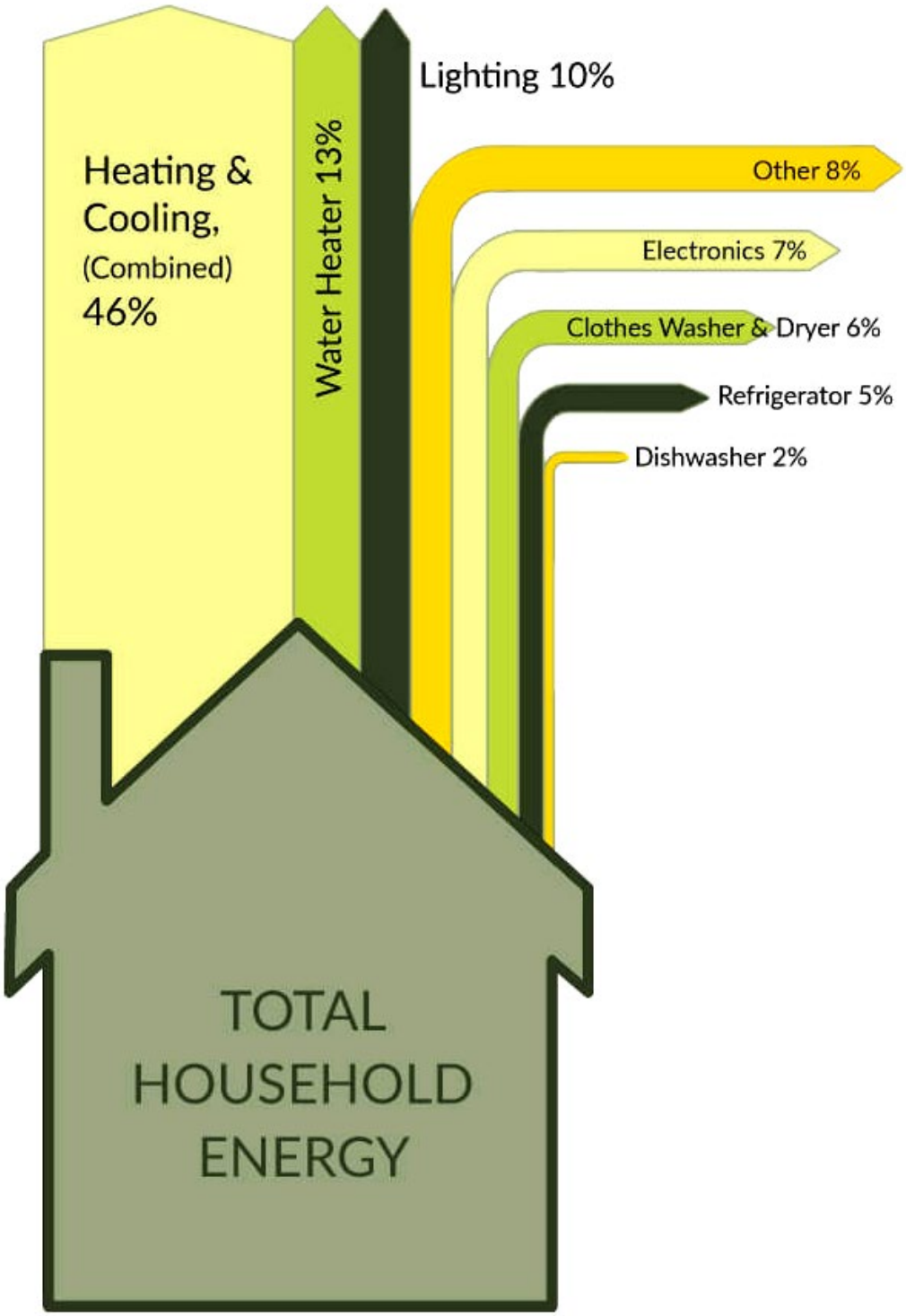
# AVERAGE U.S. HOUSEHOLD ENERGY USE



# WHAT IS A CENTRAL HEATING SYSTEM?

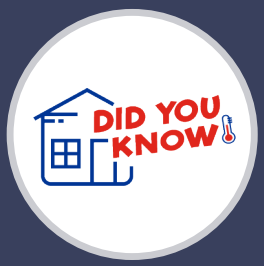
You could use individual room heaters and window AC units to heat & cool your home. But, efficiency-wise, both in equipment & fuel costs and maintenance, to use centralized systems instead.

Centralized residential heating/cooling has four main components:

1. Central Unit: Typically made up of a furnace and A/C unit plus a boiler or heat pump. These are the fuel burning centers of your HVAC system
2. Distribution System: This is the ductwork in forced air systems or pipes for water/steam systems. Their job is to carry heat/cold from the central unit and through the house.
3. Venting System: Comprised of vents and pipes that vent spent air and the poisonous gases made in the central unit by burning fuel out of your house.
4. Thermostat: This is the brain of the centralized system, controlling the entire system.

So, why does centralized heating promise to be more efficient than the alternatives?

Lets look at their component heating equipment to find out.




**Because furnace and boiler-based heating systems generate heat in a central location and then distribute it throughout the house through a duct system, they are often referred to as "central heating systems."**

# FURNACES:
# TYPES AND EFFICIENCY RATINGS

Furnaces are a type of heating unit. They are manufactured to use various types of fuel: solid fuels, like coal burning stoves; liquid fuels, like oil burning furnaces; gas such as natural gas or propane burning furnaces, and electricity in the case of electric heaters.

## GAS FURNACES

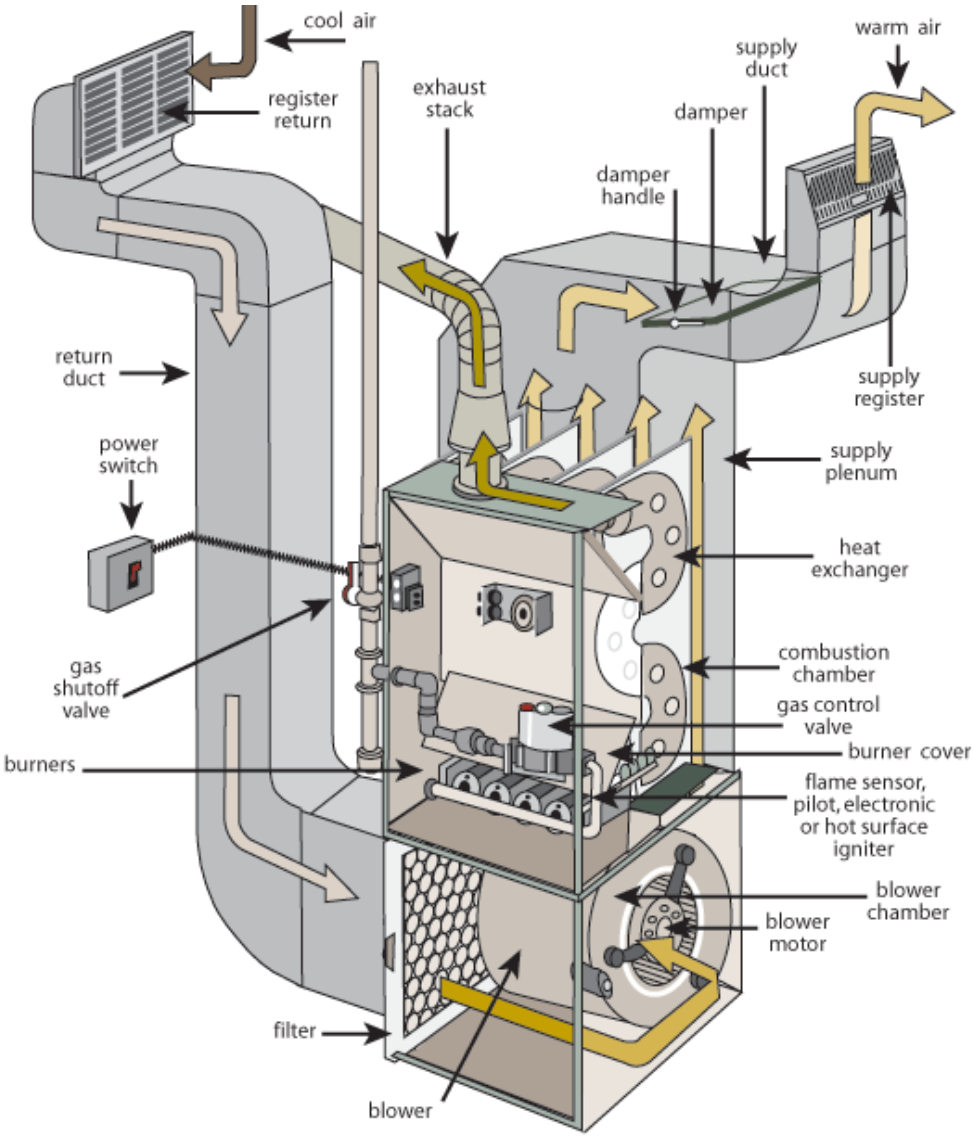
Modern central heating systems, are typically equipped with gas powered furnaces. In the last decade, efficiency scores for these units have increased from 65% to as high as 95%!

Gas furnaces are made up of a burner, an ignition device, and one or more heat exchangers. The exchangers are where the heat generated from the burning gas transferred to the indoor air the is circulated through the unit and the exhaust gas produced by the burning fuel is transferred to the venting system. Once warmed, a circulation blower moves this heated air throughout your house.

Manufacturers have focused on designing the heat exchangers to extract as much heat as possible from the hot gases and exhaust before venting them out of the home.

Mid-efficiency furnaces can now extract between 78% to 83% heat before venting. Ultra-high efficiency furnaces - with ratings of 90% to 97% efficiency - actually add a second heat exchanger to extract even more heat from the relatively cool exhaust after it leaves the first exchanger.

Extracting heat at these cooler temps, causes water vapour to condense out of the exhaust, which is why these furnaces are called "Condensing Furnaces".




DID YOU KNOW

**Natural gas is the most common home heating fuel in the U.S., used in 57% of American homes.**

## OIL FURNACES

These are very similar to gas furnaces in operation and have similar efficiencies.

The difference lies in fuel combustion: with liquid fuel, oil furnaces have a fuel atomizer that gets mixed with hot combustible air and forced into the combustion chamber.

While not as common and condensing gas furnaces, condensing oil furnaces are available, with efficiency ratings above 90%.

## ELECTRIC FURNACES

Electric furnaces convert electricity into heat using an electric resistance heating coil. The coil is housed in a cabinet with a circulation blower that transfer the heat to the circulating indoor air.

Electric furnaces are very near 100% efficient - only a very small amount of heat is lost through the cabinet.

But, given that electricity is typically very expensive relative to other fuels, electric furnaces aren't recommended for central heating.

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# HEAT PUMPS: TYPES AND EFFICIENCY RATINGS

Heat pumps, air conditioners, even your refrigerator all work the same way: they move heat from where it is to somewhere else.

Your refrigerator pumps heat from inside your fridge out into the room. Your AC pumps the warmth in your house outdoors and your heat pump does the reverse.

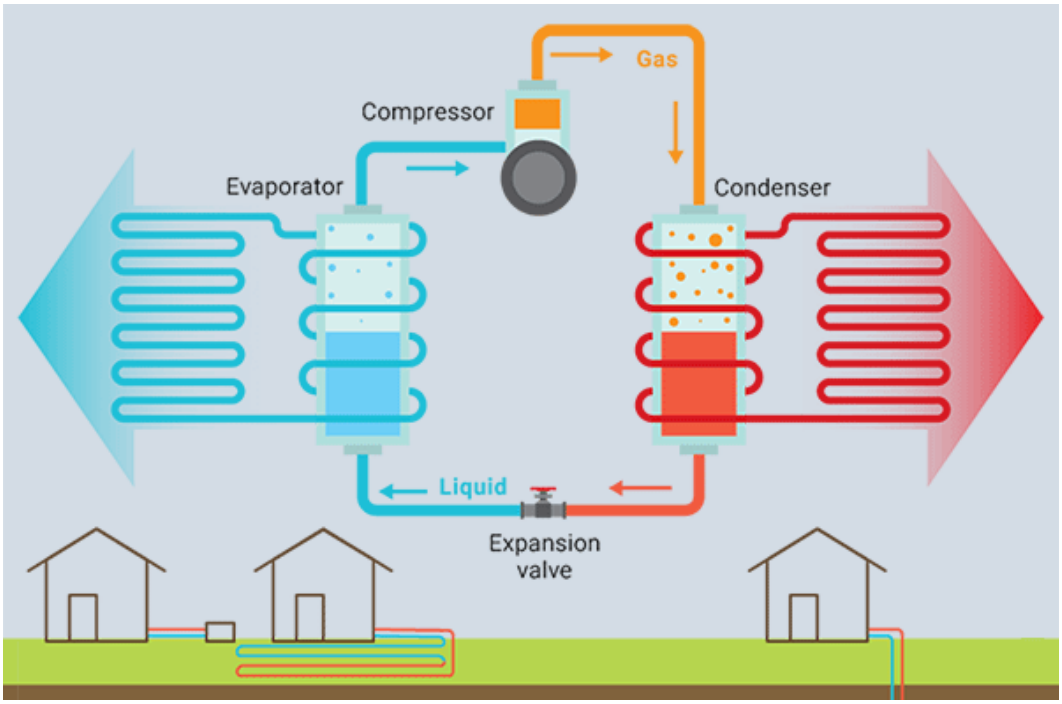
In fact, combination AC/Heat Pumps are dual purpose: using a flow control valve that reverse the flow of air, the same equipment both pumps heat out of your house to cool it and into your house to warm it as the season requires (see "Heat and Cold Storage with a Heat Pump" diagram).

This adaptability is a prime advantage of heat pumps and makes them extremely popular in temperate climates where.

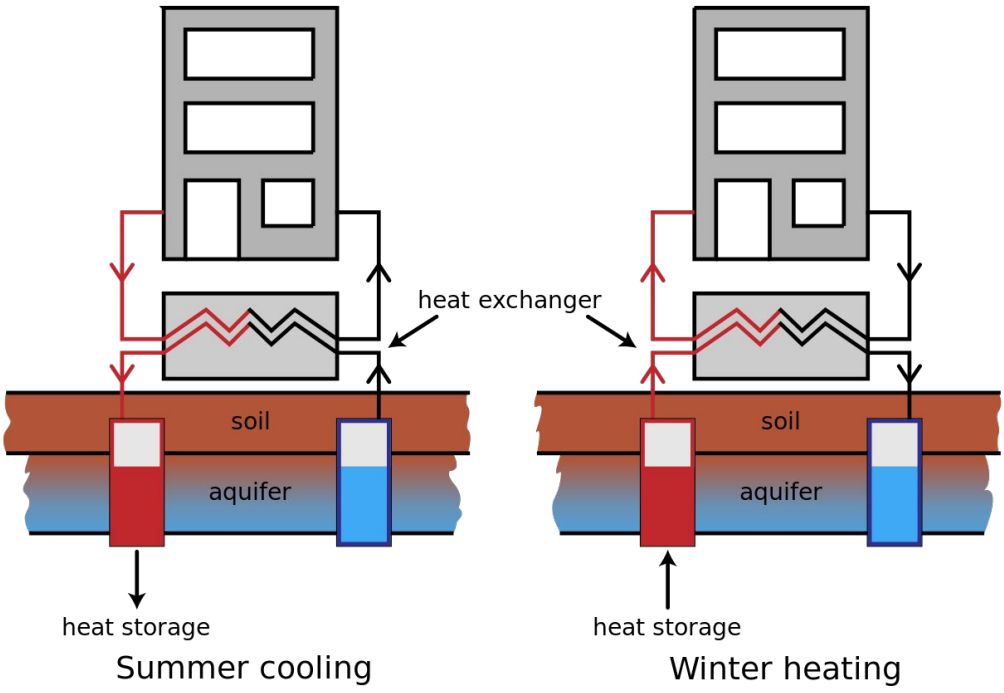
All heat pumps are made of the same components: an indoor coil to heat or cool circulating house air; and outdoor heat source to supply the heat or cool, copper tubing to circulate pressurized refrigerant between the indoor and outdoor units and finally, a compressor which does the actual air "pumping" (See "How Heat Pumps Work" diagram).

These systems are extremely good at their job. In fact, a heat pump is able to capture heat within the range of 20 to 30 degrees F and use it to heat indoor air to a warmth of between 80 to 100 degrees F.

# HOW HEAT PUMPS WORK




Heat and Cold Storage with a Heat Pump



# THE 3 TYPES OF HEAT PUMPS

Geo-Thermal Heat Pump In A Packaged Group, Cut-Away View

Geo-Thermal Heat Pump In A Packaged Group

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# GEOTHERMAL HEAT PUMP

Geothermal heat pumps use ground heat as their energy source. Ground heat is extracted via water circulating in a closed-loop pipe buried in a deep trench or well.

Because the deep-ground temperature is constant year round, Geothermal heat pumps are more efficient than air-to-air heat pumps.

Because the ground is also warmer than cold winter air, GHPs are more efficient than Air-to-air HPs because they pump heat over a smaller temperature range. The result is they GHPs use use 25-50% less electricity than conventional heat pump systems.

They are also more efficient when operating as AC units, as they only have to pump heat into the relatively cooler ground than hot, summer air.

Beyond their increased efficiency, GHPs have better humidity control, run quieter, are more durable with less maintenance and are greener, requiring less energy to operating.

The disadvantage with Geothermal HPs is their installation cost. But where you';re installing a system for a new build or replacing an outdated system in your forever home, their lifetime efficiency in both energy use and maintenance costs makes them a good long term investment.

Geothermal heat pump housed as a split group package

# ELECTRIC HEAT PUMPS

Rather than generating heat directly like with an electric furnace, electric heat pumps use an electric compressor "pump" heat from the outdoors into your home.

Because the pump's compressor is using electricity to move  heat rather than create it, it can actually generate two to three times more Btu's per Kwh than an electric furnace.

## AIR-TO-AIR HEAT PUMPS

As the name implies, an air-to-air heat pump extracts heat from the outside air and uses it to heat and circulate indoor air via a heat exchanger and fan.

To deal with extreme temperatures, these heat-pumps are equipped with a two-stage thermostat.

If your home's indoor air temperature drops below a few degrees of the setting, the heat supplied by the pump's compressor is supplemented by heat generated by a electric resistance coil.

It's this reliance on a supplemental electric heat source that dramatically reduces a heat pumps efficiency.

In temperate climates, electric resistance heat would come into play only when the outside temperature drops to around 15-25 degrees F or when turning the heat pump in a cold house.

Another factor reducing a heat pump's efficiency is is frost formation on the outdoor heat coil when temperatures drop to 40 degrees or below.

A build up of frost will impair the transfer of heat to the coil markedly decreasing the heat pump's output and efficiency.

Heat pumps have a "defrost" cycle to deal with this, using indoor heat to melt the frost and warm the outdoor coil.

Again, this reduced efficiency is the main disadvantage or air-to air heat pumps.

Where an air to air heat pump will be operating  at outdoor temperatures at or below 35 degrees F, operating costs as well as home comfort drops, because the heat pump isn't able to sufficiently heat the air.

While this is a troublesome problem in colder regions of the country, it is not a severe problem in most regions of Virginia.

# HEAT PUMPS VERSUS OTHER HEATING EQUIPMENT

Heat pumps can extract heat from various sources, such as environmental air, exhaust air from a building, or from the ground.

Efficiency-wise, heat pumps will produce approximately 3 Kilowatts of heat for every 1 Kilowatt of fuel used while a high-efficiency gas furnace will only get you 0.98 Kilowatts for that same 1 Kilowatt.

With that kind of efficiency, heat pumps must obviously be the way to go. Well, it's not that simple, unfortunately.

In more temperate parts of the country, ventilation combined with a heat pump to extract heat (or cold) from the external air or ground, is all that's needed to efficiently keep a home comfortable.  But when outside temperatures plummet to near zero or below,  your heat pump's efficiency plummets too.  To compensate, a backup heat source must also be installed.  This, of course, will significantly raise your upfront costs, requiring both the cost of the heat pump and a heater appliance.

Check out the tips below to know what you should consider when weighing a heat pump over a traditional heater on its own.

# HOW TO KNOW A HEAT PUMP IS BEST FOR YOU

Factors to consider to determine if a heat pump makes the most economic sense for you:

## CLIMATIC LOCATION

Heat pumps are most suited to moderate climates. Again, if your area experiences extreme cold, a heat pump alone will cost substantially more to heat your home on its own, necessitating some form of supplemental heating - such as a furnace or ductless heaters for localized heating. While these will offset the cost of operating the heat pump to generate heat, the cost of the heaters themselves will add to your initial cash outlay.

## AGE OF YOUR HOME AND TIME-HORIZON

Do you have a newer home insulated with higher R-value materials? If yes, your home's ability to retain heat will result in reduced loading of the heat pump and could potentially mean a supplemental heat source isn't required to generate additional heat and maintain warmth at a reasonable cost.

Alternatively, if you have to supplement your heat pump with a heat-generating appliance because your home doesn't have a high R-value, a heat pump may still make sense if you plan on living in that home for a longer period of time. Because of the heat pump's running efficiency, the savings you get from its operation, only supplementing with extra heat when necessary, can offset the cost of the heater over time.

## REBATES AND TAX CREDITS

You can obtain a 30% federal tax credit when you purchase and install an Energy-Star rated geothermal heat pump.

You may also obtain state tax credits and manufacturers may also offer seasonal incentives.

# WHAT IS A DUCTLESS HEATING SYSTEM?


While "central heating" (and cooling) usually refers to HVAC systems with a centralized heating/cooling unit, whole home temperature control doesn't require a ducted system for distribution.

Instead, ductless heat pumps and air conditioners consist of wall-mounted indoor units combined with an outside compressor.

Most homeowners typically consider going the ductless route when replacing an HVAC system in a home without ducts. But with the advantages these systems offer, they are increasingly seen as a whole home option in new builds as well.

In fact, because the average home loses 25% or more energy to duct leakage, eliminating the need for ducts makes these systems exceedingly energy efficient right off the bat.

Because ductless system compressors operate on a "revving" basis - meaning they speed up & slow down depending on the needs of the system rather than shutting down & starting up like compressors do in typical heating systems, a ductless system can save you up to 30% on energy costs.

Additionally, like with the purchase of ENERGY STAR rated heat pump systems, if you opt for ductless HVAC, you may qualify for a federal tax credit and local utility incentives as well.

# 5 BENEFITS OF DUCTLESS HVAC SOLUTIONS

## 1 HIGHLY FLEXIBLE SOLUTIONS

Ductless systems are comprised of a small outdoor unit and one or more indoor units. To operate, unit mounting and access to electricity is all that is required to deliver heated or cooled air directly into different zones and at whatever temperature is preferred in that specific area.

Traditional heat pumps and central air conditioning systems on the other hand force cooled and heated air from a central unit through ductwork built into the walls of the house. When turned on, you're heating or cooling the entire the house and not just a specific area.

## 2 THEY SAVE YOU MONEY

One of the biggest reasons why homeowners switch to ductless cooling and heating is overall cost savings.

Because ductless systems operate on less power – they are smaller than traditional forced-air systems, and because the temperature-controlled air is delivered directly into a room, there is no loss in efficiency.

Multi-split systems also allow homeowners to create "zones" in their home, which means they no longer have to cool or heat rooms that aren't occupied.

Purchasing a system may also qualify you for tax credits or utility rebates for the year they install a ductless system, offering even further savings by subsidizing their purchase cost.

## 3 IMPROVED INDOOR AIR QUALITY

To maintain indoor air quality, traditional HVAC systems require regular professional cleaning. Even so, forced air systems often result in dust and allergens.

On the other hand, ductless systems offer multi-stage filtration that can drastically reduce dust, bacteria, pollen, allergens and other particulates in the air.

## 4 THEY ARE QUICK AND EASY TO INSTALL

Unlike traditional ducted systems, multi-split ductless systems run on small pipes that require a mere three-inch hole, you don't have to worry about rebuilding walls or ceilings around ductwork and there is no loss of square footage for unit installation.

Ductless systems are far less invasive to install than traditional HVAC systems. In fact, depending upon the number of indoor and outdoor units required your new system can be up and running in as little as one day.

## 5 DUCTLESS COOLING LOWERS YOUR CARBON FOOTPRINT

The small size of a ductless cooling system and the ability to cool by room or "zones" allows for greater energy efficiency.

Ductless cooling and heating systems are also built to ENERGY STAR guidelines, which means they are far more energy efficient than the minimum standards set forth by the U.S. federal government.

Additionally, ductless systems use a refrigerant called R410A, which is known for its zero ozone depletion potential. This means the system will have less impact on the environment throughout its lifecycle.

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# CONSIDERATIONS WHEN THINKING ABOUT A DUCTLESS HVAC SOLUTION

Some things to keep in mind when looking at a ductless heating system solution.

## UP-FRONT COSTS

Up-front costs will be several times more than that for a baseboard heating unit or window air conditioner in a single room or for replacing an existing central heating/cooling system with a ductless one.

Substantially increased efficiency will provide payback - up to 30% lower energy bills for heating and cooling in fact, but the timeframe to making up the difference depends on your climate, how you use the system, and your local electricity rates.

Also keep in mind that extremely cold climates will most likely require a backup, fuel-based system to take over when temperatures fall below zero.

To work out whether a ductless system makes economic sense for you, find a reputable HVAC contractor knowledgeable about system sizing calculations and who will tell you whether you will need a secondary system in your area.

## MONTHLY MAINTENANCE

To function at peak efficiency, each unit's filter must be washed on a monthly basis - more often if you smoke or have pets.

Because ductless fans can't handle a build-up of dust and debris, the importance of filter maintenance can't be overstated.

Ignoring simple regular filter maintenance will result in having to pay for professional cleaning down the road and, because of the extra strain placed on the units' fans, could even shorten the life of your system.

## AESTHETICS

Some feel the units can detract from their decor.

Design options are certainly limited - units come in standard white or beige and can't be covered up. However, once installed, because of their mounting height and silent operation, most users usually report the unit tends to blend into the background.

Ductless system installation, unit ceiling placement

Ductless unit installation, high wall placement

# WHEN WOULD DUCTLESS BE AN IDEAL SOLUTION?

While ductless systems as a whole house heating and cooling can make sense depending on a number of factors, there are certain situations where ductless holds a clear advantage, including:

## ADDING CENTRAL AC WITHOUT DUCTING

While ductless solutions aren't cheap, it's less extensive than adding ductwork to an existing house.

Opting for a ductless AC system will not only save you money over installing ducting, but it will also offer better interior and exterior aesthetics and efficiency over window AC units.

## NEW ADDITIONS:

Garage apartments, bonus rooms, sunrooms, and "man caves."

As new additions to existing builds, you can take advantage of not having to connect these areas to existing ductwork.

The benefit in being able to heat and cool these areas without connecting to the existing distribution system is that you won't be overloading your existing HVAC; your heating/cooling solution will be sized to fit the new space; and you can isolate odours from other areas of the home.

## DOWNSIZING IN LARGER HOMES:

If kids have moved out and you're in a position where you don't want to heat and cool areas of your home, you may be tempted to simply shut off HVAC grilles.

But doing so will create pressure imbalances and could give rise to mold problems.

A better solution would be to install a ductless system in the master bedroom and main living area and set the home's main thermostat to run at a lower level.

# WHY CHOOSE A HOT AIR SYSTEM OVER RADIATORS?

Both systems are gas fueled, so assuming equal system maintenance, the cost to operate is fairly equal between the two. So, let's look at their advantages and disadvantages to understand why one may appeal over the other.

| HEATED AIR | | RADIATORS | |
|---|---|---|---|
| **Advantages** | **Disadvantages** | **Advantages** | **Disadvantages** |
| 1. Heats the house very quickly. | 1. Vents should be cleaned to reduce dust accumulation in the home. | 1. Room-level control, can shut-off individual rads. | 1. Larger, bulkier and take up more space. |
| 2. Smaller and take up less space than radiators. | 2. Without adding a humidifier indoor air can be noticeably dry. | 2. Easier to replace. | 2. Radiator covers prevent full-efficiency. |
| 3. Room-level vent control to heat necessary areas only. | 3. Fitted into ceilings. | 3. Radiator covers can add comfort to a room. | 3. If poorly placed can lose a lot of heat. |
| 4. No visible pipework and vents can be placed in hidden areas of the room without affecting air circulation. | 4. Should get serviced yearly to ensure system working well. | 4. Can dry wet items directly on rads. | 4. Messy to clean out. |
| 5. Can integrate with an AC unit for all season use. | | 5. Quiet operation. | 5. Visible pipework, interferes with decor. |
| 6. Great for drying clothes on a horse above the vents. | | 6. Moist heat. | |

AIRPLUS HEATING & COOLING

# WE'RE HERE TO ANSWER ALL YOUR QUESTIONS

Have questions we haven't answered in our **HEATING SYSTEMS BUYER'S GUIDE?**

Ask us your questions by using the form below or give us a call at **703-570-5121.**

One of our heating experts will reply with the information you need about heating systems and how to be sure you're buying the right system for your situation.

**SCHEDULE NOW!**

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