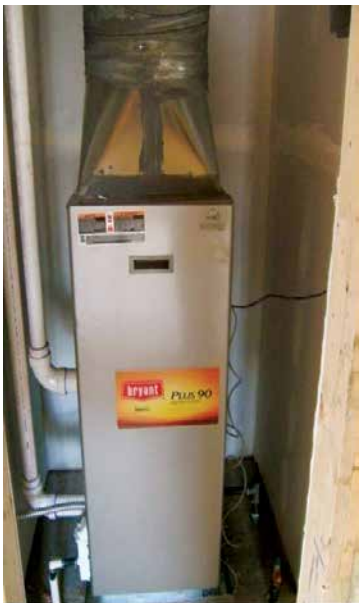
Furnace Replacement

Overview

Replacing the furnace and air handler in your central, forced-air heating system with a new, energy efficient unit with closed combustion is a quick, relatively non-invasive way to reap energy savings. An inefficient furnace can seriously affect the comfort of your home while emptying your pocketbook through inflated utility bills.

Installing a new furnace can help reduce the amount of energy needed to heat your home but may be a higher first cost than other intermediate steps such as air sealing and duct sealing. That said, rising utility costs can accumulate quickly with an old, inefficient system, thereby shortening the time to see a return on your investment of a new unit.



High Efficiency Energy Star Furnace with direct vent and condensate line. This furnace also includes ducted fresh air (not shown in the photo). Source: O'Brien & Company.

Definitions

Air Handler Unit (AHU) – *Typically refers to both the furnace which heats the air and the fan that moves it around your home.*

Annual Fuel Utilization Efficiency (AFUE) – *This value identifies the thermal efficiency of combustion equipment like furnaces, boilers, and water heaters.*

Flue Gases – *The gases generated from the burning of fuel, which includes water vapor, carbon monoxide and unburned hydrocarbons. Gas burns cleaner than oil, but an older furnace that is out of adjustment may generate more toxins than a new furnace.*

Condensing Furnace – *In a conventional furnace, only about 80 percent of the heat energy in the fuel is transferred to the air in your home. The other 20 percent goes "up the chimney" in the water vapor and other gases. A high efficiency furnace captures half to three quarters of that 20 percent by condensing the water vapor in the flue and recycling the heat to the heat exchanger.*

Modulating or Multi-stage/2-Stage burner – *Single stage burners only operate at full power so they adjust heat delivery by turning off and on. A modulating or multi-stage burner adjusts the size of the flame according to how much heat is needed, which allows the furnace to run more consistently and give more even heat, while conserving fuel.*

Electrically Commutated Motor (ECM) – *Single speed motors only allow for one fan speed, whereas ECMs enable a variable speed of air flow across a burner within a furnace. ECMs coupled with modulating burners can improve the efficiency of your system, improve comfort, and potentially*

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increase the life of your furnace by reducing the on-off cycles of the equipment.

When is this Applicable?

If your system is more than 15 years old, is noisy or in need of frequent repair, if your heating bills are going up, or if your carbon monoxide detector goes off periodically, replacement may be a good idea. If you are doing a major rennovation you may be required to upgrade your furnace to current code efficiency standards – see Permit Tips.

For new construction projects or when considering changing your heating/cooling system entirely, see "Alternative Heating Systems" within the Green Building Handbook.

What Makes it Green?

Benefits of furnace replacement include:

- Reduced energy costs:
  - Efficiency – a new furnace may use 15 to 20 percent less fuel than a 15 year old furnace.
  - Fuel-switching – propane and particularly natural gas are lower cost than oil and much lower cost than an electric furnace.
- Improved comfort and quietness of system – new furnaces can have multi-stage burners and variable speed fans (ECMs) for more consistent temperatures and quieter operation.
- Improved health / air quality – older furnaces can leak flue gases into your home from the flue or through failing heat exchangers.
- Potential to earn additional points through Built Green and LEED for Homes based on the efficiency of equipment or the overall home performance.

Best Practices

- Invest in envelope air sealing, duct sealing and insulation BEFORE spending more money on an efficiency upgrade.
- Consider hiring an energy analyst or work with a local energy efficiency program. They will help you determine if your furnace needs replacing and what size is appropriate, based on your home and duct system design.
- Select a reputable contractor – see ***"Heating & Air Conditioning Installation Bid Comparison Checklist"*** listed in Resources.
- Ensure they size the system properly, rather than installing a same-sized unit:
  - Check that they account for added or planned insulation, new windows, envelope and duct sealing, additional rooms, etc. in the load calculation and sizing selection.
  - Check that the duct system can handle the airflow from the new AHU.
- Buy an Energy Star direct vent condensing furnace with modulating burner and electronically commutated motor (ECM) with AFUE greater than or equal to 95%. The first cost is higher, but the benefits include fuel savings, improved comfort, and quiet operations. ***And***, there is likely a PSE rebate for the upgrade.
- Determine if a switch to a different system (such as ductless mini-split heat pump) may be applicable for your home. Ductless heat pumps are an increasingly popular option for replacing oil, electric, and propane

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furnaces, often providing an especially good return on investment. See the Heat Pumps Green Sheet for more information.

- See http://www.energystar.gov/index.cfm?c=heat_cool.pr_maintenance for a heating system maintenance checklist.

Certified gas furnaces labeled with the standard ENERGY STAR logo will be up to 16 percent more energy efficient than baseline models and can save an average of $94 in energy costs per year. Source: ENERGYSTAR

What about my ducts?

The efficiency (tightness) of your duct system has a huge impact on energy use, comfort, and even durability of your home. When installing a new system in new construction, be sure to test and seal the ducts during framing for optimum results. For furnace and system replacements, prioritize duct sealing as much as equipment choice and when possible bring them inside! Ducts located outside the conditioned space of your home (i.e. in your attic, garage, or crawlspace) greatly impact the efficiency and air quality. If all your ducts are "inside," duct testing is not required by code because duct leakage is less of a concern. See the "Duct Sealing" card for additional information.

References/Standards

DPER Bulletin 36: Mechanical Permits FAQs

Energy Compliance Form: This required form includes guidance for the heat loss calculations that determine system sizing.

Residential Mechanical Permit Application / Affidavit Form: This can be filled out by homeowners or mechanical contractors but must be completed for any furnace replacement.

Resources

For the complete King County Green Building Handbook and individual Green Sheet PDF files, please visit our website at: http://kingcounty.gov/property/permits/publications/greenbuild.aspx. For additional information, please email dperwebinquiries@kingcounty.gov or call 206-296-6600.

See these related DPER Green Sheets GS):

- Air Sealing Your Home, GS Number 10
- Alternative Heating Systems, GS Number 19
- Duct Sealing, GS Number 11
- Fresh Air Ventilation, GS Number 14
- Insulation, GS Number 13
- Right Sizing Heating/Cooling Systems, GS Number 17
- Routine Maintenance, GS Number 5
- Thermostats, GS Number 16

PSE Rebates and Offers: PSE offers numerous rebates; click on "Home Heating" to find furnace-related rebates and current offers.

Energy Saver 101 Infographic: Learn everything you need to know about home heating.

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Heating & Air Conditioning Installation Bid Comparison Checklist: Use this when hiring an HVAC Contractor.

WSU Extension Energy Program: This website provides a wealth of information and resources related to the energy code and energy efficiency in Washington State.

Permit Tips

For furnace replacements, the permit is "over the counter" and no plan review is required. Since a sizing form is not required for furnace replacements, see the "Sizing Heating/Cooling Systems" card for best practices associated with sizing. DPER will conduct an onsite inspection once a furnace is installed, so keep the equipment and installation documentation attached to the furnace.

If a furnace is part of a building permit, the sizing calculations (Energy Compliance Form) are reviewed by DPER staff. To ensure success, consider consulting a mechanical contractor to help with the requirements by providing a Manual S calculation.

If you are installing a propane furnace and adding a new propane tank on your property, you will also need to apply for a Fire Permit. Call the Customer Service Center for details.