

## Homeowner Guide to Home Performance

### IMPROVED COMFORT, BETTER INDOOR AIR QUALITY, AND AFFORDABLE UTILITY BILL

Does your home have rooms that are too hot? Is it drafty? Are the floors cold? Is your energy bill putting the squeeze on the household budget?

These are all common symptoms of energy waste caused by air leaks, low or no insulation, and outdated heating/cooling equipment — each of which affects your comfort and your utility bill.

The solution starts with the *whole-house approach*. Your house is composed of several integrated systems, all of which need to work together to keep you and your family comfortable.

The whole-house approach, also known as *home performance (HPP)*, uses scientific methods and tools to identify energy waste problems and plan coordinated improvements that deliver greater comfort, better indoor air quality, and lower utility bills.

### Getting Started with Home Performance

SMUD's Home Performance Program<sup>1</sup> provides information on how to improve your home's energy efficiency and comfort, rebates for HPP improvements, and a roster of qualified program contractors trained in the science of home performance.



Source: [www.iStockphoto.com/photo/house-and-stethoscope-14523451](http://www.iStockphoto.com/photo/house-and-stethoscope-14523451)

<sup>1</sup> SMUD is the electric company in Sacramento and focuses on electricity saving. For gas savings please check with your local gas supplier for more information.

### WHAT IS HOME PERFORMANCE?

Home performance improves energy efficiency by using building science and tools based on two principles:

- *Whole-house approach*, which recognizes that a house is composed of several key systems: building shell (that is, walls, windows, floors, roof, and attic), heating/cooling equipment, and other energy-related components — each of which affects the other and together the ability of the home to deliver affordable comfort.
- *Loading order*, which is a science-based sequence of energy improvements that allows the combined improvements to deliver maximum results.

### Understanding Home Energy

The first step in transforming your home into an energy efficient and comfortable environment is to think about how your home is performing. Are you cold or hot in parts of the house? Are the utility bills creeping up? Do you know how old your systems are, and what maintenance has been performed?

By inviting a SMUD HPP contractor to your home, you will discuss these problems and the contractor will educate you on probable remedies, how the SMUD Home Performance program works, including any required measures, and provide a bid to get the work completed. They have the ability to perform a complete test in to provide absolute numbers surrounding your findings, but that is not required to participate in the HPP program, and will usually have a fee involved. Only listed contractors on the SMUD HPP website are qualified to perform the required work. No DIY allowed.

(You can find a list of SMUD HPP contractors in your area by clicking [here](#).)

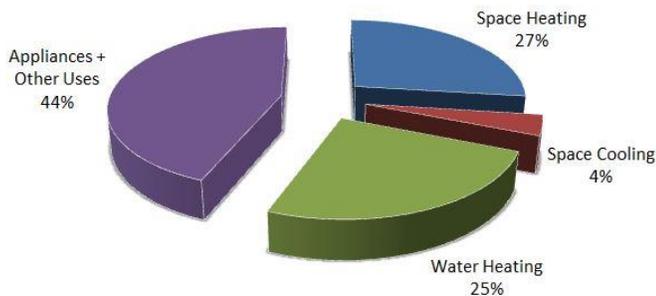
### WHAT WILL BE CONSIDERED?

- Utility bill (used to help gauge overall performance problems, or behaviors which effect the bill)

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- Air leakage of the shell ( age of home is a good indicator of this, as newer home are built to tighter building standards) ( **Required per program rules**)
- Attic, floor, and wall insulation level ( **Attic insulation to R-38 required for program**)
- Windows
- Heating, ventilation, and air conditioning (HVAC) system
- Duct system sizing and leakage ( **Leakage to 8% if re-use Or 6% if new required for program**)
- Water heater ( Electric only)
- Smoke and carbon monoxide alarms

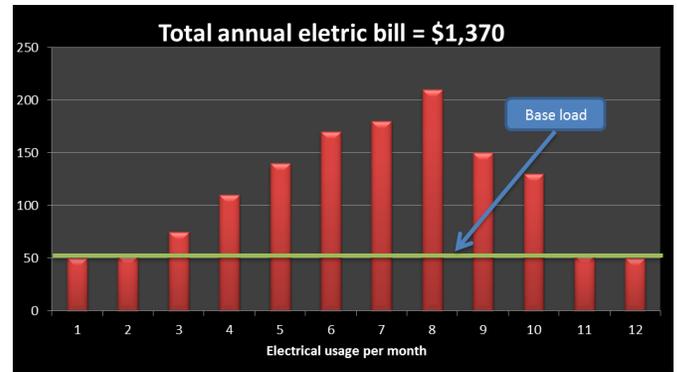
### Average Household Energy Use



Source: [http://www.eia.gov/consumption/residential/reports/2009/state\\_briefs/pdf/ca.pdf](http://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/ca.pdf)

Energy use falls into two categories: *heating/cooling load* (maintaining a comfortable air temperature) and *base load* (running your typical household appliances such as the water heater, refrigerator, lighting, other electrical items, and even your electric car).

The graph below shows twelve months of electricity use costing \$1,370; the green line indicates the base load (\$50/month or \$600/year) while everything above the line is electricity needed to cool the home (\$770/year).



Source: Efficiency First California

Knowing your base load and heating/cooling use helps your contractor identify the best efficiency opportunities.

### VIEW YOUR UTILITY BILL ONLINE:

- SMUD: <https://www.smud.org>
- Click on this link to learn more about savings and solutions to your energy consumption: <http://c03.apogee.net/clients/?hostheader=smud&utilityid=smud>

## Understanding Air and Thermal Barriers

There are two heat-related barriers within a building that help it maintain a comfortable temperature:

- *Air barrier* (that is, a well-sealed building)
- *Thermal barrier* (that is, properly insulated building)

Both these barriers are part of the *building shell* (also called the *home envelope*), which consists of the floors, walls, windows, and ceiling/roof of the home that provides that protected living space for your family.

To discuss the details of your home energy projects with the SMUD Program Manager, please call Jim Mills -916-732-6798

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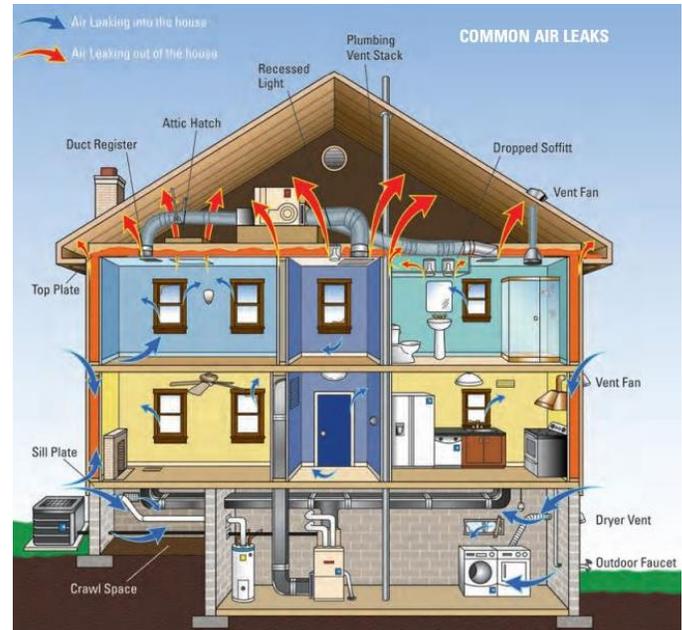


Source: [https://www.energystar.gov/index.cfm?c=home\\_sealing.hm\\_improvement\\_sealing](https://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_sealing)

### AIR LEAKS

In the typical building shell, air leaks are often found in cracks, small holes, and penetrations for plumbing, electrical wiring, and duct work. Together, these leaks can add up to as much air loss as a partially open window. Air leaks increase the need for heating/cooling, create drafty conditions, and allow dust and other outdoor elements to enter the home. Sealing the building shell prevents these comfort and indoor air quality problems while helping your heating/cooling systems maintain a comfortable air temperature in the home.

HPP contractors use national home performance standards and diagnostic equipment to ensure air sealing preserves an air exchange rate that is safe and healthy. For homeowners wanting a high degree of indoor air quality, mechanical ventilation systems can be installed for maximum control of the quality and quantity of air entering the home.



Source: [http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL\\_9-4-09.pdf](http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL_9-4-09.pdf)

### Benefits of air sealing

- **Improved comfort:** Sealing cracks and holes in the building shell will make your home tighter, which will eliminate drafts, reduce heat loss in the winter and heat gain in the summer, and provide increased comfort.
- **Improved indoor air quality:** A tighter building shell reduces the humidity, dust, pollen, and pests that can enter the home, which helps improve indoor air quality.
- **Increased durability:** When warm air leaks through your home's floors, walls, and attic, it can come in contact with cooler surfaces inside the building shell and cause condensation. This encourages mold growth, ruins insulation, and can compromise the structural elements of the home. Air sealing and insulation prevent the conditions that lead to mold and other deterioration of the building.
- **Lower utility bill:** Air leaks and poorly installed insulation can add 20 percent or more to your heating/cooling load. With effective air sealing and insulation, heating/cooling systems run less often and will not need to work as hard.

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### Sealing around doors and windows

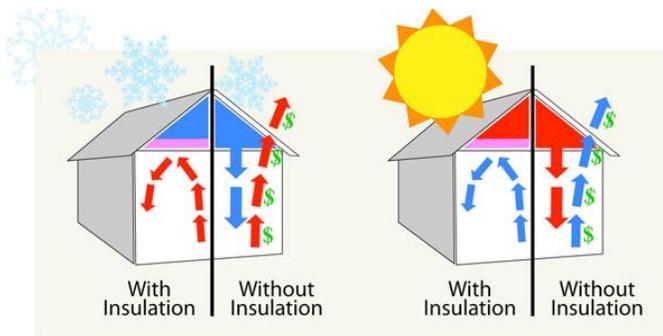
Weather-stripping is highly recommended around *movable building components*, such as doors or operable windows, to reduce air-leak related heat loss in the winter or heat gain in the summer.

For *stationary building components*, such as the attic floor and electrical wiring/plumbing, caulk or foam are the appropriate materials for filling cracks and gaps. As part of the air sealing process, your HPP contractor will test to verify the reduction in air leaks meets industry standards and assess your ventilation needs.

### THERMAL BARRIER

While air sealing plugs leaks that allow heated air to leave the building in the winter or enter in the summer, the *thermal barrier* provided by properly installed insulation provides the following additional benefits:

- **Heat transfer break:** Insulation creates a break in the building shell that reduces heat transfer to and from the inside of the home. Insulation materials are rated by their ability to resist the transfer of heat, which is known as an *R-value*; the higher the R-value the better the insulation product is at slowing the heat transfer.
- **Moisture protection:** Properly installed insulation prevents surfaces on the inside of the floor, walls, and ceiling from getting cold enough to allow moisture to condense inside the building shell.



Source: <http://www.fergusonroofing.com/insulation/>

### Seal first, insulate second

Heat loss/gain happens through leaks and through solid materials. Most standard insulation products (batts, blankets, blown-in loose fill) do not provide an air barrier, so it is important to seal air leaks before installing the insulation. (Note: Spray foam insulation

will provide both an air and thermal barrier.) SMUD HPP recommends each project include air barrier and thermal barrier measures. Depending on the condition of the existing attic insulation and the amount of air sealing that needs to be done to meet SMUD air infiltration targets, it may be necessary to remove some or all of the existing insulation to access the attic floor for air sealing, after which the insulation could be replaced or re-installed and supplemented with new insulation to reach R-38.

Note: SMUD requires that in attics with contaminated insulation (for example, insulation that is wet or contains rodent detritus), the existing insulation must be removed from the home and disposed of, the attic must be cleaned and air sealed, and the new insulation installation must meet the HPP R-38 requirement.

### Understanding HVAC (Heating, Ventilation, and Air Conditioning)

Heating and cooling your home uses more energy and costs more money than any other energy use in your home — typically representing as much as 31% or more of your utility bill.

Sealing air leaks and updating insulation reduces the amount of energy needed to heat/cool the home. This means, a new heating/cooling system can be *right sized* to the reduced heating/cooling load.

A right-sized system with duct work designed to produce comfortable air temperatures throughout the house, uses less energy and runs more efficiently while delivering increased comfort. And when combined with air sealing, insulation, and a programmable thermostat, a right-sized system can significantly lower your heating /cooling energy use.

### Additional opportunities

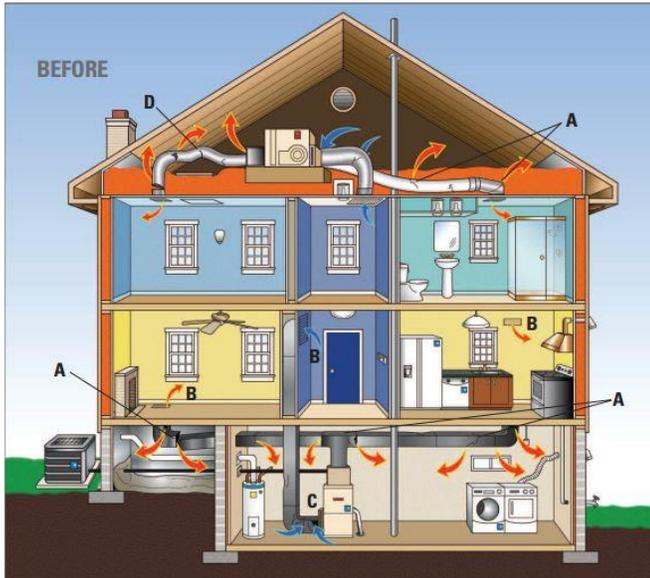
SMUD's Home Performance Program also offers rebates for:

- Installing energy efficient air conditioners and electric heat pumps
- Reducing air conditioning system size or *tonnage*

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### Understanding Duct Sizing and Sealing

The average California house leaks from 30% to 40% of the heated/cooled air distributed through the ductwork because of leaks in the duct system and insufficient and/or poorly installed duct insulation.



A = Leaky, torn, and disconnected ducts; B = Poorly sealed registers and grills; C = Leaks at furnace and filter slots; D = Kinks in flexible ductwork restricting air flow. Source: [http://www.energystar.gov/ia/products/heat\\_cool/ducts/DuctSealingBrochure04.pdf](http://www.energystar.gov/ia/products/heat_cool/ducts/DuctSealingBrochure04.pdf)

This means that a significant amount of the heated or cooled air intended to support your comfort is pouring into uninhabited areas such as the crawlspace, attic, and walls. Using testing equipment to find air leaks and sealing your duct system can improve indoor air quality by preventing dust and other particulates from entering the home through holes in the ducts.

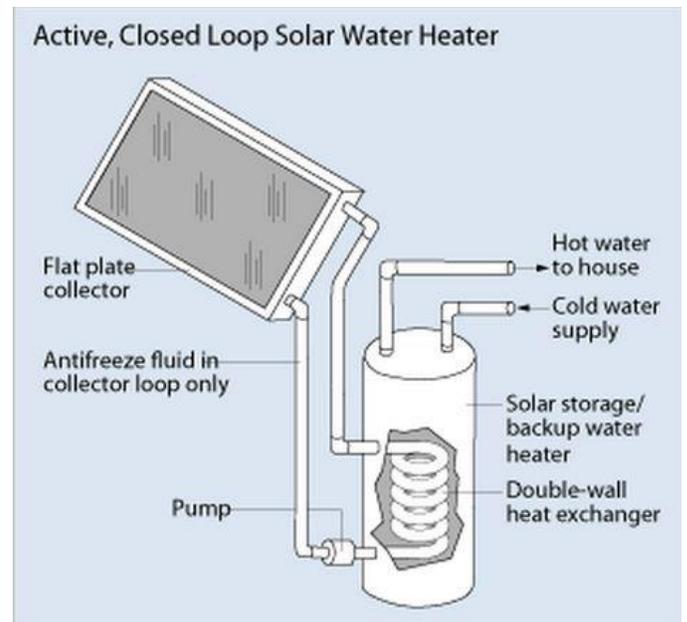
### Understanding Hot Water Heaters

Water heating is the second largest energy expense in your home. It typically accounts for about 25% of your utility bill. There are three types of water heaters: Natural gas or electric tank heaters, on-demand water heaters, and solar water heaters.



Source: <http://energy.gov/public-services/homes/water-heating>

Tank water heaters use natural gas or electricity to heat water that is stored in a tank; on-demand water heaters use natural gas to heat water as it is needed with no storage tank; solar water heaters use solar panels to heat the water that is stored in a holding tank similar to the standard tank water heater system.



Source: <http://energy.gov/energysaver/articles/solar-water-heaters>

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### Four ways to cut your water heating bill

- Use less hot water
- Turn down the thermostat on your water heater
- Insulate your water heater (tank systems)
- Buy a new, more efficient model

### Water heating tips can save you money

- Install low flow faucet aerators and showerheads
- Repair leaky faucets promptly
- Set the thermostat on your water heater to 120°F to get comfortable hot water for most uses
- Insulate your water heater storage tank
- Insulate the first six feet of the hot and cold water pipes connected to the water heater
- Install *heat traps* on the pipes leading to and from the water heater tank (heat traps are loops of pipe installed on the cold water inlet and hot water outlet pipes that prevent convection from pushing hot water through the outlet pipe when there is no demand).

Although most water heaters are designed to last 10 to 15 years, it is best to start planning to replace the unit if it is more than seven years old.

SMUD HPP offers rebates for upgrading electric water heaters. SMUD's solar water heater program offers rebates for install a solar water heater system. Talk to your HPP contractor for more details and/or check the [smud.org](http://smud.org) website for qualified water heaters.

### WATER HEATER STORAGE TANK BLANKET

An insulation blanket can make some tank water heaters more energy efficient. If your water heater is located in unconditioned space (that is, in a garage, basement, or attic), your HPP contractor may recommend installing an R-11 or better insulation blanket.

The higher the R-value, the thicker the blanket and the more insulating power. An insulation blanket is not recommended for a water heater located where its lost heat could be used (such as inside the living space).

Nor is a blanket necessary if you have a new water heater that is factory insulated with R-16 or better (the factory-installed insulation is located between the metal shell and the tank, so don't worry if you can't see it.) The manufacturer's label will tell you how much insulation your water heater tank contains.

You can purchase a water heater insulation blanket as a kit based on the size of the heater — 30 gallons, 40 gallons, 50 gallons, and so on. The kit contains a blanket that is finished with white vinyl on the outside and raw insulation on the inside and enough adhesive tape to finish the seams.

## Understanding Carbon Monoxide and Smoke Detectors

Home performance improves occupant safety by inspecting and remedying any issues with combustion appliances, which can produce carbon monoxide (CO) when the appliance does not fully burn the fuel. A *combustion appliance safety* test is performed at the conclusion of each SMUD HPP project to ensure combustion appliances are working efficiently and safely.

CO is the leading cause of accidental poisoning deaths in North America. CO gas is odorless, tasteless, invisible, and heavier than air — it is a silent killer.

The only effective way to know if CO is present is to install CO detectors on every level of your home and in sleeping areas.

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*The International Association of Fire Chiefs recommend a carbon monoxide detector on every floor of your home, including the basement. A detector should be located within 10 feet of each bedroom door and there should be one near or over any attached garage. Each detector should be replaced every five to six years.*

Source: <http://www.homesafe.com/coalert/detect.htm>

Smoke detectors are another important safety tool. Using either an ionization or photoelectric process, smoke detectors sense smoke in the home and initiate a loud alarm to alert residents. Smoke detectors save thousands of lives a year. Installing smoke and CO detectors provides affordable protection for your home.

### Why Choose Home Performance?

As you can see, a home performance project provides many benefits: improved comfortable, better indoor air quality, reduced energy needs, and safety inspection of combustion appliances. SMUD Home Performance Program rebates and financing, including SMUD Energy Efficiency Loan Program, provide all the tools you need to plan a project that meets your needs, budget, and goals.

#### FOR MORE INFORMATION

For more information about energy efficiency incentives available through SMUD: <http://hpp.smud.org/> and [james.mills@smud.org](mailto:james.mills@smud.org)