Homeowner Guide to Healthy and Safe Energy Upgrades

When making energy efficiency upgrades to your home, it is important to understand that many of the "parts" of your house, heating and cooling equipment, insulation, structure, etc., work together as one system. Updating and improving any of these individual parts may change the home's dynamics, potentially necessitating additional health and safety upgrades.

Below is some basic information on some of the common health and safety issues which should be considered as part of your energy efficiency improvements.

Information Regarding Compact Fluorescent Light ("CFL") Bulbs

As part of your efficiency improvements, you may install energy-saving, compact fluorescent light bulbs ("CFLs"). These ENERGY STAR qualified CFLs use up to 75 percent less energy than incandescent light bulbs and last up to 10 times longer. If every home in America replaced just one incandescent light bulb with a CFL, in one year it would save enough energy to light more than 3 million homes. That would prevent the release of greenhouse gas emissions equal to that of about 800,000 cars.

CFLs and Mercury

CFLs contain a very small amount of mercury sealed within the glass tubing – an average of 4 milligrams (mg). By comparison, older thermostats contain about 500 milligrams of mercury – an amount equal to the mercury in 125 CFLs. No mercury is released when the bulbs are intact (not broken) or in use.

While CFLs do contain mercury, using CFLs help to prevent mercury from being emitted into the environment, where it most affects our health. More than half of the nation's mercury emissions come from coal-fired power plants, which is the predominant source of electricity in Colorado. By saving electricity, a CFL will actually prevent the release of more mercury into the environment than the amount of mercury contained within a bulb.

CFL Recycling

To prevent the release of the mercury in a CFL into the environment, CFL bulbs should be recycled. Many retail stores accept "burned out" fluorescent bulbs for recycling, see http://www.epa.gov/cfl/cflrecycling.html or www.earth911.org for details.

Clean-Up of Broken CFLs

CFL bulbs should be handled carefully to prevent breakage. In the event a CFL bulb does break, you will want to take proper precautions to address the mercury released. To minimize exposure to mercury vapor, EPA recommends that residents follow cleanup and disposal steps. A cleanup overview is described at www.epa.gov/cfl/cflcleanup.html.

Carbon Monoxide

All combustion appliances (e.g. furnace, boiler, gas water heater, gas ovens, gas dryers) burn a mixture of fuel and air, and produce exhaust gases. The most dangerous of these is carbon monoxide - a colorless, odorless gas that is poisonous to humans. When a person breathes in carbon monoxide it displaces oxygen in the blood and can cause numerous health issues, including death. We recommend that all houses have a carbon monoxide detector on each floor of the home to minimize the risk of carbon monoxide poisoning.

Homes with combustion appliances (e.g., gas furnaces, boilers or water heaters) need to be especially careful regarding carbon monoxide. In some cases, repairs or upgrades may be required to address potential safety issues or to maintain indoor air quality.

Old and improperly maintained combustion appliances tend to burn less cleanly and exhaust a higher percentage of carbon monoxide. Some types of combustion appliances pose a greater carbon monoxide risk than others. Upgrading to a newer, high-efficiency model will not only save energy, but should also reduce your risk of potential exposure to carbon monoxide.

Atmospherically Vented Appliances

Atmospherically vented appliances pose the greatest risk of carbon monoxide exposure. The majority of existing water heaters are atmospherically vented. These units draw their combustion air from the room in which they are installed and rely on the natural tendency of hot gases to rise up the flue and out of the house.

Atmospherically vented appliances are most susceptible to a potentially dangerous condition called "back drafting." Back drafting occurs when pressure differences between the inside and outside of the house prevent potentially deadly combustion gases from being exhausted from the home. Instead, these dangerous gasses are released inside the home, where they can reach toxic levels. In extreme conditions, a back drafting appliance can experience "flame roll-out" – a leading cause of house fires.

There are many potential causes of back drafting, but oftentimes it occurs due to insufficient combustion air in the area of the mechanical equipment or pressure imbalances in the home. These imbalances may be caused by kitchen or bath exhaust fans, dryers and other systems or conditions that cause air to be exhausted from the home. Depending on the cause, these risks can be addressed with a variety of strategies, including managing combustion air, isolating the mechanical equipment from the rest of the home, upgrading to a sealed combustion unit or installing a balanced ventilation system.

A qualified contractor can perform a Combustion Appliance Zone ("CAZ") test to evaluate the potential for carbon monoxide exposure caused by back drafting.

To minimize the risk of carbon monoxide exposure, it is recommended that all contractors perform CAZ testing on all homes where insulation and/or air-sealing upgrades have been implemented. A Denver Energy Challenge Energy Advisor can help you find a contractor that will perform this test. However, as long as your home has combustion appliances, there will always be some risk of carbon monoxide exposure.

Power Vented Appliances

Power vented (or "induced draft") appliances pose less risk of carbon monoxide exposure than atmospherically vented units. These units draw their combustion air from the room in which they are installed, but they reduce the potential for back drafting by using a fan to force the combustion gases up the flue.

Sealed Combustion Appliances Can Reduce Your Carbon Monoxide Risk

Sealed combustion (or "direct-vented") appliances are the safest and pose the least risk of carbon monoxide exposure when correctly installed. These units draw their combustion air directly from the outside and vent their combustion gases directly to the outside. Currently, all high-efficiency water heaters, boilers and furnaces are sealed combustion units.

Attached Garages and Carbon Monoxide

Attached garages are another potential source of carbon monoxide exposure in the home, especially when there is living space over the garage. Air leakage between the house and garage increases the danger of carbon monoxide making its way into the living space. While air sealing may help minimize that connection between the garage and the living space, you should never let a car run inside a garage, especially a closed garage. Doing so will greatly increase the concentration of carbon monoxide in the garage and increase the possibility of bringing those gases into the living space.

Indoor Air Quality

The goal of many energy efficiency improvements is to make your home less" leaky" in order to prevent heated or cooled air from escaping. While having a well-sealed home is important for energy savings, it also has the effect of concentrating indoor air pollutants. As you make your home more energy efficient, you will also want to take steps to maintain healthy indoor air quality for you and your family.

Ventilation

While it may seem counterintuitive, providing a constant flow of fresh air via a mechanical ventilation system is an upgrade that often accompanies insulation and air sealing work. Natural ventilation occurring through gaps and cracks in the home's enclosure is uncontrolled, tending to draw in the most air when the outdoor conditions are least desirable. A continuously operating ventilation system can provide a prescribed amount of fresh air, ensuring comfort and healthy indoor air quality year round. Further, these systems can be adjusted seasonally and may allow for the installation of filters that prevent pollen and other outdoor pollutants from entering the home.

Blower door and combustion tests performed by your auditor or contractor before and after air sealing can help determine the appropriate amount of fresh air required for you and your home. If your home is found to be sufficiently "tight", then your contractor may recommend that you install a mechanical ventilation system. The tighter your house, the more important an appropriate ventilation system becomes.

Mechanical ventilation systems typically come in one of the three following configurations. You should carefully weigh the benefits and drawbacks of each approach in consultation with your contractor and Energy Advisor.

Balanced Ventilation Systems

A balanced ventilation system draws in fresh, outdoor air while simultaneously exhausting an equal amount of stale, indoor air. These systems are often fitted with a "heat recovery" core that pre-warms or pre-cools the incoming fresh air using only the energy contained in the outgoing stale air. Further, because these systems cause no pressure imbalance between the inside and outside of the house, they are unlikely to contribute to back drafting risks associated with combustion appliances.

While these systems are generally the most desirable and efficient, they are also typically the most expensive.

Supply-Only Ventilation Systems

If a home is fitted with a forced air HVAC system, then it may be possible to implement a supply-only ventilation strategy.

Typically, supply-only ventilation systems consist of a small duct that draws in fresh, outdoor air through an exterior vent, delivering that fresh air to the cold air return duct immediately adjacent to the furnace. With the assistance of a simple controller and a damper within the fresh air duct, the furnace can draw in a prescribed volume of fresh air whenever the

HVAC system is operating in heating or cooling modes. Further, the controller can force the HVAC system to run in a fan only setting, supplying fresh air during those times of year when neither heating nor cooling is desired.

Exhaust-Only Ventilation Systems

Often the simplest and least expensive means of providing fresh air ventilation is the installation of a continuously operating exhaust fan. The exhaust fan forces out stale, indoor air causing make-up air to be drawn in through the existing gaps and holes in your home's enclosure. However, because it is difficult to determine from where the incoming air is being drawn (such as the garage or crawl space), this strategy does little to ensure that the incoming air is fresh and desirable. Further, because this strategy will impose a negative pressure inside the house, it may exacerbate carbon monoxide exposure risks due to back drafting.

Building Moisture

Water and water vapor can be introduced into a house from many sources; roof leaks, crawlspace soil, humidifiers, cooking, or even the breathing of the home's occupants, just to name a few. Damage from standing or leaking water is an obvious concern, but high levels of indoor humidity and the associated condensation are often overlooked. If the moisture level within a house gets too high, water vapor can make its way into wall and ceiling assemblies where it may promote wood rot and/or mold growth after condensing on cold surfaces.

Homes with a dramatic amount of air leakage often mitigate this risk because the continuous exchange of indoor and outdoor air reduces the likelihood of condensation occurring in the building assemblies. When air leakage is reduced by the installation of insulation and/or air sealing measures, a home that historically experienced no moisture buildup may experience a higher risk of damage due to water vapor. Thus, we recommend implementing one of the mechanical ventilation strategies described above in order to mitigate the risk of mold growth or wood rot.

Indoor Air and Chemical Sensitivities

Many of the products used in household energy efficiency retrofits, including insulation and air sealing products, contain various levels of chemicals and compounds that some people might find bothersome or have sensitivity to. Materials such as insulation, caulk, air-sealing spray foam, duct mastic, etc. are all manufactured with different types of chemical compounds. While "greener" alternatives exist for almost any category of these materials, people with chemical sensitivities might prefer to forgo the use of these materials in their home.

Crawlspace Retrofits – Moisture and Radon Considerations

In years past, crawlspaces were treated as outdoor, un-insulated spaces. To that end, crawl spaces were typically fitted with passive vents intended to allow the free flow of outdoor air in order to prevent the buildup of moisture below the home.

Today, we realize that crawlspaces, even when vented, may pose significant health and comfort concerns including air leakage, moisture build-up, energy loss, frozen pipes, cold floors, mold, and radon gas exposure. Modern construction practices and building codes emphasize a different approach to

crawl space construction including sealing and insulating the crawlspace walls, adding a properly sealed vapor barrier over the exposed soil, and providing conditioned air to the space in order to maintain a constant temperature and stir the otherwise stagnant air.

Building code requires that the conditioned air be delivered in one of two ways, 1) supply conditioned air to the crawlspace through existing forced air ducts, or 2) install a continuously operating exhaust fan that forces a small amount of air, along with any pollutants, out of the crawlspace to the outdoors. Under either scenario, building code requires that a path be provided, via a floor register or some other opening, for air to travel from the interior living space into the crawl space.

Finally, we recommend that homeowners have their crawl spaces tested for radon gas prior to the implementation of any crawlspace retrofits. Affordable, do-it-yourself radon test kits can be purchased at most hardware stores. If radon levels are found to be higher than acceptable, then this is your best opportunity to install a radon mitigation system below the vapor barrier. These systems are designed to direct the radon gas from below the vapor barrier to the outdoors.