



Whole Home Performance Report Prepared for:

**Ed and Carmen Bear
3934 La Colina Road
El Sobrante, CA, 94803**



**Advanced Home Energy, Inc.
1013 Pardee Street, Suite 212
Berkeley CA 94710**



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Customer Information

Customer Name:	Ed and Carmen Bear	Site Address:	3934 La Colina Road
Phone:	(925) 260 - 9233	Email:	ed@bearfamily.com
House Built:	1945	Rooms:	
Square Feet:	1200	Occupants:	6

Primary complaints, concerns, and priorities:

During the winter they can feel cold drafts from around stairs.

Front downstairs bedroom gets very hot

May be interested in solar or wind power.

Introduction to Building Performance Improvement

You should feel comfortable in your own home. However, your home may have construction or design defects that cause you to spend extra money in an attempt to maintain that comfort. You can improve the comfort of your home and lower your energy bills at the same time. Our goal is to help you understand and prioritize the energy and comfort improvements possible in your home. We employ building science principles and use diagnostic equipment to detect the causes of home performance related problems.

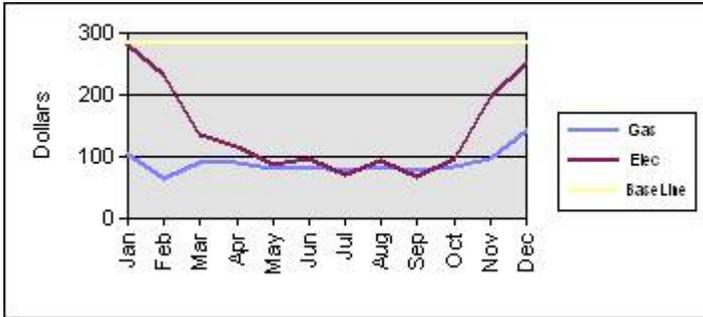
This Assessment Report summarizes test results and explains technical terms and concepts. The report also includes a list of improvement recommendations. When you are ready we can review this report with you and discuss the costs of our recommendations.

*After we make improvements to your home,
you can expect immediate improvements in comfort, indoor air quality, and energy efficiency.*

It is our goal to identify specific areas where we can reduce your energy consumption. We tend to focus on the fundamentals first. By fully understanding how your home works as a system, we can identify areas of improvement that can have the biggest impact. Many of the same factors that impact energy efficiency also impact air quality. By making your house operate properly as a system, we can reduce dust, mold, allergens, VOCs and other indoor air pollutants. In this report, we will identify combustion safety problems, humidity issues, pressure imbalances and other drivers that can lead to poor air quality. Comfort issues are also integrally tied to air quality and efficiency. A properly functioning home will consistently be at a comfortable temperature, which will also reduce humidity, and improve the efficiency of your heating system.



Energy Consumption

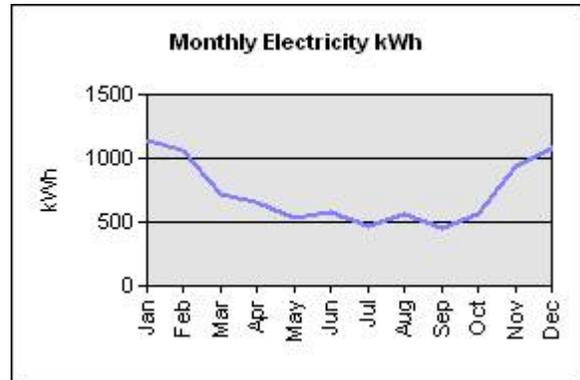
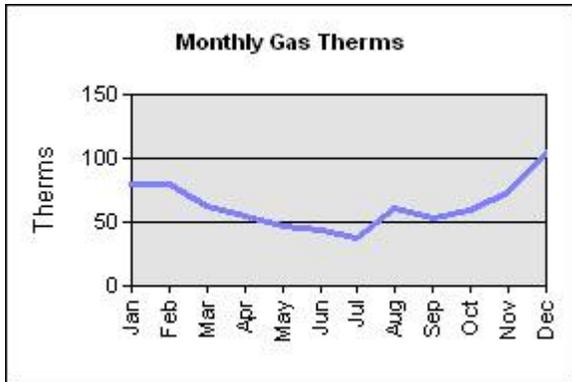


Total Cost

Electric = \$1728.57

Gas = \$1070.06

These graphs provide a representation of your energy consumption based on the bill data you provided. Note the yellow baseline which shows your year-round average consumption (for lighting, water heating, etc.) The spike you see above this line is your consumption for heating/cooling your home.

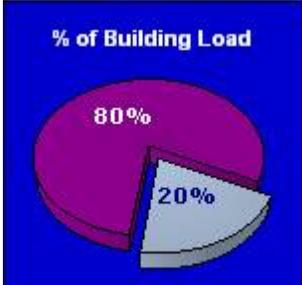




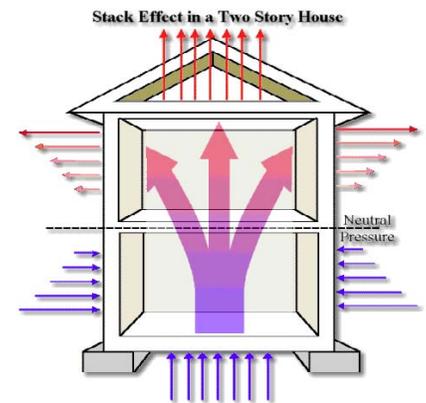
Building Envelope Leakage & Infiltration

The Blower Door test measures the leakiness of your house in Cubic Feet per Minute (CFM). During this test we use the blower door to emphasize naturally occurring conditions. A higher number means that your house is draftier and wastes more energy which can also affect other elements of your home such as indoor air quality and comfort. We translate the leakage of CFM into Air Change per Hour (ACH) which means the percentage of air that is being drawn into the house every hour. For example, 1.0 ACH means that every hour the house completely changes all of the conditioned air for outside air. Our target is for .35 or 35% of the air to be exchanged every hour.

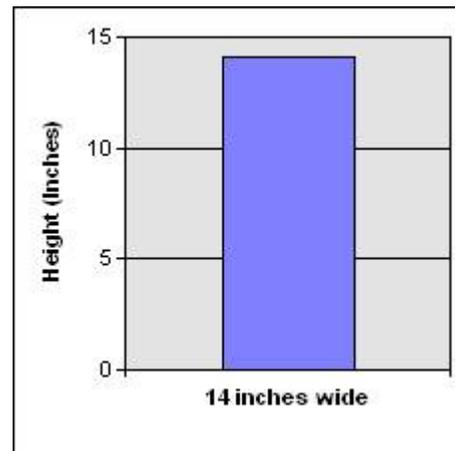
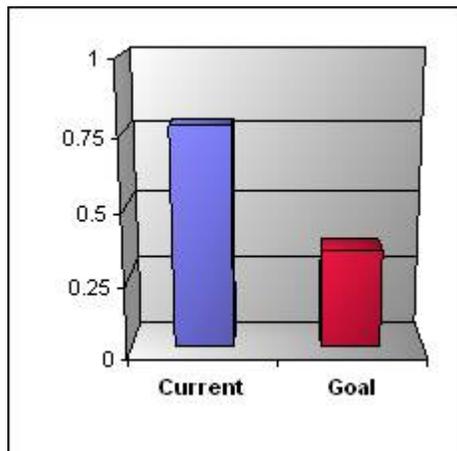
Leakage Findings	
Envelope Leakage at CFM ₅₀	2480 CFM
Natural Air Change Per Hour (ACH)	0.72
ASHREA Recommended Level	0.35
Target Envelope Improvement	106%



As heated air rises, it escapes out of holes in the building envelope, escaping into the attic and out of the building. This rising air creates low pressure in the lower part of the home which draws cold unconditioned air into the house from wherever the house is leaky. When it is windy- which often coincides with those periods when heating is the most important- we see even greater rates of air change. Replacement air is often drawn from unwanted areas such as crawlspaces, the garage, wall cavities, combustion appliance zones (CAZ), and chimneys. Air from these areas can increase moisture levels, bring dust and hazardous fumes into the living space, and cause a number of indoor air quality issues.



Your home has a high level of infiltration coming from numerous areas: Severe leakage from crack next to stairs, baseboard trim, bathroom vent (no damper), from one of kitchen skylights, both attic hatches, recessed light in master bedroom, plumbing penetrations in bathroom. Lots of leakage from plumbing and electric penetrations that are not air sealed in attic. See the graph below right which shows the equivalent building hole size of this leakage.





Insulation

Proper amounts of insulation, installation quality, and adequate air-sealing generally represent the largest components of your heating load. To accurately analyze your home we utilize a combination of visual assessment, manual investigation, and Infra Red equipment to track the movement of heat into, out of, and within your home.

Fiberglass batts are improperly installed, areas where there are gaps and missing insulation.

No wall insulation.

John Manville R-19 batts installed correctly under part of house. No insulation under Back room

Attic/Ceiling Insulation	
Recommended R-Value	R-30 or greater
Existing Insulation Type	Fiberglass
Existing Installation Quality	Poor
Existing Insulation R-Value	Approximately R-10
Recommendation	Air seal all penetrations first, then insulate on top of fiberglass with blown-in cellulose to R-38. Note that because you have knob and tube wiring, you must have this inspected by a licensed electrician before insulating.

% of Building Load

84%
16%

Wall Insulation	
Recommended R-Value	R-13 or greater
Existing Insulation Type	N/A
Existing Installation Quality	N/A
Existing Insulation R-Value	None
Recommendation	Insulate walls from inside using dense-pack technique. Recommend that this be done in conjunction with painting

% of Building Load

62%
38%

Floor Insulation	
Recommended R-Value	R-19 or greater
Existing Insulation Type	Fiberglass
Existing Installation Quality	Fair
Existing Insulation R-Value	R-19 where insulated. R-0 under back room
Recommendation	None. We would like to insulate the floor of the back room but 1/2 the floor is inaccessible.

% of Building Load

81%
19%



Heating System Summary

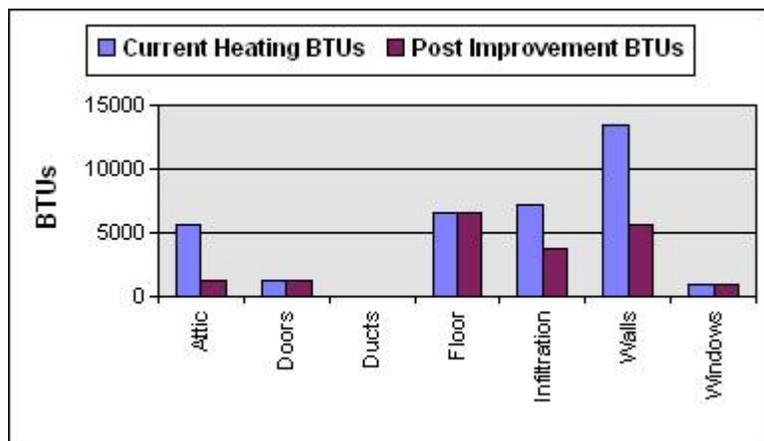
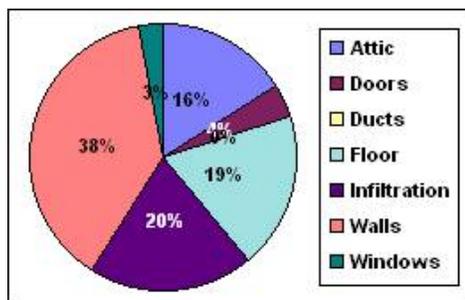
The majority of energy consumption for homes can be traced to water and space heating. Gas as a commodity is extremely volatile and the price tends to fluctuate wildly depending on demand. Thus, gas prices tend to rise just as the average person starts to heat their home in the colder months. Other forms of heat, such as electric, are even less efficient (more expensive) per BTU and are therefore even more impacted by the heating load.

Based on our Manual J calculations, the graph below shows the heating load breakdown of various elements in your home. The graph on the right estimates the heating load reduction that may be achievable through our recommendations. Your current load is fairly standard for this size home. As you can see, the lack of wall insulation, the amount of unconditioned air entering the house, and the lack of adequate attic insulation are the biggest issues. It appears that your current heating system (wall heater and pellet stove) are sufficient to heat the home. However, with remediation measures we can significantly reduce the need for using both.

Double wall heater downstairs and stand-alone pellet stove. Thermostat for wall furnace is in downstairs bedroom. Not used very much. 1200 pounds of pellets used the whole year

Wall Furnace		
	Current Heating Capacity: 40,000 kBTU estimated for wall furnace and pellet stove.	
AFUE: 80%	Current Building Load: 35140 kBTU	Furnace oversized by factor of 1.14
Year:	Post Improvement Building Load: 19444 kBTU	% reduction of 0.45
Recommendation	None at this time. It does not appear feasible to install forced air furnace due to design of the house. Focus efforts on tightening up the home instead.	

We have catalogued your building's actual performance through a method known as ASHRAE Manual J. This process allows us to precisely understand how each component of your building affects your heating load, and identify which areas are most appropriate to improve. Furthermore, we are able to look at the heat output (BTUS) of your furnace and compare it to the actual output needed for your home; in general, we find that existing heating systems are oversized which is a reason why the home is not comfortable and utility bills are unnecessarily high.





Base Load Appliances

Water Heater		
Make	Model	Year
GE	PG50T09AVH00	3/2008
	Desired	Actual
Flame Quality	100% blue	PASS
Natural Vent Draft	< -1.0 Pascals	

Next to heating the air in a home, water heaters are generally the largest energy users in the home, using more than 15 percent of the total energy of a home.

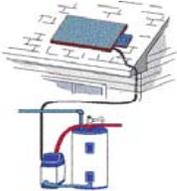
For your home we recommend insulating the first 2 feet of water heater pipes and reinstall longer flex connector (24" min) in order to create a loop and prevent thermal siphoning



Storage water heaters are the most common water heaters and typically are fueled by natural gas, electricity, propane or oil. Most Storage water heaters heat the water in the tank to the set temperature, then turn on and off as needed to keep it hot and ready for use (this is stand-by consumption). When you use hot water, the unit comes on to heat the incoming cold water that replaces what you use.



Tankless water heaters (or "on-demand water heaters") do not store water. A gas burner or an electric element heats the water rapidly when you turn on the hot water. Hot water never runs out, as long as you don't exceed its designed "flow rate". Energy is saved, or more accurately, not wasted as there are almost no standby losses.



Solar water heaters use energy from the sun to heat water. During the day, the collector heats the water directly or indirectly by heating an exchange medium, such as glycol (which won't freeze), which transfers the heat to the water in the storage tank. This can be an extremely effective and economic approach to supplying 85% and more of a home's hot water needs. This shows up as a significant reduction in gas usage in a home that uses a gas hot water heater.



Refrigerator

Make	Model	Year
Whirlpool	ED22TEXHN00#	04 2000

If a fridge is 15 years or older it may make sense to do an “early retirement” of your fridge and buy a new energy-efficient model. New models can pay for themselves within 5 years in reduced energy costs.

No recommendations.

Other Appliances

2nd fridge in the garage is 1/2 full. It draws 80 kWh/mo based on our measurements, which equals roughly \$20/month. If possible stop using it, or add jugs of water to fill up the empty space (this makes the unit more efficient). Hot tub was not assessed as it is not being used.

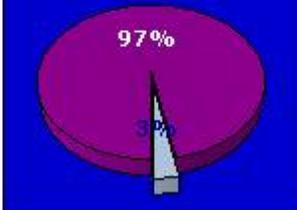
Lighting

CFLs have been installed in the majority of the house. Good work!

Windows

Windows	
Recommended Type	Double pane Low-E
Existing Type	Dual-pane vinyl
Existing Condition	Excellent
Recommendation	None

% of Building Load



97%

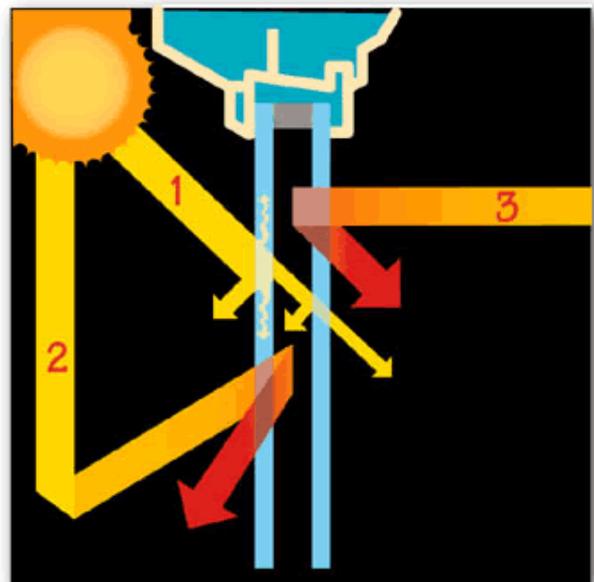
Window technology has improved dramatically in recent years, with the net result of lowering your energy bills. Some of the most important energy features of windows are explained below.

- **Dual-Pane:** insulates almost twice as well as single glazing. With double-glazed windows the air space between the panes of glass has a big effect on energy performance. A very thin air space does not insulate as well as a thicker air space because of the conductivity through that small space.
- **Low-E:** stands for Low Emissivity. There are a number of window attributes that will make a window more energy efficient. Low E is one of the more cost effective ways to increase the efficiency of the window without spending too much more on the window. See description of how it works below.:
- **Glass Tinting:** Tinted glass and tinted window films reduce heat gain through windows without reducing visibility as much as older tinted glass and films.

Low E is a metallic substance that is applied to one of the inner glazings of an insulated (double pane window).

During the winter, it reflects long-wave radiant heat back into the house (#3), while allowing a portion of the short-wave radiant heat through the glass (#1). In other words, the sun's (short-wave) infrared heat is passed into the house, while heat from your walls and floor (long-wave) is kept inside the house. During the summer, reflected heat (#2) off of the ground (long-wave) is blocked by the Low E glass.

Generally speaking it is costly to replace your existing windows with high-efficiency double pane windows, especially if aesthetics are a concern. However, there are a number of windows in your home that may perform significantly better with simple and economical repair and sealing measures.





Carbon Monoxide

Carbon Monoxide (CO) is a natural by-product of the combustion process. At high levels it can be deadly, however even at relatively low levels CO can cause a variety of health problems that often get misdiagnosed or even undetected. Carbon Monoxide is especially dangerous for children, pregnant women, the elderly or ill. With every breath a child takes in a much higher percentage of CO as a percentage of body weight than an adult.

PPM CO	Time	Symptoms
35	8 hours	Maximum exposure allowed by OSHA in the workplace over an eight hour period.
200	2-3 hours	Mild headache, fatigue, nausea and dizziness.
400	1-2 hours	Serious headache-other symptoms intensify. Life threatening after 3 hours.
800	45 minutes	Dizziness, nausea and convulsions. Unconscious within 2 hours. Death within 2-3 hours.
1600	20 minutes	Headache, dizziness and nausea. Death within 1 hour.
3200	5-10 minutes	Headache, dizziness and nausea. Death within 1 hour.
6400	1-2 minutes	Headache, dizziness and nausea. Death within 25-30 minutes.
12,800	1-3 minutes	Death

Carbon Monoxide Levels	
Ambient in House:	00
Spot Test at Appliances:	00

PPM = Parts Per Million

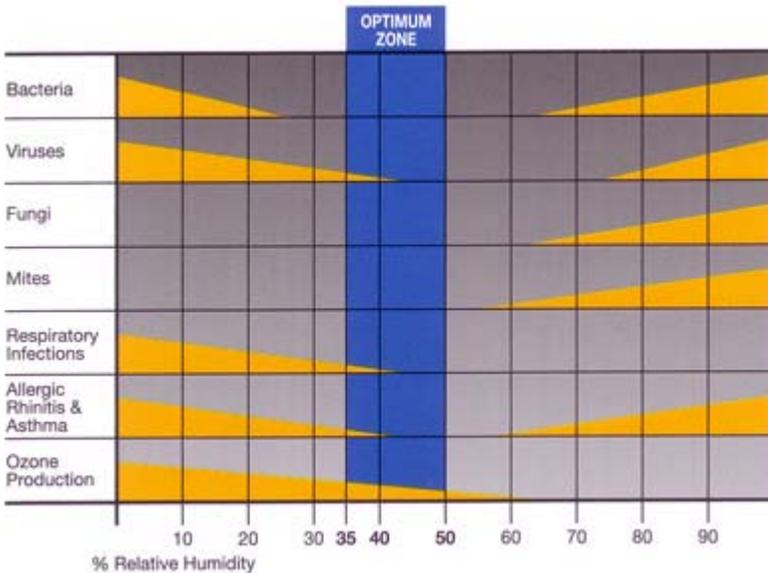
We are always pleased to test a house and find zero evidence of Carbon Monoxide throughout the home. Yours was such a house. Periodic testing is always recommended, as combustion appliances wear out with time.

Humidity and Moisture

Relative Humidity

Moisture in the home can cause a variety of problems ranging from mold to dust mites. The primary measure of moisture is Relative Humidity, which is measured in terms of how saturated the air is with moisture, relative to 100% relative humidity, or the point where we start to see condensation.

Relative Humidity is measured relative to the temperature of air. The warmer air is the more moisture it can carry. Therefore, as air temperature increases, relative humidity will tend to decrease.



Dew Point

Dew point is the temperature when air reaches 100% relative humidity, and can no longer carry additional moisture. Our concern with relative humidity is actually based on dew point temperature. When air is cooled to its dew point water vapor will fall out of suspension and form condensation. This is a particular problem in houses because high relative humidity can lead to mold and mildew growth.



On a hot day it is common to see condensation on the outside of a cold glass. This occurs when room air is reduced to its Dew Point against the cold glass. This same process can lead to mold, mildew and rot when condensation occurs in your home.

Humidity & Temperature in Your Home

	Relative Humidity %	Temperature F
Living Room	58.00%	70
bathroom	59.00%	70
Outside Reference	56.00%	75
Recommendation	No high humidity levels found	



Indoor Air Quality

Causes of Indoor Air Quality Problems

Inadequate ventilation: Inadequate and/or unregulated ventilation is a common cause of air quality problems in homes. In an effort to achieve acceptable Indoor Air Quality (IAQ) while minimizing energy consumption, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommends providing a minimum of 15 CFM of outdoor air per inhabitant, or a building total of .35 natural air changes per hour. We find many homes like yours, where the overall air changes per hour are actually too high (compromising efficiency), and not controlled (with undesirable sources such as the crawlspace and attic).

Chemical contaminants from indoor sources: Most indoor air pollution comes from sources inside the building. For example, adhesives, carpeting, upholstery, manufactured wood products, copy machines, pesticides, and cleaning agents may emit volatile organic compounds (VOCs), including formaldehyde. Combustion by-products such as carbon monoxide, nitrogen dioxide, as well as respirable particles, can come from improperly vented space heaters, woodstoves, fireplaces, hot water hot water and gas stoves.

Chemical contaminants from outdoor sources: The outdoor air that enters a building can be a source of indoor air pollution. For example, pollutants from motor vehicle exhausts, plumbing vents, or other external pollution sources, can enter the building through poorly located air intake vents, windows, and other openings.

Biological contaminants: Bacteria, molds, pollen, and viruses are types of biological contaminants. These contaminants may breed in stagnant water that has accumulated in ducts, humidifiers and drain pans, or where water has condensed on ceiling tiles, carpeting, or insulation.

What is a Volatile Organic Compound?

Volatile Organic Compounds (VOCs) are chemicals that evaporate easily at room temperature. The term "organic" indicates that the compounds contain carbon. Many studies have shown VOC levels are higher in indoor air than outdoor air. The U.S. Environmental Protection Agency (EPA) Total Exposure Assessment Methodology (TEAM) studies have found indoor VOC levels that were 2 to 5 times higher than outdoors.

Health Effects of VOCs

Organic chemicals can cause a variety of health effects varying greatly from those that are highly toxic, to those with no known health effect. As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics. At present, not much is known about what health effects occur from the levels of organics usually found in homes. Many organic compounds are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans.

VOC Sources

- New Carpeting
- Recent Painting
- New Furniture
- Home Chemicals
- Attached Garage
- Adhesives
- New Plastics or Electronics
- New Cabinets or Shelving

Hazardous Household Products and Ingredients

About 70,000 different chemicals are used by industry today, of which probably 5,000 - 10,000 can be found in households.

Knowing how to read labels will help you to analyze whether you really want these substances in your home or would prefer to use less toxic cleaners.

Most cleaning products use federally mandated hazard signal words that have specific meanings. Estimates have been made as to how much chemical could be harmful to you according to the hazard signal word used:



DANGER: one teaspoon could kill you.

WARNING: one tablespoon could kill you.

CAUTION: two tablespoons to a pint could kill you.

Another word that is commonly used is "**INERT**". This does not mean that the inert substances are not harmful. It only means that the "inert" substances are not specifically active for the labeled purpose of the chemical. The manufacturer does not have to list these chemicals under these labeling laws. Therefore, there are many ingredients in our household chemicals that we have no information on and could be harmful.

What makes a product hazardous?	
Ignitable	Meaning they evaporate easily at room temperature and can readily ignite given heat, spark, or flame. These include solvents such as alcohols, toluene, xylene, acetone, and petroleum distillates. (usually labeled "flammable", "combustible," "inflammable")
Corrosive	Includes acids and bases (alkalis). They can destroy living tissue of the skin, eyes, mouth, etc. in liquid or vapor form. Strong acids are hydrochloric or sulfuric, and strong bases are sodium hydroxide (lye), caustic soda and ammonia.
Reactive	Meaning they react vigorously with water, air, or common materials, creating lots of heat and/or hazardous vapors. Bleach is an example. That's why it must not be mixed with ammonia.
Toxic	Meaning it has systemic effects on the human body. Toxicity is measured by determining what the lethal dose (LD50) is for 50% of rats exposed to the chemical. Effects may be acute, as in immediate respiratory problems, or chronic, showing up decades later as cancer or birth defects. In some cases there is no known minimum dose that will not cause cancer



Potentially Dangerous Ingredients Found in Common Home Products

Product Type	Possible Ingredients	Potential Hazards
Air Freshener and Deodorizer	Formaldehyde	Toxic; carcinogen; irritant to eyes, nose, throat, and skin; may cause nausea, headaches, nosebleeds, dizziness, memory loss, and shortness of breath.
Bleach	Sodium hypochlorite	Corrosive, irritates or burns skin, eyes, respiratory tract; may cause pulmonary edema or vomiting and coma if ingested; contact with other chemicals may cause chlorine fumes.
Disinfectant	Sodium hypochlorite	Corrosive; irritates or burns skin, eyes; may cause pulmonary edema or vomiting and coma if ingested.
	Phenols	Flammable; very toxic; respiratory, circulatory, or cardiac damage.
	Ammonia	Vapor irritating to eyes, respiratory tract, and skin; possible chronic irritation.
Furniture Polish	Petroleum distillates or mineral spirits	Highly flammable; moderately toxic; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; entry into lungs may cause pulmonary edema.
Oven Cleaner	Sodium or potassium hydroxide (lye)	Caustic; irritant; inhibits reflexes; burns to skin, eyes; poisonous if swallowed due to severe tissue damage.
Paint	Aromatic hydrocarbon thinners	Flammable; skin irritant; benzene is a carcinogen; possible liver and kidney damage.
	Mineral spirits	Highly flammable; skin, eye, nose, throat, lung irritant; very high air concentrations may cause unconsciousness, death.
Window Cleaner	Diethylene glycol	Toxic; causes central nervous system depression and degenerative lesions in liver and kidneys.
	Ammonia	Vapor irritating to eyes, respiratory tract, and skin; possible chronic irritation.
Wood Stain/Varnish	Mineral spirits, gasoline	Highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; entry into lungs may cause fatal pulmonary edema.
	Methyl and ethyl alcohol	Flammable; damage to eyes, skin, central nervous system.
	Benzene	Flammable; carcinogen; accumulates in fat, bone marrow, liver tissues.
	Lead	Damage to digestive, genitourinary, neuro-muscular and central nervous system; anemia and brain damage.
Antifreeze	Ethylene glycol	Very toxic, 3 ounces can be fatal to adult; damage to cardiovascular system, blood, skin, and kidneys.
	Methanol	Moderately toxic; ingestion may cause coma, respiratory damage.
Car Wax, Polish	Petroleum distillates	Associated with and lung cancer; irritant to skin, eyes, nose, lungs; entry into lungs may cause fatal pulmonary edema.
Motor Oil/Gasoline	Petroleum hydrocarbons (benzene)	Highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; pulmonary edema; benzene is a carcinogen.
	Lead	Damage to digestive, genitourinary, neuro-muscular, and central nervous system; anemia and brain damage



Recommended Home Improvement Measures

The follow prescription itemizes the building performance improvements we recommend to improve your home's indoor air quality, comfort and energy efficiency. This prioritized list has been developed based on our inspection results specifically to improve your home's performance. When you are ready, we will schedule a time to re-visit you at your home and review all the recommendations, your priorities, and pricing.

1. Reduce Home Infiltration

(All air infiltration sealing is done in conjunction with strategic interval testing with the blower door to monitor progress. Once the target has been met the sealing process is complete.)

a. Air seal throughout house to achieve a reasonable % improvement of air changes per hour. Target of .40-.50 ACH.

b. Air seal all accessible gaps, cavities, leaks, and penetrations within reason, including as necessary:

i. Gaps in shell accessible from attic (note: we will also look for and seal any areas that are entry points for rodents from the outside)

ii. Gaps in shell accessible from crawlspace

iii. Gaps around electrical and plumbing fixtures

iv. Stairway wall

v. Baseboards

vi. Seal access attic access

vii. Weatherstripping for 1 door

Price: \$1480

2. Attic Insulation (1216 square feet)

a. Note: the insulation needs to happen after the air sealing is complete and after a licensed electrician has certified the knob and tube wiring or replaced the wiring.

b. Install loose-fill cellulose ontop of current fiberglass insulation to achieve R-38

c. Also insulate attic wall above downstairs bedroom

(Note: Price includes subsidy through Rising Sun Energy Center which is available through October 31 2008).

Price:\$1180

3. Wall Insulation

a. Use Infrared camera to identify fire blocking and cross framing

b. Drill and fill from inside using fill tube method

c. Close holes with plugs and patch

d. Ready for priming and painting

Price: \$1,800 per day. We anticipate this being a 3 day job. If the job goes faster then we will only charge for the time it took. Note, this time estimate assumes that the client will prepare the space for insulating by moving all furniture away from walls and clearing items from the wall.

4. Water heater

a. Install new flex-pipe with bend on hot and cold pipes.

b. Insulate all exposed hot water pipes and first 2 feet of cold intake

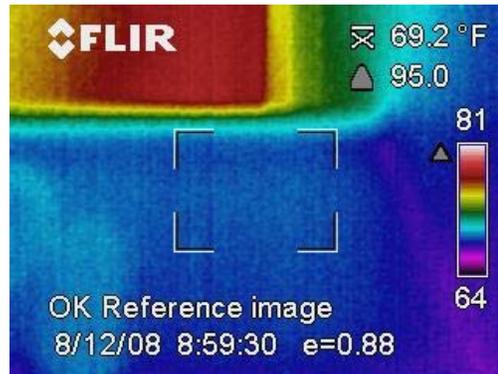
Price: \$160

Photos of Your Home

Note: The InfraRed photos in this report were taken while your house was depressurized with an outdoor temperature lower than your indoor temperature. This procedure mimics a breezy day and accentuates areas of infiltration in your home. In the IR photos, the red end of the spectrum represents heat retention, and the blue/black end of the spectrum represents infiltration. Under these test conditions, we interpret areas of infiltration to be areas of energy loss.



Leakage from under house



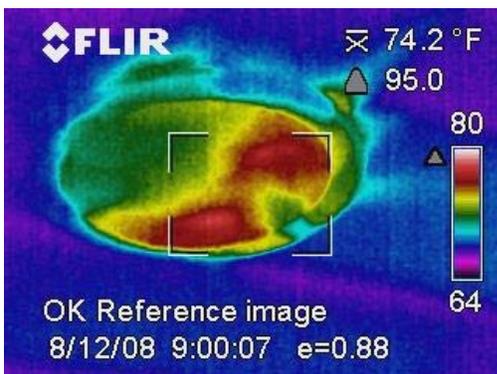
Lack of wall insulation (see cold areas)



Leaky access cover



Leaky panel to side of stairs.



Leaky light



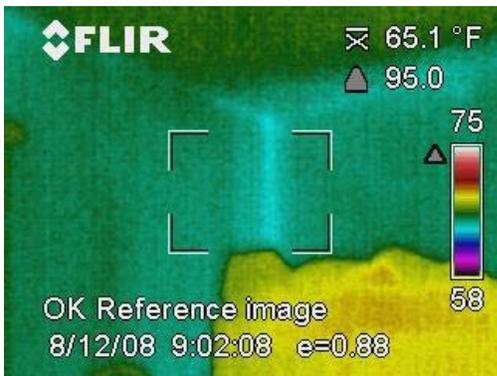
Leakage around baseboard



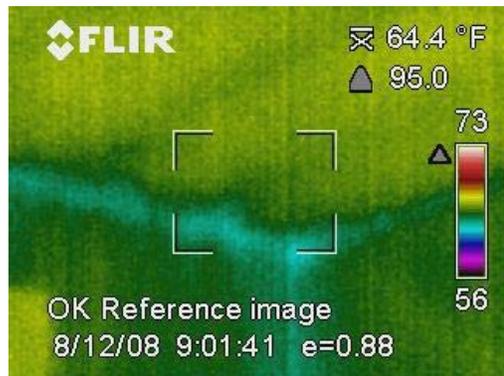
Water heater pipes lack insulation and should have a loop



Leaky recessed lights



Lack of wall insulation



Poorly performing ceiling insulation



Air leakage



Poor attic insulation



Dead rodent...need to seal all penetrations to outside



Missing insulation in attic wall



Floor insulation in good condition



Poor attic insulation and knob and tube wiring.



Missing insulation



Missing floor insulation under back room



Glossary of Terms

ACH Air Changes per Hour - The number times in one hour the entire volume of indoor air in a house or room is replaced with outdoor air through ventilation and infiltration, usually measured in cubic feet per hour. Your house should have minimum whole house ventilation equal to 0.35 air changes per hour.

Air Barrier - An air barrier is an assembly of materials and construction details that severely reduces air infiltration.

Air Infiltration - The amount of air leaking into the home through the walls, floor, and ceiling. Excessive amounts of air infiltration cause uncomfortable, drafty rooms and high energy bills. Common places of air infiltration include chimneys, attic access hatches, and plumbing and electrical penetrations.

Air Sealing - Sealing penetrations in the walls, floor, and ceiling where outside air enters the home. It's the most cost-effective way to improve the energy efficiency of a home.

Annual Fuel Utilization Efficiency (AFUE) - The measure of seasonal or annual efficiency of a residential heating furnace or boiler. It takes into account the cyclic on / off operation and associated energy losses of the heating unit as it responds to changes in the load, which in turn is affected by changes in weather and occupant controls.

Backdrafting - The flow of air down a flue or chimney and into a house caused by low indoor air pressure that can occur when using several fans or fireplaces or if the house is very tight.

Baseload - For residential customers, the remaining energy consumption after energy used for seasonal use (cooling and heating) has been subtracted. It includes energy used for water heating, refrigeration, clothes dryer, lighting, electronics, and other. Baseload use is more or less constant each month, year round.

Blower Door - A device used by energy auditors and raters to pressurize a building to locate places of air leakage and energy loss.

Btu British Thermal Unit - The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit; equal to 252 calories.

Building Envelope - The structural elements (walls, roof, floor, foundation) of a building that enclose conditioned space; the building shell.

Carbon Monoxide - A colorless, odorless but poisonous combustible gas with the formula CO. Carbon monoxide is produced in the incomplete combustion of carbon and carbon compounds such as fossil fuels (i.e. coal, petroleum) and their products (e.g. liquefied petroleum gas, gasoline), and biomass.

CFLs Compact Fluorescent Lights - A smaller version of fluorescent lamps that can directly replace standard incandescent lights. These lights consist of a gas filled tube and a magnetic or electronic ballast. The newer CFLs are vastly improved. They fit in most light fixtures and have warmer color tones and longer life. They will reduce the energy used by 75% over an incandescent bulb, and last 6-10 years.

CFM50 - The amount of cubic feet per minute (CFM) of air moving through a structure and measured at 50pascal pressure.

CFM_{natural} - The cubic feet of air flowing through a house from indoors to outdoors during typical, natural conditions. This figure can be roughly estimated using a blower door.

Chimney (or Stack) Effect - The tendency of heated air or gas to rise in a duct or other vertical passage, such as in a chimney, small enclosure, or building, due to its lower density compared to the surrounding air or gas.



Comprehensive Home Assessment Report - The report provided by a home performance contractor outlining the key recommendations for improving the comfort, safety, and efficiency of a home. It identifies problems with a home, such as poor insulation, air leaks, and ineffective moisture control, and then gives an estimate of what is required to fix the problems. It may include estimated costs for each improvement as well as financing options to get the job done.

Convective Air Flow - Air movement where less dense (warmer) air is displaced by more dense (cooler) air. Often expressed by the phrase "hot air rises." Convective air flow can be useful if controlled, as in gravity hot air heating systems, but is more often a contributor to heat loss.

Degree Day - A unit for measuring the extent that the outdoor daily average temperature (the mean of the maximum and minimum daily dry-bulb temperatures) falls below or above an assumed base temperature, normally taken as 65 degrees Fahrenheit, unless otherwise stated. One degree day is counted for each degree below (for heating) or above (in the case of cooling) the base, for each calendar day on which the temperature goes below or above the base.

Ducts - The round or rectangular tube(s), generally constructed of sheet metal, fiberglass board, or a flexible plastic-and-wire composite, located within a wall, floor, and ceiling that distributes heated or cooled air in buildings. It is important that ducts be insulated and sealed properly when in unconditioned space to avoid unnecessarily high utility bills. The best practice would be to not put ducts in unconditioned space.

Duct Blower - A fan that tests how leaky the duct system is, and determines where the holes are. Duct leakage should be below 5%. Most new homes are at 10% to 20%, and old homes can have up to 50% duct leakage. Duct leakage means wasted money.

EER Energy Efficiency Ratio - The measure of the instantaneous energy efficiency of room air conditioners; the cooling capacity in Btu / hr divided by the watts of power consumed at a specific outdoor temperature (usually 95 degrees Fahrenheit). While the SEER considers yearlong efficiency (kWh), EER is a measure of the maximum use at a given time (kW).

Heat Gain - The amount of heat introduced to a space from all heat producing sources, such as building occupants, lights, appliances, and from the environment, mainly solar energy.

Heat Loss - The heat that flows from the building interior through the building envelope to the outside environment.

Home Heating Index - The number of Btus of energy used by a home divided by its area in square feet, then divided by the number of heating degree days during the time period.

Home Performance with ENERGY STAR® - A national program from the EPA and DOE that offers a comprehensive, whole-house approach to improving energy efficiency and comfort at home, while helping to protect the environment. Specially-trained contractors who participate in the program can evaluate your home using state-of-the-art equipment and recommend comprehensive improvements that will yield the best results. They can also help you take advantage of Federal tax credits for energy efficiency improvements.

House as a System (Whole House System) - The approach to home design, building, remodeling, and weatherization that recognizes how all the features in a home are connected -and that changing one component can greatly affect another part of the house. It is based on the principles of building science and relies on diagnostics to verify results. Using this approach will improve not only the overall energy efficiency of the home, but also its comfort, indoor air quality, safety, durability and affordability.

HVAC Heating, Ventilation, and Air-Conditioning System - All the components of the appliance used to condition interior air of a building.

IAQ Indoor Air Quality - The quality of indoor air relative to its acceptability for healthful human habitation. Assessing and improving, when necessary, the quality of indoor air is a major concern of home performance and



weatherization. In particular, all by-products of major combustion appliances must be directly evacuated to the outdoors under all operating conditions.

Infiltration - The movement of air into a building through cracks and penetrations in the building envelope. Cold air often enters the structure due to depressurization, exfiltration, wind, stack effect, and / or convective airflow.

Infrared Thermography - The most commonly-used unit of measure telling the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour. A kilowatt-hour is the equivalent of using ten 100-watt light bulbs for one hour.

Kilowatt-hour (kWh) - The science of using infrared imaging to detect radiant energy or heat loss in a building. The infrared camera or scanner electronically senses heat radiated by objects and converts that thermal energy into images visible to the human eye. Some scanners can automatically record these images on video. Used in conjunction with a blower door, the scanner can provide valuable data about air leakage sites and thermal bypasses.

Low-E Windows - Windows that are coated with a metallic glass (low emissivity) film to resist flow of radiant heat.

Manual J - The standard method for calculating residential cooling loads developed by the Air-Conditioning and Refrigeration Institute (ARI) and the Air Conditioning Contractors of America (ACCA) based largely on the American Society of Heating, Refrigeration, and Air-Conditioning Engineer's (ASHRAE) "Handbook of Fundamentals."

Net Metering - For those consumers who have their own electricity generating units, net metering allows for the flow of electricity both to and from the customer through a single, bi-directional meter. With net metering, during times when the customer's generation exceeds his or her use, electricity from the customer to the utility offsets electricity consumed at another time.

Phantom Load - Any appliance that consumes power even when it is turned off. Examples of phantom loads include equipment chargers, appliances with electronic clocks or timers, appliances with remote controls, and appliances with wall cubes (a small box that plugs into an AC outlet to power appliances). Phantom loads can be a significant part of a household's electric use.

Pressurization (Blower Door) Testing - A diagnostic technique that uses a blower door to locate areas of air infiltration by exaggerating the defects in the building shell. This test only measures air infiltration at the time of the test. It does not take into account changes in atmospheric pressure, weather, wind velocity, or any activities the occupants conduct that may affect air infiltration rates over a period of time.

R-Value - A measure of the capacity of a material to resist heat transfer. The R-Value is the reciprocal of the conductivity of a material (U-Value). The larger the R-Value of a material, the greater its insulating properties.

Relative Humidity - A measure of the percent of moisture actually in the air compared with what would be in it if it were fully saturated at that temperature. When the air is fully saturated, its relative humidity is 100 percent.

Therm - A unit of heat containing 100,000 British thermal units (Btu).

Ventilation Air - That portion of supply air that is drawn from outside, plus any recirculated air that has been treated to maintain a desired air quality.

Weatherization - Modifying a home or building to conserve energy. Methods include: sealing windows and doorframes with caulking or gaskets, installing storm doors and windows, adding or increasing the insulation value, and upgrading appliances and equipment.