Home Energy Rating Certificate

Alaska Housing FINANCE CORPORATION

The Home Located At:

[redacted]

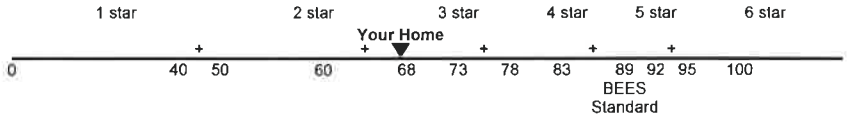
Has Been Energy-Rated As:

★★+

Two Star Plus

Overall Efficiency of Home

67.4 points



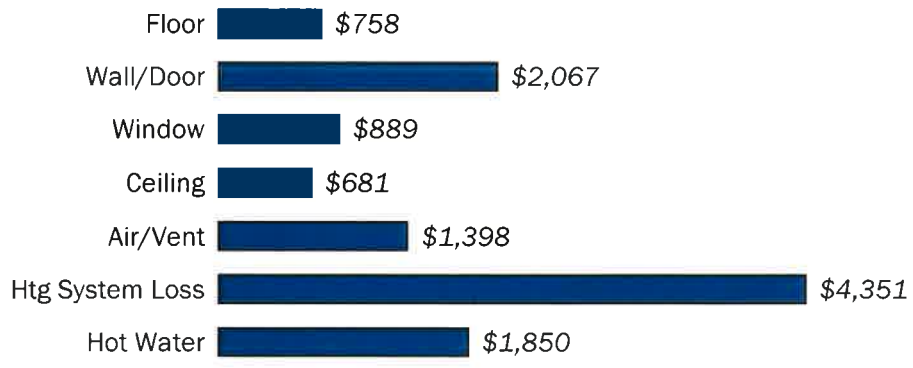
Amount of CO2 Produced by the Home

27,265 pounds per year

Projected Annual Energy Costs

$13,086 per year

Breakdown of Heating Costs, $ Per Year



[redacted]

Rater Signature

4300 Boniface Parkway | Anchorage, Alaska 99504 | P.O. Box 101020 | Anchorage, Alaska 99510
907-338-6100 (Anchorage) or (Toll-Free) 1-800-478-AHFC (2432) | www.ahfc.us

Energy Cost and Features Report

Property:

Rater:

House: Single Family
Living Floor Area: 2,615 square feet
Attached Garage, 298 square feet

Rating: As-Is
ID: ES40924

Envelope Efficiency

Floor Insulation	R-17.9 *
Wall/Door Insulation	R-12.3 *
Ceiling Insulation	R-21.5
Window R-Value	R-1.94
Window to Wall Ratio, Living Space	13.0%
South Facing Window Area	96 square feet
Air Leakage	5.6 Air Changes per Hour at 50 Pascals 0.34 Air Changes per Hour Natural

* Includes the insulating value of the ground in contact with these envelope components.

Space Heating System

System Efficiency	60%
Fuel Type	Propane
Supplemental Fuel	Electricity
Thermostat Setting	70.0 degrees F
Setback Thermostat	None

Water Heater

Efficiency	80%
Location	Semi-Conditioned Space
Fuel Type	Propane

Space Cooling System None Present

Ventilation None

Other

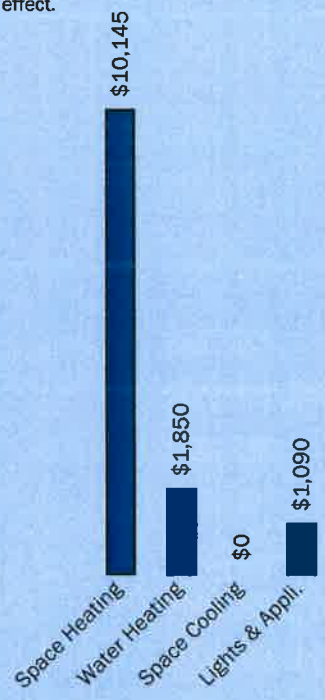
Number of Occupants	6
Clothes Dryer Fuel	Electricity
Cooking Range Fuel	Electricity
Miscellaneous Lights/Appliance Use	Average

VENTILATION WARNING: The measured air tightness of this home indicates that it may not provide sufficient ventilation air (for acceptable indoor quality) as defined by ASHRAE 62.2 2010, without adequate mechanical ventilation equipment. If whole house mechanical ventilation equipment has been installed, it is recommended that it be properly maintained and operated. If no whole house mechanical ventilation equipment has been installed, it is strongly recommended that the homeowner consider an investment in this improvement. (A test of the building's ventilation air rate would help determine the importance of a mechanical ventilation system in this home.)

ver. 2.3.2.1, library: 4/11/2014, file: ES40924.hm2

Estimated Annual Energy Costs

Actual use and costs may vary from these estimates depending upon weather conditions, occupant life styles and utility rates currently in effect.



Electricity: $0.1237/kWh, Propane: $4.5/gallons
Space Heating: 19,742 kWh of Electricity, 1,712 gallons of Propane
Water Heating: 411 gallons of Propane
Space Cooling:
Lights & Appliances: 8,811 kWh of Electricity

Energy Efficiency Improvement Options

Property:

House: Single Family
Living Floor Area: 2,615 sq.ft
1-Car Attached Garage

Rater:

ID:

Initial Rating: Two Star Plus, 67.4 points
Additional Rating Points needed to reach higher Rating Levels:
0.6 more points needed to reach **3 Stars** (a minimum 5 point increase is required to receive an AHFC rebate)
5.6 more points needed to reach **3+ Stars**
10.6 more points needed to reach **4 Stars**
15.6 more points needed to reach **4+ Stars**
21.6 more points needed to reach **5 Stars**
24.6 more points needed to reach **5+ Stars**
27.6 more points needed to reach **6 Stars**
Fuel Prices used in this Analysis: Electricity = $0.1237/kWh, Propane = $4.5/gallons

The maximum Carbon Monoxide (CO) leakage of a combustion appliance should be less than 25 ppm at steady state conditions.

The following are possible energy-saving improvements for your home.
Notes: The Rating points you receive for each improvement depend upon the other measures you install. In the report below, the points indicated for each measure assume that you install all prior measures on the list. The Break-Even cost is the *most* you could pay for the improvement and still have it be cost-effective based on energy savings over the life of the measure.

Improvement Description / Location	Annual Savings[1]	Break-Even Cost[2]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]	Design Heat Loss, Btu/hr[5]
Install a Programmable Thermostat; zone controls extra	$602	$7,796	1.2	68.6 points 3 Stars Increase: 1.2 pts, 1 step	54,100
Add R-14 rigid to rim joist of above grade wall Location - Above-Grade Wall: Rim Joist	$370	$8,121	1.2	69.8 points 3 Stars Increase: 2.4 pts, 1 step	52,493
Replace heating system with a new direct-vent space heater having AFUE of 84%. Location - Primary Heating System	$1,988	$33,662	9.1	78.9 points 4 Stars Increase: 11.5 pts, 3 steps	52,493
Caulk and Seal so that Home Air Leakage is Reduced by 500 CFM at 50 Pascals.	$385	$3,469	1.3	80.2 points 4 Stars Increase: 12.8 pts, 3 steps	49,366
Install R-21 densepack insulation in cantilevered floor Location - Exposed Floor: Entry Way	$4	$92	0.0	80.2 points 4 Stars Increase: 12.8 pts, 3 steps	49,344
Add R-3.5 insulating blanket to garage door Location - Garage Door: Garage	$59	$760	0.3	80.5 points 4 Stars Increase: 13.1 pts, 3 steps	48,856
Add R-38 fiberglass batts to attic with Standard Truss. Location - Ceiling w/ Attic: House	$382	$8,285	1.1	81.6 points 4 Stars Increase: 14.2 pts, 3 steps	46,832
Install 2' of R-40 rigid board insulation on	$205	$4,444	0.6	82.2 points	46,466

Improvement Description / Location	Annual Savings[1]	Break-Even Cost[2]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]	Design Heat Loss, Btu/hr[5]
Perimeter of Crawl Space Floor. Location - On- or Below-Grade Floor, Perimeter: House				4 Stars Increase: 14.8 pts, 3 steps	
Install R-40 rigid foam board to interior or exterior side of wall. Does not include cost of coverings. Location - Below- (part or all) Grade Wall: House	$446	$9,677	1.4	83.6 points 4+ Stars Increase: 16.2 pts, 4 steps	45,664
Add R-33 blown cellulose insulation to attic with Standard Truss. Location - Ceiling w/ Attic: Laundry	$97	$2,101	0.2	83.8 points 4+ Stars Increase: 16.4 pts, 4 steps	45,141
Add R-30 rigid foam to interior or exterior of existing wall; cost does not include siding or wall coverings. Location - Above-Grade Wall: Knee Wall	$22	$479	0.1	83.9 points 4+ Stars Increase: 16.5 pts, 4 steps	45,016
Add R-30 fiberglass batts to attic with Standard Truss. Location - Ceiling w/ Attic: House	$51	$1,116	0.3	84.2 points 4+ Stars Increase: 16.8 pts, 4 steps	44,628
Replace glass door with R-2.8 door. Location - Full Glass Back Door	$100	$1,627	0.3	84.5 points 4+ Stars Increase: 17.1 pts, 4 steps	44,061
Remove existing door and install U-0.16 fiberglass door with polyurethane core Location - Exterior Door: Entry	$48	$785	0.1	84.6 points 4+ Stars Increase: 17.2 pts, 4 steps	43,787
Replace with Air Source Heat Pump having an Actual Seasonal COP of 3.5 Location - Baseboards	$1,315	$19,211	0.0	84.6 points 4+ Stars Increase: 17.2 pts, 4 steps	43,787
Install a Mechanical Ventilation system without heat recovery Location - Bathroom's	$24	$326	0.2	84.8 points 4+ Stars Increase: 17.4 pts, 4 steps	43,787
Total, All Measures	**$6,100**	**$101,951**	**17.4**		

Annual CO2 Reduction after all improvements: 11,528 pounds per year

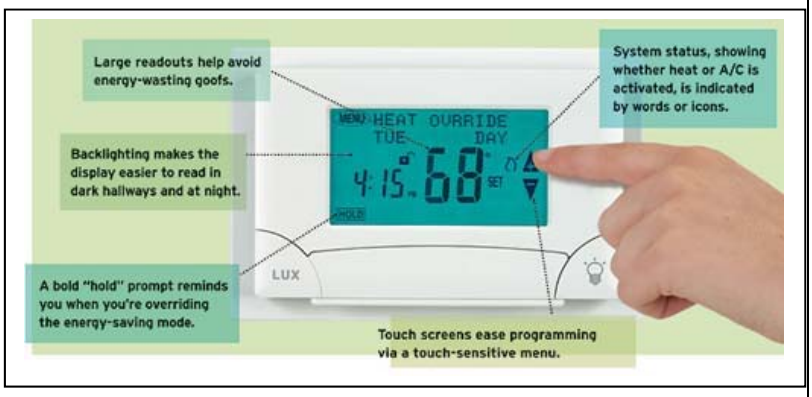
Notes:

1. *Annual Savings* is the potential savings in your home's energy cost per year.
2. *Break-Even Cost* is the most you could pay for this improvement and still have it be cost-effective based on energy savings over the life of the measure.
3. *Rating Points Gained* are the estimated rating points that would be added to your As-Is Rating score if the measure were installed. Actual points gained will only be determined by completing a post rating.
4. *Rating, after all Improvements thru this one:* This column shows the estimated energy rating that would result if all improvements prior to and including this one were done. As well as showing the estimated final rating, the column shows how much the rating will improve in terms of rating points and in terms of rating steps. For example, an increase from a 2 star rating to a 2 star plus rating is one step. The actual final rating will only be determined by completing a post rating.
5. *Design Heat Loss, Btu/hr:* This Design Heat Loss value shows the design heat loss in Btu/hour after this improvement and all before it are implemented. The Design Heat Loss is the amount of heat required to be delivered to the conditioned spaces during heating design conditions. If the heating system serves Domestic Hot Water loads in addition to space heating, you must increase this value to account for the domestic hot water load. When determining the size of the required heating system, you should also add capacity for distribution losses, pick-up requirements, and a safety margin. If you are determining the input rating of the heating system, you must also add capacity for the inefficiency of the furnace or boiler.

Detailed Improvement Information

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]
Install a Programmable Thermostat; zone controls extra		**$602**	**1.2**	**68.6 points 3 Stars Increase: 1.2 pts, 1 step**

A thermostat that adjusts the temperature at different times during the day saves energy, compared with a simple room thermostat. *Setback* or *programmable thermostats* can automatically reduce the house temperature for certain periods such as when the home is unoccupied or during sleeping hours. Thermostats generally have only two low-voltage wires and are easy to install. You will need one thermostat for each zone.

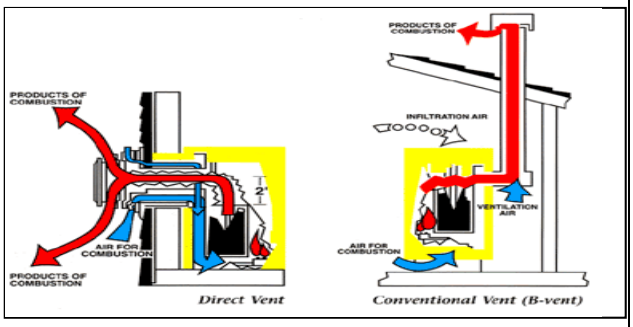


Confusing controls on some programmable thermostats may make it difficult to save energy. When choosing a programmable thermostat look for one that is easily programmed with a display that is easy to read at arm's length. All programmable thermostats let you override their energy-saving modes. Some use bold letters or lights to tell you the override is on. Others have override prompts that are relatively easy to miss, and you may not realize you are not saving energy.

Add R-14 rigid to rim joist of above grade wall	**Above-Grade Wall: Rim Joist**	**$370**	**1.2**	**69.8 points 3 Stars Increase: 2.4 pts, 1 step**

Rim joists (the perimeter joist cavities) are often poorly insulated and sealed. One of the best retrofit methods is to cut blocks (1.5" or 2") of rigid foam insulation to fit in the cavities and caulk or foam them in place. This material should be flush with the inside of the foundation wall. The space between the foam and the rim can be filled with fiberglass batt prior to installing the XPS.

Replace heating system with a new direct-vent space heater having AFUE of 84%.	**Primary Heating System**	**$1,988**	**9.1**	**78.9 points 4 Stars Increase: 11.5 pts, 3 steps**

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]
Direct vent space heaters are a newer generation of self-contained heating units. Inside air is fan-forced over a sealed burner unit. The unit draws exterior air for combustion and may be fueled by kerosene (#1 heating oil), natural gas, or propane. In comparison to the wall furnace, direct vent heaters are smaller in size, have greater fuel efficiency, provide improved heat distribution, and offer more choices of fuel sources. These units are usually surface-mounted on the inside of an exterior wall. Because there is no ductwork going to all the separate rooms, this type of heating system works best in open areas. When rooms are far from the heating source or have closed doors, an additional heat source may be needed. 				
Caulk and Seal so that Home Air Leakage is Reduced by 500 CFM at 50 Pascals.		**$385**	**1.3**	**80.2 points 4 Stars Increase: 12.8 pts, 3 steps**
Air sealing tasks include: • Seal joints and penetrations in the crawlspace rim joist. • Remove baseboard trim and seal the wall/floor joints at the wood floors. Replace the baseboards. • Seal wall/ceiling joints • Seal window and door frame/wall joints if windows are not replaced. Remove trim and seal the gaps with caulk or low-expanding foam. • Seal window sash/frame joints if the windows are not replaced. • Seal around plumbing, mechanical, and electrical penetrations into the attics. • Outlet and switch plates. Use foam gaskets and child protector plugs to seal these items. If leakage is still a problem caulk the wiring penetrations through the box (turn off the breakers first!). • Install brush quality weather-stripping on exterior doors if they are not replaced. • The best material for sealing these hidden air leaks depends on the size of the gaps and where they are located. Caulk is best for cracks and gaps less than about 1/4" wide. • Expanding foam sealant is an excellent material to use for sealing larger cracks and holes that are protected from sunlight and moisture. Today's products are safe for atmospheric ozone. Backer rod or crack filler is a flexible foam material, usually round in cross-section (1/4" to 1" in diameter), and sold in long coils. Use it for sealing large cracks and to provide a backing in very deep cracks that are to be sealed with caulk. • Use rigid foam insulation for sealing very large openings such as plumbing chases and attic hatch covers. Fiberglass insulation can also be used for sealing large holes, but it will work better if wrapped in plastic or stuffed in plastic bags, because air can leak through exposed fiberglass. Specialized materials such as metal flashing and high-temperature silicone sealants may be required for sealing around chimneys and flue pipes. Check with your building inspector or fire marshal if unsure about fire-safe details in these locations.				
Install R-21 densepack insulation in cantilevered floor	**Exposed Floor: Entry Way**	**$4**	**0.0**	**80.2 points 4 Stars Increase: 12.8 pts, 3 steps**

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]
Remove the soffit from the bottom of the cantilevers or gain access from the crawlspace if the cantilever is on the first floor. If access is from the interior, stuff the cavities with insulation. Then replace the blocking. If access is from the outside, first seal around the rim joist blocking, then fill the cavity with insulation and replace the soffit.				
Add R-3.5 insulating blanket to garage door	**Garage Door: Garage**	**$59**	**0.3**	**80.5 points 4 Stars Increase: 13.1 pts, 3 steps**
Add R-38 fiberglass batts to attic with Standard Truss.	**Ceiling w/ Attic: House**	**$382**	**1.1**	**81.6 points 4 Stars Increase: 14.2 pts, 3 steps**

- **Air seal ceiling plane.** Air sealing should be performed as part of any attic or ceiling construction or retrofit, before any new or additional insulating is done. In many homes, more heat is lost by air leakage than by heat transfer through insulation. Air leakage can also reduce the ability of the insulation to perform its function, so that insulating without also air sealing results in effectively lower R-values. When air sealing, you should consider the cost and method(s), and be aware of impacts on ventilation and the behavior of naturally drafted "appliances" such as furnaces, water heaters, and fireplaces.
- Check to verify dryer and bathroom fans are not exhausting into the attic.
- **Install additional insulation.** You can use batts, blown fiberglass, or rigid sheathing.
  - **Batt insulation.** Laying fiberglass rolls is easiest for a DIY job. If you have any type of insulation between the rafters, install the second layer over and perpendicular to the first (again, the second layer of roll insulation should be unfaced– with no vapor retarder). This will help cover the tops of the joists and reduce heat loss or gain through the frame. Also, when laying down additional insulation, work from the perimeter toward the attic opening. Never lay insulation over recessed light fixtures or soffit vents.
  - **Blown insulation** – cellulose or fiberglass - must be carefully installed to assure even coverage, avoiding high and low areas with varying R-values, and avoiding blocking ventilation paths. Ask how the insulation contractor controls for the proper amount of insulation material and depth. Loose-fill cellulose or fiberglass insulation can be blown over existing loose-fill or over batts and blankets. To keep loose-fill from shifting into vents or eaves or from coming into contact with fan motors or other heat-producing equipment, place sheet metal flashing or other non-flammable material around these areas. Make sure you install baffles to keep eave openings clear for attic ventilation. Install the insulation from the outer edges inward. Dividing the attic into segments and installing the proportionate amount of insulation in each segment will help you cover the entire attic area evenly. At the eaves consider staggering rigid foam board insulation to increase the potential R-value in this area.
  - Keep all insulation at least 3 inches away from “can” lights, unless they are rated IC (Insulated Ceiling). If you are using loose fill insulation, use sheet metal to create barriers around the openings. If using fiberglass, wire mesh can be used to create a barrier.
- **Improve ventilation**, preferably with continuous ridge and soffit vents
- **Insulate** attic access hatches and stairways
- **Air seal** attic access hatches and stairways

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]
• **Air seal** chases (shafts) and dropped soffits (bulkheads)				
Install 2' of R-40 rigid board insulation on Perimeter of Crawl Space Floor.	**On- or Below-Grade Floor, Perimeter: House**	**$205**	**0.6**	**82.2 points 4 Stars Increase: 14.8 pts, 3 steps**
Simply lay rigid foam board insulation around the perimeter of the crawlspace floor				
Install R-40 rigid foam board to interior or exterior side of wall. Does not include cost of coverings.	**Below- (part or all) Grade Wall: House**	**$446**	**1.4**	**83.6 points 4+ Stars Increase: 16.2 pts, 4 steps**

Unvented crawl space retrofits are a solution to high moisture conditions in homes. This technique is not in full compliance with local and national building codes and should not be specified for new construction. However, extensive field experience indicates that it provides exceptional environmental control for a safe and healthy crawl space environment. Your best approach is to seal and insulate the foundation walls rather than the subfloor.

Before any efforts are made to control ground or air born moisture, all bulk moisture entering the crawlspace (e.g., rainwater, underground springs) must be eliminated. The following steps must then be followed in their entirety or the desired results might not be achieved.

- Install gutters and slope grade away from the foundation at least 5% (6 inches per 10 feet) to direct rain and surface water away from the house. Empty downspouts 8 to 10 feet from the foundation.
- A foundation drain system to control groundwater. If the outside grade is higher than the inside grade, a damp-proof coating on the exterior foundation wall is recommended. If the interior grade is higher than the exterior grade, damp proofing and foundation drains may be eliminated.
- Cover the crawl space with a 6 mil polyethylene vapor barrier. Overlap all seams and seal with vapor bond tape. Extend the outside edge of the vapor retarder up the foundation wall to a few inches below the top plate. Secure the vapor retarder to the foundation wall by using construction adhesive.
- Close and seal all foundation vents with vent covers or spray foam cavity to eliminate warm, moist outdoor air from entering the crawl space. Cut blocks of ½" to 2" rigid polystyrene and pressure fit into the backside of vent openings to further reduce outside air.
- Ensure that combustion furnaces and water heaters located in the crawl space are sealed-combustion units equipped with a powered combustion system.
- Seal forced air ductwork to reduce or eliminate leakage. Supply air leaks can lower crawl space temperature leading to higher relative humidity. Return air leaks cause negative crawl space pressure, increasing the rate of soil moisture evaporation and soil gas migration. If the crawl space is saturated when corrective measures are taken, run a dehumidifier for several weeks to bring the moisture content under control. From that point forward, the space should operate safely. With outside ventilation eliminated, under no circumstances should combustion products, such a lawnmowers, gasoline, paints or solvents be stored in the crawl space. If a combustion appliance such as a gas or oil furnace is present, a dedicated combustion air supply may be necessary during the heating season.

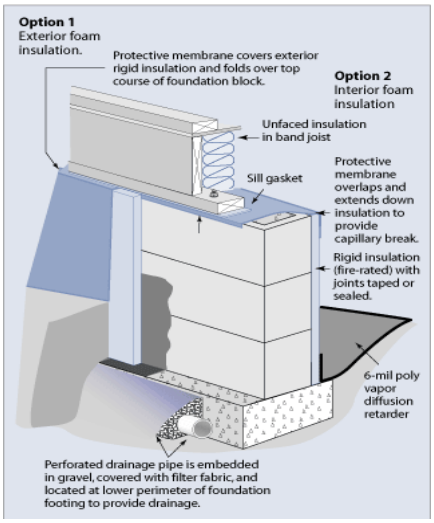
Steps for installing crawl space wall insulation

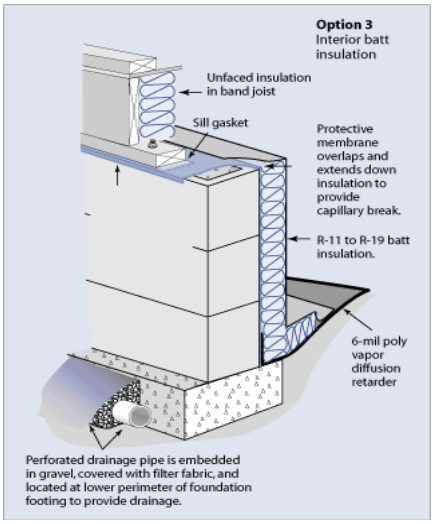
- Seal all air leaks through the exterior wall during and after construction, including the band joist.
- Locate the crawl space access inside the home or install an access through the perimeter that will remain

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]

airtight after repeated use.

- Install rigid foam board insulation – exterior foam or interior foam – to achieve complete insulation coverage. Insulate the band joist with rigid foam board insulation, as well as the crawl space access.
  - Rigid insulation extends down to the top of the footing with the polyethylene ground cover sealed to its face at the bottom.
  - Access doors are insulated using 2 inches rigid foam board or equivalent. Vapor retarder crawl space access doors can also be used.
- A dampered duct attached to the forced air heating/air conditioning system or a small exhaust fan transferring air from the house provides conditioned house air to the crawl space. The code also allows for the installation of an exhaust fan to vent crawl space air to the outside. This method is not recommended because venting can create negative pressure in the crawlspace.





Add R-33 blown cellulose insulation to attic with Standard Truss.	**Ceiling w/ Attic: Laundry**	**$97**	**0.2**	**83.8 points 4+ Stars Increase: 16.4 pts, 4 steps**

See the Description above for the Improvement: *Add R-38 fiberglass batts to attic with Standard Truss.*

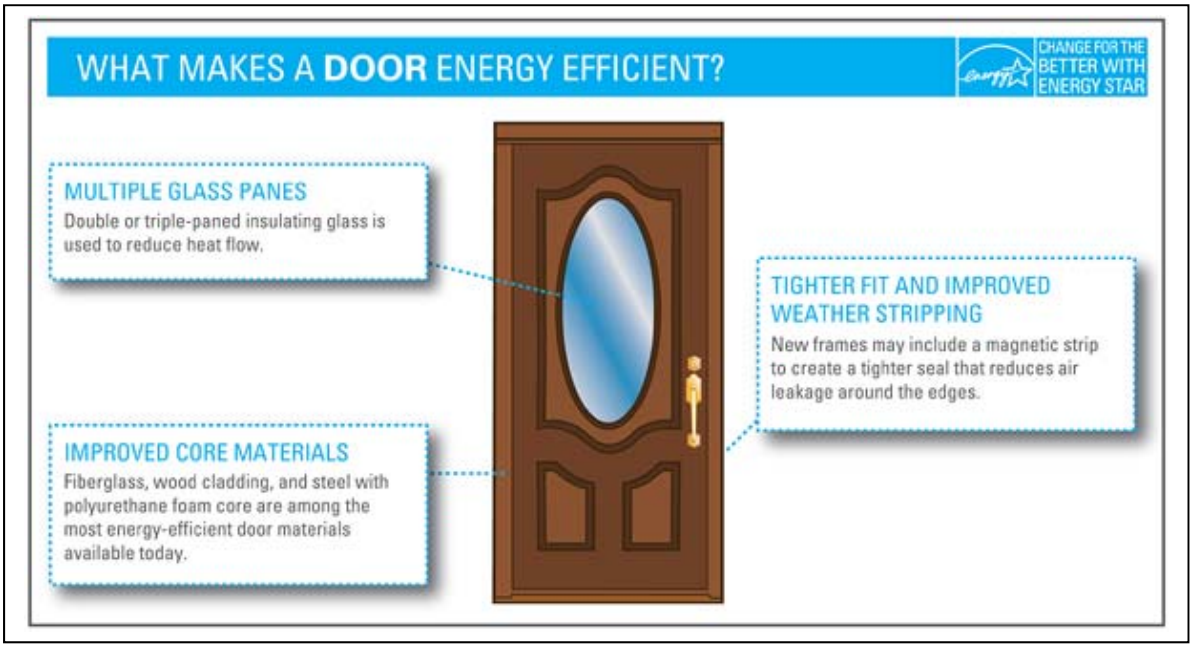
Add R-30 rigid foam to interior or exterior of existing wall; cost does not include siding or wall coverings.	**Above-Grade Wall: Knee Wall**	**$22**	**0.1**	**83.9 points 4+ Stars Increase: 16.5 pts, 4 steps**

You may have several options for increasing the R-value of the walls. Proper air sealing will significantly improve the performance of the new insulation.

Added Insulation Inside Walls. Consider having an insulation contractor inject dense-pack cellulose or one of the expanding foams into the wall cavities of the original structure. Dense-pack cellulose has a density of 3.5 pounds per cubic foot, or more. This upgrade will also reduce air leakage.

Exterior Retrofit. For added heat loss protection, consider adding rigid insulation to the exterior walls before installing the new siding. This provides more insulation as well as reducing outside air penetration and preventing wet siding from transmitting moisture into the wall cavity. Because rigid insulation is an excellent

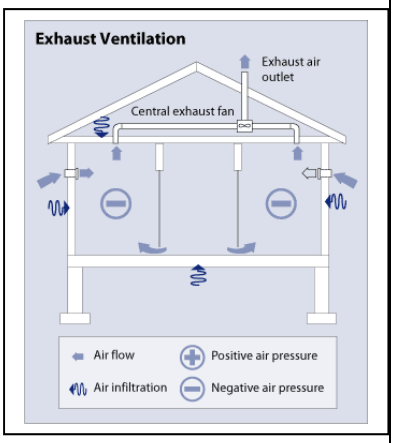
Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]
moisture retarder, and because it keeps the wood in the wall cavity warmer, walls with exterior insulating sheathing are significantly drier than walls without it. If you are planning to add new *exterior* siding, insulation should be blown into wall cavities first. Once the new siding is in place, it will be difficult and expensive to add blown-in insulation. **Interior Retrofit**. If you are planning extensive *interior* renovation, such as gutting the walls of your home during a major rehabilitation project, you should spend the extra time and money to fill the cavities with insulation as long as they're open anyway. (If you plan to repaint or wallpaper rather than rebuild the walls, you can blow insulation into the walls from the inside.) In some cases it may be possible to add rigid insulation on the interior. Any type of rigid foam can be used although the highest R-value per inch will be found with polyisocyanurate. Cover with new sheetrock.				
Add R-30 fiberglass batts to attic with Standard Truss.	**Ceiling w/ Attic: House**	**$51**	**0.3**	**84.2 points 4+ Stars Increase: 16.8 pts, 4 steps**
See the Description above for the Improvement: *Add R-38 fiberglass batts to attic with Standard Truss.*				
Replace glass door with R-2.8 door.	**Full Glass Back Door**	**$100**	**0.3**	**84.5 points 4+ Stars Increase: 17.1 pts, 4 steps**
Special Note: Replace with new fiberglass door Old glass doors often do no seal well because there is no compressive seal on the mating surfaces. Replacing the doors with new fiberglass door (make sure they glazing is Low E/Argon filled) will increase the R-value and reduce air leakage.				
Remove existing door and install U-0.16 fiberglass door with polyurethane core	**Exterior Door: Entry**	**$48**	**0.1**	**84.6 points 4+ Stars Increase: 17.2 pts, 4 steps**
Quality exterior doors are filled with foam insulation and have insulating values of about R-7 to R-14, compared to R-2.2 for conventional solid wood doors. They come in a variety of styles. Metal doors last longer than wood doors, do not warp easily, and provide greater security. Often, they cost no more than solid wood exterior doors. You may also consider a fiberglass replacement door. These provide energy efficiency and durability comparable to a metal door and have a wood grain appearance. The major drawback of metal and fiberglass doors is their inflexibility. They cannot be easily trimmed, so if the door frame is not square, it may have to be rebuilt.				

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]
Make sure the installer reads the directions that come with the door before beginning. Some adjustments can be made after the door is installed, but they will require extra time. A properly installed insulated door will seal tightly for years. 				
Replace with Air Source Heat Pump having an Actual Seasonal COP of 3.5	**Baseboards**	**$1,315**	**0.0**	**84.6 points 4+ Stars Increase: 17.2 pts, 4 steps**
Special Note: Not working in some areas.				
Install a Mechanical Ventilation system without heat recovery	**Bathroom's**	**$24**	**0.2**	**84.8 points 4+ Stars Increase: 17.4 pts, 4 steps**
Special Note: Bath fans are too weak and should be repaired or replaced. Tight buildings reduce energy costs by keeping in the heated air. But tight buildings without adequate ventilation trap humidity and pollutants so they feel "stuffy", aggravate allergies and cause general discomfort for you and your family. Moisture damage to windows and other parts of the building shell can result when humidity is too high. A properly designed and installed "**whole house ventilation system**" is the key to positive moisture control and will help ensure a healthy indoor environment. Whole-house ventilation systems provide controlled, uniform ventilation throughout a house. These systems use one or more fans and duct systems to exhaust stale air and/or supply fresh air to the house. There are four types of systems: • **Exhaust ventilation systems** force inside air out of a home. • **Supply ventilation systems** force outside air into the home. Supply ventilation systems work best in hot or mixed climates. Because they pressurize the house, they have the potential to cause moisture problems in cold climates. • **Balanced ventilation systems** force equal amounts quantities of air into and out of the home.				

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]

- **Heat recovery ventilation systems** (HRVs) transfer heat from incoming or outgoing air to minimize energy loss.

EXHAUST-VENTILATION SYSTEMS WITHOUT HEAT RECOVERY



Exhaust ventilation systems work by depressurizing the building. By reducing the inside air pressure below the outdoor air pressure, they extract indoor air from a house while make-up air infiltrates through leaks in the building shell and through intentional, passive vents.

Exhaust ventilation systems are relatively simple and inexpensive to install. Typically, an exhaust ventilation system is composed of a single fan connected to a centrally located, single exhaust point in the house. A preferable design option is to connect the fan to ducts from several rooms (preferably rooms where pollutants tend to be generated, such as bathrooms). Adjustable, passive vents through windows or walls are installed in other rooms to introduce fresh air rather than rely on leaks in the building envelope. However, passive vents may be ineffective because larger pressure differences than those induced by the ventilation fan may be needed for them to work properly.

Spot ventilation exhaust fans installed in the bathroom properly designed and installed to operate continuously represent an exhaust ventilation system in its simplest form.

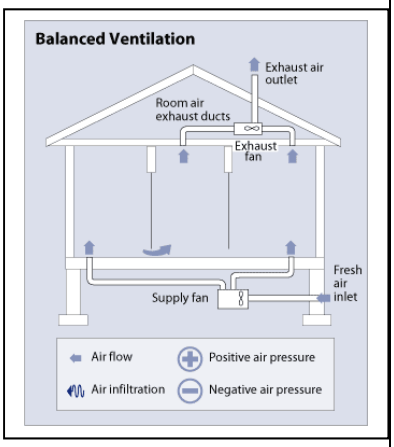
One concern with exhaust ventilation systems is that they may draw pollutants, along with fresh air, into the house. For example, in addition to drawing in fresh outdoor air, they may draw in the following:

- Radon and molds from a crawl space
- Dust from an attic
- Fumes from an attached garage
- Flue gases from a fireplace or fossil-fuel-fired water heater and furnace.

This can especially be of concern when bath fans, range fans, and clothes dryers (which also depressurize the home while they operate) are run when an exhaust ventilation system is also operating.

Exhaust ventilation systems can also contribute to higher heating costs compared with heat recovery ventilation systems because there is no heat recovery from exhausted air. Also, outdoor air may need to be mixed with indoor air before delivery to avoid cold air drafts in the winter.

WHOLE HOUSE BALANCED VENTILATION SYSTEMS WITHOUT HEAT RECOVERY



Balanced ventilation systems, if properly designed and installed, neither pressurizes nor depressurizes a house. Rather, they introduce and exhaust approximately equal quantities of fresh outside air and polluted inside air, respectively.

A balanced ventilation system usually has two fans and two duct systems. It facilitates good distribution of fresh air by placing supply and exhaust vents in appropriate places. Fresh air supply and exhaust vents can be installed in every room. But a typical balanced ventilation system is designed to supply fresh air to bedrooms and living rooms where people spend the most time. It also exhausts air from rooms where moisture and pollutants are most often generated (kitchen, bathrooms, and perhaps the laundry room). Some designs

Improvement Description	Location in Home	Annual Savings[1]	Rating Points Gained[3]	Rating, after all Improvements thru this one[4]
may use a single-point exhaust. Because they directly supply outside air, balanced systems allow the use of filters to remove dust and pollen from outside air before introducing it into the house. Balanced ventilation systems are appropriate for all climates. However, because they require two duct and fan systems, balanced ventilation systems are usually more expensive to install and operate than supply or exhaust systems. Like exhaust systems, balanced ventilation systems do not temper or remove moisture from the make-up air before it enters the house. Therefore, they may contribute to higher heating costs, unlike energy recovery ventilation systems. Also, outdoor air may need to be mixed with indoor air before delivery to avoid cold air drafts in the winter.				

Miscellaneous Improvements and General Information

Replace Incandescent Lamps with Compact Fluorescent or LED

Compact fluorescent lamps (CFL) provide the same amount of light for less than one third the energy of incandescent. CFL are available everywhere at a reasonable cost and pay for themselves many times over during their useful life. LED lamps are even more efficient but significantly more expensive.

Install Ground Vapor Retarder

Reduce moisture and soil gas concerns in crawlspace/basements by covering dirt floors. If you have a dirt floor, cover it with polyethylene sheets, overlap and tape seams by 12 inches and run the poly 6 inches up the walls. Cover poly with a layer of sand and paver stones or concrete.

You can also control crawlspace moisture by installing an exhaust fan in the crawlspace and controlling it with a humidistat.

General Energy Efficiency Notes

- Cover hot water pipes within 10 feet of the water tank with pipe insulation—and if possible, insulate all accessible hot water pipes.
- Insulate electric hot water tanks with an insulation blanket.
- Install programmable thermostats to lower temperatures at night or during the day when your home is unoccupied: stay at or above 60ºF minimum temperature to prevent condensation and mold problems and maintain heat in all rooms.
- In the coldest periods of winter, the indoor humidity should be between 30 and 35 per cent to avoid condensation on windows. Invest in a low-cost hygrometer to monitor the relative humidity levels in your home. If winter humidity levels are too high, try increasing your ventilation rate, for example, by running a small bathroom fan continuously.

- Low winter humidity levels are often due to excessive air leakage. Better air sealing will raise humidity and save energy. If, after air-sealing work has been completed, there is still a problem with low humidity levels, a humidification system may be required.

Other energy-saving improvements

- Water-saving fixtures: low-flush or dual-flush toilets, faucet and shower flow restrictors, front-loading clothes washer reduce water heating loads.
- Energy-efficient appliances: replace and recycle older refrigerators, freezers, electric ranges and dishwashers with Energy Star® rated models.
- Energy-efficient lighting: the average house has 27 light bulbs in it. On average, lighting in a house consumes 1,800 kWh annually. Switch to fluorescent, compact fluorescent and task lighting.

AkWarmCalc Ver 2.3.2.1, Energy Lib 4/11/2014