

Energy Efficiency Improvement Options

Property: Prototype Home
Northwest Region
Nome, AK 99762

House: Single Family
Living Floor Area: 1,470 sq.ft

Initial Rating: Three Star Plus, 73.7 points
Additional Rating Points needed to reach higher Rating Levels:

4.3 more points needed to reach **4 Stars**
9.3 more points needed to reach **4+ Stars**
15.3 more points needed to reach **5 Stars**
18.3 more points needed to reach **5+ Stars**
21.3 more points needed to reach **6 Stars**

Rater: Dustin Madden
CCHRC

ID:

Fuel Prices used in this Analysis: Electricity = \$0.2147/kWh, #1 Oil = \$6.28/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
Remove existing door and install standard pre-hung U-0.16 insulated door, including hardware. Location - Exterior Door: House	\$157	\$3,702	0.7	74.4 points 3+ Stars Increase: 0.7 pts, 0 steps	36,358
Add R-21 blown cellulose insulation to attic space with Energy Truss. Location - Ceiling w/ Attic: House	\$342	\$8,089	1.7	76.1 points 3+ Stars Increase: 2.4 pts, 0 steps	34,867
Add R-20 rigid foam to interior or exterior of existing wall; cost does not include siding or wall coverings. Location - Above-Grade Wall: House	\$865	\$20,442	4.1	80.2 points 4 Stars Increase: 6.5 pts, 1 step	30,887
Replace Oil-fired water heater with tankless/tiny tank, on-demand type oil water heater (e.g. Toyo, Monitor)	\$216	\$3,766	0.9	81.1 points 4 Stars Increase: 7.4 pts, 1 step	30,887
Replace existing window with triple pane, 2 low-E, argon window. Location - Window/Skylight: NonSouthWindows	\$352	\$6,114	1.6	82.7 points 4 Stars Increase: 9.0 pts, 1 step	29,100
Replace Heating System with a Boiler having an AFUE of 94%, >130 F distribution. Location - Primary Heating System	\$264	\$4,604	1.3	84.0 points 4+ Stars Increase: 10.3 pts, 2 steps	29,100
Install a Heat Recovery Ventilation system	\$0	\$0	0.0	84.0 points 4+ Stars Increase: 10.3 pts, 2 steps	29,100

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
Total, All Measures	\$2,196	\$46,717	10.3		

Annual CO2 Reduction after all improvements: 7,402 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

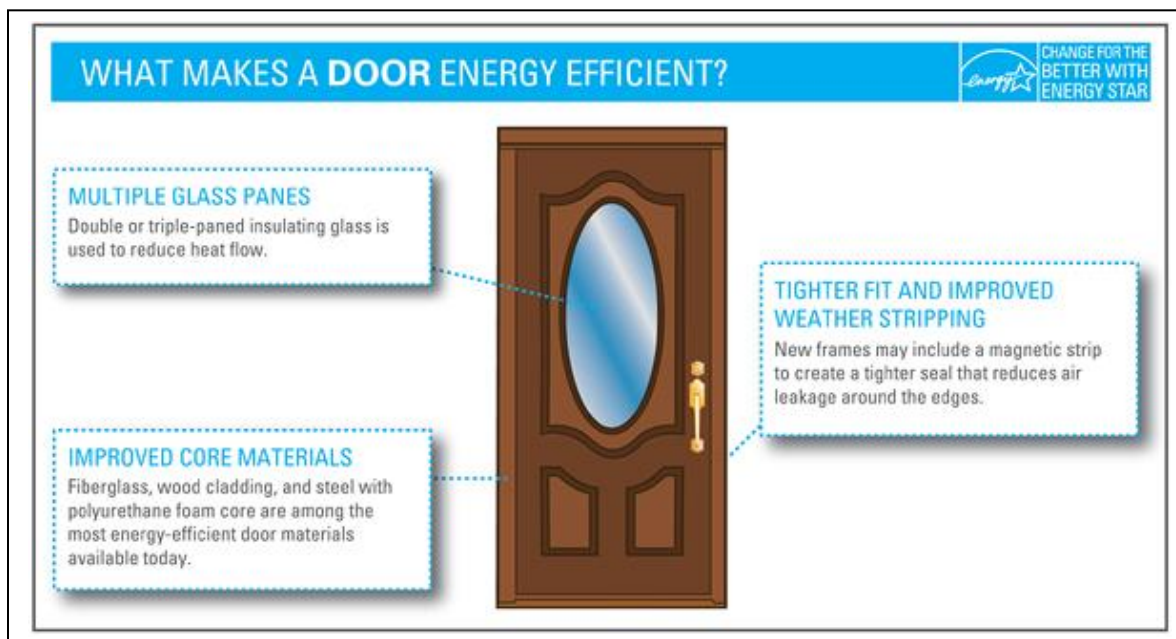
Improvement Description	Location in Home	Annual Savings ¹	Rating Points Gained ³	Rating, after all Improvements thru this one ⁴
Remove existing door and install standard pre-hung U-0.16 insulated door, including hardware.	Exterior Door: House	\$157	0.7	74.4 points 3+ Stars Increase: 0.7 pts, 0 steps

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.

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.



Add R-21 blown cellulose insulation to attic space with Energy Truss.	Ceiling w/ Attic: House	\$342	1.7	76.1 points 3+ Stars Increase: 2.4 pts, 0 steps
--	--------------------------------	--------------	------------	--

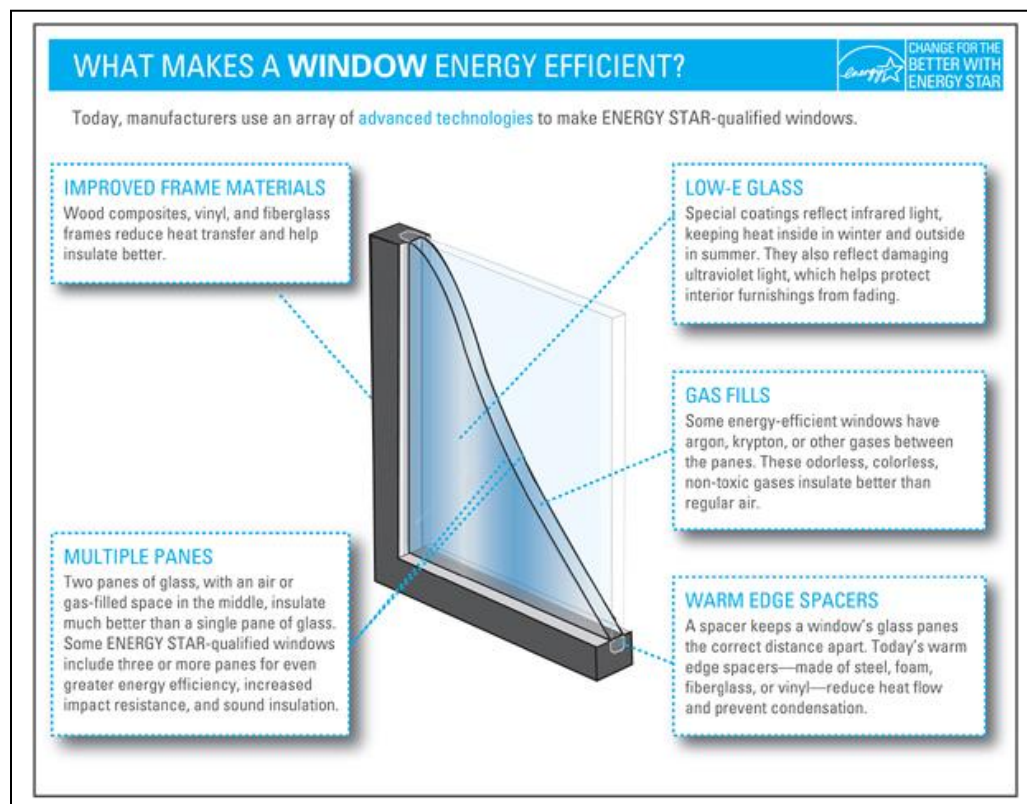
- **Air seal ceiling plane.** Air sealing should be performed as part of any attic or ceiling construction or retrofit, before any new or additional insulating is done. In many homes, more heat is lost by air leakage than by heat transfer through insulation. Air leakage can also reduce the ability of 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.

Improvement Description	Location in Home	Annual Savings ¹	Rating Points Gained ³	Rating, after all Improvements thru this one ⁴
<ul style="list-style-type: none"> • Install additional insulation. You can use batts, blown fiberglass, or rigid sheathing. <ul style="list-style-type: none"> ○ 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 • Air seal chases (shafts) and dropped soffits (bulkheads) 				
Add R-20 rigid foam to interior or exterior of existing wall; cost does not include siding or wall coverings.	Above-Grade Wall: House	\$865	4.1	80.2 points 4 Stars Increase: 6.5 pts, 1 step
<p>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.</p> <p>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. <u>Dense-pack cellulose has a density of 3.5 pounds per cubic foot, or more.</u> This upgrade will also reduce air leakage.</p> <p>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 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 <i>exterior</i> 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.</p> <p>Interior Retrofit. If you are planning extensive <i>interior</i> 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,</p>				

Improvement Description	Location in Home	Annual Savings ¹	Rating Points Gained ³	Rating, after all Improvements thru this one ⁴
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.				
Replace Oil-fired water heater with tankless/tiny tank, on-demand type oil water heater (e.g. Toyo, Monitor)		\$216	0.9	81.1 points 4 Stars Increase: 7.4 pts, 1 step
<p>Tankless water heaters do not contain a storage tank like conventional water heaters. A fuel-fired burner or electric element heats water only when there is a demand for hot water, so standby losses are minimized. Hot water never runs out, but the flow rate (gallons of hot water per minute) will be limited.</p> <p>Several of the new, high-efficiency systems can provide sufficient hot water for more than one simultaneous activity (5 gallons per minute or more). Look for sealed combustion units with an energy factor of at least .80. Here are some of the factors to consider:</p> <ul style="list-style-type: none"> • Tankless water heaters perform much better when coupled with efficient uses, including low-flow faucets and showerheads. • If the hot water uses in your home are relatively close together, with short hot water lines between them, a tankless system may work for you. In many homes, water uses are widely spaced at opposite ends of the house. If this is the case in your home, a tankless system may not meet your needs. • Residential wiring generally will not support a tankless electric water heater with large enough capacity to serve multiple uses. If you rely on electricity to heat your water, a tankless system is unlikely to meet your needs. At most, an electric unit may be appropriate for small applications, such as a remote bathroom without a bath tub. 				
Replace existing window with triple pane, 2 low-E, argon window.	Window/Skylight: NonSouthWindows	\$352	1.6	82.7 points 4 Stars Increase: 9.0 pts, 1 step
<p>Look for the NFRC label to compare energy performance of different windows. In Alaska U-factor (less than 0.35), Air Leakage (the lower the better) and Condensation Resistance (the higher the better) are the most important.</p> <p>Wood, vinyl, wood-clad, and hybrid/composite windows have very similar R-values for the same type of glass and spacers. Insulated vinyl and fiberglass have similar thermal values that are higher than the others, and better condensation prevention. They will cost more initially, but should require very little maintenance.</p>				

 National Fenestration Rating Council® ENERGY STAR	World's Best Window Co. Millennium 2000+® Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider		
ENERGY PERFORMANCE RATINGS			
U-Factor (U.S./I-P)	0.35	Solar Heat Gain Coefficient	0.32
ADDITIONAL PERFORMANCE RATINGS			
Visible Transmittance	0.51	Air Leakage (U.S./I-P)	0.2
Condensation Resistance	51		—
<small>Manufacturers stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not warrant any product and does not warrant the variability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>			

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



Replace Heating System with a Boiler having an AFUE of 94%, >130 F distribution.	Primary Heating System	\$264	1.3	84.0 points 4+ Stars Increase: 10.3 pts, 2 steps
--	-------------------------------	--------------	------------	---

The existing heating system efficiency is below what is available today. AFUE (annual fuel utilization efficiency) measures a boiler's seasonal performance. Boilers manufactured since 1992 must have an AFUE of at least 80%. Consider the following when selecting a new boiler:

Sealed Combustion. This reduces the need for a separate combustion air supply as well as the associated air leakage and is considered safer.

Buy ENERGY STAR (AFUE of 85% or higher). If you want to know what manufacturers produce high-efficiency boilers, check the ENERGY STAR list. Ask your contractor about condensing boilers that are available and consider the added investment if you have a significant heat load.

Control Options. Ask your contractor about different controls that reduce the amount of heat lost through the pipes during off-cycle periods or off-peak (warmer) days. Today there are many technologies available. Controls that modulate the boiler water temperature to reduce off-peak losses work better with condensing boilers. Ask about the cost of purchasing a boiler that has integrated controls compared to the cost of purchasing the controls as an add-on.

Low electricity usage. Tell your contractor that you would like a boiler that has low power usage. The Gas Appliance Manufacturers' Association website includes information on AFUE and annual electricity use in its product database.

Indirect Water Heater. Modern boilers with low thermal mass and good insulation can actually make very efficient water heaters, because they don't both heat and store water at the same time. When installing a

Improvement Description	Location in Home	Annual Savings ¹	Rating Points Gained ³	Rating, after all Improvements thru this one ⁴
<p>replacement boiler, consider replacing your existing storage water heater with a well insulated indirect tank that connects to the boiler with an external loop. With appropriate boiler controls, even in the summer you are likely to save energy because heat losses through the water heater flue will be eliminated.</p> <p>Proper Sizing. Make sure the heating capacity of the boiler is not too high for your home. Some mechanical contractors do not use proper heating load calculations to size heating systems and, as a result, oversized systems are often installed. Oversized systems operate inefficiently.</p> <p>The heating load for your home (prior to other retrofits) is available with your energy rating. The new system's output should not be significantly (15% or less) larger than that. <u>The size requirement will be even less after building envelope retrofits are completed, and it may make sense to recalculate the design heating load when these are done.</u></p>				
Install a Heat Recovery Ventilation system		\$0	0.0	84.0 points 4+ Stars Increase: 10.3 pts, 2 steps
<p>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 ventilation system is the key to positive moisture control and will help ensure a healthy indoor environment.</p> <p>You may have a "spot ventilation system" in your home if you have a fan in your bathroom or a hood over your range. These are both small units which attempt to solve the problem of removing moist air from the bathroom and hot air and cooking smells from your kitchen. However, these are inadequate for most newly constructed homes and all well-sealed homes. They only solve half the problem: they remove moist air or cooking odors but they draw in replacement air in ways you may not like:</p> <ul style="list-style-type: none"> • Dusty pollen-filled air from outside. • Radon and water vapor from the soil. • Fumes from an attached garage. • Hot (up to 150 degrees F.) air from attic during summer. • Smelly air from within walls and attic. <p>To provide just the amount of ventilation you need for comfort and safety while avoiding expensive and uncomfortably excessive ventilation, install a "whole house mechanical ventilation system", that provides continuous fresh air to living spaces and exhausts stale air from kitchen and bath areas. A "energy recovery ventilating system" can help make mechanical ventilation more cost effective by reclaiming energy from exhaust airflows.</p> <p>There are two general types of energy recovery recovery units, those called heat recovery ventilators (HRVs) and those called energy recovery ventilators (ERVs). HRVs and ERVs are similar devices in that both supply air to the home and exhaust stale air while recovering energy from the exhaust air in the process. The primary difference between the two is that an HRV transfers heat while an ERV transfers both heat and moisture. HRV's are usually recommended for colder climates with longer heating seasons. ERVs are used for warmer more humid climates with longer cooling seasons. There is still a lot of discussion regarding these recommendations. In most of Alaska an HRV is the preferred option.</p> <p>An HRV uses fans to maintain a <u>low-velocity</u> flow of fresh outdoor air into the house while exhausting out an equal amount of stale indoor air. Fresh air is supplied to all levels of the house while stale air is removed from areas with high levels of pollutants and moisture</p>				

Improvement Description	Location in Home	Annual Savings ¹	Rating Points Gained ³	Rating, after all Improvements thru this one ⁴
<p>The heart of an HRV system is the heat recovery ventilation unit which houses the heat exchange core. Most heating, ventilating, and air conditioning dealers can sell and install heat recovery ventilators. Manufacturers include:</p> <ul style="list-style-type: none"> • FanTech • LENNOX • HONEYWELL • United Air Specialists, Inc. (400 to 1,200 CFM) • VENMAR <p>The most common HRVs are duct-connected house units. Other types of HRVs are wall or window room units. These are more often found in multifamily dwellings than in single family dwellings. The duct-connected units are more effective because they provide for a better distribution/pickup of air. The HRV unit can be retrofitted in homes with ducted heating systems.</p> <ol style="list-style-type: none"> 1. One set of ducts collects stale moist air from the kitchen, laundry and bathrooms. This stale contaminated air passes through the HRV unit and is exhausted to the outside. 2. The other ducting system draws in fresh clean air from outdoors through the HRV unit. 3. As the two air streams pass each other within the heat exchanger core, heat is transferred from the outgoing stale air to the fresh incoming air. There is no mixing of air streams. 4. The HRV unit is able to capture up to 85% of the energy from the outgoing stale air. Filtered, preconditioned fresh air is delivered where you need it - in the living areas of your home. <p>The fan component of the duct-connected system is commonly installed in the utility or furnace room. It should be easily accessible for regular cleaning, air filter replacement, and servicing. Most contain air filters, some have dehumidifiers built in.</p> <p>Costs can vary a lot depending on the type and complexity of the installation, as well as on the size and features of the HRV. For new construction, the costs would normally run from \$1,000 to \$2,500. It will generally cost more for a retrofit, due to the difficulty of running ductwork to the source points. Volume (or non-source point) ventilation systems can be installed at a lower cost, but may not be as effective and will require the furnace fan to run continuously.</p>				