

Summit Sustainable Building RESOURCE GUIDE

January 2008

Prepared by High Country Conservation Center
to accompany the Summit Sustainable Building Code

1.0 INTRODUCTION

"The two-word definition of sustainability is 'one planet.'"

-Mathis Wackernagel

"If a house isn't resource-efficient, it isn't beautiful."

-Amory Lovins, Rocky Mt. Institute

1.1 Basis for Program

In the big picture, buildings have a significant impact on our environment; they use one quarter of the world's wood harvest and are responsible for 54% of US energy consumption and 35% of US CO₂ emissions through operation and construction. Locally, approximately 50% of our waste stream comes from construction and deconstruction of buildings.

How we build our buildings today determines how we use our resource in the future. Simply put, buildings present one of the greatest opportunities to move towards sustainability.

1.2 Local Effort & Mission Statement

Summit County is a place that has been bestowed with many gifts and most residents live in Summit County because of this tremendous natural environment. It is our responsibility to ensure that future generations have the opportunity to enjoy these gifts as present generations do. One significant way to preserve our natural and cultural heritage is to design and build efficient and healthy buildings.

Because Summit County is in a heating climate (zone 1 in the US Climate Zones Chart; see Appendix 1 for an overview), this code focuses largely on energy efficiency, including creating well-insulated buildings with efficient heating equipment.

The Summit Sustainable Building Program seeks to encourage construction of efficient and healthy buildings by considering the entire life cycle of a building, reducing its overall resource consumption, eliminating or reducing use of toxic materials, and significantly reducing the operating costs of buildings.

To provide the designer and builder with necessary flexibility, this program is designed with a large array of options to off-set house size and other measures. This program was developed by the Summit County Efficient Building Advisory Group. Please see Appendix 2 for complete list of Advisory Group members.

1.3 Scope of Program

The Sustainable Building Program addresses **all residential construction and additions**. The program is a points-based system in four sections: Mandatory Measures; Secondary Measures; Excessive Energy Measures; and the Sustainable Building Menu. A checklist (Appendix 3) accompanies this guide in PDF and Excel Formats. The Excel format will automatically calculate points needed and/or achieved.

Mandatory Measures must be met by all buildings, regardless of size or design. They include basic efficiency standards for doors and windows, baseline insulation values, baseline efficiency ratings of heating equipment, and an owner's manual.

Secondary Measures must be met by these requirements or be off-set by equal measures found in the Sustainable Building Menu. The Secondary Measures include a baseline home size of 3000 square feet of conditioned space for single family homes and 1200 square feet for multi-family units. Buildings over the baseline size must acquire additional points from the Resource Guide based on total size.

The Sustainable Building Menu includes a large variety of products and practices with associated point values. The Menu and this Resource Guide are dynamic and will respond to changes in local markets, new technologies, and new information. The High Country Conservation Center will serve as a central library and resource center for the Sustainable Building Program.

A Source List (Appendix 4) accompanies this guide, which lists some sources and additional resources for the products and practices in the code.

A Sustainable Building Technical Advisory Panel will determine point values for new products or practices. To be included in the resource guide, a product or practice must meet one or more of the following criteria: reduce waste during demolition, construction, or operation; conserve energy or water; reduce waste, energy, or the use of toxic materials in the manufacture and use of a product; contribute to a healthier indoor environment; encourage the marketplace to develop new products; or, support the use of renewable energy and resources.

The Technical Advisory Panel will consider new technologies and allowances as needed. A builder or owner can petition the Technical Advisory Panel for higher point values, innovative building or design techniques, and special circumstances. The Panel can be contacted at building@highcountryconservation.org or (970) 668-5703.

2.0 MANDATORY MEASURES

The following measures are mandatory for all projects:

2.1 Minimum Insulation Values

R-value is a measure of thermal resistance. Higher R-values have better insulating properties. Better insulation and less heat flow means less overall energy consumption. For more information on insulation, see Appendix 5.

Exterior Wall = R-21
Roof Ceiling = R-38
Basement Wall = R-10
Conditioned Crawl Space (below grade) = R-10
Conditioned Crawl Space (above grade) = R-19
Under Slab = R-10
Slab Edge = R-10
Floor (over crawl) = R-19
Cantilever Floor = R-30

Compliance: Inspected (Insulation)

R-VALUE: The R-value of any building surface, such as the floor, walls or ceiling, is the R-value of each of the components in the structural system added together. The higher the R-value, the more insulating value there is to the floors, walls and ceiling. A typical stud-framed wall with six inches of fiberglass insulation (about R-3 per inch) has an overall R-value of about R-20, depending on the insulating value of the total materials added together.

2.2 Windows and Glazed Doors – Maximum U-factor values

U-factor measures the rate of heat loss or how well a product prevents heat from escaping. For windows and doors, it includes the thermal properties of the frame as well as the glazing. U-factor ratings generally fall between 0.20 and 1.20. The lower the U-factor, the greater a product's resistance to heat flow and the better its insulating value.

Windows = .35 U-value
Doors = .40 U-value
Skylights & other fenestration = .50 U-value

Compliance: Inspected (Plan Check and Final)

GLAZING is a covering of transparent or translucent material (glass, acrylic or fiberglass) used for admitting light. Glazing is often used as a synonym for windows, but skylights, greenhouses, and clerestories are also considered glazing. Glazing may be clear, tinted, coated, or filmed –or a combination of these options.

2.3 Exterior Opaque Doors

Door maximum U-Value: of .50

Compliance: Inspected (Final)

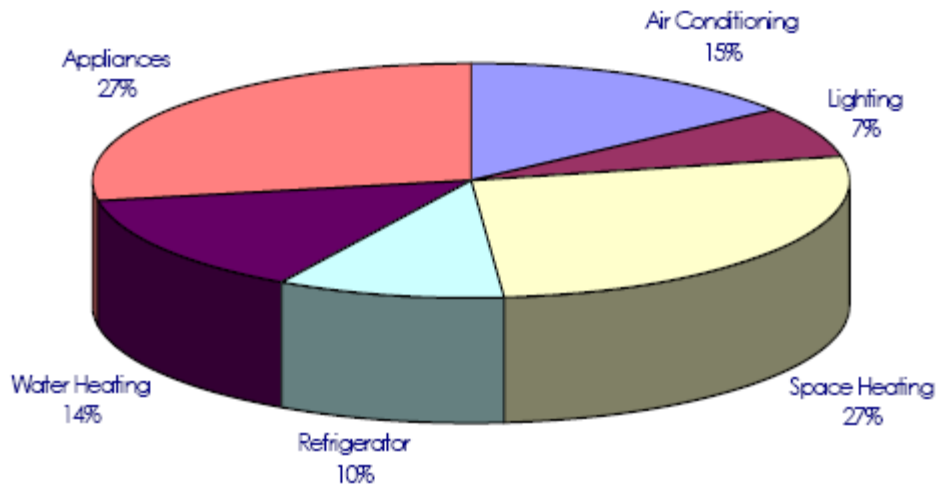
2.4 Energy Efficient Boiler or Furnace

Heating is the largest source of energy use and cost in a typical home – usually around 2/3 of cost. Using efficient heating products can reduce energy consumption and costs.

When a boiler is installed, it must meet a minimum 87% efficiency rating. For a forced air system, a minimum 88% efficient system must be installed.

Compliance: Inspected (Final)

Average Household Energy Expenditures in the U.S.



2.5 Water Heater

A typical gas hot water heater ranges between 50 - 60% efficient. A high-efficiency hot water heater is any water heater that is 88% efficient or better. While water heaters with higher efficiency ratings may cost more up front, they can save significant money over the life of the equipment. For a simple payback period calculation, see Appendix 6.

Any conventional (storage) water heater installed must meet a minimum .63 energy factor (EF) rating for gas and a minimum .90 energy factor (EF) rating for electric. If a tankless, indirect, solar, or heat pump water heater is installed, this mandatory requirement shall be deemed to be met.

Compliance: Inspected (Final)

2.6 Owners Manual

What good are energy efficient appliances and good windows if you don't know how to operate them? An Owners Manual can consist of a simple binder with the operation instructions for all major systems installed in the house. For examples of Owners Manuals, please contact the High Country Conservation Center at (970) 668-5703.

An owner's manual, which includes the operation instructions of all mechanical systems and energy saving systems installed in the house, shall be provided to the homeowner.

Compliance: Inspected (Final)

3.0 SECONDARY MEASURES

Secondary measures must be incorporated into the design and construction of all single family (attached and detached) units or offset by the designated point value through other options listed in Section 5 of this guide (Sustainable Building Menu).

3.1 **Building Size**

Bigger buildings use more energy and resources than smaller ones. For Summit County, the baseline house size was determined to be 3000 square feet.

Single Family (attached or detached): For every 50 square feet of conditioned space (including heated garage) over 3,000 square feet on a single family unit, one additional point must be off-set by an alternative in the Sustainable Building Menu.

For example, a 3,400 square foot unit would be required provide measures to off-set a total of 8 points (3,400 – 3,000 = 400; divided by 50 = 8 points).

Multi-Family Units: For every 50 square feet of conditioned space over 1500 square feet per unit, one additional point must be off-set by an alternative in the Sustainable Building Menu.

Additions: TBD

3.2 **Renewable or Engineered Lumber**

Our forests are under increasing pressure to produce wood, paper and other materials. Using certified forest products ensures that wood is sourced from sustainably managed, renewable forests. Engineered Lumber uses total wood output from our forests more efficiently by using smaller diameter trees.

Install the following quantities of renewable lumber in each unit:

Minimum of 60% of renewable or engineered lumber in roof framing

Minimum of 80% of renewable or engineered lumber in floor framing

Minimum of 80% of renewable or engineered lumber in beams and headers

Off set value, 1 point for every 10% less than required above.

Compliance: Inspected (Framing)

Currently, there are two main forest products certification programs. For information on each, please see the links below:

Forest Stewardship Council (FSC): http://www.fscus.org/green_building/

Sustainable Forestry Initiative (SFI): <http://www.sfiprogram.org/greenbuilding.cfm>

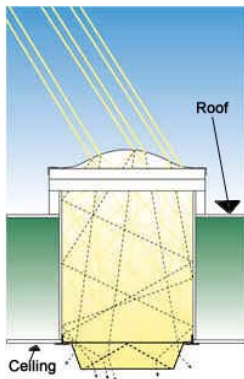
3.3 Day Lighting

Good daylight reduces power consumption by reducing the need for interior lights during the day and can promote a healthier indoor environment. Products such as solar tubes and opaque clerestory windows can allow daylight in while still allowing for privacy.

All bathrooms/powder rooms/laundry rooms have windows, skylights and/or transoms meeting natural light requirements of the Residential Code.

Offset value, 2 points for every bathroom/ powder room/ laundry room not meeting natural light requirements of the Residential Code.

Compliance: Inspected (Final)



DAYLIGHTING is the efficient use of natural light in order to minimize the need for artificial light. Traditionally, planning window, clerestory and rooflight locations has been based upon visual quality and utility (ventilation), and not on maximizing their potential for fulfilling much of a household's illumination needs. Rarely are these architectural elements thought of as a lighting element that can provide sufficient natural illumination for greater parts of the day and year. A solar tube, left, can let daylight into a room with minimal space.

3.4 Air Stratification

Using ceiling fans is one of the most important and affordable things you can do to increase thermal comfort in your home and conserve energy. Ceiling fans spread heated or cooled air throughout interior spaces using little energy. In warm seasons, they also perform cooling function without the high energy requirements of an air conditioner.

All vaulted / raised ceiling areas greater than fifteen feet above the finished floor level are to include an air circulation fan or vent system.

Off set value, 5 points

Compliance: Inspected (Final)

ENERGY STAR CEILING FANS utilize a 20% more efficient fan motor as well as blades optimized to move more air while using electricity. When used in conjunction with fluorescent light fixtures (fan/light combo units), a fan's lighting energy consumption is reduced by 60%-80%.

3.5 Window Insulation

Insulating shades are very effective for insulating windows and improving comfort indoors. Products such as Window Quilt® have a built-in vapor barrier and edge seals to prevent water damage caused by condensation, while adding an R-5 to the window. Single, double & triple cell cellular blinds also help keep the cold out.

All high windows in vaulted ceiling areas or high ceiling rooms greater than fifteen feet above finished floor level shall install insulated blinds/curtains that are readily controlled from the floor below.

Off set value, 1 points for each 10 sq/ft of window area above fifteen feet without insulated blinds/curtains.

Compliance: Self-certified

3.6 Recycling

Summit County only has one landfill, and much of our waste stream is readily recyclable in Summit County. Recycling materials instead of throwing them away saves energy, water, raw materials and landfill space. A built-in recycling bin encourages recycling behavior, thus encouraging more household waste to be recycled. Cabinets with built-in recycling centers are available where most cabinets are sold.

Install a recycling center in all kitchen areas. Provide dedicated space in all garages for the storage of recycling bins.

Off set value, 3 points

Compliance: Inspected (Final)

3.7 Energy Star® rated appliances

An Energy Star rated appliance will use 10-50% less energy and water than its standard alternative. Energy Star appliances are widely available and easily identifiable.



Energy efficient appliance designation is indicated on the required Department of Energy “Energy Star®” label. For a comparison of Energy Star rated appliances, see www.energystar.gov

Install an Energy Star rated dishwasher, refrigerator and/or freezer, and clothes washer.

Off set value, 1 points per appliance not rated or not provided

Compliance: Inspected (Final)

3.8 Energy Efficient Controls

Using thermostats that are accurate and/or programmable can increase comfort and reduce overall energy use.

In-floor Radiant Heat & Hot Water Baseboard Heat

Provide digital thermostat.

Forced Air Heat

Provide programmable thermostat.

Off set value, 1 point

Compliance: Inspected (Final)



4.0 INTENSIVE ENERGY USE AMENITIES

4.1 Decorative Gas Fireplaces/Stoves

All gas fired fireplaces, outdoor gas mounted deck heaters or other gas appliances must meet a minimum heat rating ([needs definition](#)) (excluding grills and other cooking appliances).

Off set value, 5 points for each decorative appliance that does not meet minimum heat rating.

Compliance: Inspected (Final)

4.2 Hot Tubs, Spa Pools and Swimming Pools

Off set value, 5 points for every 50 square feet of hot tub, spa, or pool water surface area.

Compliance: Inspected (Final)

4.4 Outdoor Heated Surfaces including exterior drives, pathways patios, and garage aprons, etc.

Off set value, 2 points for every 100 sq/ft of out door heated surface

Compliance: Inspected (Final)

4.5 Air Conditioners

Summit County is in heating climate (for a little while longer at least). A building with well designed ventilation and air circulation, and proper roof overhangs should not need any additional cooling system.

Off set value, 2 points for each mechanical air conditioning unit installed

5.0 SUSTAINABLE BUILDING MENU

(A Points Summary is Available under Appendix 8)

5.1 COMMUNITY BENEFIT

Simple Footprint

Keeping the footprint of a building simple by reducing the amount of corners typically reduces waste and increases energy efficiency.

4 Exterior Corners

3 points

6 Exterior Corners

2 points

8 Exterior Corners

1 point

Land Use

Good topsoil is a rare commodity in this area. Saving and reusing topsoil/fill and site-rock on-site reduces local landfill impacts, reduces transportation impacts both coming and going, and reduces the import fees of new soil and landscaping materials.

Save and Reuse all Topsoil On-Site

3 points

Save and Reuse all Excavated Fill On-Site

3 points

Site-Rock Reclaimed and Used On-Site

3 points

On-Site Batch-Plant/Crushed Rock Used On-Site

1 point per 10 yards (maximum of 4 points)

Deconstruction Recycling

Estimates show that over 50% of Summit County's waste stream is from Construction and Demolition Debris. It is in the best interest of the community at large to prolong the life of our local landfill as much as possible. By salvaging building materials and fixtures and donating them to a nonprofit reuse center, those materials have the potential to be reused, thereby removing them from our local landfill and keeping their embodied energy intact.

Deconstruction Plan Submitted to High Country Conservation Center

A deconstruction plan consists of an inventory of salvageable and reusable materials, and a list of planned sources for reuse and recycling, and a timeline for deconstruction. See Appendix 7 for a Sample Deconstruction Plan.

Submit to:

High Country Conservation Center

building@highcountryconservation.org

PO Box 4506 Frisco, CO 80443

110 3rd Ave (in Frisco Recreation Building)

970-668-5703

4 points

Wood Recycled or Donated to Reuse Center

In a deconstruction project, much of the wood can be recycled at the Summit County Resource Allocation Park (landfill) and source separated clean wood waste costs 75% less to dispose of than a mixed load (\$10 per ton for clean wood waste vs. \$65 per ton of mixed loose waste. Good beams or other wood material can also be donated to a Reuse Center. For a list of recycling and reuse options, see Appendix 4.

1 point per 25% (4 points maximum)

Metal Recycled

In a deconstruction project, much of the metal can be recycled at the Summit County Resource Allocation Park (landfill) for substantial cost savings (scrap metal is \$5 per ton vs. \$65 per ton). Source separated scrap metal can include fixtures, roofing, pipes, and other materials that contain 70% or more of metal. Appliances can also be recycled with scrap metal.

1 point per 25% (4 points maximum)

Fixtures/Materials Donated to Reuse Center

Examples of reusable fixtures that can be donated to Reuse Centers include but are not limited to Windows, Doors, Lighting Fixtures, Sinks, Tubs, Mantles, Tile, and Cabinets. For a list of recycling and reuse options, see Appendix 4.

1 point per 25% (4 points maximum)

Compaction (grinding or shredding)

Grinding or shredding construction debris before it is delivered to the Summit County Resource Allocation Park substantially increases usable air space in the landfill and also reduces the costs and impacts of transportation. For a list of C/D Grinding options, see Appendix 4.

1 point per 25% (4 points maximum)

Construction Recycling

Estimates show that over 50% of Summit County's waste stream is from Construction and Demolition Debris. It is in the best interest of the community at large to prolong the life of our local landfill as much as possible. A typical new home creates anywhere from 3.0 to 5.2 pounds of waste per square foot and roughly 80% of a homebuilder's waste stream is recyclable.

Wood Recycled

In a construction project, much of the excess wood can be recycled at the Summit County Resource Allocation Park (landfill) and source separated clean wood waste costs 75% less to dispose of than a mixed load. For a list of recycling and reuse options, see Appendix 4.

1 point per 25% (4 points maximum)

Metal Recycled

In a construction project, much of the metal can be recycled at the Summit County Resource Allocation Park (landfill) for substantial cost savings (scrap metal is \$5 per ton vs. \$65 per ton). For a list of recycling and reuse options, see Appendix 4.

1 point per 25% (4 points maximum)

Cardboard Recycled

Cardboard is a voluminous part of our waste stream, but is an easily recyclable and valuable product. Clean, source-separated cardboard is accepted for free at the Frisco or Breckenridge Drop-off Centers or the Summit County Resource Allocation Park at the Materials Recovery Facility (MRF). For a list of recycling and reuse options, see Appendix 4.

1 point per 25% (4 points maximum)

Compaction (grinding or shredding)

Grinding or shredding material prior to delivery to Summit County Resource Allocation Park (landfill) for disposal can substantially increase usable air space in the landfill and can reduce transportation costs and impacts. For a list of C/D Grinding options, see Appendix 4.

1 point per 25% (4 points maximum)

Excess New Wood/Materials Donated to Reuse Center

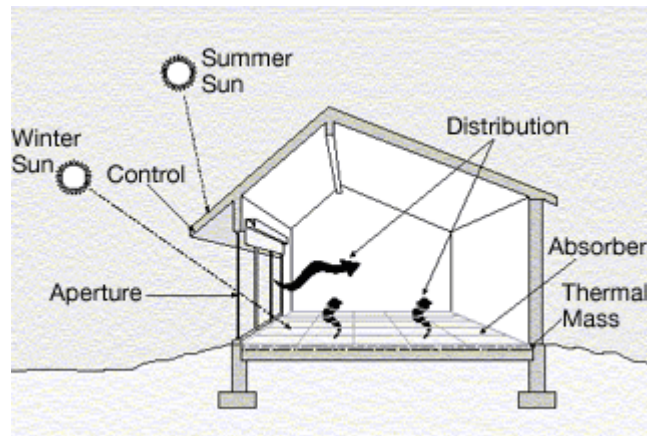
Donating materials to a Reuse Center helps conserve resources. Examples of reusable fixtures that can be donated to Reuse Centers include but are not limited to Windows, Doors, Lighting Fixtures, Sinks, Tubs, Mantles, Tile, and Cabinets. For a list of recycling and reuse options, see Appendix 4.

1 point per 25% (4 points maximum)

5.2 ENERGY EFFICIENCY

Buildings consume 48% of all energy in the United States; they represent a critical means to reduce overall energy consumption and reduce greenhouse gas emissions.

Passive Solar Design: Designing a home to take advantage of solar energy is not difficult, but does require attention to detail. The basic idea of passive solar design is to allow sun into a building when desired (winter) and to keep it out when not desired (summer). Computer modeling software such as the Department of Energy's 'Energy Plus' or SBIC's 'Energy 10' are available online for assisting in the design of solar homes. With or without the use of these programs, consulting with architects and/or builders familiar with solar design is highly recommended.



East West Axis within 30 degrees of True South

Orienting a building with the east-west axis within 30 degrees of true south can significantly improve the collection of solar heat. It should be noted that 5° is ideal, 15° is almost as good, and 30° off true south, although less effective, will still provide a substantial level of solar contribution.

5 points

Properly Designed Overhangs

Overhangs are designed so that south facing glazing is not shaded between 10 am and 2 pm on the winter solstice, and is totally shaded between 10 am and 2 pm on the summer solstice. Because of the different angles of the sun during different seasons, a properly sized overhang can successfully manage the sun.

2 points

Solar Access is Unimpeded

Passive solar design needs the sun, therefore the sun's rays should not be impeded by other homes, geographic features, evergreen trees, etc. Ideally, the glazing on the house should be exposed to sunlight with no obstructions within an arc of 60° on either side of true south, but reasonably good solar access will still be guaranteed if the glazing is unshaded within an arc of 45°. This criteria can be met by demonstrating unimpeded access on a site plan, covenants or other agreements.

3 points

Sun Tempered Design

Sun tempering refers to the use of the sun's heat for a portion of the home's heating requirements by allowing sunlight to reach uncovered floor. To meet this criteria a home must meet above 3 criteria, as well as have south facing glazing equal to 6-7% of the total heated floor area. This percentage should allow for some supplemental heat, but not enough to overheat the house in the summertime.

5 points

True Passive Solar Design

True passive solar design takes sun tempering a step further. In addition to criteria above, south facing glazing should equal 7-12 % of the total floor area. 5.5 square feet of uncovered, sunlit mass floor must be added for each square foot of south facing glass over 7 % of the floor area. The maximum floor mass that can be considered as “sunlit” may be estimated as about 1.5 times the south window area. An additional 1.0 square feet of south facing glass may be added for every 40 sq. ft. of thermal mass in the floor of the room which is not in the sun. An additional 1.0 sq. ft. of south facing glass may be added for each 8.3 sq. ft. of thermal mass placed in the wall or ceiling of the room. Mass in the wall or ceiling does not have to be located directly in the sunlight, as long as it is in the same room with no other wall between the mass and the area where the sunlight is falling. Types of thermal mass which can be used include: concrete floors, two layers of sheetrock, exterior sheet rock, gypcrete (2 inches), tile floors, masonry, thick plaster, adobe walls, stone fireplaces, etc.

5 points

South Roof Area Designed & Rough in for Future Solar Collector

Roof angled within 20 degrees of True South; provide space for solar/mechanical equipment, and extra pipe and conduit runs for future solar system expansion.

2 points

Building Envelope: The envelope refers to the part of a building (including walls, windows, doors, roofs, insulation, and sometimes floors) that comes into contact with the outside environment. Creating a well-sealed and insulated building envelope reduces heat lost and outside air infiltration.

Advanced Sealing Package

Air leakage, or infiltration, is outside air that enters a house through cracks and openings in the structure. Reducing infiltration with a continuous air barrier can significantly cut annual heating and cooling costs, improve building durability and create a healthier indoor environment, (especially when combined with the use of a mechanical ventilation system). Builders of high-performance homes typically use a performance standard for building airtightness that is less than or equal to 0.35 air changes per hour (ACH). This means that 35% of a volume of air in a given space is exchanged with fresher and typically drier air on an hourly basis. The standard for the typical home built to state code standards (Model Energy Code) is 0.50 ACH. To help achieve this higher performance standard for more airtight homes, the following air sealing practices must take place:

BEFORE DRYWALL

- Seal bottom plate of exterior walls with caulk; seal inside edge with caulk after walls are up;
- Seal rim joist (also referred to as band joist) with caulk, spray foam or gasketing between top plate and rim joist, and between rim joist and subfloor;
- For tubs, showers and stairs on exterior walls, insulate the exterior wall and air seal behind these areas with sheet goods or plastic prior to installation;

- Seal between door thresholds and subflooring;
- Seal window and exterior door rough openings with backer rod and caulk, or use non-expanding latex-based spray foam that will not pinch jambs or void window warranties;

AFTER DRYWALL:

- Seal electrical switch, outlets and circuit break boxed to drywall with caulk or foam;
- Seal light fixture boxes, medicine cabinets and bath and kitchen ventilation fans to drywall with caulk or foam;
- Seal any plumbing or electrical wire penetration through drywall with caulk or foam;
- Seal gaps at whole house fan with spray foam or housewrap tape;
- For attic hatches and kneewall access doors, weatherstrip and include a tight hatch;
- Seal between UL-approved, airtight, IC-rated recessed can fixtures and drywall with caulk.

4 points

Higher R-values

Higher R-values provide better insulating and heat retention properties in our cold climate.

1 point per R-value over Mandatory R-values as follows (maximum 10 points per structure component):

- Exterior Wall = R-22 or greater
- Cantilever Roof = R-31 or greater
- Roof Ceiling = R-39 or greater
- Conditioned Crawl Space (below grade) = R-11 or greater
- Conditioned Crawl Space (above grade) = R-20 or greater
- Under Slab = R-11 or greater
- Slab Edge = R-11 or greater
- Floor (over crawl) = R-20 or greater

Lower U-values on Windows and Doors:

High performance windows and doors can substantially improve the performance of the building envelope. The lower the U-factor, the greater a product's resistance to heat flow and the better its insulating value.

Windows Lower than 0.35 U-value:
4 points

Doors Lower than 0.40 U-value:
4 points

Exterior Opaque Doors Lower than 0.50 U-value:
2 points

Sill Plate Sealed with Foam Sealer

Using a 'sill sealer' between the connection at the concrete foundation and the beginning of wood frame construction reduces air infiltration and creates a break so the sill plate does not take up moisture from the concrete slab. Reduction in air infiltration increases homeowner comfort and helps to reduce energy bills.

1 point

Energy Heels of 6" or more in Trusses

In a situation where there is an attic space, it's usually easy to get enough insulation in place. The one problem spot is the outer edge where the rafter or truss sits on the outside wall (often referred to as a "cold corner"). In a typical case there would not be room to install 12" to 15" of insulation in this location. One solution is to use an oversized truss or "raised heel truss." In an oversized truss, the top and bottom chords come together beyond the exterior wall and typically have a steeper roof pitch. This allows enough room for both the insulation and ventilation. At the attic level, an "energy heel" raises the roof at least 12 inches above the attic floor, improving ventilation and insulation. This allows for full insulation around the house, saving time and money.

4 points

Insulated Exterior Wall Sheathing (R-3.5 or better)

Sheathing refers to the material on the outside of the exterior wall. One of the major purposes is to provide stability for the stud framing. Insulated sheathing boards can help improve the overall performance of the building envelope.

4 points

Insulated Headers (80% minimum R-10)

Rigid insulation between window, door, and opening headers with minimum R-10 on 80%.

2 points

Blower Door Test with score

A blower door test measures how well the house is sealed against penetration of outside air to the inside or "draftiness". The blower door test helps the builder to find out where leaks in the house are, and takes the guesswork away from how leaky the house actually is. How does this happen? With all planned air intakes sealed (i.e., windows closed and all doors shut) the blower door is installed in the front door of a home. A fan in the blower door slightly depressurizes the home and measures the overall amount of outside air penetrating the home through leaks in the shell. These leaks may be from many sources, such as improper seals around windows, framing, wires, pipes, or recessed lighting. Air penetration into the house is measured in Natural Air Changes per Hour (NACH). A list of regional providers of blower door tests is listed under Appendix 4.

0.45 or less = 4 points

0.40 or less = 6 points

0.35 or less = 8 points

Unvented Crawlspace per ASHRAE 23.11

Vented or unsealed crawl spaces can be a never ending source of moisture problems. They can also have a negative impact on the energy performance of the home. To eliminate the potential for these two conditions, many builders now construct a sealed, unvented and fully-insulated crawl space. The crawl space floor is covered by a poly vapor barrier (either 6 or 10 mil, some use 20 mil) that is sealed to the foundation walls. A dedicated heat duct from the furnace conditions the crawl space and keeps it dry.

4 points

Mechanical Systems: Mechanical Systems refer to the heating, ventilation, and air conditioning systems in a home (HVAC). Careful selection and sizing of mechanical systems can dramatically improve energy performance and potentially reduce operating costs in a building.

Active Solar Space Heating System Installed

There are two basic types of active solar heating systems based on the type of fluid—either liquid or air—that is heated in the solar energy collectors. (The collector is the device in which a fluid is heated by the sun.) Liquid-based systems heat water or an antifreeze solution in a "hydronic" collector, whereas air-based systems heat air in an "air collector." Both of these systems collect and absorb solar radiation, then transfer the solar heat directly to the interior space or to a storage system, from which the heat is distributed.

2 points

Active Solar Domestic Hot Water System Installed

Solar hot water systems designed for domestic hot water use solar collectors to harness the heat from the sun to heat the water. By reducing fossil fuel energy consumption, solar hot water systems lower energy bills and help create energy independence. These systems are very simple and cost-effective.

2 points

TANKLESS or ON-DEMAND HOT WATER HEATERS can help save energy and reduce costs in the right applications. These water heaters heat the water where it is needed without incurring the stand-by losses from traditional hot water heaters. However, these tankless systems capacity limitations so hot water demand must be a consideration.

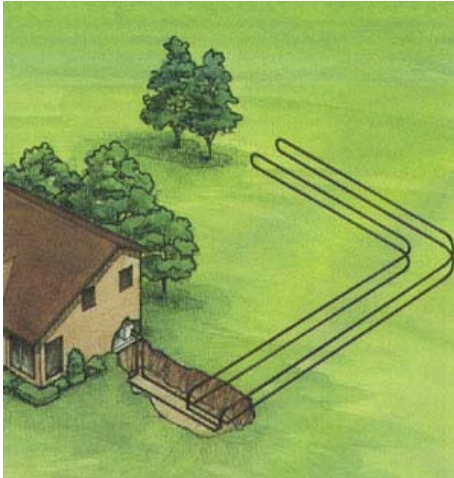
Geothermal/Ground Source Heating System Installed

Ground source heat pumps are electrically powered systems that take advantage of the earth's relatively constant temperature to provide heating, cooling, and hot water for homes and commercial buildings. The system does not convert electricity to heat;

Summit Sustainable Building Program Resource Guide, January 2008, page 16

rather, it uses electricity to move thermal energy between the ground and the building and condition it to a higher or lower temperature according to the heating or cooling requirements. GSHP systems conserve energy and, because they move heat that already exists rather than burning something to create heat; they reduce the amount of toxic emissions in the atmosphere. They use renewable energy from the sun, and because the system doesn't rely on outside air, keeps the air inside of buildings cleaner and free from pollens, outdoor pollutants, mold spores, and other allergens.

1 point per 200 Watt Equivalent (maximum 50 points)



GEOHERMAL OR GROUND SOURCE HEAT PUMPS are electrically powered systems that take advantage of the earth's relatively constant temperature to provide heating, cooling, and hot water for homes and commercial buildings. Refer to the following fact sheet for more information:
<http://www1.eere.energy.gov/geothermal/heatpumps.html>

High Efficiency Boiler Installed (greater than 91%)

Heating is the largest source of energy use and cost in a typical home – usually around 2/3 of cost. Using efficient heating products can reduce energy consumption and costs.

4 points

High Efficiency Forced-Air Furnace Installed (88% or greater)

Heating is the largest source of energy use and cost in a typical home – usually around 2/3 of cost. Using efficient heating products can reduce energy consumption and costs.

4 points.

Furnace Centrally Located

Centrally located equipment reduces the size and therefore much of the inefficiency of a distribution system. Centrally located is defined as having no mechanical run (distribution system of conditioned air or water) being longer than 2/3 the distance of the longest diagonal dimension of the house.

4 points

Hydronic (Radiant Heat) System Installed

Hydronic heating systems combine a boiler or hydronic heat pump with heat emitters, piping, and controls. Hydronic (hot water baseboard or in-floor) heating is considered to

be a safer, more effective, and a more affordable method of space heating than most alternatives. This measure is available through most plumbing contractors.

4 points

HVAC Equipment & Duct Sizing, Balancing and Sealing

When contractors use these Manual J calculations and computer programs to size the HVAC system, the actual heating and cooling loads of the building can be better determined, so that the smallest, least-expensive, least energy consuming HVAC unit can be bid. A balancing report can test for leaks and airflow efficiencies. Sealing all ducts, plenums, and register boots with low-toxic mastic can improve indoor air quality and ensure efficient performance of a forced air heating system.

4 points

MANUAL J CALCULATIONS were developed by the Air Conditioning Contractors of America as the industry standard for estimating equipment sizing loads associated with residential structures. This sizing takes into account specific components of a house.

LOAD refers to the home's heating or cooling requirements, which are influenced by many factors, including local climate, insulation levels, window area and type, as well as the efficiencies of lights and major home appliances which give off heat.

Energy Star House

Energy Rated Homes of Colorado (E-Star™) is the local home energy rating organization. An energy rating quantifies a homes' energy efficiency, and also suggests cost-effective improvements. These ratings also include a Blower Door Test that quantifies air infiltration. But most importantly, an energy rating can provide the solutions for increased comfort and reduced energy bills. An Energy Star® certified house is simply a house that scores an 86 or higher through an energy rating.

4 points

Heat Recovery Ventilation or Air to Air Heat Exchanger Installed

Buildings can't be built too tight, only under ventilated. The down-side to some mechanical ventilation systems is that they introduce unconditioned air into a house. Heat recovery ventilation systems provide ventilation of conditioned air, which increases comfort and energy efficiency. Heat-recovery ventilation systems can be stand alone ventilation systems or tied into forced-air heating. Products include but are not limited to mixing-box ventilators and heat recovery ventilators such as the Venmar AVS Solo, the Vent-Aire ECS45M, and the PerfectAire® Fresh Air Exchanger. These products are available through most mechanical contractors and suppliers.

3 points

Side Arm Water Heater Served by the Boiler

An indirect-fired water heater circulates water through a heat exchanger in the boiler. This heated water then flows to an insulated storage tank (Side-arm hot water heater). Because the boiler does not need to operate frequently, this system is more efficient than an under-fired hot water heater. In fact, when an indirect water heater is used with a highly efficient boiler, the combination may provide one of the least expensive methods of water heating. These products are available through plumbing/mechanical contractors.

3 points

Replace Electric Hot Water Tank to Gas (remodel/addition)

Although electric systems have higher efficiencies than gas systems, electric heat can be as much as 3 times as expensive as natural gas in Colorado. Electric heat is not considered energy-efficient due to the negative environmental impacts from high resource consumption and emissions at the power generation plants.

3 points

Convert Electric Resistance Heat to Gas (remodel/addition)

Although electric systems have higher efficiencies than gas systems, electric heat can be as much as 3 times as expensive as natural gas in Colorado. Electric heat is not considered energy-efficient due to the negative environmental impacts from high resource consumption and emissions at the power generation plants. Gas heat includes but is not limited to gas-fired forced air, gas-fired hot water baseboard or in-floor, or gas appliances. This measure is available through most mechanical /plumbing contractors.

3 points

ELECTRICAL/LIGHTING/APPLIANCESSolar-generated electric system (PV)

The amount of solar energy produced by the sun per hour is equal to the total worldwide energy consumption per year! Solar-generated electricity can be used for off-grid applications where tying to the grid is prohibitive, or it can be used in conjunction with the grid. Grid-inertie systems (using the electrical grid for storage instead of batteries) has reduced the cost of solar-generated electricity considerably. And better yet, rebates from local utilities and federal tax incentives substantially reduce the overall cost of residential solar electric systems. For more information on rebates, see Appendix 9.

1 point per 200 watts/5 points per KW (50 point maximum)

Wind-generated electric system.

This point relates only to on-site wind generation and does not refer to purchasing renewable energy credits or wind power from a utility. On-site wind generation is generally only feasible on properties of 5 acres or more. Electricity from the wind is clean, renewable, and inexhaustible!

1 point per 200 watts/5 points per KW (50 point maximum)

RENEWABLE ENERGY CREDITS (RECS) refers to the purchase of off-site renewable energy equivalent to a portion or all of your residential energy use. Purchasing renewable energy credits is a good way to help support overall demand for renewable energy and reduce greenhouse gas emissions. Xcel Energy's Windsource Program is easy to sign up for and provides one convenient bill for this service. There are multiple providers of renewable energy credits available for purchase over the internet.

Clothes Washer is Front Loading (Horizontal Axis)

Horizontal axis clothes washers are generally more energy-efficient than vertical axis clothes washers. Using an energy efficient washer will save both water and energy, typically 25-40% less water and 50-65% less energy. To qualify for this measure, washers must be selected from tier 2, 3, 4A, or 4B from the list at www.cee1.org. These models are available at most stores where appliances are sold.

1 point

Clothes Line Installed (Inside or Outside)

Drying clothes on an indoor or outdoor clothesline is more energy-efficient than any machine dryer on the market. An installed clothesline is an incentive not to use the dryer as often. Available at most hardware stores.

1 point

Non-incandescent Light Fixtures (90%)

Electric lighting uses energy in two ways: it uses electricity directly to produce the light, and it produces waste heat. Compact fluorescent lights (CFL'S) cut electrical consumption by as much as 50% without producing all of the waste heat that incandescent bulbs produce. New CFL and other fluorescent lamps technology create better light quality without the hum-and-flicker of obsolete fluorescent technology. LED lights are another super-efficient lighting technology. T8 & T5 fluorescent bulbs also qualify. Available at most stores where light bulbs are sold.

4 points

Occupancy/Motion Sensor Controls Installed

Occupancy or Motion Sensor controls are an effective means of reducing energy loss that happens by lighting unoccupied rooms. They are particularly useful in basements and other areas that are not used often.

1 point

Automatic Daylight Dimming Controls

Automatic daylight dimming uses a light sensor to measure the amount of illumination in a space. Then, light output from a dimming ballast is adjusted to maintain the desired level of illumination. The combination of daylight dimming with appropriate task lighting is often very effective. Corridors are good candidates for daylighting controls.

Private offices with windows can also be equipped with individual daylight sensors. Initial commissioning and calibration of light sensors and controls is critical for effective daylighting, however; poorly calibrated daylight sensors can result in little or no savings.

2 points

Motion Sensor or Timers on Exterior Lights

Motion sensors or timers on exterior lights help reduce wasted energy by lighting outdoor areas only when activity is happening or likely. Timers are also an effective way to help reduce light pollution by ensuring that lights are turned off in late night hours.

2 points

No Recessed Lights in an Exterior Insulated Ceiling

Because of the heat build-up inside the typical recessed light, units must be spaced away from the insulation in ceilings. The result of that space is like keeping a window open all winter long.

4 points

Air-Loc, IC Rated Recessed Light Fixtures

When installed in the building envelope between conditioned and unconditioned spaces, use airtight, insulation-contact (IC) rated recessed can lights in order to reduce the potential energy loss associated with connections between conditioned and unconditioned spaces and maintain an airtight building envelope. Insulation can be safely blown over these recessed cans.

2 points

5.3 MATERIAL & RESOURCE EFFICIENCY

INSULATION

Blow or Sprayed Insulation in 50% or more of all insulation

Blown / sprayed insulation, such as cellulose or blown fiberglass, out-performs most other insulation products in regards to energy efficiency. Blown / sprayed insulation tends to insulate more effectively and reduce air infiltration, with a small cost premium compared to fiberglass batt insulation.

5 points

Insulate All Hot water Pipes to All Locations to R-3

Pipe heat loss is wasted energy. Pipe insulation is a very cost-effective method to saving energy and reducing the 'wait time' for hot water. Insulated or not, it is recommended that pipes be kept inside the house envelope.

3 points

Insulate All Hot Water Pipes in Unconditioned Space to R-6

It is easy to forget the importance of insulating pipes that are hidden from view, but they can be a major source of heat loss.

4 points

Window Quilts or Insulated Shades Installed in 75% of Exterior Windows

Insulating shades are very effective for insulating windows and improving comfort indoors. Products such as Window Quilt® have a built-in vapor barrier and edge seals to prevent water damage caused by condensation, while adding an R-5 to the window. Single, double & triple cell cellular blinds can also help keep the cold out.

4 points

Wall Insulation is 70% Recycled Content

Recycled insulation has many benefits. While creating an outlet for recycled material, it also reduces energy consumption and increases comfort in the home. Products include but are not limited to cellulose, cotton, mineral wool, and Ottawa Fibre fiberglass insulation.

3 points

Roof Insulation is 70% Recycled Content

Recycled insulation has many benefits. While creating an outlet for recycled material, it also reduces energy consumption and increases comfort in the home. Products include but are not limited to cellulose, cotton, mineral wool, and Ottawa Fibre fiberglass insulation.

3 points

Formaldehyde Free or Low Toxic Insulation Used

The added benefit to low-toxic insulation is improved indoor air quality. Formaldehyde, a common ingredient in many building products is a suspected carcinogenic hazard. Products include but are not limited to most cellulose products, Johns Manville's Thermal-SHIELD Free™, Sound-SHIELD Free™; CertainTeed's InsulSafe 4®; Owens Corning's Miraflex®, and GREENGUARD™ Certified products. Products are available at most building material stores as well as from insulation companies

2 points

Non-Toxic Water Based Spray On Insulation

Foam insulation can be very harmful to the environment and the workers. By using a non-toxic alternative, this ensures the health of the workers. Foams with HCFC's as expanding agents contributes to ozone depletion.

2 points

HCFC-Free Rigid Foam Insulation Used

Foam insulation products are all petroleum derived, but most have superior air-sealing, moisture resistance, and insulating properties when compared to fiberglass and other fiber-insulation materials. Many foams require a blowing agent to create the foaming action. CFC's were used for this in the past, but have been eliminated because of their high ozone-depleting potential. CFC's were replaced primarily by HCFC's (hydrochlorofluorocarbons), which still have ozone depleting potential, but are still scheduled for phase out. HCFC's have ozone depleting effects and contribute to greenhouse gases.

2 points

Existing Ceiling Insulated to R-30 or capacity (remodel/addition)

Insulation reduces heat loss from the house, keeping it more comfortable and lowering energy bills. Adding insulation to an attic, such as a blown-in product, is typically a very cost-effective energy-efficient improvement for all seasons.

5 points

Existing Walls Insulated to Capacity or Rigid Insulation Added to Exterior

Adding insulation to exterior walls has a similar benefit to adding it to the ceiling. Although adding ceiling insulation tends to be more cost-effective than adding wall insulation, adding wall insulation tends to be more effective at increasing comfort levels in the home.

5 points

Single Pane Windows updated to Double Glaze with U-factor 0.40 or less

The insulation value created by two panes of glass effectively cuts the heat loss to ½ that lost through single glazing.

5 points

FOUNDATIONInsulated Concrete Foundation System Used

Insulated concrete forms, or ICF's as they are commonly referred to as, are permanent forms with integral insulation that are not disassembled after the concrete has cured. The advantage of ICF's are that they are less labor-intensive, more energy-efficient through better insulation value, and some "waffle" systems use less concrete than typical foundation walls.

4 points

Recycled Content Insulated Concrete Foundation

This product offers the energy-efficiency benefits of insulated concrete forms combined with the resource-efficiency of using fly ash in the form itself. Using fly ash, a coal-fired power plant waste product, utilizes an otherwise landfilled product. Products include, but are not limited to Perform Wall and Rastra®.

4 points

Frost-protected Shallow Foundation

A frost-protected shallow foundation (FPSF) is a practical alternative to deeper, more-costly foundations in cold regions with seasonal ground freezing and the potential for frost heave. A FPSF incorporates strategically placed insulation to raise frost depth around a building, thereby allowing foundation depths as shallow as 16 inches. The FPSF has been so well-received in Nordic countries that it is considered standard practice for residential buildings in Scandinavia. The advantages are greater energy-efficiency with slab edge insulation, and by reducing the foundation depth, you reduce excavation and concrete costs while minimizing the impact to the site.

4 points

Western Coal Fly Ash Concrete

Using fly ash, a coal-fired power plant waste product, in concrete mixes not only utilizes an otherwise landfilled product, but it reduces the use of high embodied energy cement. Typically a 50% mix is the maximum for structural concrete depending on the season, but a structural engineer must design mixes exceeding the standard mix. It is recommended that the design team get a mix design submittal from the batch plant before construction. It is possible to verify Fly ash in the mix the day of the pour with a batch weight ticket, but it is very important to let the plant, the driver and the sub-contractor know that you are requesting it.

3 points

Non-asphalt Based Damp Proofing

Non-asphalt based damp proofing is less toxic than the alternative.

2 point

Non-solvent Based Foundation Waterproofing

Solvent-based waterproofing products tend to have a high VOC content and may be a source of groundwater contamination. Products include, but are not limited to Safecoat's® DynoSeal and Tremco's Mulseal™.

2 points

STRUCTURAL FRAME

Structural Insulated Panels (SIPS)

'SIPs' as they are commonly referred to as, are manufactured panels of an insulating material, typically expanded polystyrene, sandwiched in between two layers of an engineered sheet good, typically OSB. There is also a SIP panel made of compressed straw sandwiched between a wheat-based sheetgood. Structural Insulated Panels tend to be more resource and energy efficient than typical wood-framed homes. They produce very air-tight homes, so although mechanical ventilation is recommended for most homes, it is *strongly* recommended for SIP homes. SIP panels also take advantage of a

factory-controlled environment for manufacturing and are typically less labor intensive to install.

1 point per 25% for walls (maximum 4 points)

1 point per 25% for roof (maximum 4 points)

Factory Built or Panelized Construction

Premanufactured components tend to be more resource and energy-efficient than typical wood-framed homes. They take advantage of a factory-controlled environment to maximize efficiency.

4 points

Finger-jointed Plate Material

Finger-jointed material is fabricated from short pieces of 2x4 or 2x6 material that are glued together to form standard stud lengths. Not only are they resource-efficient, but also they tend to be straighter and less expensive than solid sawn material.

2 points

Low-Toxic OSB Wall Sheathing

Engineered lumber products, such as OSB, offer significant environmental savings over plywood in that it utilizes fast growing, small-diameter trees efficiently. Most OSB is made with urea formaldehyde that will continue to outgas high levels of VOC's for several months. Specify low-toxic Oriented Strand Board (OSB) when purchasing. Products include but are not limited to Huber's 'Advantech' and other GREENGUARD™ Certified products.

2 points

Recycled Content Wall Sheathing

Sheathing represents a significant percentage of the building materials on any given project. Using recycled-content sheathing therefore has a significant environmental benefit. Products include but are not limited to Thermo-Ply (www.simplex-products.com) and Homasote, (www.homasote.com).

2 points

Use of Locally Produced Beams, Studs, Lumber

Using materials that are produced from local sources reduces transportation costs and overall environmental impacts. Materials produced within a 100 mile radius of Summit County are considered local.

1 point per 10% (10 points maximum)

Reclaimed Structural Materials

Reclaimed wood offers an environmental benefit because it reuses existing materials and therefore reduces the impact that the materials would have had on our local

landfills, had it not been reclaimed. The use of reclaimed lumber also reduces the impact of timber harvesting. Reclaimed timber frames can receive credit of this measure.

1 point per 10% (10 points maximum)

OPTIMAL VALUE ENGINEERING (OVE) METHODS: “Optimum value engineering” refers to a set of practices that save material and money by reducing the amount of materials and time used in construction. These practices typically rely on an up-front investment in design and engineering time, as well as framing crew training, as a means of achieving these savings. This initial investment typically produces significant long-term savings. Incorporating less wood into a house also allows more room for insulation and has proven to reduce drywall cracking.

OVE 24” On Center Studs: 24” o.c. framing uses less wood than 16” o.c. Be sure to verify structural loads.

OVE Two Stud Corners: Two stud corners still allow for dual-sided exterior nailing and provide backing for drywall with the use of drywall clips, which also reduce cracking.

OVE Efficient Headers: This includes site-built or pre-manufactured, insulated headers, and/or eliminating headers when not necessary. You can also save wood & space by using header brackets instead of trimmer studs.

OVE Stacking Joists/Studs (eliminating double top plate): Most codes allow for the elimination of a top plate when members are stacked. Walls are then tied together with nail plates.

OVE Building with 2’ Increments: Since a majority of building materials come in two-foot increments, there is less waste if the building was designed to take advantage of a materials’ dimensions materials’ dimensions.

Recycled Content Deck Material

Recycled-content decking takes advantage of recycled waste wood fiber and recycled plastic resins in its construction. This combination also produces a maintenance-free, yet durable surface. Products include, but are not limited to recycled plastic lumber such as, EcoDeck and Epoch; and plastic/wood composite lumber such as, ChoiceDek™, NexWood, and Trex.

3 points

Renewable (FSC or other) Deck Material

FSC® (Forest Stewardship Council) or SFI (Sustainable Forestry Initiative) certified forestry principles include forest management for biological diversity, long term forest health and long-term economic well-being of local communities. As a true third party, FSC® certification is considered to be the most well-respected of all the certifiers. Certified material is still difficult to obtain and a longer lead time should be anticipated.

3 points

Salvaged or Reclaimed Deck Material

Reclaimed wood offers an environmental benefit because it reuses existing materials and therefore reduces the impact that the materials would have had on our local landfills, had it not been reclaimed. The use of reclaimed lumber also reduces the impact of timber harvesting.

3 points

SUB FLOOR

OSB in Sub Floor

Engineered lumber products, such as OSB, offer significant environmental savings over plywood in that it utilizes fast growing, small-diameter trees efficiently. There are now OSB products available that are designed to be weather-resistant in flooring & roofing applications. Products include but are not limited to Louisiana Pacific's 'BarrierFloor™' and Huber's 'Advantech.'

3 points

Low-Toxic OSB in Sub Floor

Most OSB is made with urea formaldehyde that will continue to outgas high levels of VOC's for several months. Specify low-toxic Oriented Strand Board (OSB) when purchasing. Products include but are not limited to Huber's 'Advantech' and other GREENGUARD™ Certified products.

1 point

WINDOWS & DOORS

Exterior Doors U-value 0.20 or less

Doors and windows are generally key places of heat loss. By selecting exterior doors with high lower U-value, heat loss can be minimized.

1 point per door (maximum 3)

Use of Salvaged, Reclaimed Doors (75% of total doors)

Using reclaimed doors helps reduce energy and resource costs of using doors made from raw materials.

4 points

Use of Salvaged, Reclaimed Windows (50% of total; must meet mandatory measures)

Using reclaimed windows helps reduce energy and resource costs of using doors made from raw materials.

4 points

All doors made from Renewable (FSC or Other) Wood

FSC© (Forest Stewardship Council) or SFI (Sustainable Forestry Initiative) certified forestry principles include forest management for biological diversity, long term forest health and long-term economic well-being of local communities. As a true third party, FSC© certification is considered to be the most well-respected of all the certifiers. Certified material is still difficult to obtain and a longer lead time should be anticipated.

2 points

ROOFRecycled Content Roofing Material with Minimum 30 Year Life

The two primary benefits of recycled-content roofing are that it provides an outlet for the recycled plastic and metal stream and it has end-of-life recyclability. Products include but are not limited to Authentic Roof™ 2000, Eco-Shake, Eco-Star, Majestic Slate, (all designed to look like wood shakes or slate) and Ondura, Rustic Shingle, and reclaimed slate roofing.

3 points

Metal Roof with minimum 30Year Life

Metal roofs typically cost more than other roofing materials but last much longer. Metal roofs are durable and made from a recyclable material.

3 points

WALL FINISHESFiber Cement Siding on 50% or more of Exterior Wall

Fiber-cement siding has many benefits in that it is a very durable material, and therefore has less maintenance and disposal impacts. It should be noted, that just like wood siding, durability depends on how well the material is sealed and backvented. Composition siding, such as Cladwood® is considered recycled-content siding. Fiber cement products include but are not limited to Cemplank, Hardi- Plank, and CertainTeed-WeatherBoards.

3 points

Recycled Content or Reclaimed Wood Siding (50% or more)

Recycled or Reclaimed material uses less energy and resources than material from raw materials.

3 points

Low VOC or Low Toxic Paint/Stain Used for 75% or more

Most latex paints, although preferable to oil based paints, have high VOC content and contain harmful biocides and preservatives, such as formaldehyde. VOC's have a potential impact on indoor air quality, as well as contributing to smog. It should be noted that even zero-VOC paints may use a colorant system that contains VOC's. Low VOC / non-toxic paints are one alternative to typical paint products. Petrochemical-free

plant or mineral based paints offer more alternatives. Chemically-sensitive people should experiment with any product, prior to application. Products include but are not limited to AFM's Safecoat products, Benjamin Moore's Pristine® Eco-Spec™, Devco's Wonder-Pure™, Glidden's Healthspec, Kelly-Moore's Enviro-Cote, Sherwin-Williams' HealthSpec™, BioShield, Livos®, EarthTech and GREENGUARD™ Certified products.

4 points

Natural Clay Used

Natural Clay is low in VOC's, made with natural pigments, and easily repairable making it a durable, long-lasting choice. American Clay is one example of natural clay.

2 points

Locally Produced Trim

Using materials that are produced from local sources reduces transportation costs and overall environmental impacts. Materials produced within a 100 mile radius of Summit County are considered local.

1 point per 25% (4 points maximum)

FLOOR FINISHES

Wood Flooring from Reused/Reclaimed/Remilled Sources

Recycled or Reclaimed material uses less energy and resources than material from raw materials.

1 point per 25% (4 points maximum)

Wood Flooring from Renewable Sources (FSC or Other)

FSC® (Forest Stewardship Council) or SFI (Sustainable Forestry Initiative) certified forestry principles include forest management for biological diversity, long term forest health and long-term economic well-being of local communities. As a true third party, FSC® certification is considered to be the most well-respected of all the certifiers. Certified material is still difficult to obtain and a longer lead time should be anticipated.

1 point per 25% (4 points maximum)

Wood Flooring from Local Source

Using materials that are produced from local sources reduces transportation costs and overall environmental impacts. Materials produced within a 100 mile radius of Summit County are considered local.

1 point per 25% (4 points maximum)

Ceramic Tile is Recycled Content

Recycled-content tile is made from either recycled glass or feldspar tailings, which is a post-industrial waste product. These products represent an excellent example of

resource-efficient manufacturing. Products include but are not limited to Summitville, Blazestone®, Environmental Stone, and Oceanside tiles.

1 point per 25% (4 points maximum)

Ceramic Tile is Reclaimed Material

Reclaimed material uses less energy and resources than material from raw materials

1 point per 25% (4 points maximum)

Bamboo Flooring is Used in Place of Hardwood

Bamboo is a fast-growing, rapidly-renewable material that grows to a harvestable size in as little as five years. Bamboo flooring is a very hard and durable, wood flooring substitute. The above mentioned benefits outweigh the transportation impacts of importing these products from overseas.

1 point per 25% (4 points maximum)

Cork Flooring is Used in Place of Hardwood

Cork is also a renewable resource that comes from the bark of the cork oak tree, and can be harvested sustainably every ten years. There is almost no material waste in the manufacturing of cork flooring.

1 point per 25% (4 points maximum)

Natural Fiber Carpet Used in Place of Synthetic

Natural fiber carpet, like wool, is a renewable material that also contains no toxic chemicals and can promote healthier indoor air quality.

1 point per 25% (4 points maximum)

Natural Linoleum is Used in Place of Vinly

Natural linoleum is made of linseed instead of polyvinyl chloride (PVC). Natural linoleum will not off-gas through its lifecycle improving indoor air quality. Natural linoleum also reduces the use of toxic materials in its manufacturing process. Marmoleum is one brand name of natural linoleum.

1 point per 25% (4 points maximum)

Recycled-Content Carpet is Used

Many carpet manufacturers are producing carpet made from recycled plastic. Purchasing recycled-content carpeting is one way to help close the loop in manufacturing. Products include but are not limited to Interface, Collins & Aikman, WabiSabi by Interface, Second Nature, Envirotech, Envirelon, and Mohawk Aladdin. Most carpet retailers also offer a recycled content carpet.

1 point per 25% (4 points maximum)

Recycled-Content or Natural-Fiber Carpet Padding is Used

Carpet padding is a readily recyclable material and there are many choices for recycled content padding. Natural-fiber carpet padding is low in VOC's.

1 point per 25% (4 points maximum)

Replaceable Carpet Squares Used in High Traffic Areas

Replaceable carpet squares are a terrific choice for high-traffic areas, like corridors in multi-family units or entrance ways. Individual squares can be replaced, reducing the need to replace the whole carpet and thereby reducing waste.

1 point per 25% (4 points maximum)

Stone, Granite, or Concrete Used in Floors

Generally, stone, granite, or concrete floors are less toxic than other materials and most importantly are very durable.

1 point per 25% (4 points maximum)

Solvent-Free or Low-Toxic Construction Adhesive is Used

Wood adhesives commonly contain harmful solvents floors and GREENGUARD™ Certified products.. However, solvent free solutions are readily available. Products include but are not limited to Franklin's Titebond ES 747, Safecoat's '3 in 1' Adhesive, Elmer's Carpenter Glue, Phenoseal's 'Does it All!' caulk, 100% Pure Silicone Caulk and GREENGUARD™ Certified products.

2 points

Solvent-Free or Low-Toxic Wood Finishes Used

Most standard sealers for wood are solvent based and contain several highly toxic chemicals that outgas for long periods of time after application. Low-toxic alternatives are water based or natural finishes. Products include but are not limited to AFM's Safecoat products, BioShield, Livos®, OS Hardwax , EarthTech and GREENGUARD™ Certified products.

2 points

CABINETS & OTHER FINISHES

Recycled Wood Particleboard for Cabinets

Recycled material uses less energy and resources than material from raw materials.

1 point per 25% (4 points maximum)

Recycled Wood Particleboard for Shelving/Countertops

Recycled material uses less energy and resources than material from raw materials.

1 point per 25% (4 points maximum)

Agricultural Waste Particleboard for Cabinets

Agricultural waste includes wheat and other materials. Using agricultural waste helps reduce waste products and saves energy and raw materials.

1 point per 25% (4 points maximum)

Agricultural Waste Particleboard for Shelving/Countertops

Agricultural waste includes wheat and other materials. Using agricultural waste helps reduce waste products and saves energy and raw materials.

1 point per 25% (4 points maximum)

Formaldehyde-free Particleboard/MDF for Cabinets

Particleboard is typically found throughout the house in cabinetry, shelves, stair parts, to pre resins-manufactured furniture, and sometimes sub-flooring. Most particleboard is made with urea formaldehyde that will outgas high levels of VOC's for several months. Alternative, less toxic products include but are not limited to SierraPine's Medite and Medex, Isobord, ALLGREEN MDF®, Hemp MDF, Phoenix Biocomposites' Environ, NewStone Biocomposite, Dakota Burl, and wood. Another alternative is to use wire shelving for closets or formaldehyde-free engineered products for stair treads.

2 points

Formaldehyde-free Particleboard/MDF for Shelving/Countertops

Particleboard is typically found throughout the house in cabinetry, shelves, stair parts, to pre resins-manufactured furniture, and sometimes sub-flooring. Most particleboard is made with urea formaldehyde that will outgas high levels of VOC's for several months. Alternative, less toxic products include but are not limited to SierraPine's Medite and Medex, Isobord, ALLGREEN MDF®, Hemp MDF, Phoenix Biocomposites' Environ, NewStone Biocomposite, Dakota Burl, and wood. Another alternative is to use wire shelving for closets or formaldehyde-free engineered products for stair treads.

2 points

All Exposed Particleboard is sealed with Low-VOC or water-based sealer

Sometimes it is difficult to completely eliminate particleboard from a house. The next best approach is to seal it well to reduce outgasing. Products include but are not limited to AFM's Safecoat products, Benjamin Moore's Pristine® Eco- Spec™, Devoe's Wonder-Pure™, Glidden's ProMaster, Kelly-Moore's Enviro-Cote, Sherwin-Williams' HealthSpec™, BioShield, Livos®, and EarthTech.

1 point

Solvent-Free or Low-Toxic Wood Finishes Used

Most standard sealers for wood are solvent based and contain several highly toxic chemicals that outgas for long periods of time after application. Low-toxic alternatives are water based or natural finishes. Products include but are not limited to AFM's Safecoat products, BioShield, Livos®, OS Hardwax , EarthTech and GREENGUARD™ Certified products.

2 points

NO Particleboard or MDF with Urea-Formaldehyde Used Inside Building Envelope

Particleboard is typically found throughout the house in cabinetry, shelves, stair parts, to pre resins-manufactured furniture, and sometimes sub-flooring. Most particleboard is made with urea formaldehyde that will outgas high levels of VOC's for several months.

2 points

Cabinets made from Renewable Fiber

Rapidly renewable resources require far less land to produce the same amount of material as other resources. Soy-based cabinets and countertops are made from a renewable resource, are durable, and do not off-gas.

1 point per 25% (4 points maximum)

Cabinets made from Renewable Lumber (FSC or Other)

FSC© (Forest Stewardship Council) or SFI (Sustainable Forestry Initiative) certified forestry principles include forest management for biological diversity, long term forest health and long-term economic well-being of local communities. As a true third party, FSC© certification is considered to be the most well-respected of all the certifiers. Certified material is still difficult to obtain and a longer lead time should be anticipated.

1 point per 25% (4 points maximum)

Countertops made from Renewable Fiber

Rapidly renewable resources require far less land to produce the same amount of material as other resources. Soy-based cabinets and countertops are made from a renewable resource, are durable, and do not off-gas.

1 point per 25% (4 points maximum)

Reclaimed Tile on Countertops and Walls

Reclaimed material uses less energy and resources than material from raw materials and saves landfill space.

1 point per 25% (4 points maximum)

Recycled Content Tiles on Walls and/or Countertops

Using recycled content materials use less energy than other materials, save landfill space, and help close the loop.

1 point per 25% (4 points maximum)

Locally Sourced Wood Used in Countertops or Other Finishes

Using materials that are produced from local sources reduces transportation costs and overall environmental impacts. Materials produced within a 100 mile radius of Summit County are considered local.

1 point per 25% (4 points maximum)

Reclaimed/Reused Cabinets or Fixtures

Using reclaimed materials helps keep the embodied energy of existing materials in use and helps save landfill space, conserve energy, and reduce the use of raw materials.

1 point per 25% (4 points maximum)

Stone, Granite, or Concrete Countertops Used

Stone, granite, or concrete is often less toxic than the alternatives, and most importantly is very durable.

1 point per 25% (4 points maximum)

5.4 WATER EFFICIENCYDual-flush toilets installed

A water-saving toilet that has a 1.6-gallon flush for solids or a half-flush (0.8 gallons) for liquids. Average flush is just 1 gallon.

2 points

WATER CONSERVATION is an important concept for our arid mountain climate. Water heating represents a large percentage of a home's utility bill. Therefore, low water-use fixtures and appliances not only save water, but save energy and money too. These savings typically translate into hundreds of dollars and thousands of gallons annually.

Drip irrigation installed

Using drip irrigation helps reduce moisture loss and minimizes evaporation.

2 points

Engineered or Vegetated Swales Installed to Filter Storm Water

Storm water can contain many toxic elements for its interaction with streets and cars. Using vegetated swales can help filter storm water.

1 point

Grey Water Used for Irrigation

Grey water is water that has been used for other applications, generally from certain indoor applications, like kitchen sinks, showers, or laundry. Careful use of non-toxic and biodegradable soaps and such is necessary.

2 points

Native Plants from Building Site Slaved and Replanted

Salvaging native plants from a building site and replanting them helps save energy and minimizes impacts from building.

2 points

LOW WATER or NATIVE PLANTS dramatically reduce water consumption. For best results, plants should be grouped by water need. For a list of drought-tolerant plantings, refer to **The Rocky Mountain Plant Guide** available at most nurseries. This guide is not intended to be exhaustive or necessarily specific to all areas and climates. Consultation with a landscape architect, nursery, and/or a landscape professional is recommended.

5.5 INDOOR ENVIRONMENTAL QUALITY

Radon Mitigation System Installed

Radon is a clear, odorless gaseous by-product of the natural breakdown of uranium in soil, rock, and water. While radon gas dissipates in open spaces, it tends to cling to particulate matter and accumulates when enclosed. The surgeon General has stated that radon exposure is second only to tobacco smoke as a cause of lung cancer. Radon mitigation systems are designed to ventilate this gas out of the house before it has a chance to accumulate. Radon testing can be difficult, and not always conclusive. Radon may not be evident until the home is finished.

2 points

Rough-in for Radon Mitigation System

A ‘Rough-in’ system includes the infrastructure that can be installed easily during construction. Then, once the house is complete, it can be tested for radon. If the radon test is positive, which the EPA considers 4.0pCi/L (pico-curies per liter of air) or higher then the rest of the system can be completed.

1 point

Mechanical Ventilation System Installed (15 cfm per person of outside air)

Once we started using revolutionary products such as plywood, good windows, and other engineered products, homes got tighter. Then we started introducing indoor air pollutants to the interior of homes. Remember that a house can’t be too tight, but it can be under-ventilated. ASHRAE standards suggests a minimum ventilation rate of 15 CFM per person or minimum of 0.35 air changes per hour. Mechanical ventilation systems can be as simple as a stand-alone exhaust and/or supply fan system, or can be tied into a forced-air heating system with an ECM/Blower or Fan Flow Controller. Systems and products are available through most mechanical contractors.

2 points

Install HEPA filter sized for whole house

EPA studies of human exposure to air pollutants indicate that indoor air levels of many pollutants may be 2-5 times, and occasionally more than 100 times, higher than outdoor levels. These levels of indoor air pollutants are of particular concern because it is estimated that most people spend as much as 90% of their time indoors. Forced-air systems come with a throw-away filter media, either fiberglass or washable sponge media. These are designed to keep the blower/motor assembly clean. They ARE NOT designed to protect the occupants of the home or building from harmful airborne particles. Pleated filters, electrostatically-charged filters and other high efficiency filters are designed to remove the harmful particles. HEPA systems are the top of the line, and are specifically designed to remove respirable size particles from the conditioned air. HEPA filters can filter bacteria, viruses, gases, pollen, dander, mold, fungi, and/or smoke. High efficiency filters are available through some mechanical contractors.

1 point

Furnace and/or Dust-mounted Air Cleaner Meeting ASHRAE 52.2

Using a permanent filter that meets ASHRAE standard 52.2 can help improve indoor air quality.

1 point

Exhaust Fan in Garage in Timer or Wired to Door Opener

Installing an exhaust fan in a garage can eliminate the hazards of carbon monoxide. Exhaust fans should be designed for continuous operation and be energy efficient. It is recommended that the fan be set on a timer to coincide with vehicle use, or incorporate a sensor switch. Products include but are not limited to Panasonic exhaust fans and Tamarak's Preventilator 2. Building a detached garage is a safer alternative.

1 point

One Hard-wired Carbon Monoxide Filter Installed

Exposure to carbon monoxide can cause depression, fatigue, irritability, an inability to concentrate, or possibly even death. Recent testing has shown carbon monoxide infiltration from the garage into the house is a common occurrence. Carbon monoxide detectors can warn occupants of this problem. CO detectors are available at most hardware stores.

1 point

Range Hood vented to outside

Venting a range hood to outside helps reduce the chance of potentially toxic fumes lingering in the residence

1 point

No Attached Garage

No attached garage reduces the chance of air pollutants from the garage entering the residence.

1 point

Permanent Mat or Snowgate at Main Entrance(s)

Much of our indoor air pollution comes from what we track in on our feet. Using a snowgate or mat at entrances can help reduce dirt, dust, and chemicals into the home.

1 point per door (2 maximum)

5.6 EDUCATION & INNOVATION

Innovative Product TBD

Innovative Design TBD

New Technology TBD

INDEX

Introduction.....	Page 1
Mandatory Measures.....	Page 3
Secondary Measures.....	Page 5
Intensive Energy Use Measures.....	Page 8
Sustainable Building Menu.....	Page 9
Community Benefit.....	Page 9
Land Use.....	Page 9
Deconstruction.....	Page 9
Construction Waste Recycling.....	Page 10
Energy Efficiency.....	Page 11
Passive Solar Design.....	Page 11
Building Envelope.....	Page 13
Mechanical Systems.....	Page 16
Electrical/Lighting/Appliances.....	Page 19
Material & Resource Efficiency.....	Page 21
Insulation.....	Page 23
Foundation.....	Page 21
Structural Frame.....	Page 24
Sub Floor.....	Page 27
Windows/Doors.....	Page 27
Roof.....	Page 28
Wall Finishes.....	Page 28
Floor Finishes.....	Page 29
Cabinetry & Other Finishes.....	Page 31
Water Efficiency.....	Page 34
Indoor Environmental Quality.....	Page 35

APPENDICIES

- Appendix 1 – Summit County’s Heating Climate
- Appendix 2 – Efficient Building Advisory Group Members
- Appendix 3 - Checklist
- Appendix 4 – Source List
- Appendix 5 – Insulation Fact Sheet
- Appendix 6 – Payback Periods
- Appendix 7 – Sample Deconstruction Plan
- Appendix 8 – Points Summary
- Appendix 9 – Renewable Energy Rebates Summary