

JACKSON COUNTY, MISSOURI GREEN BUILD PROGRAM



A guide to incorporating sustainable building features to save money, reduce energy usage, and maintain a healthy home.



1ST EDITION: REVISED FEBRUARY 2006

Working smarter...not just harder.

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I. PROGRAM OVERVIEW

The Jackson County Green Build Permit program is envisioned to be a voluntary green building initiative for owners/builders/developers in the UNINCORPORATED AREAS of Jackson County, MO. It provides incentives to the owner/builder, and allows Jackson County Public Works to inspect and certify homes that meet sustainable building and energy standards. The program objective is to partner with area builders in cooperation with other participating agencies, utilities and environmental organizations to further promote green building throughout the region.

The goal of this handbook is to serve as general guidelines that builders and homeowners can refer to when designing or renovating for sustainable living features. It contains information relevant to the area, such as regulatory issues, climate, installation guidelines, and sources of assistance. It also includes pertinent aspects of sustainable building strategies and possible implementation issues.

The information contained is presented in a practical way, with the hope that readers choose to implement sustainable building features. It does not present specific building details as found in a construction manual, but offers general building guidelines with the goal of safe, durable, livable, environmentally responsible homes. Even if a person does not wish to participate in the program formally, there are hundreds of sustainable design and renovation options that any homeowner can incorporate.

Special Thanks goes to the following organizations for permitting Jackson County to use portions of their Green programs, and/or for providing information to assist us in the development of The Jackson County Green Build Program:

Greater Kansas City Chapter of the USGBC
Alameda County, CA Waste Management Authority and Recycling Board
City of Austin, Texas
Metropolitan Energy Center of Kansas City
Kansas City, MO Environmental Management Commission
U.S. Department of Energy
City of Gardner, Kansas

KEY CONCEPTS

Green building is a term that refers to a wide variety of measures to make a home or other building healthier, safer, more comfortable, more durable, energy efficient, and environmentally responsible. This idea initially developed out of the energy crisis of the 1970's and the prevalence of "sick building syndrome" in the '80's and '90's. Since that time, the concept of green building has come to represent a **whole systems** approach to issues related to indoor air quality, energy-efficiency, and natural resource depletion.

Some other terms you may run across that describe "green" are:

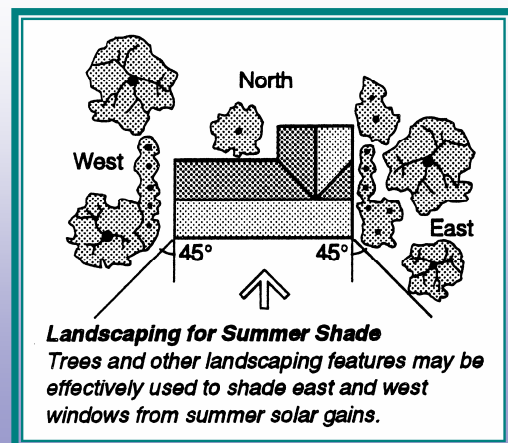
*Sustainable
High-Performance*

*Environmentally Responsive
Healthier*

"A Wide Variety of Green Features"

Sustainable home features come in many forms. The following are some, but not all of the things you can take into consideration when building a new home.

- **Home Site**
 - ◊ Direction of the home in relation to the sun
 - ◊ Landscaping and use of natural vegetation
- **Energy usage**
 - ◊ Energy Star Appliances
 - ◊ Location of ductwork
 - ◊ Programmable thermostat
 - ◊ Roofing material
 - ◊ Insulation choices
 - ◊ Solar water heating
 - ◊ Windows
- **Materials**
 - ◊ Use of materials with recycled content, including insulation, carpet and roofing materials
 - ◊ Certified framing lumber
 - ◊ Minimum 30-year roofing materials
 - ◊ Use of natural materials, regional materials
- **Indoor Air Quality (IAQ)**
 - ◊ Carbon monoxide detectors
 - ◊ Exhaust fans
 - ◊ Use of low-VOC adhesives
 - ◊ Air filters
 - ◊ Foundation drainage
- **Recycling**
 - ◊ Built-in kitchen recycling center
 - ◊ Job site recycling guidelines
 - ◊ Purchase of recycled materials



II. APPLYING FOR A GREEN BUILD PERMIT

The Green Build Permit Process is similar to the regular permit process, except that you will also be submitting a **“Commitment Form”** indicating which level of Green you will be trying to achieve. You will be paying all regular permitting fees at the time of application. This program is available to owner/builders/developers in the **UNINCORPORATED AREAS of Jackson County** only.

Once the project is complete and ready for inspection, you will submit a checklist of the items that you incorporated to get to the desired level. This checklist (Appendix A) will be based off the categories and points system on the following pages. A Jackson County building inspector will certify the building and award the proper level of Green designation: GREEN, SILVER, GOLD, or PLATINUM. Once it has been verified that the home is certified, the applicant/homeowner/builder will receive a rebate of permit fees and a plaque or certificate, as appropriate for the level of certification.

INFORMATION REQUIRED FOR APPLICATION

Jackson County requires that **TWO (2) complete sealed prints** by a Licensed Missouri P.E. be provided at the time of application for **ALL permits!**

1. Legal description of property (from deed or tax bill)
2. Plot plan, drawn to scale showing existing and proposed structures, septic system
3. Construction plans
4. PAID property tax receipt

*Permit fees are calculated at the time application is made.
FULL permit fee is paid at time of application.*

All permits expire if work is not started, or is stopped for 180 days or more. If this occurs, you may request an extension for up to 90 days, or you may be required to make a new application.

CURRENT BUILDING CODES

2003 International Building Code (exc. Ch 29, plumbing)
 2003 International Residential Code (exc. Ch 27, plumbing)
 2003 Uniform Plumbing Code
 2003 International Energy Code
 2003 Uniform Mechanical Code
 2005 National Electrical Code
 2003 International Fire Code

CONSTRUCTION PLANS

Plans for new construction or additions to existing residential structures should provide the following:

1. Floor Plan
2. Typical Wall Section
3. Foundation Plan
4. Electrical Diagram
5. Elevations
6. Square Footage for each Floor, Basement, and Garage

PLOT/SITE PLANS *

Jackson County requires that TWO (2) complete sealed prints by a Licensed Missouri P.E. be provided at the time of a application for ALL permits!

These should be drawn to scale and include the following:

1. Tract dimensions and setback lines
2. Dimensions of the proposed and existing structures
3. North, South, East, West specifications
4. Signature and date of person preparing the plot/site plan
5. Existing and planned on-site septic system with laterals

**Permit clerks are not permitted to draw any plans.*

SEWAGE DISPOSAL AND WASTEWATER TREATMENT

Jackson County ordinances are intended to safeguard the contamination of our natural water supply and protect the health, safety, and welfare of our citizens. If public sewer is not available, a residence will be serviced by on-site wastewater disposal. The following is an outline of the major requirements:

Permit Required

No person shall install, add to, modify, expand or repair a private wastewater system without a valid permit.

Permit Fees

New Installations	\$100.00
Repair of Existing System	\$ 50.00

Application Process

1. Prior to the issuance of a construction permit for the installation of a new wastewater disposal system, the applicant must submit two (2) copies of a design plan proposal prepared by a Missouri Licensed Professional Engineer.
2. The design will be reviewed for compliance to current county regulations.
3. Upon receipt of a design plan and site plan meeting those regulations, a site evaluation will be conducted. If corrections/revisions are required, a review report will be returned indicating the items needing to be addressed, and then resubmitted with those corrections.
4. Applicant or agent must request an inspection of the installation a minimum of 8 working hours in advance.

Permits are taken Monday through Friday, 8:00a—4:00p

****Payment is due at time of application****

303 West Walnut, Independence, Missouri 64050

816-881-4530

JACKSON COUNTY GREEN BUILD PERMIT PROGRAM

GREEN BUILD PERMIT POINTS SYSTEM

The Points System for the Jackson County Green Build Permit Program has been developed to offer builders, homeowners, and municipalities a tool to assess how environmentally friendly or “green” a home is. The system is based on the various green features incorporated into the home. A home design that has earned **50 points or more** across the 3 main categories—Indoor Air Quality, Energy Efficiency and Resource Efficiency—can be considered a “green” home and eligible for certain permitting rebates.

There are 4 levels of certification that can be reached: Green, Silver, Gold, Platinum. A total of 332 points across the 3 main categories are available, although 50 points is the very minimum number required to reach “green” certification. Please refer to the tables below for the points needed for each level of certification, and the points per category. Following these tables are more comprehensive descriptions on how to achieve the points for each specified item.

GREEN	SILVER	GOLD	PLATINUM
50+ points	70+ points	125+ points	180+ points
15% Rebate	25% Rebate	35% Rebate	50% Rebate

POINTS PER CATEGORY	Resources	Energy	IAQ/Health
A. Site			
1. Recycle job site construction & demolition waste 50% recycling rate is required: 65%=1 point; 75%=2 pts; 80%=4 pts Documentation required: receipt from recycling facility; amount of recycled vs. waste material in lbs., etc.	Up to 4		
2. Donate unused materials Documentation required: itemized receipt from recognized donation center.	4		
3. Protect native soil	2		
4. Minimize disruption of existing plants and trees	1		
5. Implement construction site stormwater practices	2		
6. Protect water quality with landscape design	2		
7. Design resource-efficient landscapes	4		
8. Reuse materials/use recycled content materials for landscape	2		
9. Install high-efficiency irrigation systems	2		
10. Provide for on-site water catchment/retention	2		
Available Points	25	0	0

POINTS PER CATEGORY	Resources	Energy	IAQ/Health
B. Foundation			
1. Incorporate recycled flyash in concrete 15% recycled flyash=2 pts; add 1 pt for every 10% increase, up to 5 pts Documentation of flyash purchase and usage required.	Up to 5		
2. Reuse form boards	1		
3. Use aluminum forms	3		
4. Use recycled content aggregate	2		
5. Insulate foundation/slab before backfill		3	
6. Install rigid foam, insulated concrete forms (ICF)		3	
Available Points	11	6	0
C. Structural Frame			
1. Substitute solid sawn lumber with engineered lumber a. Floors b. Headers (non structural) c. Structural beams and headers	1 1 1		
2. Use FSC certified wood for framing (for every 10% of FSC lumber used = 2 points, up to 10) <i>documentation required</i>	Up to 10		
3. Use wood I-joists for floors and ceilings	2		
4. Use steel interior web trusses	2		
5. Design energy heels on trusses		2	
6. Use OSB a. Subfloors b. Sheathing	1 1		
7. Use finger-jointed studs for non structural vertical applications	2		
8. Use engineered studs for vertical applications	2		
9. Use recycled content steel studs for interior framing <i>documentation required</i>	2		
10. Use structural insulated panels (SIPs) a. Floors b. Walls c. Roof		3 3 3	
11. Apply advanced framing techniques	4		
12. Use reclaimed lumber for non-structural applications	3		
Available Points	32	11	0

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POINTS PER CATEGORY	Resources	Energy	IAQ/Health
D. Exterior Finish			
1. Use sustainable decking materials— <i>documentation required</i> a. Recycled content b. FSC certified wood—	3 3		
2. Use non-CCA treated wood— <i>documentation required</i>			1
3. Install house wrap under siding			1
4. Use alternative siding materials a. Recycled content b. Fiber-cement	1 3		
Available Points	10		2
E. Plumbing			
1. Insulate all hot water pipes		2	
2. Install flow reducers a. Faucets (1 pt each, up to 2 points) b. Showerheads (1 pt each, up to 2 pts)	2 2		
3. Install ultra-low flush toilets (1 pt each, up to 4 pts)	Up to 4		
4. Install chlorine filter on showerhead			4
5. Install tankless water heater		2	
6. Pre-plumb for graywater conversion (check Jackson County code)	4		
7. Install water filtration units at drinking water faucets (2 pts each, up to 4 pts)			Up to 4
8. Install on-demand hot water circulation pump	4		
Available Points	16	4	8
F. Electrical			
1. Install compact fluorescent bulbs—CFL's (6 bulbs=2 pts; 12=4 pts; up to 4 pts)		Up to 4	
2. Install air-tight, insulation-compatible recessed fixtures for CFL's (1 point each, up to 5 pts)		Up to 5	
3. Install lighting controls (1 pt per fixture, up to 4 pts)		Up to 4	
4. Install high efficiency ceiling fans with CFLs (1 pt each, up to 4 pts)		Up to 4	
Available Points		17	

POINTS PER CATEGORY	Resources	Energy	IAQ/Health
G. Appliances			
1. Install Energy Star dishwasher		1	
2. Install horizontal axis washing machine		1	
3. Install Energy Star refrigerator		1	
4. Install built-in recycling center	3		
Available Points	3	3	
H. Insulation			
1. Upgrade insulation to exceed Title 24 requirements a. Walls b. Ceilings		2 2	
2. Install recycled content, formaldehyde-free fiberglass insulation <i>Documentation required</i>			3
3. Use advanced infiltration reduction practices		2	
4. Use cellulose insulation a. Walls b. Ceilings	4 4		
Available Points	8	6	3
I. Windows			
1. Install energy-efficient windows a. Double-paned b. Triple-paned c. Low-emissivity (Low-E) d. Low conductivity frames		1 3 2 2	
Available Points		8	
J. Heating, Ventilation and Air Conditioning (HVAC)			
1. Use duct mastic on all duct joints		1	
2. Install ductwork within conditioned space		3	
3. Vent range hood to the outside			1
4. Clean all ducts before occupancy			2
5. Install attic ventilation system		2	
6. Install whole house fan		4	

JACKSON COUNTY GREEN BUILD PERMIT PROGRAM

POINTS PER CATEGORY	Resources	Energy	IAQ/Health
HVAC Continued...			
7. Install sealed combustion units a. Furnaces b. Water heaters			3 3
8. Install 14 SEER/11 EER or higher AC with a TXV <i>Documentation required.</i>		3	
9. Install AC with non-HCFC refrigerants	2		
10. Install 90% annual fuel utilization efficiency (AFUE) furnace		2	
11. Eliminate wood burning fireplaces			1
12. Install zoned, hydronic radiant heating		3	
13. Install heat recovery ventilation unit (HRV)		5	3
14. Install high efficiency particulate air (HEPA) filter			4
15. Install separate garage exhaust fan			3
Available Points	2	23	20
K. Renewable Energy and Roofing			
1. Pre-plumb for solar water heating		4	
2. Install solar water heating system		10	
3. Pre-wire for future photovoltaic (PV) installation		4	
4. Install PV panels (1.2kw=6 pts; 2.4kw=12 pts; 3.6kw=18 pts)		Up to 18	
5. Install solar (PV) walkway lights		4	
6. Install radiant barrier roof sheathing		3	
7. Install 20-year roofing <i>Documentation required</i>		1	
Available Points		44	
L. Natural Heating and Cooling			
1. Incorporate passive solar heating		5	
2. Install overhangs or awnings on south facing windows (24 inch min.)		3	
3. Plant deciduous trees on the east, west and south sides		3	
Available Points		11	

POINTS PER CATEGORY	Resources	Energy	IAQ/Health
M. Indoor Air Quality and Finishes			
1. Install whole house vacuum system			3
2. Use low/no VOC paint			1
3. Use low VOC, water-based wood finishes			2
4. Use solvent-free adhesives			3
5. Substitute particleboard with formaldehyde-free materials			6
6. Use exterior grade plywood for interior uses			1
7. Use formaldehyde-free MDF and materials <i>Documentation required.</i>			4
8. Seal all exposed particleboard or MDF			4
9. Use FSC certified wood for interior finish <i>Documentation required.</i>			4
10. Use finger-jointed or recycled content trim	1		
TOTAL POINTS ACHIEVED	1		28
N. Flooring			
1. Select FSC certified wood flooring <i>Documentation required.</i>	8		
2. Use rapidly renewable flooring materials	4		
3. Use recycled content ceramic tiles	4		
4. Install natural linoleum or cork in place of vinyl			5
5. Use exposed concrete as finished floor	4		
6. Install recycled content carpet with low VOCs <i>Documentation required.</i>	4		
Available Points	24		5
OTHER			
1. Incorporate listing of green features into cover of blueprints	1		
2. Develop homeowner manual of green feature/benefits	1		
3. Offer coupons for compost & recycle bins to homeowners	1		

JACKSON COUNTY GREEN BUILD PERMIT PROGRAM

MINIMUM OF 50 TOTAL POINTS	Resources	Energy	IAQ/Health	Total
TOTAL points available	132	133	66	331
Points REQUIRED from each category	10	10	10	30
Additional Points needed from any category				20

*Project must acquire a minimum of 50 points. 10 points must be acquired for each category. Additional 20 points can be acquired by incorporating any green features listed to reach a total (minimum) of 50 points for GREEN certification.

NOTE: A detailed description and application of each item for each category can be found in the “Methods and Materials” Section following....



III. METHODS & MATERIALS

Every green feature listed in the Guidelines benefits the builder, homebuyer and the environment. This section lists each feature, describes the conditions under which it should be used, and the benefits. Identify the features you have incorporated into your homes and use the benefits to help sell the new “green” home!

COMMUNITY DESIGN IDEAS

The following measures should be considered in the initial site planning and community design stages of new home developments. By considering issues such as lot orientation, stormwater management, access to transit, and minimizing street widths early on, many environmental benefits can be accrued at later stages of the project.

The following is a list of approaches that should be considered in the first stages of community design:

1. Orient homes on an East/West axis for solar access.
2. Orient Living Rooms and porches to streets and public spaces
3. Build mixed-use, residential/commercial, walkable communities
4. Design for diverse family types
5. Provide “granny flats” above garages (Residential space of 1,000 sf max.)
6. Build within 1 mile of public transit hub
7. Minimize street widths
8. Locate or cluster buildings to preserve open space and wildlife habitat, especially sensitive areas such as wetlands.

Description:

Construction waste generally consists of wood, dry-wall, metals, concrete, dirt and cardboard—materials that can be reused or recycled if prepared properly.

Application:

Identify the types and quantities of materials generated on the job site and recycle at least 50% of the construction/demolition debris. Contact local recycling facilities and haulers to identify terms and conditions required for recycling materials. Allocate space for recycling bins and containers. Call Bridging the Gap at 816-561-1087 for more info.

Benefit:

Recycling reduces pressure on landfills, saves money by reducing tipping fees, and provides raw materials for future building products.

2. Donate Unused Materials

Description:

Unused or salvaged materials such as surplus wood, windows, doors and other uninstalled materials can be donated to organizations such as Habitat for Humanity (www.habitatkc.org or 816-924-1096) or other programs.

SITE

1. Recycle Job site Construction & Demolition Waste



Applications:

Materials should be clean and in good condition.

Benefit:

Donating unused materials reduces landfill deposits and helps local charitable organizations. Donations may be tax deductible.

3. Protect Native Soil

Description:

Typically, a building site is cleared of vegetation and the topsoil is removed. After building, sod is laid on subsoil, beginning a cycle of high water and chemical dependency. Ideally, construction is coordinated with a landscape professional to protect the soil, which is a valuable, living resource.

Applications:

Design for minimum building and hardscape footprints and little or no grading. Retain native vegetation. Delineate and limit the construction footprint; restrict heavy equipment that compacts soil, including cars, to areas that will be paved over. When grading is unavoidable, identify areas to be paved as a place to store native topsoil during construction. Amend soil with compost and respread topsoil after construction.

Benefits:

Preserving native soils, along with nurturing the health of disturbed soils, can significantly reduce storm runoff, reduce fertilizer and pesticide requirements, improve water quality, and conserve irrigation water.

4. Minimize Disruption of Existing Plants & Trees

Description:

Through careful planning and construction practices, valuable trees and plants can be preserved

and incorporated into new developments and neighborhoods.

Applications:

Complete a landscape survey to determine the feasibility of preserving or relocating mature trees and shrubs. Fence trees and shrubs for protection from equipment.

Benefits:

Preserving existing, mature landscape features helps prevent soil erosion, maintains existing sources of natural cooling (e.g. shade from a tree), diverts waste from landfills, and adds a unique character to the community.

5. Implement Construction Site Stormwater Practices

Description:

Stormwater runoff is part of a natural hydrologic process. However, land development and construction activities can significantly alter natural drainage patterns and pollute stormwater runoff.

Applications:

Identify all storm drains, drainage swales and creeks located near the construction site, and make sure all subcontractors are aware of their locations to prevent pollutants from entering them.

Train employees not to dump anything down storm drains. Protect all storm drain inlets using filter fabric cloth to prevent sediments from entering the storm drainage system during construction activities. Keep materials out of the rain, and prevent runoff pollution at the source. Store hazardous waste in drums and covered bins and contract a company to dispose of it properly.

Benefits:

Properly managing a gallon of water on site saves money in avoided engineering costs downstream. Keeping pollutants out of the storm drains minimizes erosion and water pollution and protects local creeks and reservoirs.

6. Protect Water Quality with Landscape Design

Description:

Designing landscapes to allow irrigation and storm-water to soak into the soil recharges groundwater systems and filters out pollutants.

Application:

Use permeable paving, which allows water to percolate into the soil, for walkways, patios, and driveways. Install like conventional pavers. Minimize roadway width and avoid contiguous impermeable surfaces. Design infiltration basins and berms.

Permeable Pavers

**Benefits:**

Allowing stormwater percolation reduces the volume of polluted water that flows into rivers and creeks, while replenishing soil moisture and local aquifers. Additional benefits include reduction in irrigation requirements, non-source pollution, as well as lower risk for flooding.

7. Design Resource-Efficient Landscapes and Gardens

Description:

Conventional landscapes have high inputs of water and chemicals and are often over planted or planted without regard for climate and soil conditions. This results in excess water and fuel consumption, water pollution and waste generation.

Application:

Specify plants that are appropriate for the climate and soil; select slow-growing, drought tolerant, preferably native plants. Design with perennials instead of annuals; choose and site trees to reduce building heating and cooling energy. Give plants plenty of room to mature, reducing the need for pruning. Avoid invasive species and hedges that require constant shearing. Limit turf to the smallest area that will meet recreational needs. Recycle yard trimmings by grasscycling, mulching and composting.

Benefit:

Sustainable landscape techniques are in harmony with the local environment and help conserve water, reduce use of chemicals, create healthier soil and plants, and increase biodiversity in landscape.

8. Reuse Materials or Use Recycled Content Materials for Landscape Areas.

Description:

Plastic or composite lumber makes a very durable landscape edging, broken concrete can make a very attractive retaining wall or path, and ground glass cullet can be used for walkways.

Application:

Use salvaged or recycled content materials for hard-scapes (patios, decks and driveways) and other landscape structures.

Benefit:

The durability of plastic or composite lumber is greater than wood as they do not rot, crack or splinter. Salvaging or buying recycled content landscaping products conserves natural resources and strengthens markets for recycled materials.

9. Install High-Efficiency Irrigation Systems

Description:

New irrigation technologies apply water to the soil at the plant root zones at the rate the soil can absorb it, significantly reducing water waste from overspray.



Application:

Install low-flow drip, sub-surface drip, or low-flow sprinklers in place of standard sprinkler systems for all landscape applications. Base watering levels on moisture sensors or weather based controllers. Use captured rainwater. Group plants by water requirements.

Benefit:

High-efficiency irrigation systems dramatically reduce landscape water use, and are critical to preventing disease and minimizing weed growth.

10. Provide for On-Site Water Catchment/Retention

Description:

Rainwater is channeled through gutters and downspouts to an aboveground cistern or underground gravel dry well. Stored water is used for landscape irrigation.

Application:

Install wherever there is guttered roof runoff and room for the cistern.

Benefit:

Water catchment reduces the need to use drinking water for irrigation of lawns and gardens.

FOUNDATION

1. Incorporate Recycled Flyash in Concrete

Description:

Flyash is a byproduct of coal burning power plants and can be an inexpensive substitute for a portion of cement used in concrete.

Application:

Typically, 15-50% of cement can be replaced with flyash in residential concrete mixes, however it must be cured longer than standard concrete.

Benefit:

Flyash increases the strength and durability of the concrete. Using flyash also reduces the amount of cement needed, thereby decreasing the overall environmental impacts of cement production.

2. Reuse Form Boards

Description:

Form boards are often 2x10 or larger solid sawn lumber typically cut from old-growth trees.

Application:

Forms are used whenever concrete is poured. By carefully removing and separating the forms, they can be reused several times.

Benefit:

Reuse of forms saves money and conserves resources. Solid sawn lumber is becoming increasingly expensive and scarce.

3. Use Aluminum Forms

Description:

Aluminum forms come in all sizes and shapes and produce a smooth finished surface on the concrete. They can be used repeatedly.

Application:

Aluminum forms can be used in most applications to replace wood forms.

Benefit:

Because they can be reused many times, aluminum forms reduce wood use and, despite higher initial cost, pay for themselves quickly.

4. Use Recycled Content Aggregate

Description:

Recycled aggregate consists mainly of crushed concrete and asphalt pavement. Most of the recycled material is used as base material for road projects.

Benefit:

Even though a large percentage of asphalt and concrete are recycled, there is still some that end up in landfills. Using recycled instead of virgin materials saves money, natural resources and energy.



5. Insulate Foundation/Slab Before Backfill

Description:

All foundations, including slab floors, can be insulated to reduce heat loss.

Application:

Insulate foundation with extruded polystyrene insulation of at least R-4 (1" or greater).

Benefit:

Insulating the foundation minimizes heat loss from the floors and basement, reduces energy loss, and therefore reduces utility bills.

6. Use Rigid Foam, Insulated Concrete Forms (ICFs)

Description:

Rigid foam forming systems hold concrete in place during curing and remain in place afterwards to serve as thermal insulation for concrete walls.

Application:

Use rigid foam forming systems wherever an insulated foundation is desirable.

Benefit:

Unlike untreated lumber, ICFs are not subject to rot, deter pests such as woodworms, termites and mice, and result in a better insulated foundation.

STRUCTURAL FRAME

1. Substitute Solid Sawn Lumber with Engineered Wood

Description:

Solid sawn lumber in sizes of 2x10 or greater typically comes from old-growth forests. Engineered lumber products, on the other hand, come from small-diameter and fast growing plantation trees. These products include glulams, laminated veneer lumber, wood I-joists, oriented strand board, parallel strand lumber, and other manufactured wood fiber structural materials.

Application:

A. FLOOR JOIST

2x10 and larger lumber are typically used for floor and ceiling joists and some seismic applications. Large size lumber can be replaced with engineered lumber in most applications unless required by seismic codes.

B. NON-LOAD BEARING HEADER

Solid-sawn 4x6 are often used for headers when smaller dimension lumber would suffice, such as double 2x6.

C. STRUCTURAL HEADERS & BEAMS

Engineered lumber should be used whenever structural members are required. They substitute for 4x12 in most interior applications such as the structural framing of floors, walls and roofs.



Benefit:

Reducing demand for large dimensional lumber decreases pressure to cut down old-growth trees. Engineered lumber uses wood fiber more efficiently than conventional lumber, resulting in stronger and higher quality homes.

2. Use Forest Stewardship Council (FSC) Certified Wood for Framing

Description:

FSC certification assures that the forest from which the wood is produced is managed in a sustainable and socially responsible manner.

Application:

Use FSC wood where solid wood framing is required. Certified framing materials and plywood are available at many local suppliers.

Benefit:

FSC certification guarantees that forests are managed in a way that will assure the long-term availability of precious woods while protecting old-growth forests.

3. Use Wood I-Joists for Floors & Ceilings

Description:

Wood I-joists are engineered to use only the wood fiber necessary for the structural function required. They typically use oriented strand board (OSB) for the web and either laminated veneer lumber or solid sawn lumber for the chords (top and bottom pieces).

Application:

Replace solid sawn lumber with wood I-joists for floor and ceiling joists. Often they can be used at 19.2" centers to save materials.

Benefit:

Wood I-joists use 50% less wood fiber to perform the same structural function as similar sized solid sawn lumber and will never twist, warp, or split. They are stronger and lighter than 2x10 or 2x12 and can span greater distances.

Application:

Use primarily for long-span floor joists.

Benefit:

Web trusses eliminate waste since they are made to order. They reduce the pressure on old growth forests by replacing 2x10s and 2x12s traditionally used in floor joists.

5. Design Energy Heels on Trusses 6" or more

Description:

Energy heels raise the height of the truss at the exterior wall top plates to accommodate increased insulation at the perimeter of the house.

Application:

Install where conventional trusses are used. They need to be specially ordered. The increased height may require modifications to exterior soffit and trim details.

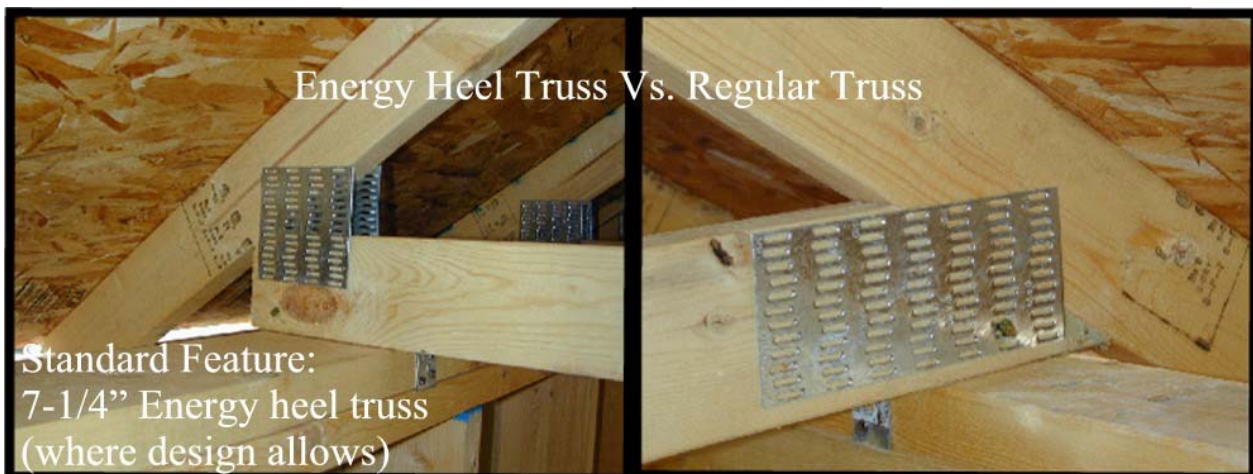
Benefit:

The perimeter intersection between walls and roof framing is often an area of increased heat loss since conventional trusses reduce insulation to less than 6". Raising the heels allows for full insulation around the house, saving energy and money.

4. Use Steel Interior Web Trusses

Description:

Steel web trusses use wood or laminated veneer lumber top and bottom chords that are connected by steel webbing for structural integrity.



6. Use Oriented Strand Board (OSB) for Sub-floor and Sheathing

Description:

OSB is manufactured from fast growing farm trees and comes in sheets.



Application:

Use OSB as an alternative to plywood for sheathing or sub-floors.

Benefit:

OSB is as strong as traditional plywood sheet material and is less expensive. OSB reduces the need for large diameter old-growth trees required for plywood. Some OSB uses lower formaldehyde content adhesives.

7. Use Finger-Jointed Studs

Description:

Finger-jointed studs use short pieces of 2x4 material glued together to form standard stud lengths.

Application:

Use finger-jointed studs wherever conventional studs are typically used, in vertical applications. Use may require code approval by your local jurisdiction, and may need to be submitted to the structural engineer of record for approval.

Benefit:

Finger-jointed studs reduce the use of solid sawn wood studs. They are straighter and stronger than solid sawn studs, eliminating crooked walls and reducing material waste.

8. Use Engineered Studs for Vertical Applications

Description:

Engineered studs are laminates, like OSB, that are used in structural applications.

Application:

Use for interior or exterior wall applications except where prohibited by seismic codes. They are particularly appropriate for tall cathedral wall applications.

Benefit:

Engineered studs are straighter than conventional studs and will not deform, twist, split or warp. They save wood by using small laminated pieces.

9. Use Recycled-Content Steel Studs for Interior Framing

Description:

Steel studs can be either stand-alone, or provide a "C" channel over wood studs. Steel often contains 75% or higher recycled content.

Application:

For use in non-insulated interior walls.

Benefit:

Steel reduces the need for wood and provides strong interior walls.

10. Use Structural Insulated Panels (SIPs) for Walls and Roof.

Description:

SIPs are high-performance, load-bearing sheets that consist of a core of foam insulation with OSB on either side. SIPs can be used for floors, walls and roofs in residential buildings.

Applications:

Use SIPs for structural exterior walls and roofs in place of stick framing. Note: it is important to seal the joists well, to avoid water penetration.

Benefit:

SIPs are more energy-efficient, provide excellent soundproofing, and reduce infiltration relative to frame construction. They can be erected quickly, allowing for faster construction. They save wood by eliminating much of the conventional framing lumber.

11. Apply Advanced Framing Techniques

Description:

Advanced framing involves framing exterior and interior walls 24" on center.

Application:

Framing on 24" centers can replace most conventional 16" on center framing. The expanded centers may reduce some types of siding options. Advanced framing may also include stacking trusses over studs and using drywall clips.

Benefit:

Expanding centers makes the home more energy efficient while saving wood and construction costs. It also allows for a higher percentage of the wall to be insulated, reducing frame conduction heat loss.

12. Use Reclaimed Lumber

Description:

High quality dimensional lumber in long lengths can often be salvaged from old buildings that are being deconstructed or salvaged.

Application:

Use reclaimed lumber for non-structural applications, in place of new material.

Benefit:

Reclaimed lumber reduces resource consumption and landfill deposits. Reclaimed lumber is often of higher quality than new lumber.

EXTERIOR FINISH

1. Use Sustainable Decking Materials

A. Recycled Content Decking

Description:

There are two types of recycled content decking: plastic lumber and composite lumber. Recycled plastic lumber contains only recycled plastic resins, while composite lumber is made by combining recycled wood fiber and recycled plastic resins.

Application:

Use recycled content decking in all non-structural deck applications. Both products can be used in place of old-growth redwood, cedar, and pressure treated pine. These products accept



screws and nails, and cut like wood. Follow manufacturer recommendations closely regarding the amount of expansion that will occur when using plastic lumber.

Benefit:

The durability of these materials is greater than wood. They will not rot, splinter or crack, do not require staining, and are not treated with potentially hazardous chemicals. Using recycled content decking also reduces pressure on old-growth forests.

B. Forest Stewardship Council (FSC) Certified Wood Decking.

Description:

Certified, sustainably harvested lumber comes from forests managed in an environmentally and socially responsible manner.

Application:

Use FSC certified lumber for all exterior decking applications or as structural deck members in conjunction with recycled content decking.

Benefit:

FSC certification guarantees that forests are managed in a way that will assure long-term availability of precious woods while preserving old growth forests.

2. Use Treated Wood that Does Not Contain Chromium or Arsenic for Decking and Sill Plates.

Description:

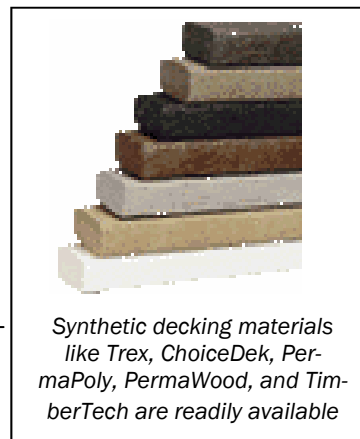
TimberSil and Wolman Natural Select are alternative treated woods that do not contain chromium—a heavy metal—and arsenic, which are detrimental to human health.

Application:

Use non-chromium/arsenic treated wood for any application that specifies treated lumber including decking, fencing, sill plates, and site furnishings.

Benefit:

TimberSil and Wolman are a better alternative to lumber treated with Chromium and arsenic, particularly for children who play on or near decks. TimberSil uses glass encased wood fiber which is inert, dry, lightweight, stainable, bugproof, and fire resistant. www.timbersil.com



3. Install House Wrap Under Siding

Description:

House wrap protects the sheathing from moisture and allows vapor from inside to escape.

Application:

Install house wrap according to manufacturer's specifications over all sheathing before exterior finish is installed. To provide an effective drainage plane for water, it needs to be lapped and edges should be taped with manufacturer's tape. Special products have been developed for wrapping window and door opening and for stucco applications.

Benefit:

House wrap provides a continuous drainage plane that diverts water away from openings and protects the home from mold. It can also help reduce moisture build-up in stud cavities by allowing water vapor to migrate through the material.

4. Use Alternative Siding Materials

A. Use Recycled Content Siding

Description:

Recycled content siding is often called hardboard. Hardboard includes varying amounts of recycled content materials and looks and performs like wood siding.

Application:

Use hardboard where wood siding is installed.

Benefit:

Siding that has been manufactured with recycled wood fiber will not crack, split, or warp, and hold paint longer than solid wood siding, therefore reducing maintenance costs and resources.

B. Use Fiber-Cement Exterior Siding

Description:

Fiber-cement siding is composed of cement, sand, and cellulose fibers. It is usually textured to look like wood siding or stucco finish.

Application:

Fiber-cement siding can be cut with a carbide or diamond-tipped saw blade, snapper shears, or with a guillotine cutter. Dust protection and control are required when cutting with a circular saw.

Benefit:

Fiber-cement siding is more durable than wood, termite resistant, non-combustible, and warranted to last 50 years. Using fiber-cement siding reduces the demand for old-growth redwood or cedar siding. It may also reduce the homeowner's insurance rates due to fire resistance.

PLUMBING

1. Insulate Hot Water Pipes

Description:

Insulating water pipes reduces heat loss or gain in the pipes while water is standing.

Application:

Insulate hot water pipes in all runs through unconditioned spaces: basements, crawl spaces, attics, etc. At a minimum, insulate both hot and cold pipes at least 6 feet from the hot water heater to prevent convective circulation from the heater through the pipes.

Benefit:

Insulated pipes save energy and water. The water does not need to run as long to get hot water to a distant faucet, thereby reducing hot water heating costs.

Survey Says...

In terms of resource-conserving features, consumers' top choices were:

Water-saving washers and dishwashers 84%

Water conserving faucets and fixtures 64%

Recycled content decking 63%

Engineered lumber 62%

Source: The State of Green Building 2001

2. Install Flow Reducers in Faucets and Showers

Description:

Flow reducers fit into the aerator at the tip of the faucet and reduce the rate of water flow through the faucet. Low-flow showerheads replace standard showerheads.

Application:

Specify low-flow water conservation devices according to the following recommendations:

- ◇ Kitchen faucets ≤2.0 gpm
- ◇ Bathroom faucets ≤1.5 gpm
- ◇ Showerheads ≤2.5 gpm

Limit showerheads to one head per shower.

Benefit:

Flow reducers can cut water usage of faucets and showers by as much as 40% with little noticeable effect.

3. Install Ultra-Low-Flush Toilets**Description:**

New high-efficiency toilets use 1.6 gpf or less. Some manufacturers offer dual flush toilets.

Benefit:

Ultra-low-flush toilets reduce the amount of water usage.

4. Install Chlorine Filter on Showerheads**Description:**

Water filters on showerheads reduce chemicals and particulates from the water stream.

Application:

Install the water filter between the pipe and existing showerhead.

Benefit:

Chlorine is absorbed 6 times faster through the skin than through the digestive system. It has been shown that chlorine absorption can have adverse effects on some people, especially children.

5. Install Tankless Water Heater**Description:**

Tankless water heaters (flash or on-demand heaters) heat water as needed rather than having a tank in which hot water is stored. Their capacity to provide hot water is virtually unlimited.

Application:

Install tankless water heater as close to the point of use as possible. The device should have a variable set thermostat and be appropriately sized. Gas tankless water heaters typically have more capacity than electric tankless heaters.

Benefit:

Conventional water heaters lose 15% of their energy through standing tank losses, whereas tankless heaters use energy only for immediate hot water needs. Tankless water heaters often are quicker and more reliable.

6. Pre-Plumb for Graywater Conversion**Description:**

Graywater is wastewater from sinks, showers, and washing machines that is not contaminated by human waste.

Application:

Graywater plumbing separates the waste pipes from sinks, showers, and washing machines from the toilet waste. Graywater drains are run to a holding tank similar to a septic tank which, in turn, is used to water plants, lawns and gardens. Check with you County Building Official for requirements.

Benefit:

Graywater utilization cuts down on the use of potable water for outside irrigation and lawn watering. It is essentially recycling water at home.

7. Install Water Filtration Units at Faucets

Description:

Water filtration units can be installed at individual faucets or for the whole house. They reduce chlorine and many other chemicals, particulates and microorganisms.

Application:

Whole house filters are for drinking water and plumbing (not for hosebibs or toilets). Install filtration system between the cold water line and the main drinking water faucets in the house.



Benefit:

Agricultural runoff, chemical leaching and microorganisms increasingly contaminate public water systems across the country. House filtration systems reduce the health threat of these contaminants.

8. Install On-Demand Hot Water Circulation Pump

Description:

An on-demand hot water circulation pump can send hot water to fixtures in seconds, without wasting water while waiting for it to get hot. It uses a pump to rapidly move water from a water heater to fixtures. It stops when water reaches a pre-set temperature.

Application:

Install the pump at the furthest faucet from the water heater. Only one pump is needed to supply hot water to any fixture and can easily be installed.

Benefit:

Both water and energy are saved since water doesn't have to be wasted until it reaches the correct temperature for use. Hot water arrives to the fixture 5 times faster than on average.

ELECTRICAL

1. Install Compact Fluorescent Light Bulbs (CFLs)

Description:

CFLs screw in like conventional bulbs but consume up to one-fourth of the electricity used by incandescent bulbs to produce an equivalent amount of light.

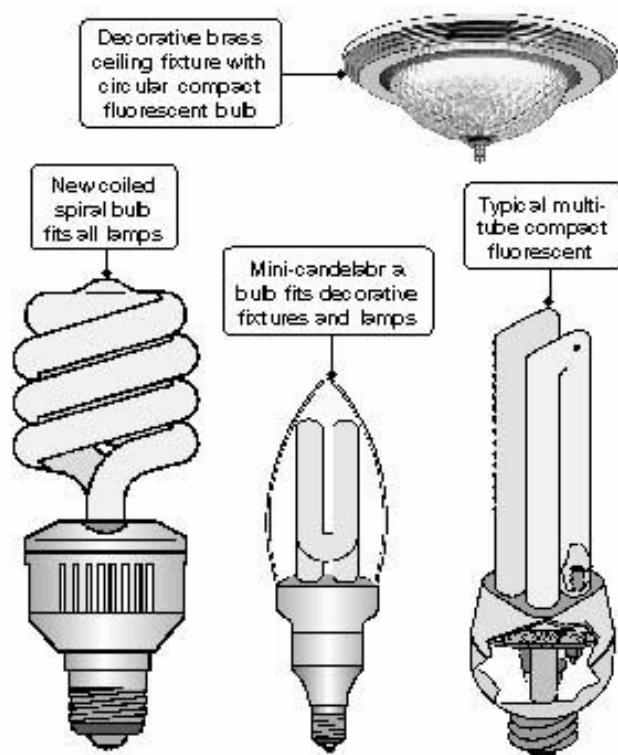
Application:

Install CFLs in place of standard incandescent bulbs. CFLs are not recommended for fixtures that are turned on and off many times per day, i.e. a busy bathroom. Choose a CFL that is one-fourth the wattage of the incandescent bulb.

Benefit:

Compact fluorescent bulbs are a profitable investment, saving several times their purchase price through reduced electricity bills and fewer replacement bulbs because they last 8 times longer.

2. Install Insulation-Compatible (IC) Recessed lighting fixtures for CFLs



Existing Incandescent Lamp	Proposed ENERGY STAR Compact Fluorescent Bulb	Savings over the life of the bulb
40–60 watts	11–15 watts	\$22–\$35
75 watts	16–20 watts	\$43+
90–100 watts	23–40 watts	\$52+

Description:

Conventional recessed fixtures allow heat to be exhausted into the attic space. Air-tight IC fixtures are sealed, allowing insulation to be blown on top to keep the heat in.

Benefit:

Typical recessed fixtures lose heat as well as allow hot attic air to infiltrate into the house in summer months. Air-tight IC fixtures dramatically reduce the amount of heat loss/gain through these openings.

3. Install Lighting Controls

Description:

Lighting controls use dimmers, sensors and timers to turn lights off in unused areas or during times when lighting is not needed.

Application:

Install lighting controls either at specific locations or as a whole house system. Lighting controls are especially applicable for exterior uses. Dimmable CFLs are available at a premium.

Benefit:

Lighting controls reduce energy use by having the lights on for shorter periods of time.

4. Install High-Efficiency Ceiling Fans with Compact Fluorescent Lamps

Description:

Ceiling fans improve interior comfort by circulating cold and warm air. They can be adjusted to either draw warm air upward during summer months, or push it downward during the winter.

Application:

Preferable locations are bedrooms and living rooms where occupants spend time. Ceiling fans must be supported adequately between ceiling joists.

Benefit:

Ceiling fans can reduce the need for air conditioning and heating.

APPLIANCES

1. Offer ENERGY STAR® Dishwasher

Description:

Energy Star dishwashers use water and energy more efficiently.

Application:

Select Energy Star dishwashers—they use an internal water heater to boost temperatures inside the dishwasher. For this reason, water heaters can be turned down to 120 degrees, saving water heating costs.


Benefit:

Water efficient dishwashers are also energy efficient because most energy consumed by dishwashers is used to heat water.

2. Offer Horizontal Axis Washing Machine

Description:

Horizontal axis washing machines load from the front, spinning clothes in and out of the water to tumble them clean.



If all consumers, businesses and organizations in the U.S. chose Energy Star products over the next decade, the national energy bill would be reduced by about \$200 BILLION!

Application:

Select Energy Star horizontal axis washing machines.

Benefit:

Horizontal axis machines saving resources by using less water and energy. They use up to 40% less water and 50% less energy than conventional top loading washers, translating into lower energy and water bills. Manufacturers claim that there is less wear and tear on clothes compared to traditional machines.

3. Offer Energy Efficient Refrigerator

Description:

Refrigerators and freezers are among the largest users of electricity in most homes. They can account for up to 25% of household energy use. New appliances are much more efficient.

Application:

Select Energy Star rated refrigerators.

Benefit:

Energy Star refrigerators can save over 10% of the total annual electrical bill. Check with your local utility company for rebate programs.

4. Install Built-In Recycling Center

Description:

Built-in recycling centers provide bins for separated recyclables and food waste.

Application:

Recycling bins can be built into kitchen cabinets, as well as stand alone units in the garage.

Benefit:

A built-in recycling center keeps materials separated and free from contamination, making it easy and convenient to recycle.

INSULATION

1. Upgrade Wall and Ceiling Insulation to Exceed Local Code Requirements

Description:

Insulation in exterior walls and ceilings can reduce the demand for air conditioning and heating and make homes more comfortable.

Application:

Insulate walls to exceed minimum code requirements. At least 20% above code.

Benefit:

Increased wall and ceiling insulation improves comfort, decreases heating and cooling requirements, saves money, and makes the home quieter.

2. Install Recycled Content, Formaldehyde-Free Fiberglass Insulation

Description:

Many fiberglass insulation products include recycled glass, formaldehyde-free binders, non-asphalt adhesives or colored dyes.

Application:

When using fiberglass insulation, specify recycled content and no formaldehyde. Fiberglass insulation can be used for any typical insulation installation.

Benefit:

Formaldehyde-free binders reduce indoor air quality problems and insulation may contain up to 30% recycled glass.

3. Use Advanced Infiltration Reduction Practices

Description:

Expandable foam and caulk are used to prevent infiltration where wood connections are made or framing is drilled to provide for plumbing and electrical runs.

Application:

These methods are especially important when fiberglass insulation is installed, since fiberglass does little to reduce infiltration. Seal holes between floors and between stud cavities around wire runs. Caulk top and bottom plates on all floors.

Benefit:

Reduction in infiltration increases comfort and reduces energy bills.

4. Use Cellulose Insulation

A. WALLS

Description:

Cellulose is a highly effective insulation made out of recycled newspaper. Damp-blown spray cellulose wall insulation is mixed with low toxic binders to adhere to stud and joist cavity surfaces.

Application:

This installation is appropriate for new construction. Avoid damp-blown cellulose during wet months and install drywall only after testing for 25% (max) moisture content. Use boric acid treatment only; avoid ammonium sulfate treated cellulose insulation.

Benefit:

Spray insulation completely fills cavities and penetrations, thus reducing air infiltration. The binder in the insulation also reduces the air movement within wall cavities, reducing moisture intrusion and flame spread. Using cellulose insulation makes the home quieter and 20-40% more energy efficient.

B. CEILINGS

Description:

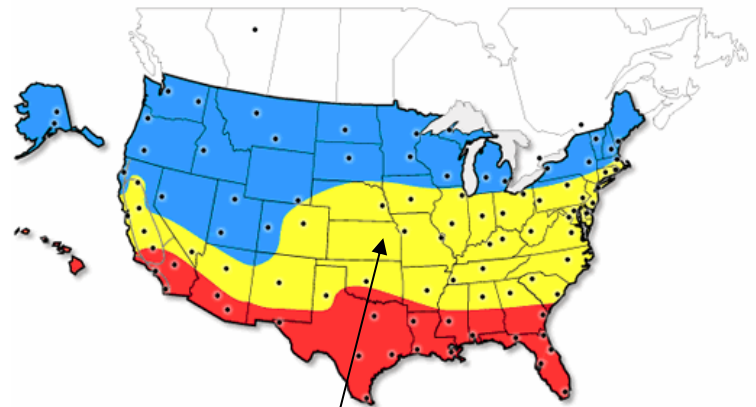
Dry-blown or loose-fill cellulose is treated with borates to fire and insect resistance. Cellulose does not contain formaldehyde, which is common in many fiberglass insulations.

Application:

Spread cellulose over ceiling joists or blow into tight cavities to increase ceiling R-value. It is important to maintain attic or ceiling ventilation pathways, especially in cathedral ceiling applications. Avoid excessive blown-in cellulose behind netting as it may make it difficult to achieve flat walls and ceilings with drywall. Best to use 5/8" drywall only over dry-blown cellulose insulation. Use boric acid treatment only; avoid ammonium sulfate treated cellulose.

Benefit:

Cellulose insulation is formaldehyde-free, provides up to 22-55% higher fire resistance, and is manufactured from recycled materials. It also reduces air leakage and contributes to a more comfortable and energy-efficient home.



REQUIREMENTS FOR ENERGY STAR WINDOWS

CENTRAL ZONE:
U-Factor = 0.40 or less
(0.45 or less for skylights)
SHGC = 0.55 or less

Application:

Install double- or triple-paned windows whenever possible.

Benefit:

High quality double-paned windows make the whole house quieter and more comfortable during all seasons, while saving energy and money.

WINDOWS

1. Install Energy-Efficient Windows

Windows play a big role in the energy efficiency of homes. In the summer, they can allow unwanted heat into the house, and in the winter, windows can account for as much as 25% of the heat loss. When selecting windows, look for models with the following energy saving features:

A. Double-Paned Windows

Description:

Double glazing insulates almost twice as well as single glazing.

B. Low-Emissivity (Low-E) Windows

Description:

Low-E coatings, virtually unnoticeable to the eye, are installed inside the air space of a double-paned window. The low-E coatings help prevent heat from escaping through the glass in winter, and block heat from entering the home in the summer.

Application:

Use low-E, double or triple-paned windows.

Benefit:

Low-E windows reflect heat, making the home more comfortable in cold weather and on hot summer days. The cost premium for low-E glass typically pays

for itself in a few years. Low-E, double paned glass coating increases glass R-value to 3 compared to R-1 for single-glazed windows.

C. Low-Conductivity Frames

Description:

Most window frames and sashes are made of wood, vinyl, fiberglass or aluminum. Wood, vinyl and fiberglass generally insulate better than aluminum frames.

Application:

Consider specifying wood windows as standard window packages.

Benefit:

Wood windows create greater comfort and better energy efficiency and are an environmentally preferable material.

HEATING, VENTILATION & AIR CONDITIONING (HVAC)

1. Use Duct Mastic on all Duct Joints

Description:

Leaks in the joints between ductwork allow conditioned air to escape into attics and basements. Duct tape loses its effectiveness in 3-5 years. Mastic maintains its seal for decades.

Application:

Install mastic at every duct joint and around the bends in elbows.

Benefit:

Leaky air ducts can cause negative pressure in the house which can allow carbon monoxide from gas water heaters and furnaces into the home. Well-sealed ductwork also keeps the house more comfortable and energy-efficient.

2. Install Ductwork within Conditioned Space

Description:

Ducts in exterior walls, attics and in uninsulated spaces lose a significant amount of heated or cooled air capacity.

Application:

All ductwork for heating or cooling should be run through conditioned space inside the insulated envelope. Duct runs require chases to be designed into the home from the beginning.

Benefit:

Locating ducts in the conditioned space significantly reduces energy loss and improves occupant comfort.

3. Vent Range Hood to the Outside

Description:

Steam, gasses, smoke and other combustion by-products (such as unburned hydrocarbons) can result from cooking. Stovetop range hoods expel these by-products to the outside.

Application:

Range hoods are particularly important for gas stoves and can be installed where stoves are adjacent to exterior walls.

Benefit:

Range hoods improve indoor air quality, prevent overheating and excess moisture build-up.

4. Clean all Ducts Before Occupancy

Description:

Debris and dust from construction can cause allergic reactions in occupants.

Application:

Clean or vacuum all ductwork before occupancy to eliminate dust. Clean ducts before carpet is laid and finishes are applied. Reduce dust build-up by temporarily blocking registers at time of duct installation.

Benefit:

Children are especially sensitive to micro particulates like drywall dust. Cleaning and vacuuming ductwork reduces dust around the house after occupancy.

5. Install Attic Ventilation Systems

Description:

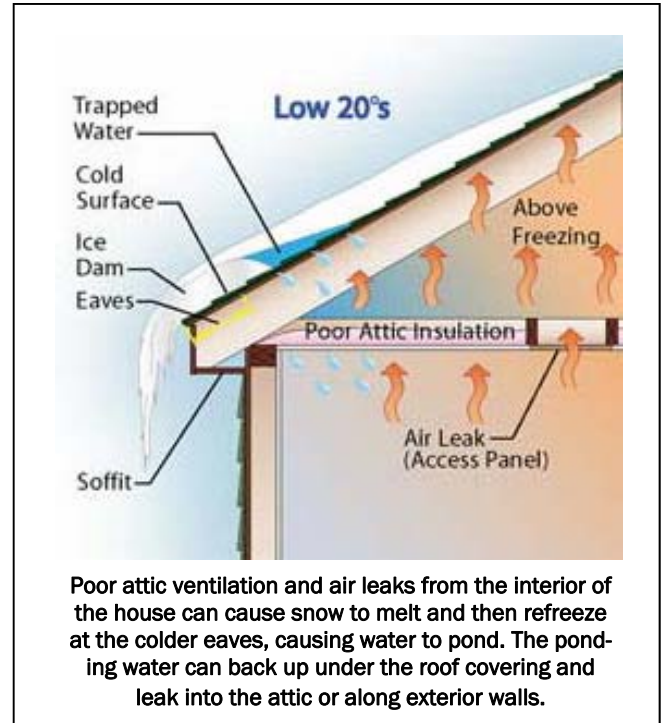
Soffit and eave ventilation and gable/continuous ridge ventilation exhausts excess heat and moisture from attic spaces by natural convection.

Application:

Install equal amounts of ventilation between the soffits/eaves and the gables/ridges. The code requirement of 1 square foot of net free area of ventilation for every 150 square feet of attic floor area should be doubled. Keep insulation from blocking the soffit vents.

Benefit:

Attics can reach 140-160 degrees on a hot summer day. That heat migrates into the house, exchanging air with the living space. Eave and soffit venting and continuous ridge venting increases comfort, reduces air conditioning costs and reduces problems associated with excess attic moisture.



6. Install a Whole House Fan

Description:

Whole house fans can cool a house without using an air conditioner by bringing in large volumes of fresh air at night.

Application:

The fan must be mounted in a hallway ceiling on the top floor. An insulated, airtight seal is necessary to prevent air leakage in winter. Fans should be sized to produce between 4-5 air changes per hour and should have two speeds: low speed for continuous ventilation, and high speed. Keep a window open at night to avoid backdrafting of carbon monoxide in gas appliance flues.

Benefit:

An average whole house fan uses one-tenth the electricity of air conditioning. Moving large volumes of air can achieve indoor comfort at higher temperatures without air conditioning.

7. Install Sealed Combustion Furnaces and Hot Water Heaters

Description:

Sealed combustion furnaces and water heaters duct fresh air directly into a sealed jacket around the combustion chamber eliminating the use of house air for combustion.

Application:

Install in place of conventional furnaces or hot water heaters.

Benefit:

Natural gas furnaces and hot water heaters use indoor air for combustion. When a negative pressure situation is created in the home by exhaust fans, dryers, or leaky ducts, carbon monoxide can be pulled into the house from the combustion chamber. Sealed furnaces and hot water heaters eliminate that condition, thereby improving indoor air quality and reducing the danger of carbon monoxide poisoning.

8. Install 14 SEER and 11 EER or Higher Air Conditioning with a Thermostatic Expansion Valve (TXV)

Description:

Air conditioning equipment is one of the greatest loads on power grids. SEER (Seasonal Energy Efficiency Ratio) measures cooling system efficiency at low temperatures while EER (Energy Efficiency Ratio) is a high temperature performance rating. The higher the SEER/EER value the less power is required to provide comfort. This assures that the air conditioning operates a high efficiency during the full range of summer temperatures. TXV is a refrigerant regulation device that can help ensure that the air conditioning system operates at maximum efficiency over a wide range of conditions.

Application:

Higher SEER (14-18) and EER (11+) units are in-

stalled like any other HVAC equipment. Some AC equipment comes with a factory installed TXV, and others accept a TXV that can be bolted on. Zoned AC systems allow multiple zones to be conditioned at different temperatures so only the spaces being used are cooled. Thermostats are required in each zone.

Benefit:

High SEER units save money and energy, and reduce peak load problems for utilities. High EER systems not only save money and energy but offer more cooling when you need it most. Installing AC systems with a TXV lowers utility bills and saves energy.

9. Install Air Conditioning with Non-HCFC Refrigerants

Description:

R-22 is an HCFC refrigerant used in residential heating and cooling systems. R-22 contains chlorine, which is an ozone-destroying chemical. In 2010, under the Clean Air Act, HVAC manufacturers can no longer produce new air conditioners using R-22.

Application:

Some new AC units already use the alternative to R-22 refrigerant, **R410A**, such as the trade brand Puron. Additional care should be taken when handling refrigerants.

Benefit:

Using alternatives to HCFC refrigerants eliminates depletion of the ozone layer in case of leakage during replacement.

10. Install 90% Annual Fuel Utilization Efficiency (AFUE) or Greater Furnace

Description:

High efficiency furnaces convert gas to heat with greater efficiency.

Application:

Install high efficiency furnace in place of conventional furnace. Installing the proper size of furnace for the home is just as important as its efficiency. Check with your local utility company for rebate information.

Benefit:

A properly sized, high-efficiency furnace costs less to operate. It saves natural resources, reduces air emissions and helps create a cleaner environment.

11. Eliminate Wood Burning Fireplaces

Description:

The burning of wood in fireplaces is a major source of air pollution during the winter months, generating up to 1/3 of the particulate matter on cold evenings.

Application:

Install EPA certified wood stoves, fireplace inserts, pellet stoves or natural gas units. These units should have outside combustion air vented directly into the insert or unit.

Benefit:

The amount of pollutant particulate matter will be reduced significantly compared to that of a standard wood burning fireplace.

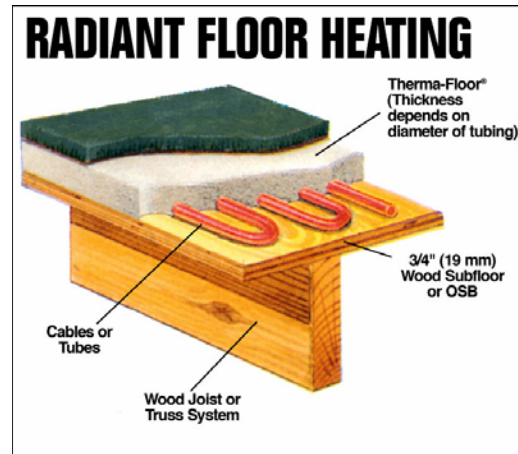
12. Install Zoned, Hydronic, Radiant Heating

Description:

Hydronic heating forces hot water through radiators located in different areas or zones throughout the house. It is typically installed as baseboards or in floors.

Application:

Use hydronic, radiant heating instead of forced air heating. The system must be designed before construction starts.



Benefit:

Hydronic heating is more comfortable and saves energy by heating only the zone that requires heat.

13. Install High-Efficiency Particulate Air (HEPA) Filter

Description:

HEPA filters remove over 90% of the dust and particles from the air.

Application:

HEPA filters are installed in the return air stream at the air handler, which should be sized to handle the increased resistance caused by the filter. Some units have an air conditioning setting for the fan that will allow the retrofit later.

Benefit:

The EPA has identified microparticulates as a leading cause of respiratory discomfort. By removing these particles, the HEPA filter makes the living space healthier.

14. Install Heat Recovery Ventilation Unit (HRV)

Description:

An HRV is a mechanical ventilation system that recovers heat from exhausted indoor air and transfers it to the incoming fresh air stream.

Application:

The unit should be designed into the HVAC system to capture heat from exhausted air from the house.

Note: use of this equipment is particularly appropriate with blower door test results of less than .35 Natural Air Changes per Hour (NACH), which measures the air tightness of the house.

Benefit:

Air-to-air heat exchangers provide for fresh air in winter while exhausting stale indoor air. Heat is captured from the exhausted air stream and transferred to the incoming air.

15. Install Separate Garage Exhaust Fan

Description:

According to the U.S. EPA, an attached garage is the single most significant contributor to poor indoor air quality. Car exhaust contains many known carcinogens and can migrate into living spaces through door and cracks in walls and ceilings adjacent to the garage.

Application:

Install exhaust fan on the opposite wall from the door to the house. It can be wired to an electric garage door or put on a timer to run for 15 minutes after door has been opened or closed.

Benefit:

An exhaust fan creates a healthier indoor environment by reducing the potential hazard of car exhaust from entering the house.

RENEWABLE ENERGY & ROOFING

1. Pre-Plumb for Solar Water Heating

Description:

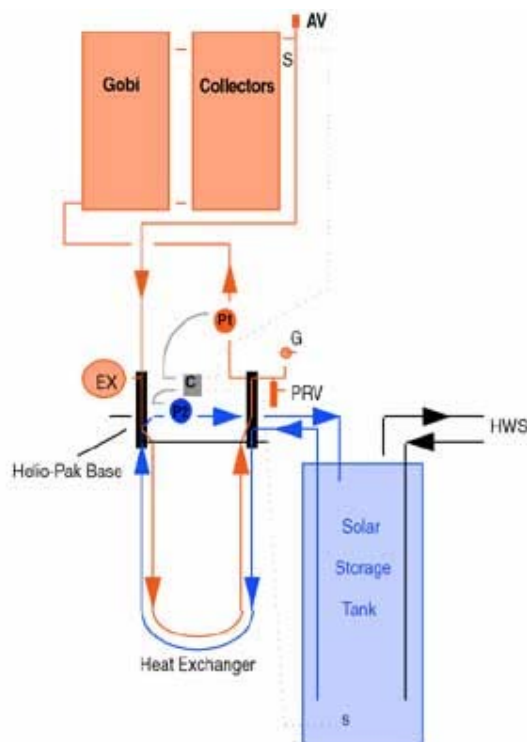
Insulated copper pipes are installed from the attic to a hot water closet or mechanical room for future solar installation. This option allows the homeowner to install an active solar system at a later date if desired.

Application:

Provide south-facing roof area for collectors and access for piping to a mechanical room.

Benefit:

Solar hot water pre-plumbing can save money for the homeowner if, at some point in the future, a solar-powered system is installed.



2. Install Solar Water System

Description:

Solar water heating systems use solar panels to collect heat from the sun. The hot water is stored for use at a later time. Water pre-heated by a solar system can also supplement use of a standard water heater

Application:

Provide sufficient south-facing roof area for collectors, and allow space in a hot water closet for the additional hot water storage tank.

Benefit:

Solar hot water systems can pay back in as little as seven years and reduce the use of gas or electricity for water heating.



3. Pre-Wire for Future Photovoltaic (PV) System

Description:

Running wires from the roof to the electric service entrance/circuit breaker panel can reduce the cost of installation of photovoltaic panels at a future date.

Application:

Run two pair #10 THHN wire plus #8 ground in conduit from the south facing roof to a junction box near

the panel; don't wire the panel. East and West facing roofs can work if the south is unavailable or too shaded for panels.

Benefit:

PV panels and systems will continue to drop in price over the next several years. Homebuyers may not be able to afford the system today but may be interested in the future when the price comes down.

4. Install Photovoltaic (PV) Panels

Description:

PV panels contain hundreds of small cells that collect the sun's energy and convert it into electricity. Excess electricity can be sent back into the utility grid. The collected energy can also be stored in large batteries to meet the needs of nighttime energy requirements.

Application:

Typical PV installations include flat roof, sloped roof, building integrated PV, and ground mount. Items to consider when installing PV include: sunlight-minimum of 4 hours required during peak period with no shade; orientation-anything but North; angle-flat to 60 degrees; adequate roof area-depending on type of PV selected (monocrystal, polycrystal or amorphous).

Benefit:

PV panels can be used as a means to decrease reliance on conventional power plants that contribute to air pollution.

5. Install Solar (PV) Walkway Lights

Description:

Solar walkway or exterior lighting use PV cells to create electricity during the day and store it in batteries for nighttime use.

Application:

Lights can be placed anywhere without the need to run wires as long as they receive sunlight during the day.

Benefit:

PV lighting is cost-effective and reduces the need for grid-provided electricity.

6. Install Radiant Barrier Roof Sheathing

Description:

When radiant energy from the sun strikes a surface, it is converted to heat energy. A radiant barrier reflects radiant heat and does not emit it to the cooler surfaces around it. Radiant barrier sheathing is a roof sheathing material with a reflective layer (film or foil) applied to the underside.

Application:

Radiant barrier sheathing can be used in place of conventional roof sheathing. Apply reflective material to the underside of rafters.

Benefit:

Radiant barrier sheathing reduces heat build-up in attic spaces by not re-radiating heat from the roof to the attic. It can prevent up to 97% of the sun's radiant heat from entering the home and can bring attic temperatures down by as much as 30 degrees on hot days, keeping the whole home cooler and reducing energy consumption for air conditioning.



NATURAL HEATING & COOLING

1. Incorporate Passive Solar Heating

Description:

Passive solar systems provide heat to the structure through south facing windows in conjunction with thermal mass.

Application:

The house must incorporate windows that face within 30 degrees of due south and have the ability to store excess heat in massive elements such as a slab floor or stone fireplace.

Benefit:

Passive solar design can reduce heating requirements by 30-50%, saving energy and money.

2. Install Overhangs or Awnings over South Facing Windows

Description:

Properly-sized overhangs or awnings on south facing windows are important components of passive solar heating and natural cooling. They help keep the heat of the sun from entering the home during unwanted times, but allow heat to enter in the winter. These shade control devices can be oversized roof overhangs, wood trellises/arbors with deciduous plants, or adjustable or demountable awnings made of fabric or metal.



Application:

The overhang or awning design should keep out summer sun by shading the entire window during the hottest month of the year (minimum 24" overhang). Size overhangs or awnings above south windows so that winter sunlight is allowed into the space, where it can be absorbed by thermal mass, and be re-radiated as heat. Also consider shading devices on the west and east facing windows to protect from morning and afternoon heat.

Benefit:

Overhangs, awnings and trellises are an integral part of making passive solar heating and natural cooling work. Removable/retractable fabric awnings offer a low-cost solution to reduce heat gain, lower energy bills, and make the home more comfortable in the summer.

3. Plant Deciduous Shade Trees on the West and South Sides of the Home

Description:

During summer months, the sun shines on the south and west sides of the home causing the home to heat up, which in turn makes air conditioners work their hardest. Trees offer the best solution for keeping out low-angle

sunlight from west and south windows in the summer. The additional cooling demanded by low-angle sun penetration of west windows in late summer afternoons create the most significant summer peak utility costs.

Application:

Plant shade trees on the west and south sides of the home to provide shade and summer cooling. Minimum requirements for Green Build Permit points = 2 trees on each the west and south sides of the home; 3" caliber at 3 ft above grade. The most important areas to shade are windows and paved areas. Keep trees three feet from the foundation to avoid introduction of pests and root intrusions. Avoid planting trees too close to the home or utilities.

Benefit:

Planting shade trees can reduce summer air conditioning costs by 20-35%. Trees provide numerous additional benefits to the environment including cleansing the air, creating habitats for birds and play places for children, as well as adding aesthetic beauty to the neighborhood. Through shade and evapotranspiration, trees can create a microclimate that is up to 15 degrees cooler than the surrounding area.



1. Install whole house vacuum system.

Description:

Whole house vacuums exhaust the dust from the house outside rather than collecting it in a bag that may not filter the dust effectively.

Application:

Whole house vacuum systems must be vented outdoors, not into a garage, and not to any area where air may be taken back into the house.

Benefit:

New generation portable vacuum cleaners may have HEPA filters that reduce the size of dust particles blown back into the house. Most vacuum cleaners do not filter the dust effectively and merely redistribute the dust that is most harmful to the respiratory system. This can aggravate asthma and other respiratory problems. Whole house vacuums expel the dust outside the house.

INDOOR AIR QUALITY & FINISHES

2. Use Low/No VOC & Formaldehyde-Free Paint

Description:

Most paint releases volatile organic compounds (VOCs), a major indoor air pollutant, into the home. Once outside, VOCs react with other pollutants, producing ground level ozone that also affects human health. Often low/no VOC products are manufactured without mercury or mercury compounds, or pigments of lead, cadmium, chromium, or their oxides.

Application:

Paint with low/no VOCs is available from most major manufacturers and is applied like traditional paint. High washability should be specified for bathrooms, kitchens and childrens bedrooms. Every finish and most colors are available in low/no VOC paints.

Benefit:

Low/no VOC paint reduces the emissions of VOCs into the home, improving indoor air quality and reducing the formation of urban smog.

3. Use Low VOC, Water-Based Wood Finishes

Description:

Conventional solvent-based wood finishes can “offgas” for months, and can be harmful to children. “Offgassing” means the solvents are continuously released into the air, which contributes to poor indoor air quality. Low VOC finishes, such as water borne urethane and acrylic, are lower in toxic compounds compared to conventional solvent-based finishes while providing similar durability.

Application:

Low VOC wood finishes can be used in most applications where solvent-based finishes are typically used. If solvent-based wood finishes must be used, they should be left to offgas for 3-4 weeks prior to occupancy.

Benefit:

Using low VOC wood finishes reduces offgassing into the home, improving indoor air quality, and reducing the formation of urban smog.

Survey Says...

In rating improved indoor air quality features, the majority of consumers said the following should be standard:

<i>Formaldehyde-Free Insulation</i>	<i>85%</i>
<i>Low VOC Paints</i>	<i>73%</i>
<i>Heat Recovery Ventilation System</i>	<i>70%</i>

Source: The State of Green Building 2001

4. Use Solvent-Free Adhesives

Description:

Unlike solvent-based adhesives that offgas toxic compounds for months, solvent-free adhesives reduce the toxic gasses such as aromatic hydrocarbons or solvents that contribute to air pollution.

Application:

Use solvent-free products in place of standard adhesives for all interior applications such as installation of flooring, countertops, wall coverings, paneling, and tub/shower enclosures.



Benefit:

Solvent-free adhesives are often stronger, emit fewer pollutants, and reduce the potential harmful impacts on the health of the occupants and installers.

5. Substitute Formaldehyde-Free Materials for Particleboard

Description:

Particleboard is made from wood fibers and an adhesive that contains urea-formaldehyde, a suspected human carcinogen. The formaldehyde is continuously released, which contributes to poor indoor air quality. Particleboard is typically used for cabinets, countertops, stair treads, and shelving.

Application:

Whenever possible, eliminate new particleboard in-

side houses by using solid wood for stair treads, certified exterior grade plywood or formaldehyde-free medium density fiberboard (MDF) for shelving, cabinets and substrate for countertops.

Benefit:

Elimination of particleboard reduces formaldehyde exposure to residents, particularly children, who are most susceptible.

6. Use Exterior Grade Plywood for Indoor Uses

Description:

Exterior plywood uses phenolic resins that offgas much less than interior plywood. Interior plywood typically uses urea-formaldehyde glue which offgasses into the house.

Application:

Substitute exterior plywood for interior plywood in custom cabinets and shelving.

Benefit:

Formaldehyde is a suspected human carcinogen and should be avoided whenever possible.

7. Seal all Exposed Particleboard or MDF

Description:

Using less toxic, low permeability paint or sealer to seal exposed particleboard or MDF will reduce the release of harmful gasses and is the next best solution to elimination of particleboard.

Application:

Whenever formaldehyde-based MDF or particleboard is used, seal all exposed edges of cabinets, undersides of countertops, stairs, shelving, etc. with at least two coats of less-toxic, low permeability paint or sealer prior to installation.

Benefit:

Sealing all exposed particleboard reduces exposure of harmful emissions to residents, particularly children, who are most susceptible.

8. Use Forest Stewardship Council (FSC) Certified Materials

Description:

FSC certified materials come from forests that are managed in accordance with sustainable forest practices. It is particularly important to specify certified wood instead of clear, knot-free trim as this material is typically harvested from non-sustainable, old growth forests.

Application:

Use FSC certified materials in any application that normally uses conventional stain-grade materials.

Benefit:

Sustainable forest certification assures that the forest from which the trim is produced is managed in such a way that will assure the long-term availability of these precious woods while protecting old growth forests.

9. Use Finger-Jointed or Recycled Content Trim

Description:

Finger-jointed trim is manufactured from short pieces of clear wood glued together to create finished trim. Recycled content trim is made from recycled polystyrene/plastics.

Application:

Use finger-jointed or recycled content trim in any application where trim is to be painted.

Benefit:

Finger-jointed or recycled content trim is straighter and more stable than conventional clear wood, and uses materials more effectively.



FLOORING

1. Use Rapidly Renewable Flooring Materials

Description:

Bamboo and cork flooring are alternatives to hardwood flooring. Bamboo is a fast growing grass that can be harvested in three to five years. Cork is a natural flooring material that is obtained from the outer bark of the cork oak tree that is regenerated every 10 years.

Application:

Use these alternative flooring materials in place of conventional hardwood. Make sure that a durable finish is used on this product.

Benefit:

Fast growing, rapidly renewable floor substitutes are attractive and reduce pressure on hardwood forests. Bamboo is as durable as wood; cork is naturally fire and moisture resistant as well as sound absorbing.

3. Use Recycled Content Ceramic Tiles

Description:

Recycled content ceramic tiles can contain up to 70% recycled glass. Originally developed for high traffic commercial conditions, recycled content tiles are very durable and wear well in residential applications.

Application:

Install recycled content tiles wherever conventional tiles are specified.

Benefit:

Some recycled content ceramic tile is very dense which significantly reduces the amount of moisture and stains that are absorbed into the tile, making it more durable and easier to maintain.

4. Install Natural Linoleum in Place of Vinyl Flooring

Description:

Natural Linoleum is manufactured from natural materials such as cork and linseed oil. Unlike vinyl, linoleum does not contain petroleum-based products or chlorinated chemicals such as PVC, which may be a source of VOC offgassing. There is also a concern of by-products such as cancer-causing dioxins, which may be produced during the manufacturing of vinyl.

Application:

Use natural linoleum in place of vinyl flooring.

Benefit:

Linoleum is low-toxic, easy to repair, durable and stain resistant. Linoleum can last up to 40 years, whereas vinyl typically lasts 7-10 years.

5. Use Exposed Concrete as Finished Floor

Description:

For slab-on-grade construction, the concrete can be polished, finished with expansion joints in various patterns, or stained with pigments to make an attractive finish floor, this approach is especially appropriate for in-floor heating systems.

Application:

Use this approach for slab-on-grade construction. Finish must be designed and constructed when slab is being poured.

Benefit:

When using the slab as a floor finish, it eliminates the need to use other flooring materials. Additionally, it is durable and easy to clean.

6. Install Recycled Carpet with Low-VOCs

Description:

Recycled content carpet is made from recycled plastic bottles, nylon/wool, or cotton. It does not differ in appearance or performance and the price is comparable to conventional carpet. The Carpet and Rug Institute (CRI) has a Green Label Indoor Air Quality Test Program which labels the VOC content of carpeting.



Purchase carpeting that is made out of recycled materials, such as this one made of 100% recycled pop bottle fibers.

Application:

Use recycled content carpet in all applications where conventional carpeting is specified. Choose carpet that meets or exceeds the CRI Green Label Requirements.

Resource: www.carpet-rug.com

Benefit:

Recycled content carpet saves resources and diverts waste from landfills. Approximately 40 two-liter soda bottles are recycled per square yard of carpeting. Recycled carpet is often more resilient and colorfast than carpet made from virgin fibers.



* * * * *

These Green Building Methods and Materials should provide you with a wide variety of things to consider when building or renovating your home. Remember, every little bit can help, both the environment AND your wallet!

Small, incremental changes to the way we design our homes and businesses, as well our daily routine can have a major impact on your quality of our lives now and for future generations.

IV. APPROACH TO “GREEN”

The Jackson County Green Build Permit Program is a voluntary program that encourages and rewards homes that go the extra mile to reduce environmental impacts. A Green Build Permit modifies requirements for compliance with environmental regulations if it meets certain qualifications. A “tiered” approach offers different levels of Green Build Permits, in which more and better sustainable features receive a higher certification, and more rewards.

This program focuses on building homes that will maintain all the comforts expected in today’s new housing market while offering homebuyers a greater value. Research has shown that today’s homebuyers are willing to spend more on homes with sustainable building features; especially those that will pay them back over time.

The average cost to incorporate “green” features into a new home design is between \$2,000 and \$10,000. This is an investment which can easily be recovered with energy savings, while increasing the value of the home.

DID YOU KNOW...

The average home emits TWICE as many greenhouse gases (GHG) as the average car?

Green building is a whole systems approach to the design, construction and operation of buildings – from the early stages of development through the final finishes in the home. This approach benefits both builders and homeowners by reducing resource consumption and improving livability. Green building benefits are spread throughout the systems and features of the home.

Green buildings use recycled-content building materials, consume less energy and water, have better indoor air quality and use less wood fiber than conventional homes. Green homes reduce potentially carcinogenic volatile organic compounds (VOCs) and formaldehyde in the home, and construction waste is often recycled and remanufactured into other building products.

Every builder struggles for market differentiation. Building green is a practical way to address issues buyers really care about. A green building dimension to your business adds a strong selling point. Building green is good for both the economy and the environment.

The Jackson County Green Build Permit Program translates Green Construction into three categories, and points are assigned to different measures within each category :

1. Natural Resource Conservation
2. Increased Energy Efficiency
3. Improved Indoor Air Quality



NATURAL RESOURCE CONSERVATION

Conventional building practices consume large quantities of wood, plastic, cardboard, paper, water and other natural resources that lead – unnecessarily – to their depletion. For example, wood is one of the most common building materials, but is often used wastefully. We have already harvested 95% of the nation's old-growth forests – a trend that simply cannot continue. Engineered lumber products such as wood I-joists, wood fiber laminates and oriented strand board, utilize fast growing farm trees as an alternative to old-growth forests. These products can use as little as 50% of the wood fiber to perform the same structural functions and are typically stronger, straighter and lighter than solid-sawn lumber. And more efficient framing techniques can reduce drywall cracking and nailpops, improve insulation, and save a significant amount of growing lumber.



Remodelers have a rapidly expanding range of green building materials from which to choose. Recycled-content decking, insulation, reclaimed lumber and other products divert waste from landfills, while providing quality and durability that often exceed conventional materials. For example, decking material made out of recycled plastic resins mixed with wood waste fibers can last up to five times longer than wood decks, and never need to be treated or painted.

Water conservation is another important issue. Wise water use reduces the strain on resources as well as lowers expenses. Today, remodelers can take advantage of a new generation of water conserving washers, dishwashers, and landscape water management systems.

CONTRACTOR TIP: PROVIDE A HOMEOWNER'S MANUAL OF PRODUCTS INSTALLED

Provide homeowners with a product manual that describes the benefits of the various green materials installed and how to maintain them. Informing the homeowner about the green features and products will ensure the effective use and maintenance of the features for many years after the project is completed.

ENERGY EFFICIENCY

Energy efficiency is a cornerstone of any green building project. Generation and use of energy are major contributors to air pollution and global climate change. Improving energy efficiency and using renewable energy sources are effective ways to improve air quality and reduce the impacts of climate change. Improving energy efficiency and lowering utility expenses allows residents to enjoy the financial benefits year after year.

The first step to increasing energy efficiency is to add insulation and control infiltration wherever possible, install double-glazed/low-E windows and upgrade to high-efficiency appliances. Other energy upgrades/choices include installing solar water heaters, photovoltaic panels, and purchasing “green power” generated from renewable sources like the sun, wind and biomass. See www.green-e.org

INDOOR AIR QUALITY

The United States Environmental Protection Agency (EPA) reports that the air in new homes can be ten times more polluted than outdoor air. According to the New England Journal of Medicine, 40% of children will develop respiratory disease, due in part to the chemicals in their homes. Poor indoor air quality is caused by the off-gassing of chemicals found in many building materials as well as mold and mildew that build up in homes due to poorly designed and maintained heating and cooling systems.

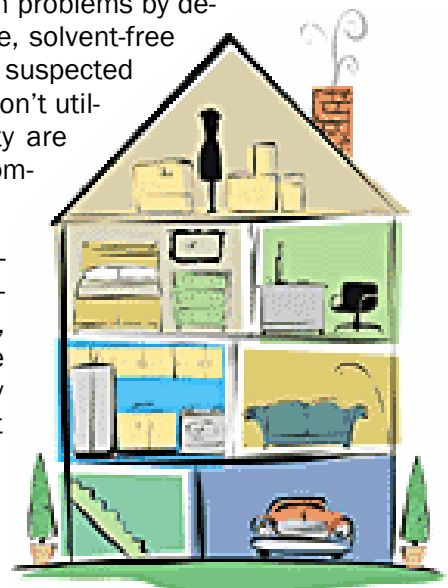
One of the most common indoor pollutants is formaldehyde, a suspected human carcinogen. Kitchen cabinets, countertops, shelving and furniture are typically made from particleboard held together by formaldehyde-based adhesives. The formaldehyde is released into the home for years after these products have been installed. Many paints, adhesives and floor finishes also contain unhealthy volatile organic compounds (VOCs). That “new house smell” is actually the odor of these volatile compounds off-gassing and is a telltale sign that there are harmful chemicals in the indoor environment.

DID YOU KNOW...

That “new house” smell is actually the odor of volatile organic compounds (VOCs) and is a telltale sign that there are harmful chemicals in the indoor environment.

The building products industry has responded to these indoor pollution problems by developing alternative paint, finish, and adhesive products. For example, solvent-free adhesives used in flooring and countertops can eliminate many of the suspected and known human carcinogens. Paints, varnishes, and cleaners that don't utilize volatile compounds and have improved durability and washability are now commonly available from most major manufacturers at costs comparable to conventional products.

In addition to the growing number of readily available and cost-effective green materials – an increasing number of builders and remodelers are also using natural building materials such as straw-bale, rammed earth, adobe and cob. While less common in their use, these building products have a positive impact on the environment as they are renewable and abundant; energy efficient in production, transport and use; non-polluting; durable and long lasting.



V. 7 STEPS TO GREEN

STEP 1: ASSESS YOUR NEEDS

First of all, think about how you and the other members of your household need and want to live, and how that might change over the next several years. When you've analyzed this as well as you can, then think about what kind of site and what kind of house will best meet these needs and wants.

Here are some examples of questions you need to consider:

- ◇ Are you looking for a neighborhood school for your kids?
- ◇ A park where they can walk or bike to by themselves?
- ◇ Do you find gardening and yard work a pleasure or an aggravation?
- ◇ Are you a homebody, or do you love to go to restaurants and theaters?
- ◇ Do you cook and entertain at home a lot?
- ◇ Is it important to have close neighbors?
- ◇ Do you hate to commute?
- ◇ Do you need a home office?
- ◇ How often do you grocery shop—once a week? Daily?
- ◇ Do the members of your household need a lot of private space, or not?



Urban, suburban, or rural? New or old? Large or small? Conventional or unusual? What kind of house is right for YOUR family?

As you try to set your building goals, you may be surprised to find you have conflicting wants and needs. That's inevitable, but all the more reason to spend a lot of time on this step. When you have a good start answering questions like the ones above, you'll be able to make good choices about site and space needs.

STEP 2: FORM A TEAM

It takes a lot of people to make a house a reality—designers, engineers, a general contractor (builder), construction workers, appraiser, lender, insurer, realtor, building officials, inspectors, and more. Maybe you won't choose all of them yourself (for example, the lender may choose the appraiser; the builder will select the construction workers), but you need to make sure that all these people are on the same team—YOUR TEAM—all communicating and cooperating to produce the best possible result.

You might assume teamwork is the norm. IT ISN'T! It's actually more common for the various parties to have little or no contact with each other. They may even view each other as adversaries. What starts as a lack of

communication can snowball into a lack of coordination and to conflicts that result in a lower quality and higher-priced home.

A good team will help you refine and prioritize your goals, and then help you make the specific choices that meet your goals. For example, it may not have occurred to you that a building affects your health, but a good green team will be sure you understand this. They will advise you about what to include and exclude in your home to promote a healthy indoor environment, where you will spend the most hours of your day.

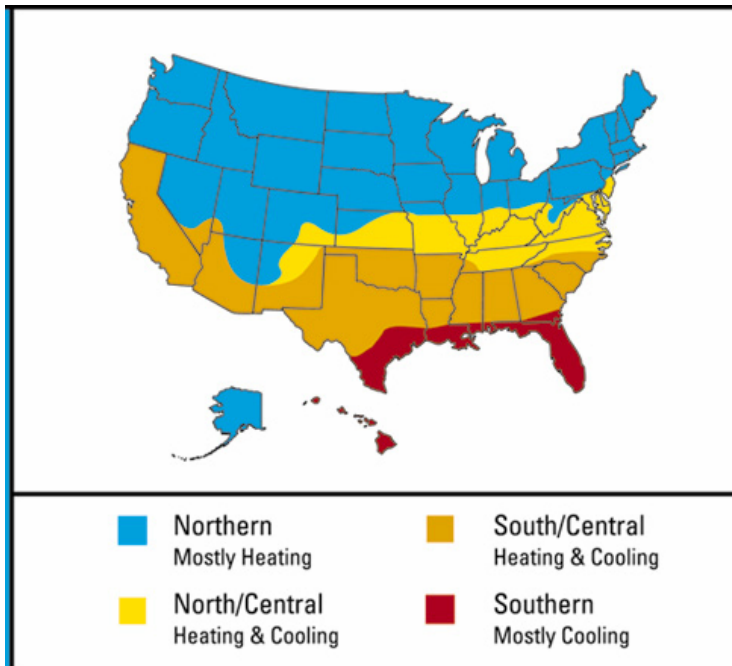
You may worry that you won't know how to choose the right people, but once you've begun to grasp all seven steps, you will have a sharper focus and have many good questions to ask prospective team members. Ask how they have gained their knowledge of green building, how they keep up with the developments in the field, and most importantly, what aspects of green building they have been able to incorporate in their previous work.

If you live in an area where building professionals are not very familiar with green practices, you will have to do a little more homework yourself. Don't be afraid to ask for recommendations from local environmental organizations!



STEP 3: DESIGN FOR YOUR CONDITIONS

Before you design our house—even before you choose a site—you need to know the conditions of your region. These conditions include such things as the climate, topography, and soil type. They determine what kind of building will be durable, comfortable, safe, and efficient in that area.



No region has ideal conditions. The better you understand your conditions, the more you can maximize the positive ones and minimize the negative ones—by your choices of site, design, materials, and systems. It's easier and cheaper to work with nature than against it.

Following are some things you need to consider about your regional conditions:

A. TEMPERATURE

Severity of winter and summer temperatures.

How much of the time and when is it too cold to be comfortable? When is it too hot? Knowing this precisely will help you decide matters such as how much insulation you'll need, whether you'll need a heating and/or cooling system, and how efficient it should be.

For example, if you need a lot of heat in the winter, a sunroom may be a good idea. It can provide free heat to the rest of the house. In a hot climate, poorly designed sunrooms tend to overheat the house.

Temperature differences between day & night.

Understanding temperature shifts from day to night helps you determine the best building materials to use. For example, in the desert southwest, where there are warm days and cool nights, masonry materials such as adobe walls and tile roofs and floors work well.

Ground temperature.

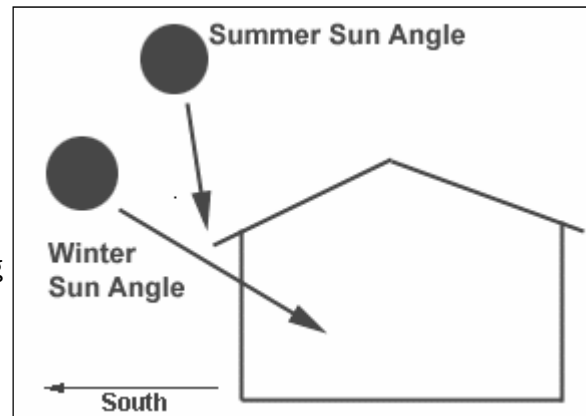
Understanding ground temperature helps you decide what foundation type and flooring materials will work best in your area.

For example, in a hot climate with a constant comfortable ground temperature, an uninsulated concrete slab provides both a serviceable foundation, and an energy-efficient, comfortable finish floor. As long as occupants don't cover the floor with an insulating material like carpet, they'll benefit from the cool ground temperature, and won't need as much air-conditioning. In a cold climate, such a floor would get too cold for comfort.

B. SUNLIGHT

Notice that the arc of the sun is higher in the summer than in the winter. Fortunately this arc is entirely predictable, unlike the weather. By knowing exactly where this arc is in your region at the hottest and coldest times of the year, you can place and size windows and overhangs to let in just the amount of heat you need to make your home comfortable.

For example, in a hot climate, a west-facing window without a large overhang would take in too much solar heat. However, the same window in a northern climate would make the most of heat gain and help lower winter heating costs. *In JACKSON COUNTY, the angle from window sill to south facing overhang should be 59° from horizontal.*



C. RAINFALL

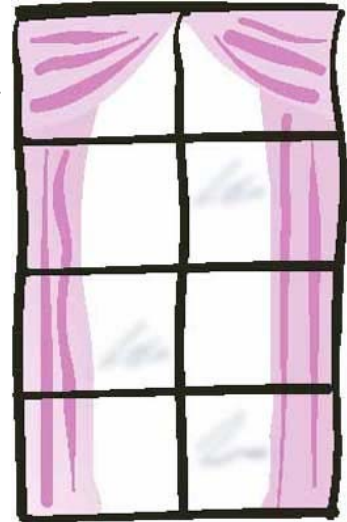
Knowing average annual rainfall, volume in a short period, and time of year that rain typically falls helps you make choices about landscaping, roof pitch, and *building* materials that will reduce landscape failure, leaking, erosion, rot and mold.

For example, in regions with torrential rains, it's important to get water off the roof as fast as possible, so it doesn't drive back up under the roofing and leak into the house. A steeply pitched roof does this much better than a flatter one.

D. RELATIVE HUMIDITY

Low humidity encourages the growth of viruses, and high humidity encourages mold growth, which causes problems with rot and allergies. Both extremes are uncomfortable and unhealthy. Understanding relative humidity in your area enables you to choose the proper construction methods, materials, and ventilation systems to avoid these problems.

For example, in areas with long, cold winters, a *vapor barrier* must be installed on the inside of the exterior walls. This keeps the warm, moist interior air from entering the wall where it could cool down, condense, damage the insulation, and rot out the wall. In warm areas, sometimes it's more humid outside, sometimes inside. This is true in Jackson County. There's no ideal way to build for this, so it's best not to install vapor barriers and let the vapor move freely through the wall.



E. PREVAILING WINDS

Understanding the wind patterns of your site helps you design to take advantage of refreshing breezes and avoid harsh winds. This will affect your choices about window size and placement, and roof shape.

For example, in areas that get a lot of pleasant gentle breezes, windows can be placed to maximize cross-ventilation. In areas with cold winter winds, window area can be reduced on the side of the house where the winds hit the hardest. In most places that's the north side.

STEP 4: CHOOSE GREEN MATERIALS

Materials should not be divorced from site and design. If you have an extremely steep site, for example, the direction of slope and foundation design are very important.

It's great that there are so many green building materials readily available now. But that can make it a bit overwhelming when you have to choose one over another. Fortunately, there are several reference sources available. Be sure to keep your building goals in mind, then use the following seven criteria to help you sort out the options.

A. Is the material effective in your conditions?

Most materials have a range of conditions in which they work best. There are good choices for every circumstance, so find out what works well where you are. For example, a material that functions well in the mild humidity of Alabama may be unable to stand up to the severe freeze/thaw conditions in Idaho. We experience some of both conditions in Jackson County.

B. Is the material healthy and safe?

Materials and products need to be healthy and safe for the workers who extract, harvest, manufacture and install them, and for the inhabitants who are exposed to their fumes and particles. For example, both

painters and inhabitants will benefit from paints that don't give off toxic fumes. A ceramic tile floor is good for occupants because it won't harbor allergy-causing dust mites and molds the way some carpets can.

Above all, materials, their production, use, and disposal, must be safe for the planet. We don't want our homes to add to such problems as pollution, ozone depletion, climate change, loss of habitat, and depletion of irreplaceable resources. For example, clay tile can be disposed of or recycled easily, whereas pressure-treated lumber must be handled as a hazardous waste. If wood comes from a certified sustainably-managed forest, the forest remains viable for future tree harvesting, wildlife habitat, and other benefits. That's not the case with a tree farm or clear-cut harvesting.



When you see these logos on a building material, you can be assured it has passed rigorous independent testing to gain certification as an environmentally sound material.

C. Is the material durable and easily maintained?

Using materials that last a long time saves the resources needed to replace them and reduces disposal problems and costs. Using materials which require little or no maintenance saves time, money and work. For example, if the exterior of your home is brick or stone, it won't rot and termites won't eat it. Every material will reach its end of life eventually and will need maintenance or replacement. It is helpful to minimize the time and material required for maintenance.

D. Is the material used efficiently?

1. Is the material from your region and processed there?

Transportation results in pollution, so the less transport needed, the better. Buying from your region has the added benefit of helping your local economy too.

2. Can the material be used in a natural state, or with very little processing?

Processing resources into usable building products, such as vinyl siding or carpeting, tends to use a lot of resources, especially energy and water. But some materials, like stone and wood, can be used with little or no processing.

DESIGN TIP:

It's helpful to look at the historical styles of buildings in your area to see how people got comfort passively from the building design and site, in an era before they could get additional comfort from modern technology, such as heating, cooling and humidity control systems.

STEP 5: CHOOSE THE RIGHT MECHANICAL SYSTEM

Modern heating, cooling, and ventilation systems, lighting, and appliances play a major role in providing us with comfort and convenience, good health and safety. If you understand a few basics about each of them, you'll be able to get all these benefits for a reasonable price.

A. Mechanical systems: heating, cooling & ventilation

Feeling comfortable depends on a complicated mix of factors—not just the temperature of the air, but also the relative humidity, the rate of air movement, and the temperature of the materials around us.

Example: A hot day in Palm Springs, CA probably won't feel as bad to you as an equally hot day in Raleigh, NC, because Raleigh is humid as well as hot.

By far the most cost-effective way to feel comfortable in a building is to control your environmental conditions by passive means: finding a site that protects you from the worst elements of your region, and designing your home and choosing materials that will do the same. But passive methods won't make you perfectly comfortable all the time, especially in Missouri. For that, you'll need the right system.

Design the HVAC system AFTER all the inexpensive measures to insulate the seal the building envelope, and after solar control has been maximized.

Note: much of the following discussion applies only to a forced-air system—one in which heated or cooled air is blown by fans through a duct system, which distributes the air throughout the building.



Correctly sizing your equipment is a very important consideration.

1. Buy the most efficient equipment

Your mechanical system costs you money every time it runs. In a cold climate, choose equipment with the highest heating efficiency rating you can afford.

2. Correctly size equipment

Equipment size should be based on the actual amount of cooling and heating a building needs. Need is based on the climate, size, design, and construction of a building—factors such as the amount of window area and the direction it faces, the kind of windows and how they are shaded, the amount of insulation, etc.

Most systems are oversized because it's easier to make assumptions about the heating and cooling load than to do calculations. In a well-insulated and carefully sealed building, relying on assumptions can result in very poor performance. If the equipment is too small, it can't heat or cool adequately, but in most homes, the equipment is too big to work right. Because an oversized unit reaches the temperature on the thermostat very quickly, it doesn't run long enough at one time to reach the efficiency it was designed for. It's like a car always driven in town and never on the highway: operating expenses are higher and it wears out faster.

In a hot, humid climate, you cheat yourself even more with an oversized unit. To be comfortable in these conditions, you need the cooling system to dry out the air, as well as cool it. The system can only respond to the thermostat however, and the thermostat only reads the air temperature (NOT humidity!), so it shuts off before it can dehumidify properly. As a result, you'll feel clammy, and maybe sick as well from the mold thriving in the warm, moist air.

3. Place the equipment effectively

The best location for equipment and ductwork is *inside the building envelope*, so conditioned air is less affected by outside conditions. If a house has an insulated basement, that's a good location. For houses without basements, equipment is usually put in the attic, which is the **WORST** possible place, since an attic may get up to 160 degrees on a summer day. So, it's better to create a closet on the main level for the system.

4. Design the equipment correctly

The extra money you pay for high efficiency equipment will be wasted if the system is poorly installed. For example, if the installer puts 90-degree turns in the ducts that weren't anticipated in the design, the extra friction caused by air swirling around the sharp bend will prevent the needed amount of air from getting to the rooms. If the ducts leak (and they always do), conditioned air seeps out of the duct, or unconditioned air gets sucked in. Care can be taken to seal duct seams. If ductwork goes through unconditioned attic or crawl space, they should be very well insulated (more than the typical 1" duct board). These two steps alone will save a bundle in energy costs.



No duct tape here! Duct tape is good for lots of things, but not for connecting ducts, because it doesn't make a lasting seal. For a tight, durable seal, you need latex mastic.

5. Humidity control

At moderate temperatures, if relative humidity drops below 20%, viruses proliferate; if it rises above 60%, molds grow. Mold is the leading cause of occupant health problems and rotting building materials. Mold wasn't such a problem in old leaky buildings, but now that we building tightly to save energy, it is a serious problem.

Reminder: be sure the cooling equipment is sized small enough to run a lot, since it can only dehumidify when it's running. A smaller unit is also cheaper to buy and cheaper to run.

In very humid rooms such as the bath laundry, and kitchen, be sure to install vent fans that exhaust air to the outside. Consider asking the HVAC maintenance company to install a UV light in the return air plenum—it kills mold spores every time they pass through the system.

6. Air movement

It is important for a heating and cooling system to move enough air to and from every room (both supply and return) to function properly and provide comfort. The location of supply and return registers is also critical to good airflow.



7. Air quality and safety

When you run your forced air system, huge changes in air pressure occur. Dangerous fumes from a gas furnace or water heater (such as carbon monoxide) may get sucked into the living space instead of exhausting out of the house through the vent pipes. This is called *backdrafting*. For safety's sake, choose a *sealed combustion* unit that gets oxygen for combustion from outside the house.

A good filter improves air quality and protects your equipment (typical 1" filters do neither). Filter efficiency ratings are often wildly misleading. A *pleated-media filter* does a good job for the least money, but do your research to find out what works best for your conditions!

B. Lighting

We typically spend 90% of our time indoors, but humans evolved under constantly changing conditions outside, under the sun and shade and stars. Light quality goes deep to human nature. If you compare a well-lighted building with a poorly-lighted one, you'll know that good lighting is not a luxury. It's necessary for people to be productive, healthy, secure and safe. It's also important for its psychological effects—the way it can make space cheerful, welcoming, cozy, interesting, romantic, or dramatic. Let's look at how we can get better light in buildings—whether from daylight or electric lighting.

1. Daylight

There's nothing like light from the sun for high quality and efficient light, but bringing it inside a home is tricky. Be sure to consider this at step 3, when you decide on size and placement of windows, and at step 4, when you choose the window units.

To get the maximum benefit from daylight, be sure your designer gets light as *deep* into the living space as possible. Windows high on a wall are especially effective for doing this with a minimum of annoying glare. You want light to hit as many surfaces as possible and reflect back on other surfaces. Light colored paint increases reflection. Be cautious about the use of skylights because they may allow too much heat in or out.



Gary E Clark's Home - Ann Arbor, MI - 36' x 18' Home and 34' garage

2. Electric lighting

When there's not enough daylight, we must depend on electric lighting. Luckily, there is a wide selection of fixtures and bulbs to choose from, depending on what you need light for, the amount you need, the efficiency you want, the way you want your colors to look, whether you need focused or diffused light, and where you place your light fixtures.

◇ *Purpose of the light*

Your lighting choices should depend on what you're trying to accomplish with lighting. Do you need general lighting to get around easily and safely; indirect lighting to bounce off surfaces and keep spaces from looking gloomy; intense, highly focused and totally glare-free light for tasks such as reading or sewing, accent lighting to highlight a painting or architectural feature. Do you want decorative lighting, such as a chandelier?

◇ *Type of light*

Choose the best kind of light for your purpose. For residential use, you will probably stick to standard incandescent lighting for creating a warm, cozy atmosphere; halogen incandescent when you need a very intense or focused light for reading or highlighting an object, or fluorescent for most other uses.

Over its lifetime, an 18-watt fluorescent light will save about 570 KW hours of electricity (which saves over 1,300 lbs of carbon dioxide emissions) compared to a 75-watt incandescent bulb, which gives about the same amount of light.

◇ *Fixture type and placement*

Choose fixtures that throw light where you need it, and place light fixtures where they will do their job best, without causing annoying glare. Note: recessed can fixtures are very popular, but unless they are the sealed, energy-efficient type, they are an energy disaster. The unsealed kind produces so much heat, it can't be safely insulated, and is like a hole in the ceiling. Also recessed cans are frequently placed and finished out with useless and glaring down-lighting, when they could be used for effective and attractive wall lighting instead. Avoid exterior uplights (lights shining up the side of your home or into the trees).

C. Appliances

Americans love the convenience of appliances. In spite of the increased energy efficiency of new appliances, households are using more energy than ever, because they are using MORE appliances. Computers are a big culprit, since they are often never turned off.

◇ *Look for energy-efficiency labels, such as the EnergyGuide or Energy Star.*

It's easy to find and understand the bright yellow EnergyGuide label on appliances and refrigerators, dishwashers and stoves. Be sure to compare the actual energy use of a given appliance with other sizes and models. For example, a larger refrigerator could actually have a lower energy use than a small one.

When buying appliances such as computer, look for the Energy Star label. Check the U.S. Department of Energy website at www.energystar.gov to find out the energy efficiency of models you're considering.

◇ *Estimate the life-cycle cost.*

What is the true cost of your choice over time, not just the purchase price?



Life-Cycle Costs for 13-year Operation of Different Types of Water Heaters

Compare the purchase

Water Heater Type	Efficiency	Cost	Yearly Energy	Life (years)	Cost over
Conventional gas storage	55%	\$425	\$163	13	\$2,544
High-efficiency gas storage	62%	\$500	\$145	13	\$2,385
Oil-fired free-standing	55%	\$1,100	\$228	8	\$4,751
Conventional electric storage	90%	\$425	\$390	13	\$5,495
High-efficiency electric storage	94%	\$500	\$374	13	\$5,362
Demand gas	70%	\$650	\$140	20	\$2,243
Demand electric (2 units)	100%	\$600	\$400	20	\$5,590
Electric heat pump	220%	\$1,200	\$160	13	\$3,280
Indirect water heater w/efficient oil or gas boiler	75%	\$700	\$150	30	\$2,253
Solar with electric back-up	n/a	\$2,500	\$125	20	\$3,250

Source: American Council for and Energy-Efficient Economy.

STEP 6: GET MAXIMUM BENEFIT FROM YOUR SITE & LANDSCAPE

Think of your house and site as a single unit and try to understand in the planning stage how they affect each other.

A. Potential benefits from good site use

1. Greater comfort and energy efficiency

Your site affects your comfort and energy bills. If your site does not provide ideal conditions for your climate, you can modify it with appropriate landscaping. For example, in a cold climate, you can plant trees as protection against winter winds, and in warm climate you can use trees to channel cooling breezes into your house. Vegetation has a general cooling effect because it transpires moisture, which cools the air as it evaporates.

2. Enjoyment of plants and wildlife

Most everyone loves to look out on a beautiful landscape. Luckily, with all the easy-care, low-water native and well-adapted plants available at nurseries now, people can have an attractive, thriving landscape. Such a landscape will attract birds, butterflies and bees, and be less likely to attract pests. On the following page is a table of Missouri Native plants and trees from the Missouri Department of Conservation website: www.grownative.org

3. More living space

Landscaping is more than vegetation. It can include play areas for children, sport courts, decks and patios for outdoor living. As well as being useful, they reduce the need for water.

4. Your own healthy food and water supply

Your yard can provide you with space to grow reliably fresh and healthy fruits and vegetables, herbs and nuts. It's a good place to store rainwater too. Rainwater has a pH balance that's kind to skin and hair, and doesn't have minerals that clog up plumbing, fixtures and appliances.

5. Better stormwater and erosion control

Stormwater can erode soil from your site and foundation if it's heavy and fast-moving, but you can grade and plant your site so water drains away from buildings to areas made to contain it. That enables storm water to seep slowly into the ground, giving your landscape a healthy drink, without washing away valuable topsoil. This benefits the whole community because slow filtration through the ground gives water time to purify before entering the water table, streams, and lakes.




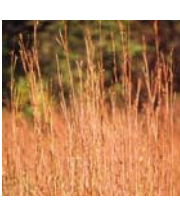










B. Ways to maximize benefits from your landscape

A good way to find out what vegetation thrives best in your area is to go out in the county and see *what's doing well with NO care at all!* Take note of the plants and trees that appeal to you most, look for them at your local nursery, and ask if they will do well with little or no watering in the conditions of your site.

Choose mainly evergreens and perennials. You can enjoy them every year, winter and summer. Choose trees that have a long life span—it's tempting to plant fast-growing trees for quick shade and beauty, but they are usually short-lived. If you take good care of slower-growing trees, you'll be surprised at how fast they develop.

MISSOURI NATIVE PLANTS & TREES: (These are just a few examples)

www.grownative.org

	<p>RED MAPLE:</p> <p>Excellent specimen or shade tree for large areas. Habit is pyramidal when young then develops irregularly rounded crown. One of the first trees to color in fall, leaves may be bright yellow, flaming orange or red.</p>		<p>SHINING BLUE STAR:</p> <p>Rounded spikes of starry, sky blue flowers emerge in spring and last for several weeks. Deep green willow-like leaves turn bright gold in the fall. The plant takes on a substantial rounded form in the garden.</p>
	<p>SUGAR MAPLE:</p> <p>One of the finest of any trees for a large shade tree. Fall color is fabulous, the foliage is clean, the branches are strong and it is long lived. Typical maple leaves open after a spectacular display of the pale yellow haze of flowers in spring.</p>		<p>BIG BLUESTEM:</p> <p>Columnar upright clumps of green to blue-green leaves in summer. Foliage turns rich orange and copper-red in fall. Flower heads appear in late August. They open red and turn darker with age.</p>
	<p>MAIDENHAIR FERN:</p> <p>This fern's delicate appearance disguises its tough nature! The name comes from the shiny, dark, hair-like stalks that branch to hold the fan-shaped leaves almost horizontally with a delicate strength.</p>		<p>COLUMBINE:</p> <p>Lots of red and yellow nodding flowers for many weeks in spring. A great source of early nectar for butterflies and hummingbirds. Found naturally on rocky ledges.</p>
	<p>OHIO BUCKEYE:</p> <p>Large spikes of green-yellow flowers in spring bloom at the same time the bright green leaves unfurl. This is one of the first trees to leaf out and also one of the first to lose its leaves in the fall.</p>		<p>GOAT'S BEARD:</p> <p>Large wands of frothy, creamy white flowers in June. Tiny brown seed capsules dry and stay on plants after flowering is finished. Foliage is similar to astilbe but growth habit is shrub like.</p>
	<p>RED BUCKEYE:</p> <p>Usually a single-stemmed, rather open shrub with palmate leaves. Spikes of showy red flowers, 4-8 in. long, are pollinated by ruby-throated hummingbirds in spring. Foliage drops naturally in late summer. Brown, egg-shaped fruit in the fall.</p>		<p>WILD GINGER:</p> <p>A deciduous ground cover with soft green, kidney-shaped leaves and inconspicuous green-brown flowers in the spring. Forms large colonies in cool moist woodland areas.</p>
	<p>SERVICEBERRY:</p> <p>Tall shrub or small tree bearing clusters of fragrant white flowers in April. Flowers give rise to very flavorful, purple-black, berrylike fruits relished by both songbirds and people.</p>		<p>MARSH MILKWEED:</p> <p>Sweetly scented clusters of rose-pink flowers bloom in summer. Butterflies find the fragrance irresistible and larvae feed on the foliage. Grows naturally in swamps and wet meadows but also grows well in the garden.</p>
	<p>LEAD PLANT:</p> <p>Grows like an herbaceous perennial but takes on shrublike characteristics as it matures. Tight spikes of iridescent purple and orange flowers appear from May-August.</p>		<p>PAW PAW:</p> <p>Multistemmed shrub or small tree with tropical-looking, 6-12" long leaves. Edible, 2-5" yellowish fruit is relished by many birds and small mammals. Plant is larval food of Zebra Swallowtail butterfly.</p>



This house is being tested via a “blower door” test to see how tight the outer shell of the house is—the walls, floor, and ceiling. If it’s too leaky, it won’t be energy efficient.

STEP 7: TEST AND MAINTAIN

Once you’ve built your green home, you’ll want to make sure it’s safe for occupancy and able to perform as efficiently as you and your team intended. You’ll also want to maintain it properly to prevent deterioration, and keep it healthy, safe, and efficient in the future. Even though your house won’t be tested or maintained until after it’s built, you still need to address these matters in the planning stage, so you’ll make contracts and building choices that make testing and good maintenance possible.

A. Preparing your home for occupancy

1. Get rid of harmful fumes

It’s a good idea to air out a new building as much as possible. New building materials contain a lot of chemicals, such as formaldehyde, that release unhealthy gases. These gases gradually dissipate, so the more time that elapses before people move in, the better. Once people move in, they may find it difficult to do much airing—for security reasons, or because of the time of the year.

Your best bet is to avoid choosing materials containing unhealthy chemicals in the first place. Also avoid choosing materials that are difficult to maintain with-

out introducing nasty chemicals into your home in the future.

2. Test for safety and efficiency

Your contract with your builder should include a list of tests to be performed on your house, and should spell out the extent to which problems will be corrected, and who is qualified to do the tests and repairs. These three tests are the most important:

- ◇ **Duct leakage test**
If you have a forced air heating or cooling system, you need to get the ducts tested for leaks. A well-sealed system has no more than 5% leakage.
- ◇ **Safety backdraft test**
If you have a gas water heater and a gas furnace that don’t have sealed combustion and are located where fumes from the flame could get into your living space, their vents should be tested.
- ◇ **Blower door test**
This test will tell you how much air is leaking in and out of the “envelope” or outer shell of the house. The more extreme your climate, the more important it is to control leakage, since air leaking out has been heated or cooled. As a general rule, leakage of more than 0.50 Air Changes per Hour (ACH) is not energy efficient.

For good health, you DO NEED some fresh outside air coming into the house—at least 0.35 ACH. Air will leak through any cracks it can find in the building shell, but you can’t control the temperature, humidity, or the amount of incoming air. For control you need mechanical ventilation.

B. Maintaining your home

Just like your car, your home needs maintenance if it's to keep performing effectively. Here are some of the most important aspects of maintaining your home:

- ◇ Materials—timely caulking, painting, replacing weatherstripping, etc.
- ◇ HVAC System—Get it checked at least once a year; change your air filter quarterly, etc.
- ◇ Cleaning—Regular cleaning extends the life of your home; use cleaning products that don't have chemicals that may damage your house or health, for instance.
- ◇ Pest Control—Keep moisture away from your house; keep your home clean; choose building materials that don't attract pests.
- ◇ Site and Landscaping—Periodically check drainage patterns to make sure water isn't draining into your foundation; keep trees trimmed away from roof; avoid toxic fertilizers. NOTE: The biggest environmental impact is over fertilizing

CONCLUSION

If you've established your goals thoughtfully, and assembled a good green team that works effectively together to meet those goals, you will have a house that easily gives you convenience, comfort, safety and health. At the same time, it will be easy on your pocketbook and protective of the planet, so your descendants can have the same benefits and pleasures.

VI. BUILDERS: MARKETING A GREEN PROGRAM

Building green means new ways of thinking about common building practices. Generally, it is best to build from your existing market base, adding green features as the market evolves and matures. If you start gradually, you are less likely to make expensive mistakes. It is critical to carefully consider the changes you make and the additional costs you might incur. The earlier you start integrating alternative products and green design into your building process, the less it may cost you and the consumer in the long run.

When consumers think about a new home, they think about what it offers them, not necessarily what it does for the environment. Quality always rates highest next to location when buyers buy new homes. Green homes offer higher quality since most products were developed to perform better than the conventional



products they replace .

The Guidelines and accompanying resources will assist you in developing and implementing green building packages into your building projects. What makes a home truly green is a combination of all of the features listed in the Guidelines. In this way, the home combines the collected benefits of resource conservation, energy efficiency and good indoor air quality.

Offering segregated packages is a starting point to help clarify what your market is most interested in, so you can make the most appropriate incremental steps toward a truly green home.

GETTING STARTED

A strategic way to start building green is to develop green options, and then describe the environmental features and benefits to the homebuyer. Giving your customers a choice allows you to refine your product and market approach. Home buyers speak their own language, and understand and embrace green building only when it is explained in their terms. Energy efficiency, improved indoor air quality, water conservation and saving old-growth forests are terms that may have different meanings to different buyers. All these things together mean a new home that offers more value and a more comfortable and healthier living environment.

Knowing about the benefits of resource-efficient construction is one thing; spending money for those same features is quite another. One survey (2001) asked consumers to choose their three most important upgrades when buying a new home. In top-down order, responses were:

1. Energy Efficiency—93.9%
2. Indoor Air Quality—59%
3. Kitchen Cabinet Upgrades—40.2%

GREEN BUILDING “PACKAGES”

Following are samples of “packages” that could be developed to respond to consumer demands for green homes.

Natural Resource Package

Natural resource conservation is becoming more important to buyers every year. Saving forests for camping, fishing, and hiking is a value that families hold for their children’s future. Conserving resources today by incorporating green alternatives is a great way to get your buyer’s attention. Using recycled content products in your homes “closes the loop” for families that are committed to recycling. Using water more efficiently only makes sense as population growth puts stress on a limited resource.

Consider offering the following as a part of a Natural Resource Package:

- ◇ Engineered lumber—OSB, wood I-joists
- ◇ Recycled newsprint cellulose insulation
- ◇ Water-conserving plumbing fixtures
- ◇ Fiber-cement siding and trim
- ◇ Recycled-content decking
- ◇ Recycled-content carpeting
- ◇ Treated wood that does not contain arsenic or chromium

Energy Efficiency Package

Energy upgrades are one of the first things that consumers would pay extra for—\$2,300 on average—if they could expect to see a payback through lower monthly energy costs in four years.

According to recent studies, only 2% of homebuyers said they would not be willing to pay more in up-front costs for energy efficiency upgrades that would reduce monthly utility bills. 83% said that insulation should be above code and that a 90% efficiency or higher furnace should be standard features in new homes.

Consider offering the following as part of an Energy Efficiency Package:

- ◇ Low-E windows
- ◇ High efficiency (90%) or higher, sealed combustion furnace and hot water heater
- ◇ High SEER/EER air conditioning units
- ◇ Compact Fluorescent light bulbs
- ◇ Advanced sealing and caulking to reduce drafts
- ◇ 2x6 wall framing and increased insulation
- ◇ Insulated foundation

SURVEY SAYS...

“New homeowners were surprised that green building and the use of environmentally friendly products had not been brought to their attention before. They felt that there should be a green option made available by the builder.”

Source: Focus Group Research, Alameda County Waste Management Authority,

Indoor Air Quality Package

While energy efficiency is at the top of the consumer list, improved air quality is also a priority for homebuyers. Almost nine in ten respondents are aware of products that emit gas chemicals into their living environments. 75% of those people say it's extremely or very important to live in a home free of toxic chemicals.

Consider offering the following options as part of an Indoor Air Quality Package:

- ◇ Formaldehyde-free insulation
- ◇ No or low-VOC paints
- ◇ Solvent-free wood finishes
- ◇ Less-toxic adhesives
- ◇ Natural linoleum instead of wood flooring
- ◇ FSC-certified wood or bamboo flooring instead of carpeting
- ◇ Sealed particleboard in cabinets and countertops

VII. GREEN MORTGAGES



As more consumers are interested in purchasing environmentally-friendly homes, more lending institutions are offering lower-interest energy efficient mortgages (EEM) that can help increase homeownership opportunities. The EEM recognizes that borrowers who choose energy efficient homes can afford to spend more on their housing expenses because they will likely spend less on energy and operational costs. The EEM allows buyers to qualify for a larger mortgage as a result of the energy savings.

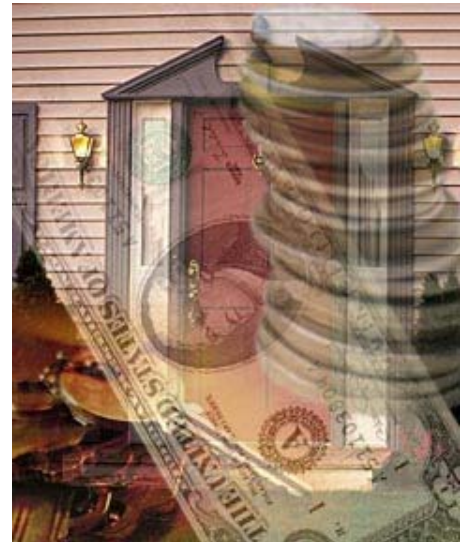
The most common EEM loans are administered through the Federal Home Administration, Veterans Administration, and Fannie Mae, and encourage lenders to make mortgage credit available to borrowers who would not otherwise qualify for conventional loans. A local lender offering the EEM loans is Countrywide Home Loans.

BENEFITS

- ◇ Increase borrower qualifying income
- ◇ 100% of energy improvements can be financed – up to 15% of the value of the home for existing homes and 5% of the home's value for new construction
- ◇ Quality assurance with required third-party energy rating report

ELIGIBILITY REQUIREMENTS

- ◇ No income limit on borrower's income
- ◇ Borrower must purchase energy efficient home, or provide a plan outlining energy-efficient improvements to an existing home.
- ◇ Properties must be one-family, owner-occupied home.
- ◇ New homes must be deemed energy efficient by the energy rating report. As an alternative, the home can meet standards for a prescriptive program, such as the U.S. Environmental Protection Agency's (EPA) Energy Star Building Option Package, or the Jackson County Green Build Program!
- ◇ Existing homes must be upgraded with cost-effective efficiency measures.



For more information on EEMs, check out the HUD/FHA website at <http://www.hud.gov/offices/cpd/energyenviron/energy/apply/index.cfm>

VIII. RESOURCES

GREEN BUILDERS

The home builders below are builders of traditionally built and/or systems-built (modular, SIPs, ICFs) homes that have partnered with ENERGY STAR and have built an ENERGY STAR qualified new home in the last 12 months.

The partner's main phone number is displayed where a service area-specific phone number is not available. FOR A CURRENT LISTING, see www.energystar.gov and click on "New Homes Partner Locator."



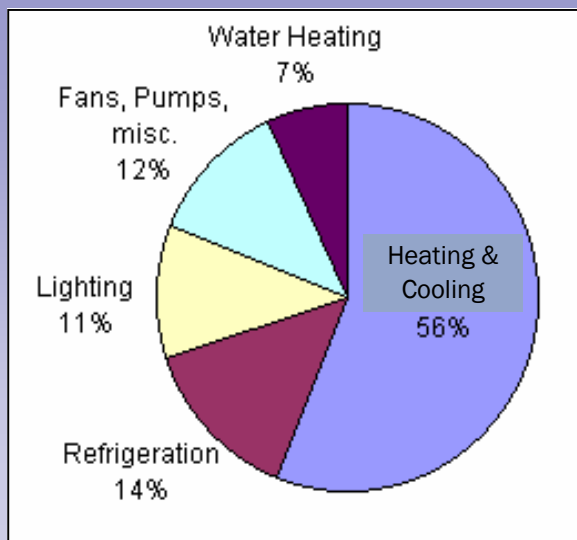
Name	Service Area	Phone	Partner Since	Total Homes Labeled
Benton Homes, LLC	Missouri	513-469-0036	2002	1
Canadiana Homes, Inc.	Midwest to East Coast	905-659-1622	2003	0
Dream Home Builders	Joplin, MO	417-624-0066	2004	0
Eagle Panel Systems, Inc.	Missouri	800-643-3786	2004	0
Envision Development Corporation	Kansas City, MO	816-537-7600	2002	3
Fuqua Homes	Missouri	660-882-3411	1998	0
Homewright Construction	Missouri	417-353-1059	2004	0
Hunt Building Company	Nationwide	915-533-1122	2004	0
IntegraSpec ICF	Nationwide	800-382-9102	2003	0
Logix Insulated Concrete Forms	Missouri	416-462-9118	2003	0
New Vision	Kansas City, MO	816-350-7374	2003	0
Nudura Corporation	Missouri	866-468-6299	2003	0
Pachmayr-Chen & Assoc.	Missouri	573-729-6383	2004	0
Ritz-Craft Corporation	Missouri	570-966-1053	2004	0
Robson Builders	Kansas City, MO	816-505-2639	2003	0
Stitt Energy Systems, Inc.	Kansas City, MO	913-636-7374	1996	21

JACKSON COUNTY GREEN BUILD PERMIT PROGRAM

GREEN UTILITIES

Utilities and other regional energy efficiency program sponsors play a key role in promoting the construction and sales of ENERGY STAR qualified new homes. Utilities, state energy offices, and other sponsors listed here have partnered with ENERGY STAR and offer various incentives to homebuyers and businesses involved with building and marketing ENERGY STAR qualified new homes, including technical assistance, marketing support, home energy performance verification, and financial incentives. Please contact the utilities/sponsors directly for more details and current information.

Name	Service Area	Phone	Partner Since	Homes Sponsored
Aquila, Inc.	Kansas City, MO	816-767-7779	2004	0
Building America	Missouri	303-384-7433	2003	0
Environments for Living	Missouri	866-912-7233	2002	0
MidAmerican Energy	Missouri	515-242-4300	1997	1

*Where do your energy dollars go?*

Lifestyles and living situations affect your monthly energy bills. Two houses that look alike on the outside can have dramatically different energy use.

Depending on each family's energy-use habits, one family might use 50 percent less energy than another living in a similar home right next door.

However, the typical home energy usage looks like the pie chart at left.

WHERE TO BUY

Since sources to buy sustainable building, landscaping, and design products are constantly adding and updating, we suggest checking the following websites for their suggestions:

www.heartlandgreensheets.org

Www.greenpages.org

www.thenaturalhome.com

www.heartland-res.org

www.strawsticksandbricks.com (115 W. 18th Street, KCMO)

Or call Jackson County's local recycling partner, Bridging the Gap, at 816-561-1087 for help finding resources. www.bridgingthegap.org

435 Westport Road, #23, Kansas City, MO 64111

GREEN BUILDING DESIGN TOOLS

This is a general overview of resources and tools for those interested in green building. By no means comprehensive, its purpose is simply to introduce professionals and interested laypersons alike to existing resources presented in a variety of media.

GENERAL:

Environmental Building News (A must for all building professionals--and anyone interested in Green Building!)

This bi-monthly newsletter for builders and architects is recognized as the leading publication on environmentally responsible design and construction. The content is clear and objective. The publication is subscription-funded instead of manufacturer-funded, insuring an unbiased position, and considering all points of view to allow readers to make their own decisions. They have indexed all articles. They also have a product catalogue--**EBN Product Catalog**, featuring building product information.

www.ebuild.com

Newsletter subscription form:

122 Birge St., Ste. 30

Brattleboro, VT 05301

DESIGN AND SPECIFICATION TOOLS:

Green Building Advisor

Produced by the Environmental Building News team. This CD has many databases and case studies embedded into the program. It walks you through sustainable design choices. A very comprehensive tool, especially for the Green Building novice.

Center for Renewable Energy and Sustainable Technology
1200 18th St. NW, Ste. 900
Washington, DC 20036

Resourceful Specifications (formerly Green Spec)

This specifying guide is prepared by the Alameda County Recycling Board, and is a basic starting point for spec writers. \$35 for disks and binder.

For information contact: Larry Strain
1295 59th St.
Emeryville, CA 94608
510-547-8092

Waste Spec

This program available on disk provides the specifier with model language to insert into specifications to address waste reduction techniques, salvage and reuse of materials, and recycling of construction waste.

Published by Triangle J Council of Governments
P.O. Box 12276
Research Triangle Park, NC 27709
919-549-0551

ONLINE INFORMATION AND RESOURCES:

Green Building Resource Center

Global Environmental Options is a non-profit organization that acts as both a coordinating entity and a clearinghouse of information for professionals and non-professionals alike. Their web site contains The Green Building Resource Center and is a listing of green design and building Internet sites: www.greendesign.net

The Harris Directory

B.J. Harris. Online database that contains more than 1000 recycled-content and resource-efficient materials, continually updated: www.harrisdirectory.com

AIA Environmental Resource Guide

This comprehensive guide is a good text for sustainable issues as well as how to make material selections.

This is now only available on-line for a fee.

American Institute of Architects' Publications is now Rizzoli Publications, Inc.
300 Park Ave. South
New York, NY 10010
888-272-4115.

Healthier Indoor Environments: Canadian Sources of Residential Products and Services

This web site includes a section on "Low Polluting Building Products, Materials, and Technologies", also lists consultants who provide screening, evaluations of materials, and cleaning and maintenance products. This is the most comprehensive source of information for an Indoor Environmental Quality interrelationship with building materials.

Canadian Housing Information Center, CMHCa

613-748-2367 / Fax 613-748-2098 www.cmhc-schl.gc.ca

For materials listings: www.sampleroom.buygreen.com

EPA's Energy Star Buildings Web Site

Information on energy-efficient technologies, equipment and calculation programs for buildings and home appliances. Building components have their own links from this site:

202-233-9114 / Fax back line 202-233-9659 www.epa.gov/buildings

The Building Research Establishment Environmental Assessment Method (BREEAM)

BREEAM is a rating method currently for commercial buildings. Widely accepted in the UK as an important part of environmental policy of many major businesses for design, operation, management, and maintenance. BREEAM is one of many programs of BRE, which is the UK's leading center for research on buildings and construction. Extensive and continually updated, so best accessed on-line:

Center for Sustainable Construction BRE
Garston, Watford WD2 7 JR.
breeam@bre.co.uk
www.bre.co.uk

BuildingOnline

This is a building industry search engine and web site marketing agency:

Dana Point, CA

714-496-6648

www.buildingonline.com

Oikos

This is a discussion site for green building topics. For log-on instructions, send e-mail to: www.greenbuilding-request@crest.org

www.oikos.com

Center For Energy and Sustainable Technology (CREST)

Energy efficiency information and listings of other related web sites. Mostly energy efficiency resources:

www.crest.org

HOK's Healthy and Sustainable Building Materials Database

Product database along with specifying guide available through website: www.hok.com

HELPFUL BOOKS & MAGAZINES

Environmental By Design, Professional Edition

By Kim Leclair and David Rousseau. This is a hard copy notebook style publication with symbols representing various criteria including: recycled content; renewable resource; in-plant energy efficiency; low emissions in plant; minimum packaging; minimum transportation; minimum installation hazards; low toxic emissions; durability; simple non toxic maintenance; reusable; recyclable; fair business practices; research and education programs.

P.O. Box 95016

South Van C.S.C.

Vancouver, B.C., Canada V6P 6V4

Green Building Resource Guide

By John Hermannsson, AIA. Soft cover book in CSI format includes price and green significance in icon form.

The Taunton Press

P.O. Box 5506

Newton, CT 06470-5506.

ISBN 1-56158-219-0

www.greenguide.com

Guide to Resource Efficient Building Elements

Contains contact and product information for resource efficient and recycled material manufacturers producing everything from foundations to roofing. Updated annually.

Center for Resourceful Building Technology
P.O. Box 100
Missoula, MT 59806
406-549-7678 / Fax 406-549-4100

Prescriptions for a Healthy House

By Paula Baker, Erica Elliott, and John Banta. This recent book covers healthy building theory, specification language, case studies, resources, construction details, and more. Written by an architect, a physician, and an indoor environment expert.

InWord Press
2530 Camino Entrada
Sante Fe, NM 87505-4835

The Resource Guide to Sustainable Landscapes and Gardens

This 368-page softcover book lists more than 1100 environmentally responsible landscaping materials, products, and information sources. Sorted by CSI division. Not regionally based.

Environmental Resources, Inc.
2041 East Hollywood Ave.
Salt Lake City, UT 84108-3148
801-485-0280

R-2000 Procurement List

This list assists builders in selecting products that will meet R-2000 IAQ requirements. Includes sections on carpet and padding, resilient flooring, paints and finishes, adhesives and composite wood products.

Available through John Broniek, Canadian Home Builder's Association

Sustainable Building Technical Manual

A step-by-step guide to energy- and resource- efficient design, construction, and operations. Background information and case studies included. This document was funded by the EPA, the U.S. Green Building Council, and PTI and included contributions from expert practitioners. \$68 (free to PTI members) through Public Technology Inc. 301-490-2188

Woods of the World

JACKSON COUNTY GREEN BUILD PERMIT PROGRAM

Diskette or CD-ROM interactive multimedia database of the world's wood species. Gives 85 fields of data on each species, including substitutes, and scans of colors and grains. The listing also provides information on well-managed sources and suppliers.

Tree Talk Inc.
P.O. Box 426
431 Pine St.
Burlington, VT 05402
802-863-6789

City of Austin Sustainable Building Guidelines

A general overview of the sustainable goals set out for Austin's municipal buildings. Along with both Specifying Guide and Operations and Maintenance guides, this series forms the basis of our Green programs for the City of Austin's own buildings.

Available through Program or website: www.ci.austin.tx.us/greenbuilding

NATIONAL RESEARCH LABORATORIES:

All of these agencies have useful reports, studies and design information.

The Florida Solar Energy Center (FSEC)

The energy research institute of the State of Florida. The Center is nationally recognized for comprehensive programs in solar energy and energy-efficiency. On-line reports on research for building performance. Also thorough information on planning photovoltaic systems. www.fsec.ucf.edu

The Environmental Protection Agency (EPA)

Has several applicable sites relating to environmentally preferable product development and energy efficiency. The Energy Star web site is a good start to what they offer for building design. www.epa.gov/buildings

ENERGY CALCULATION PROGRAMS

Most of these programs have demonstration capabilities on their web sites.

Elite Software

Two programs which quickly and accurately calculate maximum heating and cooling loads for commercial buildings. Ability to enter weather data, zone loads, envelope analysis, full screen editing, and automatic building rotation are some of the features. Demonstration available on website www.elitesoft.com/hvacr/elite.

Order through Elite Software
P.O. Drawer 1194
Bryan, TX 77806

800-648-9523

EZDOE

Energy calculation program also by Elite Software. An easy to use version of the Department of Energy's DOE program. Calculates hourly energy use and a building's life cycle cost of operation by using location, construction, operation, and heating and air conditioning system. Simulates all types of heating and cooling plants and allows for complex utility rate structures and other costs to be analyzed. Demonstration available on website www.elitesoft.com/hvacr/elite_ezdoe. \$1250.

Order through Elite Software
P.O. Drawer 1194
Bryan, TX 77806
800-648-9523

For many more **energy modeling tools**: www.eren.doe.gov/buildings