Converting an Existing Home into an Environmentally Responsible "Green Home"

ENVIRONMENTALLY RESPONSIBLE BUILDING – BLT 140

TERM PAPER

Prof. Anthony Floyd

By

Gary D. Miller

April 23, 2003

Converting an Existing Home into an Environmentally Responsible "Green Home"

The writings within this paper are examples of recent homes that were purchased and have been converted from an every day standard American home, into an environmentally responsible home for tenants/owners that would like to live a healthier and happier life. Some of this information also includes projects in the works. Much credit is due to what I have learned from this class and other recent Green Building educational experiences. Many thanks to the Green Building Council.

Recently a home was purchased for the purpose of being converted to a more healthy and sustainable living environment for its new occupants. First a budget was conceived and set for the particular projects. The budget was determined by the market conditions for rent or sale, location and what the home can absorb in expenses. The main goal is to make the home as Green as possible without going over the budget for the project. Many times the budget is expanded to cover the cost of a particular material or technique to compensate for a Greener building. The budget is only a guideline and can be adjusted slightly.

The next step is to evaluate the home for what the existing conditions of the home are and what can be realistically accomplished. Start with a remodeling checklist. The checklist is intended to serve as a tool for project planning and design, materials selection, and construction. When building or remodeling, it is important to look carefully at the type of project and incorporate as many green features as possible. The items listed on the checklist represent a small variety of green building opportunities; however, not all of them may apply to the specific remodeling project. There is no standard definition for what constitutes a "green building", but in general, a green project will incorporate as many items on this checklist and more, that are practical and applicable to the project.

Some of the areas I concentrate on the most are: site orientation, overhangs (shading), windows condition, landscaping, type of home construction, type of flooring and paint coverings, lighting, cooling unit and natural ventilation available, insulation in attic, the total building envelope, indoor air quality… The results of this evaluation will give us a basis to determine which areas of the budget to allocate more than others.

Green Remodeling Checklist

A. Site Condition
1. Recycle Job Site Construction and Demolition Waste
2. Salvage Reusable Materials
3. Install Drip Irrigation
4. Incorporate Permeable Paving
5 . Design Resource-Efficient Landscapes and Gardens
6. Provide for On-Site Water Catchment / Retention
7. Remodel for Mixed Use, Adaptive Reuse, and Historic Pre s e rv a t i o n

B. Foundation
1. Incorporate Recycled Flyash in Concrete
2. Reuse Form Boards
3. Use Recycled Content Rubble for Backfill Drainage
4. Insulate Foundation Before Backfill
5. Use Aluminum Forms
6. Install Rigid Foam, Insulated Concrete Forms (ICFs)

C. Structural Frame
1. Substitute Solid Sawn Lumber with Engineered Lumber
2. Use FSC Certified Wood for Framing
3. Use Wood I-Joists for Floors and Ceilings
4. Use OSB for Subfloor and Sheathing
5. Use Finger-Jointed Studs
6. Use Structural Insulated Panels (SIPs) for Walls / Roof
7. Use Reclaimed Lumber

D. Exterior Finish
1. Use Sustainable Decking Materials
2. Use Treated Wood that Does Not Contain Chromium or Arsenic for Decking and Sill Plates
3. Use Alternative Siding Materials

E. Plumbing
1. Install Hot Water Jacket Insulation
2. Convert Gas to Tankless Water Heaters
3. Insulate Hot and Cold Water Pipes
4. Retrofit all Faucets and Showers with Flow Reducers
5. Replace Toilets with Low Flow Models
6. Install Chlorine Filter on Showerhead
7. Pre-Plumb for GrayWater Conversion
8. Install Water Filtration Units at Faucets
9. Install On-Demand Hot Water Circulation Pump

F. Electrical
1. Install Compact Fluorescent Light Bulbs
2. Install Lighting Controls
3. Install Ceiling Fans

G. Roofing
1. Select Light Colored Roofing
2. Select Safe and Durable Roofing Materials

H. Appliances
1. Replace Dishwasher with Low Water Use Model
2. Install Horizontal Axis Washing Machine
3. Install Energy-Efficient Refrigerator

I. Insulation
1. Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements
2. Install Recycled Content, Formaldehyde-Free Fiberglass Insulation
3. Use Advanced Infiltration Reduction Practices
4. Use Cellulose Insulation

J. Windows
1. Install Energy-Efficient Windows
2. Install Low Heat Transmission Glazing

K. Heating, Ventilation and Air Conditioning (HVAC)
1 . Use Duct Mastic on all Duct Joints
2. Install New Ductwork within Conditioned Space
3. Vent Range Hood to the Outside
4. Install 90% or Greater Efficiency Gas Forced Air Furn a c e
5. Install Solar Attic Fan
6. Clean all Ducts Before Occupancy
7. Install Whole House Fan
8. Replace Electric and Wall-Mounted Gas Heaters with Heat Pumps
9. Install Zoned, Hydronic, Radiant Heating
10. Retrofit Wood Burning Fireplaces
11. Install / Replace Dampers on Fireplaces
12. Install Airtight Doors on Fireplaces
13. Install Heat Recovery Ventilation Unit (HRV)
14. Install Separate Garage Exhaust Fan
15. Install High Efficiency Particulate Air (HEPA) Filter

L. Renewable and Solar Energy
1. Incorporate Natural Cooling
2. Incorporate Passive Solar Heating
3. Pre-Plumb for Solar Water Heating
4. Install Solar Water System
5. Install Photovoltaic (PV) Panels

M . Indoor Air Quality / Finishes
1. Use Low/No-VOC and Form a l d e h y d e - F ree Paint
2. Use Low VOC, Water-Based Wood Finishes
3 . Use Solvent-Free Adhesives
4 . Substitute Part i c l e b o a rd with Form a l d e h y d e - F ree Materials
5. Use Exterior Grade Plywood for Interior Uses
6. Substitute Formaldehyde-Based Medium Density Fiberboard (MDF) with Formaldehyde-Free Materials
7. Use FSC Certified Trim Material
8. Seal all Exposed Particleboard or MDF
9. Use Finger-Jointed Trim

N. Flooring
1. Select FSC Certified Wood Flooring
2. Use Rapidly Renewable Flooring Materials
3. Use Recycled Content Ceramic Tile
4. Replace Vinyl Flooring with Natural Linoleum
5. Use Exposed Concrete as Finish Floor
6. Install Recycled Content Carpet and Underlayment

*Courtesy of Alemada County CA Green Building and Waste Control

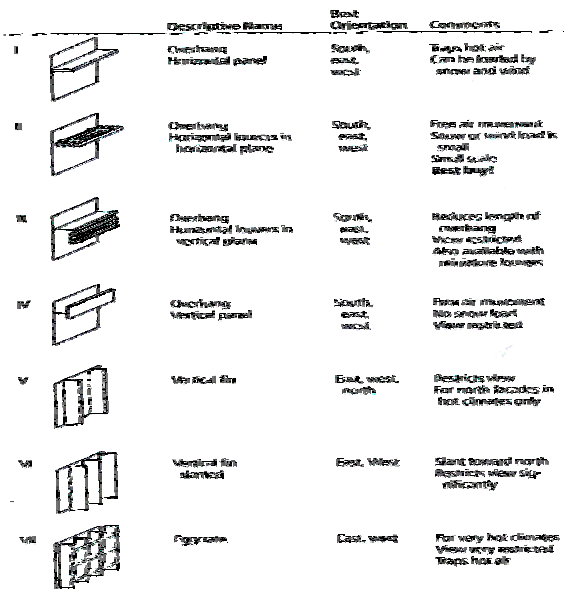
This home I concentrated on many of the important issues and here is what was done to keep the project as much as an Integrated whole system as possible:

Exterior

Landscaping: It was a complete eyesore with tall weeds and dead trees in the back but with a newer desert-scape in the front with rock and a few cacti. The front of the home faced south. It was determined to keep the existing low water use plants and add some mesquite trees to the front to shade the home from the hot summer sun. Some other plants were added to align with the style of landscaping and a drip system to support the growth of these plants. The rear yard faces North and the windows were shaded nicely on the east and west from the neighboring trees. Again the yard was desert-scaped with matching stone, a drip system and low water tolerance plants and trees along with the existing fig tree which was trimmed and brought to life in the new plan. The West wall was planted with climbing vines to keep it cool from the hot afternoon sun.

Shading Devices: The existing overhangs on the home were 24” around the perimeter with a 40” covered walkway in front. These overhangs were sufficient for the existing windows to shade out most of the summer sun.

A trellis with vines will be added in the future to cover the north patio and also serve as a cooling courtyard for natural ventilation through the house. On the South wall above the large front window a louvered panel overhang will be added to accomplish the proper shading from the sun in the summer. This will still leave enough room to allow for the direct winter solar gain.

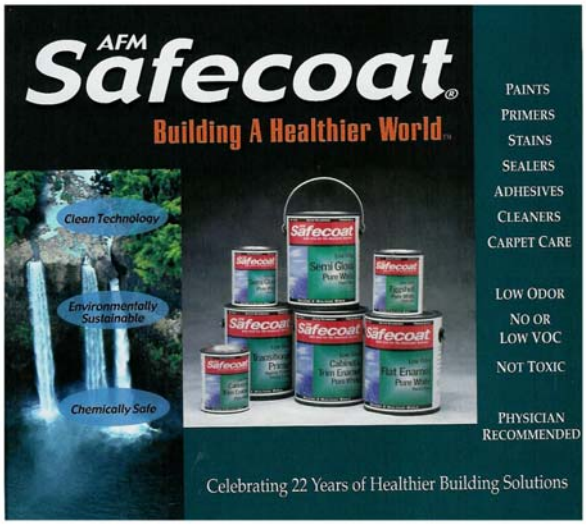


Type of Construction: The home was built in the late 1950s and was constructed of brick. This solid brick construction acts as a great solid mass for allowing the solar gain to be absorbed and released slowly. This also works well for night cooling. The roof is a wood structure with asphalt shingles. Cellulose insulation and 3 turbine roof vents were added. Overall this is a very comfortable type of home to live in.

Windows: The existing windows were steel with many broken panes. Since this was a rental property the budget did not allow for the replacement of the windows. The existing windows were repaired with new panes, cranks and weatherstripping to improve their efficiency.

Interior:

Wall Coverings (Paint): The home has drywall interior walls and plastered brick exterior walls. Several of the rooms has pressed paneling on nailed and glued over the existing walls. This was removed and scraped, and patched and painted. The entire interior of the home was painted with AFM Safecoat Eggshell paint coatings. I have found this to be the best of all No-VOC paint



coatings on the market. The ingredients are primarily plant based and has no off gassing after it dries in a few hours. This product also seals in any toxic products it covers. It acts like a shell once it dries. This was also used to paint older cabinets and doors to seal any toxins that may be emitting from the material.

Air Handling Equipment: The existing heating and cooling unit was only 5 years old and efficient for our standards. A programmable thermostat was added and a MIRV 12 pleated filter was installed with instructions for future changes.

Plumbing: The existing toilets were changed to low consumption 1.6 gallon/flush insulated tank units. Several faucets and shower heads were also changed to more efficient units. All other fixtures and the existing water heater were checked for leaks and adjusted for maximum efficiency. The water pipes exposed in the attic were insulated to keep the heat loss and condensation sweating to a minimum.

Lighting: The existing lighting in the home was relatively efficient. Many fluorescent fixtures were already in place, several fixtures needed replacement to accommodate fluorescent bulbs and some just needed the bulbs changed. A fluorescent valence was added.

Flooring: Flooring is a large factor in our budget and decision making. There are so many choices available. Many products were looked at for the project including: ceramic tile, exposed stained concrete, Marmoleum, wool carpet with blue jean cotton padding, cork and bamboo flooring. The best products for this project were: ceramic tile in the kitchen, baths, laundry. Wool carpet with blue-jean padding in the living room and stained concrete in the bedrooms and rest of the home. WOOL CARPET>

Rosin
Rosin, the binding agent in Marmoleum and Artoleum, is tapped from pine trees, without affecting growth. Together with linseed oil, rosin gives Marmoleum and Artoleum its strength and flexibility.

Wood flour
Wood flour is used to bind the pigments and to ensure colorfastness. Marmoleum and Artoleum thus keep their beautiful, vibrant colors throughout their lifespan. Another reason for using wood flour is that it helps to optimize a smooth surface. We have chosen not to use tropical hardwood flour but wood flour made from timber grown in controlled European forests, where every tree felled is replaced.

Cork flour
Cork flour is made by grinding the bark of the cork oak, which is grown around the Mediterranean. The bark is peeled every seven to ten years without affecting the tree's growth. Cork flour is used as a raw material in two of our products: Bulletin Board and Corklinoleum.

Limestone
Limestone is found all over the world in enormous quantities. Very finely ground, it is a valuable ingredient of Marmoleum and Artoleum.

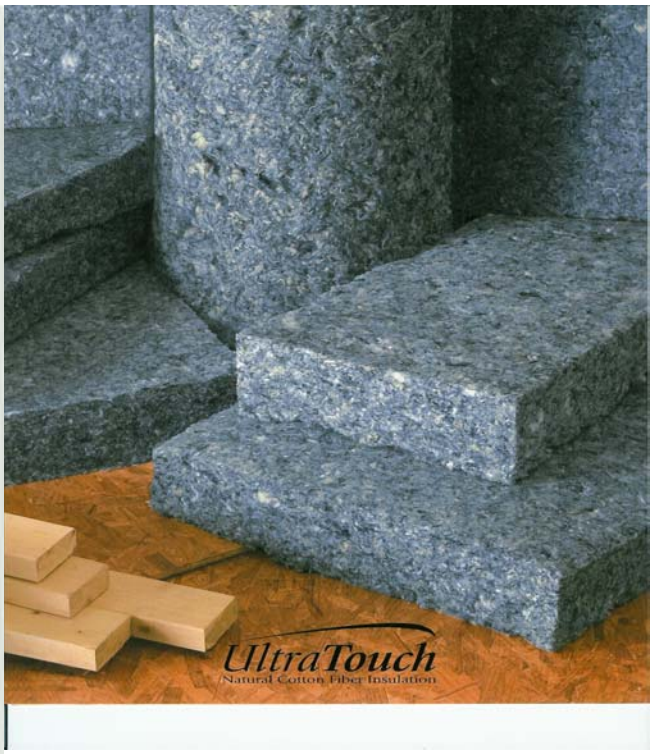
Pigments
The most beautiful colors are created by using ecologically responsible pigments that do not contain heavy metals such as lead and cadmium.

Jute
From the wide variety of materials available for making the floor covering's backing we prefer natural jute. The yarn for the webbing is spun from jute grown in India and Bangladesh. This also makes vital economic contributions to these developing countries.

Marmoleum Sample (Left)

Cork Samples (bottom left)

Blue Jean Padding/Insulation



Cleaning: The final stage in getting a house ready to sell or rent is to clean it thoroughly using environmentally safe products. There are many products sold at health stores or on the web. These products are safe for the environment as well as the occupants and users. The other side to cleaning up is recycling as much of the debris as possible during the project, therefore lessening the need for large dumpsters going to the landfill.

In summary converting an existing home into a Green Home can be a simple process. It takes learning the techniques of Green Building and going through a list of what is feasible for your particular project. Many times the expenses of going Green can be equal or only slightly more than conventional remodeling.

The main idea is to look at your home as a whole system, everything working together to achieve the results you desire for a safer, more energy efficient and happier place to live in.