

WNC Green Building Directory

2002 - 2003

A regional resource guide to environmental building



This directory includes:
listings of green building
professionals, materials and
suppliers, as well as educational
articles on green building methods
and local examples of green building



HELPING TO BUILD A SUSTAINABLE COMMUNITY



**Western North Carolina
Million Solar Roofs Initiative**

see page 43



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Want to be included in the
next edition of the WNC
Green Building Directory?
CONTACT:
Duncan McPherson
duncan@samselarchitects.com
828-255-2690 ext. 114

On the cover: the Davis Residence, an active and passive solar, low-toxic home located in Horseshoe, North Carolina

INTRODUCTION

USING THIS DIRECTORY

Who can use this Directory? Everyone can! It is that simple. Whether you are getting ready to design, renovate, add on, buy or build new - this directory is designed to be user friendly to homeowners, builders, architects, consultants, and anyone interested in green building. Regional suppliers and resources are the focus of this directory, however, due to limitations of production in this region, some national resources are occasionally listed as well. The directory is divided into five main sections:

- **Introduction** – a general overview on the directory, green building, and the WNC Green Building Council to help you understand the basics
- **Listings** – contact information and descriptions of regional green building professionals, materials, and suppliers to help you find the right people and products for your project
- **Articles** – educational articles explaining green building issues and techniques in more detail including some regional case studies of successful projects
- **Case Studies** - local examples of “green” buildings
- **Resources** – a concise list of publications and web pages that can help expand your knowledge of sustainability and green building

It's important to note that while all businesses listed in this directory provide environmental building services and products, *all* their services or products might not be considered environmentally sound. Therefore we encourage readers to always specifically inquire about the *environmental* features a business provides. So, happy reading and building from all of us at the WNC Green Building Council.

DISCLAIMER

Though great attention has been made to ensure the accuracy of the WNC Green Building Directory, the publication assumes no responsibility and disclaims any injury, damage, or economic loss resulting in the use or effect of any product or information specified within this publication. Information in the WNC Green Building Directory does not necessarily reflect the endorsement of the advertising sponsors. The publication cannot be a substitute for product quality assurance by the manufacturers and providers of these products and services; it cannot be a replacement for preferences of individual consumers; and it cannot be an alternative to common sense employed by consumers who use the products and services discussed herein. It is recommended that consumers follow instructions in product and service manuals and on labels to ensure safe use.

Green Building

The growth and development of our cities and communities have a major impact on our environment. How and where we build is one of the most important factors in our future health and happiness. The manufacturing, design, construction, and operation of the buildings we live and work in is largely responsible for the consumption of many of our resources. Certain design and construction techniques can be used to considerably reduce these affects of development. Green building is a broad term for the design and construction of energy and resource efficient, durable, and healthy buildings that minimize their impact on the environment.

Green buildings include the following:

- Least-toxic, renewable, recycled building materials
- Energy efficiency, renewable energy, lower operational costs
- Resource efficiency, reduced construction waste, water conservation
- Durability, quality construction, low-maintenance
- Healthy indoor air quality
- Sustainable landscape, protection of ecosystems, native plants, drought resistant landscaping

The Council estimates that the building industry consumes over sixty percent of the natural resources and is responsible for more than half of the waste produced in the United States each year. The operations of residential and commercial buildings consume one-third of all energy used in the United States. A properly designed and constructed green built home will use 30 - 60% less energy to operate than the conventional home and require fewer resources in the building process.

A building is not necessarily "green" solely by using recycled building materials. Green building techniques must be an integral part of the overall design and construction process. Varying factors that influence the process should be taken into consideration including local, regional, and global environmental issues, functional requirements, existing site conditions, and availability of resources. Priorities should be established to help determine which strategies will be most effective in reducing the building's overall environmental impact. A systematic approach that incorporates these factors into the entire decision making process not only allows for a more environmentally conscious building and landscape, but also a more environmentally conscious way of living.

What is Sustainability?

The term "sustainable" is used with great enthusiasm these days. A general definition of sustainability is: a process that can be continued indefinitely without degrading the environment. Sustainability encompasses a board range of factors including cultural, environmental, and economic issues. Paraphrased from a United Nations Environmental Programme Document:

'... meeting the needs of people today without destroying the resources that will be needed ... by persons in the future; based on long range planning and the recognition of the finite nature of natural resources...'

Green Building Checklist For the Lay-Person

By Robin Raines Elliott

One of the challenges in utilizing green building methods is learning how to implement practices in an easily accessible and understandable way. Here is a beginner's checklist for responsible design solutions.

- Design for the minimum size needs, not the maximum. Find out how much space is really needed, and make that a rule. Make energy efficiency a priority. Use high levels of insulation, good windows, and sound construction. Renovate older spaces to meet a higher standard of energy efficiency.
- Consider renewable energy. With the California energy crisis heading east, we cannot afford to depend on finite energy sources alone.
- Recycle waste. Place recycling bins where you are most likely to choose them over the garbage can.
- Build structures for durability. Most buildings in the United States are designed for a small life span. We can lessen building waste by designing long-life structures.
- Design with future adaptability in mind.
- Eliminate use of potential health hazards. Don't use things like radon or pesticides. Look into low toxic products.
- Renovate older existing buildings. They are already there.
- In-fill development should be considered before using undeveloped green spaces.
- Minimize your automobile dependence. Walk to a convenience store. Walk to school.

Landscape to absorb water rather than carrying it off in the sewer system.

Use trees as natural air-conditioners.

Avoid HCFCs, Hydro chlorofluorocarbons.

Select materials that require minimum upkeep (paint, waterproofing).

Buy locally. Support the businesses in your neighborhood. Not only will this keep your neighborhood alive; it will reduce gasoline use required for transportation of goods.

Use recycled building materials. The manufacturing has already been done, and no new resources are being extracted.

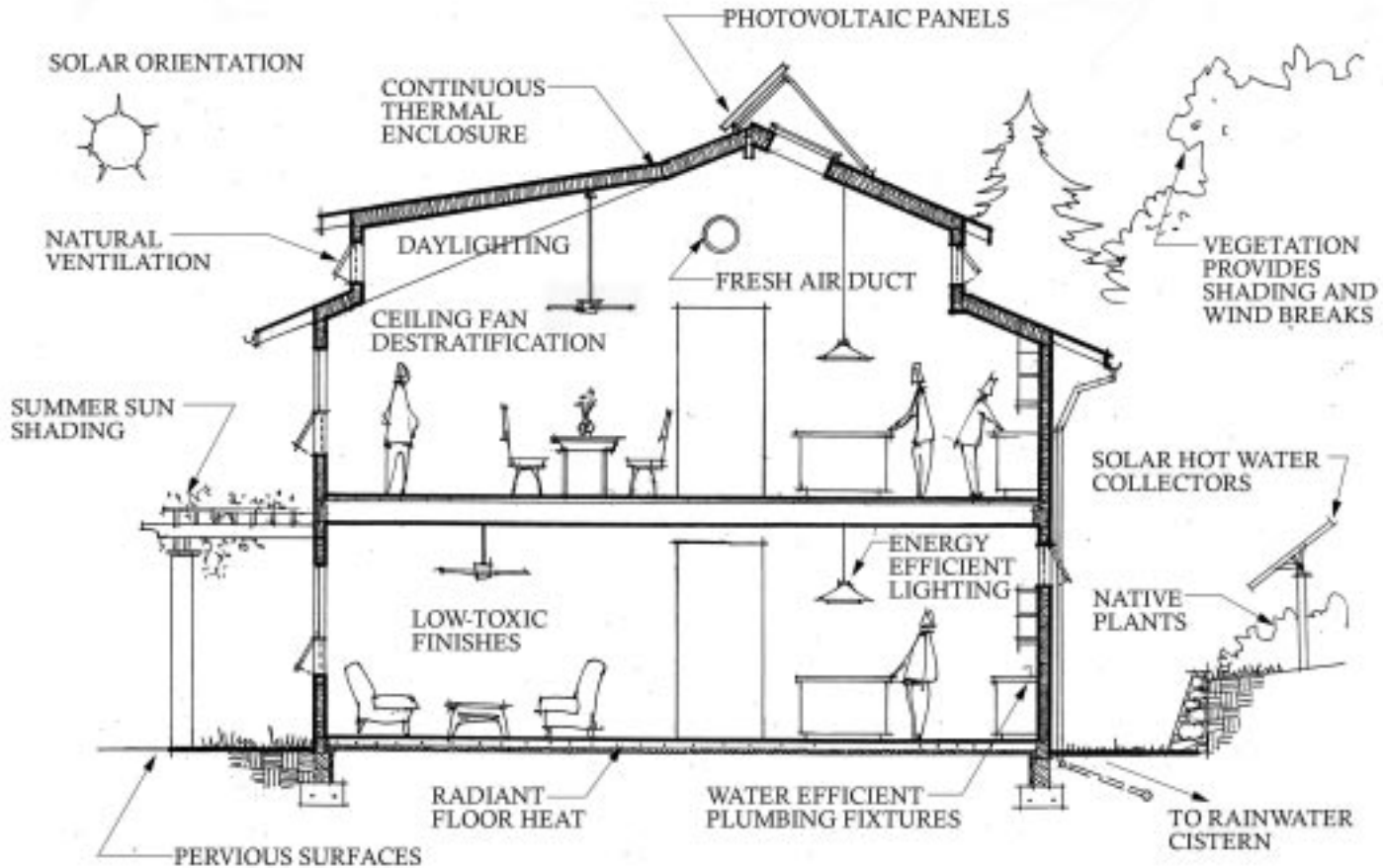
Salvage your building materials. Reuse old doors, plumbing fixtures, etc.

Use wood from certified forests. Engineered wood is also an option for old-growth wood. Minimize the use of treated woods. Detail wood conditions so that they do not come in contact with the soil. Choose products with less packaging. Complain to your favorite suppliers if the packaging is excessive.

Fluorescent lights are improving. Consider replacing incandescent bulbs for fluorescent bulbs throughout your home. Always look for "energy-star" appliances.

Educate yourself.

Taken from an article in [Environmental Building News](#)
Checklist for Environmentally Responsible Design and Construction,
December 11, 1998



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Green Building Diagram

Image courtesy of Samsel Architects

WNC Green Building Council

The Western North Carolina Green Building Council, formed in August 2000, is a non-profit organization whose mission is to promote environmentally sustainable and healthy building practices through community education. The term sustainability can be defined as a process that can be continued indefinitely without degrading the environment. This approach provides a framework for making environmentally conscious decisions during the research, design, and construction phases of the building process.

Members of the Council include architects, builders, homeowners, consultants, product distributors, and governmental organizations. The members are well versed in the issues of sustainable design. It is the Council's goal to share this knowledge with the community in order to raise awareness of green buildings and how they can benefit the community by using less energy, providing healthier environments, and creating less waste.

There is a need to educate the public and other building professionals about the options of creating healthier, more efficient buildings that have less impact on the natural environment. The council and this directory aim to protect the natural environment by promoting green building.

GOALS:

- Develop educational programs and opportunities for professionals and the public
- Develop and implement a "Green Building Program" for western North Carolina
- Enhance networking opportunities among regional homeowners, professionals, governments, and organizations
- Help the region become a model of successful green building and sustainable development.

How can I join?

photo copy this page and mail with check made out to WNC Green Building Council

Name	<input type="text"/>	Phone #	<input type="text"/>
Affiliation	<input type="text"/>	Fax #	<input type="text"/>
Address	<input type="text"/>	Email	<input type="text"/>
	<input type="text"/>	Date	<input type="text"/>

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WNC Green Building Council
PO Box 8427
Asheville, NC 28814
www.wncgbc.org

LISTINGS

ALTERNATIVE BUILDERS

Earthaven Forestry Cooperative

Brandon Greenstein
1025 Camp Elliot Rd
Black Mountain, NC 28711
(828) 664-1732
Fax (828) 669-8879
Email
forestrycooperative@earthaven.org
Website
www.earthaven.org/fc/fc.htm
The Earthaven Forestry Cooperative has brought together wood lot management and low-impact felling and skidding with custom milling, site planning, natural home design and construction. Earthaven FC specializes in systems that use small timber and non-toxic materials like unique timber frames with natural insulation and earthen plasters. Milling and innovative designs allows the company to minimize waste and maximize efficiency, while providing a beautiful, responsible product at an affordable price.

Kleiworks

Janell Kapoor
80 1/2 Cumberland Ave
Asheville NC 28801-
(828) 252-7701
Email janell@kleiworks.com
Website www.kleiworks.com
Kleiworks works with a team of experienced designers and builders dedicated to building beautiful natural homes that make sense for you and your environment. We work with your visions incorporating site, climate and local natural materials to build minimal-impact, whole-system design dwellings that will gracefully last through the

ages. Kleiworks also teaches natural building workshops empowering people to build their own homes. Kleiworks also provides beautiful handcrafted tiles that will warm any home.

Skypeople Gallery and Design Studio

Kitty Brown, Artist
51 North Lexington Ave.
Asheville, NC 28801
(828) 232-0076
Email
skypeople@mindspring.com
Sky People Gallery and Design Studio is a fine art and craft gallery, interior design studio, and building collective which offers an array of options for the home. From additions to remodels, home furnishings, art pieces and custom art installations, we create spaces that are spiritually evocative, eco-friendly, and beautiful. Our aesthetic focus is on the natural and hand-built, and we offer an array of building materials that support our focus.

APPLIANCES

Ballard's Appliance & Cabinet Co., Inc

1238 Hendersonville Rd
Asheville NC 28803-
(828) 274-0406
Fax (828) 274-1084
Email rbal611945@aol.com
Ballard's sells appliances to retail customers and offers builder discounts. Our cabinet dept. does interior design for kitchen and baths. In our appliance dept. we carry several appliances that carry the federal Energy Star label for conservation.

ARCHITECTS

Appalachian Architecture PA

PO Box 179

Boone NC 28607-

(828) 265-2405

Fax (828) 265-2406

Appalachian Architecture employs site sensitive design practices.

Architectural Design Studio, PA

Donny Luke

90 Church Street

Asheville NC 28801-

(828) 252-0355

Fax (828) 252-4059

Email

schoolarchitect@worldnet.att.net

Architerra

Chris Larson

16 Whisper Creek Lane

Asheville NC

(828) 253-4621

Email clarson809@aol.com

This architectural practice is interested in connecting people to people and people to nature, through two design theories: Sociable Design and Natural-Form patterns. Environmentally conscious design and building practices emerge from these theories and are tailored specifically to fit each client and project. Our open, holistic, and integrated design approach reflect the vision, respect and commitment required to build and still keep the planet green.

Cameron Designs

David Cameron

150 Private Drive

Union Mills NC 28167-

(828) 287-7931

Fax (828) 288-0850

Camille-Alberice Architects PA

Robert Todd

32 Broadway Street,

Asheville NC 28801-

(828) 251-5550

Fax (828) 251-1465

Email cd@camille-alberice.com

Camille-Alberice Architects incorporates numerous sustainable and efficient building practices in our design including: integrated day lighting, energy efficient equipment, and passive solar design in commercial and institutional buildings. Other techniques include efficient space planning, renovation of existing buildings, and energy efficient, recycled, and natural materials.

Michael Chelnov, AIA

Michael Chelnov

PO Box 2162

Blowing Rock NC 28605-

(828) 265-2282

Cort Architectural Group

John Cort

239 Haywood St

Asheville NC 28801-

(828) 251-5100

Fax (828) 252-8535

Email plan@cortaia.com

Website www.cortaia.com

Architectural services with extensive experience in energy conscious school design, including passive solar design and day lighting.

Alice Dodson

Alice Dodson

45 Lula Cove Road

Weaverville NC 28787-

(828) 645-9326

Fax 645-0440

Primarily residential building and land development design for healthy and harmonious living by incorporating solar design, non-toxic materials and finishes, and appropriate design methods to honor our natural environment. Design principles also include Bau-biologie and Feng Shui.

We shape our buildings and there
after they shape us.

—Winston Churchill

Glazer Architecture, PA

Laurie Miller
 78 1/2 Patton Ave
 Asheville NC 28801-
 (828) 254-5853
 Fax (828) 254-5856
 Email
 info@glazerarchitecture.com

Glazer architecture does innovative commercial and residential, site sensitive design. It has complete architectural services including adaptive re-use of existing buildings, new construction, co-housing communities, and feng shui. Laurie Miller, AIA, while with Pimsler Hoss Architects in Atlanta, completed two environmental education centers incorporating passive solar, daylighting, energy efficient appliances and lighting, geo-thermal heating and cooling, porous parking, cistern for rooftop water collection, cupola for heat release and sustainable building materials throughout.

Gresham Architecture

Warren Gresham
 89 Overbrook Street
 Waynesville NC 28786-
 (828) 456-4114 Fax

This thirteen year old design firm is now committed to using ecologically sustainable, or green design principles, as the overall design guide for new work.

RS Griffin Architects PA, AIA

Robert Sweetser
 1 Village Lane
 Asheville NC 28803-
 (828) 274-5979 Fax (828)
 274-1995
 Email
 robbie@griffinarchitectspa.com

Commercial and residential architecture that achieves superior economic and environmental performance to meet our client's program and achieve a better building environment for their physical needs. Green buildings provide a more healthful working and living environment with greater benefit to the broader community.

HarleyEllis

Douglas R Campbell
 1095 Hendersonville Rd
 Asheville NC
 (828) 274-1551 Fax (828)
 274-8458
 Email

DRC@harleyellisashville.com
 Architecture and engineering for non-residential building. Knowledgeable of energy efficient utility systems, low V.O.C., and recycled materials, and the LEED program.

JMC Partners

Crawford Murphy
 46 Haywood St Ste 5
 Asheville NC
 (828) 252-3031 Fax (828)
 252-6677

Specializing in church designs that incorporate energy efficiency, recycled materials, and indoor air quality. Projects include renovations, historic preservation, and adaptive reuse.

Bruce Johnson Architecture, PA

Bruce Johnson
 66 Forrest Dr
 Asheville NC 28803-
 (828) 274-3922

Design specializing in environmentally sensitive, custom residences.

Legerton Architecture Planning

John Legerton
 6 Bowling Park Road
 Asheville NC 28803-
 (828) 251-9125
 Fax (828) 281-1287

Legerton provides architectural design services for new residences, renovations, additions, historic preservation, commercial & institutional projects, and sustainable design.

Mahaley Odell Thompson, Architect

Thompson Odell
 P.O.Box 1197
 Cullowhee NC 28723-
 (828) 293-0248
 Fax (828) 293-2148
 Email motarch@aol.com

This firm provides environment-

tally sensitive architectural design services that are based upon timeless, site-specific responses to nature and human-made context.

Mathews Architecture, P.A.

Shane Elliott
34 Wall Street, Suite 307
Asheville, NC 28801
(828)-253-4300
Fax: (828) 253-4567
shane@mathewsarchitecture.com
www.mathewsarchitecture.com

Michael J. McDonough Architect, PA

Michael McDonough
46 Tacoma Street
Asheville NC 28801-
(828) 253-4878
Fax 253-3830
Email mjmachitect@att.net
Michael Mc Donough provides smart growth site design and architectural services incorporating passive solar, energy efficiency, day lighting, and local materials.

Moore Associates, PA

283 Pinnars Cove Road,
Asheville NC 28803-
(828) 684-6895
Moore Associates has 35 years experience in architectural design, using efficiency and economy in materials, methods, and systems for earth-friendly buildings.

William O Moore, Architect

Bill Moore
12A Wall Street
Asheville NC 28801-
(828) 252-6439
Fax (828) 252-6437

When we build, let us think that we build forever. Let it not be for present use alone. Let it be such work as our descendnts will thank us for.

John Ruskin circa 1870

O’Cain Design Group

Bill O’Cain
118 5th Ave. West
Hendersonville NC
28792-
(828) 692-4991
Fax (828) 698-8058
Email bill@ocaindesign.com

Fred Reidinger, AIA

Fred Reidinger
24 West Jordan St
Brevard NC 28712-
(828) 884-5525
Email fred_aia@citcom.net
Fred Reidinger has been a member of the American Institute of Architect’s Committee on the Environment since 1994. Our firm does entirely residential design work. We strive to incorporate as many “green” principles into our projects as possible, given the constraints of building in Western North Carolina.

Samsel
ARCHITECTS



828.253.1124

samselarchitects.com

Christopher A. Rogers, Architect

Chris Rogers
117 Bell Rd
Asheville NC 28805
(828) 299-3903
Fax (828) 299-3903
Email unaj@earthlink.net
Residential and small commercial architectural design in the mountain-rustic natural style. Sensitive planning for steep slope sites and woodland settings, new construction and renovation/adaptive reuse, solar responsive siting and passive energy building principles. Designs emphasize outdoor/indoor seasonal living.

Rouse, Michael AIA Architect

Michael Rouse
37 Woodvale Avenue
Asheville NC 28804
(828) 252-9609

Samsel Architects, P.A.

Jim Samsel
60 Biltmore Avenue
Asheville NC 28801
(828) 253-1124
Fax (828) 254-7316
Email jim@samselarchitects.com
Website
www.samselarchitects.com
The thoughtful integration of the natural and built environment has been a key design principle of our firm since its founding over 15 years

ago. High-efficiency building envelopes, solar energy considerations and resource efficient, healthy materials are incorporated in all of our projects. Our experience ranges from custom residences and inns to galleries and non-profit facilities.

Schauer, Jacquelyn AIA

12-A Wall Street
Asheville NC 28801
(828) 252-1043

Sinsky, Mark F AIA

Fine Custom Homes Architect
Mark Sinsky
1 Wild Cherry Road
Asheville NC 28804
(828) 258-2288
Email mfsinsky@att.net

Stevens Smith Farrell, Architecture

Steven Farrell
17 Zillicoa Street
Asheville, NC 28801
(828) 252-3002
Fax 255-7783
Stephens Smith Farrell Architecture endeavors to serve residential and institutional clients with artful and sustainable design solutions, new construction, remodel and reuse, historic preservation and site evaluation.



45 Lula Cove Rd Weaverville NC 28787
phone/cell 828.645.9326 / 712.9326
greendragondesign.net

Alice F. Dodson
ARCHITECT, A.I.A.
solar design • feng shui

Building & Site Design for Healthy & Harmonious Living

Support this publication by telling our vendors that you saw their name in the *WNC Green Building Directory*

Verdi Group

David Anthony Hill, AIA
430 West Haywood Street
Asheville, NC 28801
(828) 252-7118
Fax (828) 252-5076
Email verdi@aonta.com

Green Building is not just an application of special materials or technology, but an approach to design and construction that begins with an office philosophy and runs throughout a project from initial planning concepts to construction site management and owner "training". We are designers and developers of green residential and commercial projects.

Yurko Design & Architecture PA

John Yurko
15 Zillicoa Street
Asheville NC 28801
(828) 254-0550
Fax (828) 254-5599
Email

yurkoarchitects@mindspring.com
YDA believes in an holistic approach in all areas of a project. A building that is properly sited and landscaped to take advantage of solar and weather patterns, supported with energy efficient systems, and built with recycled and renewable resources is not only a responsible approach, but healthier and more pleasing in the end.

BUILDING SUPPLY

Westall-Chandley Lumber Co.

Ralph Carl, Merchandise Manager
Box 5755 Asheville, NC 28813
828-253-5331
Fax 828-254-0135
Email Westall1@AOL.com
Westall-Chandley carries Trex decking made from recycled wood and plastic. We also special order arsenic free treated wood. Our insulation is made from recycled glass. Our Panel products and LVL's are made from fast growing pine.

COMMUNITIES

Neighborhood Design Build

Dev Thomas
2 Elliot St, Suite E
Asheville NC 28803-
(828) 250-9339
Fax (828) 254-4888
Website www.ndb.com

Neighborhood Design/Build, developer of "green" cooperative neighborhoods in Western North Carolina, is starting a new project. Central solar-generated radiant floor heat and hot water, efficient fixtures and appliances, and low air leakage make these dwellings extremely energy efficient. A large Community Building, for socializing and for sharing services and resources, will complement the private dwellings. Also included will be Permaculture landscaping and a big creative playground.

Unahwi Ridge

John Beckman
PO Box 471
Webster NC 28788
(828) 586-5462
Fax (828) 586-5462
Email info@unahwiridge.com
Website
www.unahwiridge.com

Unahwi Ridge community has been designed and developed to protect natural resources, preserve productive farmland and promote community in western NC. Our 600-acre eco-development offers home sites, gardens, amenities and miles of nature trails for the discerning buyer seeking the best of "green" mountain living and convenient location. Home sites are arranged overlooking our certified organic farm and 25 mile views of the surrounding mountains, while conservation areas provide protection and insure privacy.

CONCRETE & MASONRY

Advantage Wall Systems

Rob Robinson
PO Box 656
Montreat NC 28757
(828) 669-0443

Advantage Wall System is a supplier of Reward Insulated Concrete Forms for exterior walls of residential and commercial buildings.

K-X Faswall

Leni Walter
PO Box 88
Windsor SC 29856-
(800) 491-7891
Fax (803) 642-9346

Email faswall@faswall.com
K-X Faswall provides Insulating permanent wall forms for poured concrete structures made out of recycled, mineralized waste wood chips mixed with portland cement in a patented process. It provides, 4 hour fire rating, soundproofing and a breathing wall system with high R-value.

MATRIX PAAC L.P.

6600 Highlands Parkway
Smyrna Ga 30082-
800-994-3235

Website www.matrixpaac.com
Matrix is a supplier of pre-cast Autoclave Aerated Concrete (AAC) blocks and panel for structural and non-structural walls, floors, and roofs.

Metromont Materials

Maurice Edwards
190 Meadow Rd
Asheville NC 28803-
(828) 253-9383
Fax (828) 258-0335

Metromont is a full service supplier of masonry and masonry related items. The company carries low VOC products. The use of masonry provides a long-lasting structure that reduces the replacement needs of other materials.

"What's the use of a house if you haven't got a tolerable planet to put it on?"

CONSTRUCTION – BUILDERS

A D Grant Building

50 Booker St
Asheville NC 28803-
(828) 274-7557

Appropriate Building Solutions

Damian Keyes
195 Rippling Water Lane
Blowing Rock NC 28605-
(828) 268-0032

Email marcusrenner@hotmail.com
Appropriate Building Technologies is a company that provides services relating to sustainable construction and renewable energies. We specialize in design consultation, green building products and construction. We offer sustainable, non-toxic building methods and materials for the Western North Carolina community.

Bald Mountain Homes

John Senechal
PO Box 1665
Asheville NC 28802-
(828) 255-0428

Email JASenechal@aol.com
Website www.buncombe.main.nc.us/~senechal/bmh

John Senechal specializes in solar and non-toxic construction techniques "In Partnership with our Environment". Bald Mountain Homes builds residential environments that are sustainable and appropriate today and well into the future. Their focus is healthy housing for caring people, using a multifaceted approach where people and their relationships to each other and their environment are key. Consultation services also offered.

The Biltmore Group

Richard Green
101 Hibiscus Lane
Asheville NC 28803-
(828) 681-5100

Black Hawk Inc

109 South Main Street,
Hendersonville NC
28792-
(828) 692-4550

Blue Ridge Energy Systems

28 Sourwood Dr
 Fletcher NC 28732-
 (828) 684-8665

Blue Ridge Energy Systems has built more than thirty homes in Ravenwood Estates and around Buncombe county incorporating Energy efficiency and passive solar design. The Woodward home located at 28 Sourwood lane in Ravenwood Estates in Fairview is a 4400 square foot passive solar, super insulated house. The heating and cooling bill averages less than \$250 per year.

Building For Life

Stuart Zitin
 139 Third Street
 Asheville NC 28803-
 (828) 277-7574

Email stuzi4@aol.com
 Building for life, L.L.C. is a licensed, insured general contractor in North Carolina, particularly interested in the partnership of green building with affordable housing in traditional neighborhood design/development. Combining energy efficiency (quality window, doors, insulation and passive solar heating) with indoor air quality (low toxic materials, excellent ventilation) reflects the new paradigm we embrace-comfortable, low-impact homes in a livable, walkable, multi-level community development.

Bulldog Truss

Michael Jennings
 PO Box 21
 Greenville NC 28736-
 (828) 743-6581
 Fax (828) 743-2020

Bulldog Truss offers today's builder or homeowner a somewhat unique service. We build not only floor and roof trusses, but wall panels as well. We also offer these items as a "dried

in" package, erected on your foundation! By consolidating all these items, we are able to fabricate your entire home in a controlled atmosphere, with minimal waste of our fastest disappearing natural resource—wood.

Cady/Guyton Construction

Boone Guyton
 378 Jenkins Valley Rd
 Alexander NC 28701-
 (828) 683-3688

Email bguyton@aol.com
 Cady and Guyton Construction has experience with passive solar design and energy and resource efficiency. They also do custom wood-working and owner/builder consulting.

Consider It Done

Case Edwards
 164 Southern Cross
 Weaverville NC 28787-
 (828) 645-5766

Email caseedwards4@yahoo.com
 Consider It Done specializes in soundly built, properly oriented, energy efficient buildings and additions as well as passive and active solar design.

Cosmic Carpenters

Hamish Ziegler
 31 Pinnacle Park Rd
 Weaverville NC 28787-
 (828) 658-0318

Cosmic Carpenters does retrofits for solar additions to conventional homes and photovoltaic systems through a subcontractor, as well as conventional building using green materials. We like using low toxic substances for building and encourage alternative materials such as strawbale. We also make decks with cedar lumber. Our specialties are windows, doors and trim work.



Bald Mountain Homes
 INCORPORATED

Solar & Non-Toxic Building
in Partnership with Our Environment

John Senechal • 828-252-9357
<http://buncombe.main.nc.us/~senechal/bmh>

Crest Renovators+ Builders

Vincent Camilleri
 825 C Merrimon Ave. Box 362
 Asheville NC 28804-
 (828) 281-0168
 Fax 281-0168

Deltec

Clay Johnson
 604 College Street
 Asheville NC 28801-
 (828) 253-0483
 Fax (828) 254-1880
 Email

cjohnson@deltechomes.com
 Since 1968 Deltec Homes has been the world's leading supplier of circular homes. These unique structures are easy to build, offer quick construction and produce a minimum amount of waste. Deltec homes are twice as energy efficient as conventional houses and also offer high wind resistance and panoramic views

Evergreen Construction of Western Carolina, Inc.

William Higgins
 431 Locust DR
 Maggie Valley NC 28751-
 (828) 926-0967
 Builder of energy efficient homes.

Forward Construction

Jim & Sue Forward
 24 Smokey Rd
 Asheville NC 28803-
 (828) 298-9532
 Email sef28803@aol.com
 Forward Construction provides environmentally conscious home building with a reputation for quality custom homes. We complete one project at a time thereby giving full attention to each home constructed. We work with each clients needs and have used reclaimed lumber, antique flooring, water based stains, sealants etc.

Garden Construction

Sean Garden
 25 Barnard Ave
 Asheville NC 28804-
 (828) 236-1241
 Garden Construction is a small,

well-organized company that specializes in additions and renovations. I am a builder who believes one should look at a house not as individual components, but as a system dependent with the interactions of its surrounding environment and with its occupants.

Heartwood Renovation and Building, Inc.

Allen Roderick
 291/2 Page St
 Asheville NC 28801-
 (828) 253-8537
 Fax (828) 253-7868
 Email Rallenrode@excite.com
 Heartwood Renovation specializes in Adaptive Re-Use of older buildings as well as commercial renovations.

Healthy Living

Scott Baxla
 P.O. Box 1757
 Fairview NC 28730-
 (828) 628-1090
 Healthy Living provides consulting, designing and building of health conscious and environmentally responsible homes and communities. Having personal experience with chemical sensitivities, Scott Baxla specializes in small homes, which support the health of the individuals who live there. He is currently developing a community in Fairview, NC of small, low toxic and environmentally sensitive homes in a planned neighborhood with shared facilities and common spaces.

Robert Jenkins

7408 Willow Tree Lane
 Knoxville, TN 37938-
 (865) 922-1209
 Fax (865) 922-1209
 Email rjenkins@msn.com
 Healthy Homeworks is experienced in log, timber frame and conventional housing design and construction, domestically and internationally. They are able to provide additional services including electromagnetic and geomagnetic testing, feng shui applications, solar and alternative energy options.

There is one timeless way of building. It is thousands of years old, and the same today as it always has been.

– Christopher Alexander

Bobby Mchugh

Bobby Mchugh
 374 North Fork Road
 Black Mountain, NC 28711-
 (828) 669-2760

Email Rebaloo@mindspring.com
 A designer, builder and carpenter experienced with straw bale building, passive solar design, and custom carpentry using salvaged and locally acquired lumber.

Rare Earth Builders

Mark Bondurant
 5183 Beaverdam Road
 Canton, NC 28716-6748
 (828) 648-0009

Email rareearth@earthlink.net
 Rare Earth does both remodeling and new construction, always with an eye toward minimizing negative environmental impacts. We employ passive solar design principles, air sealing, beefed up insulation and other energy efficient practices. We segregate and recycle our construction waste and attempt, whenever possible, to use resource conserving materials and technologies. We're very interested in the emerging alternative technologies and the natural house methods. Thus far, we've built two geodesic domes.

Soderquist Construction

Richard & Katherine Soderquist
 PO Box 1324
 Asheville NC 28802-
 (828) 258-3303

Tovill Inc.

William Safford
 432 Turkey Creek Rd
 Leicester NC 28748-
 (828) 683-1185

Email tovwill@aol.com
 In our rapidly expanding world the necessity to take responsibility for our environment is becoming apparent. One of the most direct and feasible approaches to this responsibility is the house in which we live. By choosing a builder with working knowledge of environmentally safe products you can take direct responsibility for your immediate environment. In choosing our company we will provide you with an efficient, responsible, working knowledge for an environmentally conscious living space.

Sunny Day Homes Inc

Sam Zimmerman
 747 Rocky Creek Rd
 Boone nc 28607
 828-265-4564

Email zims@bellsouth.net
 Licensed General Contractor doing all types of residential construction: total renovation, remodel, additions, new custom homes. We welcome inquiries regarding green building, renewable energy, energy conservation retrofits; reduced toxicity/improved indoor air quality, sustainable design, passive solar, and alternative construction.

CONSTRUCTION - ELECTRICIANS

Ampla Apex Inc

Jeff Stilber
 6050 Asheville Hwy, Suite 1
 Hendersonville NC
 28791-
 (828) 687-1266

Email amplapex@earthlink.net
 Ampla Apex is an electrical contractor that works with low voltage system integration and alternative energy sourcing.

Bedrock Services

Steve Wood
 70 Bennett Rd
 Candler NC 28715-
 (828) 665-8864

Email sjw43@juno.com
 Bedrock Services provides electrical and data contracting, specializing in home automation and home network wiring.

Harrington Electric, Inc.

Rick Harrington
 301 Royal Pines Drive
 Asheville NC 28704-
 (828) 681-0297

Email rsharrington@juno.com
 Harrington Electric is a quality electrical contractor with over twenty years experience working with traditional and alternative construction materials and techniques; accustomed to working together with architects, builders, home-owners and other trades to provide efficient and effective solutions to the many challenges that face today's environmentally conscious home builder.

CONSTRUCTION- WOODWORKERS

Wildwood Cabinetry Studio

Carl Giesenclag
2163 Riceville Rd.
Asheville NC 28805-
(828) 299-8696
Email wildwoodstudio@ioa.com
Traditional cabinet making with
sensitivity to special needs of all
customers.

EDUCATION & OUTREACH

Appalachian State University Sustainable Development Program

Dr Dennis Scanlon
Appropriate Technology Dept.
Boone NC 28608-
(828) 262-6361
Fax (828) 265-8696
scanlindm@appstate.edu
Along with the Appropriate Tech-
nology Program, the Sustainable
Development Program offers under-
graduate minor, undergraduate
concentration, and with Appala-
chian Studies, a masters degree
concentration in sustainable devel-
opment, including a concern for
energy efficiency, renewable en-
ergy, and culturally appropriate
construction and community/re-
gional planning designs. The Sus-
tainable Development Program fo-
cuses more on the socially and cul-
turally appropriate approaches to
sustainable community and re-
gional planning and empowerment.

Buncombe County Center/ NC Cooperative Extension

Nancy Ostergaard
94 Coxe Ave
Asheville NC 28801-
(828) 255-5522
Fax (828) 255-5202
Website
www.buncombe.ces.state.nc.us/
North Carolina Cooperative Exten-
sion provides research-based edu-
cational information to the resi-
dents of North Carolina. If addi-
tional information is needed prior
to making a building decision, our
Buncombe County Center can as-
sist you. Since we are an entity of

North Carolina State University,
there are no charges for our ser-
vices.

Guilford County Center - NC Cooperative Extension

Brenda Morris
3309 Burlington Rd
Greensboro NC 27405-
(336) 375-5876
Fax (336) 375-2295
The Cooperative Extension Service
in Guilford County is an extension
of NC State University, Guilford
County, and the U.S. Department
of Agriculture. The Guilford
County Center provides research-
based information in the areas of
housing, solar energy, entomology,
energy conservation, indoor air
quality, horticulture and environ-
mental issues. The Center has
been a part of the million solar roofs
initiative since 1996. They have
numerous publications, flyers,
workshops and seminars address-
ing these issues that are free and
available to Guilford County citi-
zens.

NC Coop. Ext Service

Nancy Ostergaard
2016 Fanning Bridge Rd
Fletcher NC 28732-9216
(828) 687-0570
See previous Buncombe county
listing

ENGINEERS

Arthur Martin Associates

Arthur Martin
PO Box 926
Waynesville NC 28786-
(828) 926-8195
Art Martin is a Consulting engi-
neer doing energy efficient re-
source management, indoor air
quality, and gas technologies for
heating, venting, air conditioning,
and power generation.

No generation, institution, govern-
ment organization or political leader
has the right to change the biochemi-
cal reactions of the earth.

-Anonymous

Solar Guys

99 Hannah Branch Rd.
Burnsville, NC
800-614-1484

Website www.solarguys.com

The Solar Guys do renewable energy systems for residential and commercial customers, including photovoltaics, hydropower, wind power, and hot water heating for domestic water and space heating. Call for a free energy audit and/or site survey in the WNC area and surrounding states.

United Engineering Group

Robert Wiggins
1328-c Patton Ave
Asheville NC 28806-

(828) 232-1695

Fax (828) 232-1697

Email bw@unitedega.com

United Engineering designs energy efficient HVAC systems, lighting, plumbing and electrical systems.

ENVIRONMENTAL CONSULTANTS

Equinox Environmental Consultation and Design

David Tuch
64 Biltmore Ave
Asheville NC 28801-

(828) 253-6856

Email equinoxdt@earthlink.net

Equinox offers a variety of environmental and conservation based planning and design services that include: stormwater management, private lands site conservation, habitat and wildlife enhancement, native plant restoration, conservation planning for subdivisions, sustainable residential landscape design, and greenway design. These services are offered to those interested in the protection and enhancement of the natural and cultural resources of the Southern Appalachian Mountains and their foothills.

Forest Care, Inc

Lislott Hambergs
437 Walnut St
Statesville NC 28677-
(828) 872-1930

Nine Pearls of Wisdom- Feng Shui

Helen Emmet
PO Box 1019
Black Mountain, NC 28711

828-669-1836

Website

ninepearlsofwisdom.com

Nine Pearls of Wisdom, established in 1994, offers consultation services for your home or business, as well as workshops and seminars. Helen Emmet is a certified Feng Shui consultant with the Metropolitan Institute of Design, and is trained in BauBiology and BioGeometry. She has studied in China and with Grand Master Professor Lin Yun. A harmonious haven of prosperity and blessings are created for your home or business using the principals of Feng Shui, BauBiology and BioGeometry.

STS Technologies

Jim Stone
9 West Walnut St, suite 3D
Asheville NC 28801-

(828) 232-0208

Fax (828) 281-2772

Email info@sts-technologies.com

Website

www.sts-technologies.com

STS provides environmental permitting and health and safety services that keep our industrial clients in compliance with state and federal regulations which protect the land, air, water, and workforce. Examples of consulting services include air quality, industrial hygiene, and NPDES services.

Wetland and Natural Resource Consultants, Inc.

Jennifer Robertson
PO Box 553
Hazelwood, NC 28738

828-712-9205

Fax 828-454-5033

WNR, Inc. provides wetland identifications and permitting, buffer determinations, GIS / GPS resource location, endangered species consultation, habitat assessments, and bank stabilization permitting. WNR, Inc. is currently managing the highest level of biological inventory and broad base habitat assessment required by the National Park Service, Great Smoky Mountains National Park. WNR, Inc. has developed a monitoring protocol for isolated wetlands in the coastal plain of South Carolina and for restored wetlands in the coastal plain of North Carolina.

Be the change you wish to see
-Ghandi

Wood Resource Group

Rachel Wood
389 Webb Cove Rd
Asheville NC 28804-
(828) 285-0134
Email

racwood@buncombe.main.nc.us
The Wood Resource Group provides forestry consulting services including forest stewardship and forest tax plan preparation, sustained improvement tree marking and harvest administration, timber appraisals, and timber marketing. We work with private landowners doing low-impact multi-aged or sustained improvement work on their woodlands. Wood can be used for their own buildings or go to a larger network of "green" certified lumber or other "green" wood products.

FABRICS

Sew and Quilt

Shelly Cook
330 SW 43rd st #k576
Renton WA 98055-
(206) 394-9677
Fax (206) 575-3367
Email

service@sewandquilt.com
Sew and Quilt has the full line of Warm Window products-insulated night shades that are available on line or at Joann and Hancock Fabrics.

FINISHES

Carolina Colortones

Chuck Campbell
10 Industrial Dr
Arden NC 28704-
(828) 687-9510
Fax (828) 687-9532
Email

info@carolinacolortones.com
Carolina Colortones provides prefinished cedar and fiber cement sidings and trim to homebuilders, commercial developers and residential developers coated with environmentally safe water based paints and stains.

Gails's Details

Gail Caduff-Nash
89 Cumberland Ave
Asheville NC 28801-
(828) 258-2214

Shelter Ecology

Cindy Meehan-Patton
43 Pine Ridge Dr
Asheville NC 28804-
(828) 251-5888
Fax (828) 258-0408
Email sheltereco@earthlink.net
Website

www.shelterecology.com
Shelter Ecology provides mail orders, internet orders and pick up orders for 7 environmentally safe, natural or recycled content finishes for interior and exterior building projects including: AFM SafeChoice (water based), Bio Shield earth pigments, Livos Phytochemistry (natural oil), OS Color (natural oil), Tried and True (natural oil), E-Coat recycled paint (water based) and Velvit (low toxic exterior oil).

Vincent Wrenn

Vincent Wrenn
22 Shorewood Dr.#2
Asheville NC 28804-
(828) 232-4370

Vincent Wrenn prefers to use water based paint and always recommends low VOC materials including Livos, BioShield and EcoSpec. When creating decorative wall finishes he uses latex glazing compounds and latex based paints rather than oil based. Vincent hopes to work for the green building industry as an environmentally conscious interior painter.

FLOORING

Collins & Aikman Floor Coverings, Inc

Jennifer Young
311 Smith Industrial blvd.
Dalton GA 30721-
(800) 248-2878
Fax (706) 259-2179
Website www.powerbond.com

Heartwood Pine Flooring

Lawrence Green
P.O. Box 187
Pittsboro NC 27312-
(919) 542-4394
Website heartwoodpine.com
Heartwood Pine Floors specializes in the manufacturing of solid wood flooring produced from salvaged decking and beam material from turn-of-the-century textile mills and tobacco warehouses. All of our material is 100% reclaimed and remilled.

Vincent Wrenn
Faux Finishes
Color Consultations
& Fine Interior Painting

(828) 252-4370
E-Mail: vlw@bellsouth.net
22 Shorewood Dr. #2
Asheville, NC 28804



SPECIALIZING IN ENVIRONMENTALLY SAFE PAINTING

Shelter Ecology

Cindy Meehan-Patton
43 Pine Ridge Dr
Asheville NC 28804-
(828) 251-5888
Fax (828) 258-0408

Email sheltereco@earthlink.net
Website www.shelterecology.com
Shelter Ecology provides mail orders, internet orders and pick up orders for 6 environmentally safe flooring lines including: Natures Carpeting (100% virgin, chemical free wool), Fibreworks (100% natural fiber carpeting and area rugs), Envirelon (100% post consumer recycled plastics commercial grade carpet), Natural Cork tiles, Natural Linoleum sheet and tiles and carpet padding made from 100% recycled wool sweaters.

FURNISHINGS

Appalachian Design

Lang Hornthal
7 Pinehurst Rd
Asheville NC 28805-
(828) 628-9994
Fax (828) 628-2929

Email
info@appalachiandesigns.com
Website

www.appalachiandesigns.com
Appalachian Designs offers custom-built hand carved rustic furnishings and stair railings. Everything Appalachian Designs builds is constructed from hand peeled logs and made to order, allowing for you to get the perfect piece of furniture for any setting. You can also customize your finish, using any of the locally available low toxic or natural products. This combina-

tion offers you a piece of furniture made from natural materials and low toxic or natural finishes- a winning combination.

Natural Home

Sandi Tomlin-Sutker
36 N Lexington Ave
Asheville NC 28801-
(828) 285-9442

Website
www.naturalhomestore.com

The Natural Home, located in downtown Asheville, offers retail home furnishings made from recycled and natural materials, organic or green cotton and linen sheets, mattress pads, comforters, bath linens and more. They also have diverse handcrafted objects for the home including cabinet knobs and pulls, indoor fountains, copper switch plates, Japanese dishes and garden accessories. Natural oil and water based finishes are available for home improvement projects.

Robert Berglin Co

Chris Bergelin
628 E Meeting St
Asheville NC
(828) 432-0053

Email Chrisbe@RBCFurn.com
Located in Morganton, NC with a showroom at the Hickory Furniture Market- Robert Bergelin Company offers Certified Sustainable wood furnishings and millwork. All of their furniture is made from Smart Wood certified Cherry including bedroom, dining and living room collections. The style choices are simple European and Arts & Crafts. Robert Bergelin Company also offers custom dining room tables and sustainably certified millwork for green building.

Rustic Raven

Todd Barrow
PO Box 121
Mars Hill NC 28754-
(828) 689-9672
Email raven@madison.main.nc.us
Website

www.brwm.org/rusticraven/
Rustic Raven does many styles of rustic work. My goal is to get materials from sites before clearing begins for homesites or development.

Tyson Furniture Co, Inc.

Joe Tyson
109 Broadway
Black Mountain NC
28711-
(828) 669-5000
Fax (828) 669-8292

INDOOR AIR QUALITY

Asheville Radon & Environmental Consultants

Dr. Eric Wellisch
19 Robinhood Road
Asheville NC 28804-
(828) 252-2577

Earthsafe & Wellness Technologies

Ledie Bond
PO Box 1110
Asheville NC 28802-
(828) 281-1060
Fax 281-1055
Email
earthwell@mindspring.com
Earth Safe and Wellness Technologies is a specialty chemical house dedicated to developing, manufacturing and marketing the safest cleaning solutions possible. Our goal is to increase the awareness of the link between the use of hazardous chemical cleaning agents and the personal health of the individuals, as well as that of the environment. Our technologically advanced formulas are beyond compare for their exceptional cleaning, degreasing and polishing capabilities as well as their safety both for the planet and humanity.

Green R Inc.

Ron Pariseau
PO Box 1435
Mars Hill NC 28754-
(828) 680-9615
Fax (828) 689-9384
Email

rpariseau@mindspring.com
Green R Inc. is a distributor of indoor air quality products, including energy recovery ventilators, and high efficiency air filters, and ventilation fans.

Indoor Air Services

Dick Van Dyke
PO Box 9013
Asheville NC 28815-
(828) 299-7103
Fax 299-7133

Indoor Air Services has been remediating Indoor Air Quality since 1974. The web page shows our mobile laboratory and credentials. Richard Van Dyke is a Certified Indoor Environmentalist. Indoor Air Services provides air testing, mold remediation, HVAC system analysis along with recommendations on how to achieve and maintain healthy indoor environments. Because we spend up to 95% of our time indoors, the air we breathe should be very important to us.

Shelter Ecology

Cindy Meehan-Patton
43 Pine Ridge Dr
Asheville NC 28804-
(828) 251-5888
Fax (828) 258-0408
Email sheltereco@earthlink.net
Website

www.shelterecology.com
Shelter Ecology is a multi-faceted service oriented company specializing in environmentally focused interior and building consultation, interior design, education, IAQ remediation reports, product sales and architectural collaboration. Cindy Meehan-Patton, Allied Member of ASID and chair of the WNC Green Building Council, has been researching and practicing green building as it relates to Healthy Indoor Air Quality for over 10 years.

A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. A thing is wrong when it is otherwise.

- Aldo Leopold, A Sand County Almanac

STS Technologies

Jim Stone
9 West Walnut St, suite 3D
Asheville NC 28801-
(828) 232-0208
Fax (828) 281-2772
Email info@sts-technologies.com
Website
www.sts-technologies.com

Indoor air quality services are a specialty of STS Technologies, Inc. Mold and indoor air quality investigations, management plans, and remediation protocols provide our clients with the information needed to maintain safe and healthy buildings.

T & E Technology

9 West Walnut Street, Suite 3B
Asheville NC 28801-
(828) 236-1631
Fax (828) 236-2854
Email
tetechnology@bwwonline.net
T & E Technology provides asbestos and lead paint inspections and remediation services. They are certified in hazardous material management.

Wellborn & Associates

Bob Wellborn
90 Westgate Parkway
Asheville NC 28806-
(828) 251-9971
Fax (828) 251-9972
Wellborn & Associates specializes in asbestos and lead paint inspections for residential, commercial and institutional buildings. They also offer sample testings for airborne asbestos dust and other indoor air pollutants. HVAC duct design and air flow along with recommendations for energy conservation can also be made. Wellborn and Associates is professionally accredited for all of the above.

INSULATION

Green R Inc.

Ron Pariseau
PO Box 1435
Mars Hill NC 28754-
(828) 680-9615
Fax (828) 689-9384
Email
rpariseau@mindspring.com
Green R Inc. is a sales representative working in conjunction with Southern Foam and Coatings, which provides Icynene foam insulation. Icynene is an expanding foam designed to minimize air leakage of buildings. It contains no CFC's, HCFC's, or VOC's and is safe for people who are chemically sensitive.

MWB R-Pro

Gregg Forrest
PO Box 1228
Black Mountain NC
28711-
(828) 669-4525
Fax (828) 669-0134
Website www.mwbrpro.com
Cellulose insulation is a recycled fiber product mixed with powdered adhesives and effective fire retardants. It is an earth-friendly product and significantly reduces waste in landfills. The energy requirements to make cellulose are much less than fiberglass or other popular insulation materials. It contains more than 75% recycled material.

APPALACHIAN



Realty Associates

(828) 255-7530

www.appalachianrealty.com

INTERIOR DESIGN

Gail's Details

Gail Nash
89 Cumberland Ave
Asheville NC 28801-
(828) 258-2214

Gail's Details does small painting jobs and decorative painting for both commercial and residential clients. We also do feng shui consultations. We use primarily biodegradable and non toxic materials and paints. We also recycle furniture into beautiful and useful items.

Nine Pearls of Wisdom- Feng Shui

Helen Emmet
PO Box 1019
Black Mountain, NC 28711
828-669-1836
ninepearlsofwisdom.com

O'Cain Design Group

Bill O'Cain
118 5th Ave. West
Hendersonville NC
28792-
(828) 692-4991
Fax (828) 698-8058
Email bill@ocaindesign.com

Shelter Ecology

Cindy Meehan-Patton
43 Pine Ridge Dr
Asheville NC 28804-
(828) 251-5888
Fax (828) 258-0408
Email sheltereco@earthlink.net
Website
www.shelterecology.com

Shelter Ecology is a multi-faceted service oriented company specializing in environmentally focused interior and building consultation, interior design, education, IAQ remediation reports, product sales and architectural collaboration. Cindy Meehan-Patton, Allied Member of ASID and chair of the WNC Green Building Council, has been researching and practicing green building as it relates to Healthy Indoor Air Quality for over 10 years.

□Find your place on the planet.
Dig in, and take responsibility
from there.□

– Gary Snyder

Skypeople Gallery and Design Studio

Kitty Brown, Artist
51 North Lexington Ave.
Asheville, NC 28801
(828) 232-0076
Email
skypeople@mindspring.com
See listing under alternative
builders

LANDSCAPE ARCHITECTURE & DE-

Carolina Native Landscapes, Inc.

Tom Mainolfi
Asheville, North Carolina
Phone/Fax: (828)665-7234
e-mail: tmain61@aol.com
Carolina Native Landscapes specializing in: custom designs, native landscaping and plants, edible landscaping, organic gardening, stonework, brickwork & patios, water gardens, ponds & waterfalls.

Earthwise Designs

Caroline Edwards
Asheville NC
(828) 247-0067
Email kudzukid@rfci.net
Earthwise Designs provides site and planning with a focus on sustainable use of natural land preservation through conservation easements; soils investigations for septic permits; wholistic forestry plans; and contractor services in biosolids recycling and management for municipalities and industries.

Equinox Environmental Consultation and Design

David Tuch
64 Biltmore Ave
Asheville NC 28801-
(828) 253-6856
Email equinoxdt@earthlink.net
Equinox offers sustainable residential landscape design services and conservation planning services to the individual homeowner and to those interested in creating environmentally sensitive landscapes. Equinox focuses on creating integrated solutions that meet the client's needs while creating landscapes that conserve water, lower energy and resource consumption, create wildlife habitat, are low-maintenance, and are aesthetically pleasing.

Highland Heritage Landscapes

Tadd Cole
112 Kingsgate Rd
Asheville NC 28805-
(828) 298-9565
Fax 298-9563

Highland Heritage is an innovative, environmentally conscious, quality oriented business of integrity that provides a design/build landscape service to clients. They emphasize drought tolerant, low maintenance landscapes, with water conserving drip irrigation systems. Highland Heritage improves the quality of life for clients by reducing time and energy resources maintaining landscapes. They strive continually to introduce plants that are well adapted to Western North Carolina and encourage more diversity within landscapes.

Landscapes/Fine Gardens

Art Streppa
45 Cisco Rd
Asheville NC 28805-
(828) 299-4231

This firm specializes in landscape design and installation with a naturalistic approach. Drought tolerant plants and natives are used when available. Renovation and rejuvenation of sites is a specialty. Landscapes/Fine Garden also provides landscape lighting services. Edible landscaping and natural backyard habitats can be created. Organic gardening methods are employed.

Landscape Services

Kasty A Latven
Kase Latven
134 Beverly Road
Asheville NC 28805-
(828) 299-3632

Website www.arborist.rkla.com
Kasty Latven provides arborists reports for lot surveys, tree health and hazard assessments, tree value appraisals and tree preservation programs during construction; to land owners, developers, and government. She also provides teaching and training in the basics of tree biology, expert testimony, depositions, and mediation.

Mary Weber Landscape Architecture

Mary Weber
131 Evelyn Place
Asheville NC 28801-
(828) 281-3153
Fax (828) 281-3153
Email
mweber@buncombe.main.nc.us

Mary Weber Landscape Architecture strives to create designs that fit the ecological setting of Western North Carolina. The firm develops site plans that try to minimize grading, tree removal and storm water runoff, while meeting the needs of the client. Native plants or other appropriate plants are used to improve aesthetics, help conserve energy, minimize erosion, conserve water and attract wildlife. In the context of the larger community, the firm supports pedestrian and bicycle access, public parks and encourages open space conservation.

Preserving Our Trees

Brian Newsom
256 Wool Branch Road
Marshall NC 28753-
(828) 649-0492

Email racoona@nclink.net
Preserving our Trees provides consultations on insect & disease diagnosis & control cabling, guying, bracing & lightening, protection tree pruning, and hazardous takedowns. This company promotes the overall health of trees- the environmentally friendly way-without the use of spikes. All brush is chipped or used as firewood.

Rockenstein Tree Service

Joe Rockenstein
1414 Caney Fork
Cullowhee NC 28779-
(828) 586-3199

Email rockenstein@cs.com
Rockenstein Tree Service offers a personal touch for all your tree needs. Tree care includes feeding, trimming, and shaping. They recycle all end products with logs going to the saw mill, brush turned into mulch and shorter logs used for firewood.

Ross Landscape Architecture

Henry Ross
1921 Franklin Rd PO Box 354
Highlands NC 28741-
(828) 526-4498

Ross Landscape Architecture is a professional land design firm providing site planning, landscape architecture and consulting services. When preparing a master plan, many factors are reviewed including vegetation, topography, drainage and natural habitats. Ross Landscape Architecture can provide design drawings to best utilize the natural conditions of your property and enhance it with native plant material.

**Scott R. Melrose & Associates,
P.A.**

Sonja Allen
3 White Oak Rd
Arden NC 28704-
(828) 684-5155

Scott R. Melrose & Associates, PA is Western North Carolina's largest landscape architectural firm with eight degreed landscape architects. Their professional services include: master planning, site design, and conservation and land planning. The firm's broad-based background provides design solutions that integrate the complex interrelationships among people, their structures and the natural environment. They strive for an end product that addresses client needs, the site context and the environmental quality of the community as a whole.

Tovill Inc

William Safford
432 Turkey Creek Rd
Leicester NC 28748-
(828) 683-1185

Email tovwill@aol.com

William and Tovia Safford are offering a unique service to those interested in deepening their connection with healing and gardening. An in-depth consultation for you and your family will be woven into a medicinal herb and vegetable garden to encourage optimum health. We also incorporate permaculture principles into our designs. Tovia is a trained herbalist and Ayurvedic consultant. William is a skilled landscaper and carpenter. Both have 15 years experience in their respective fields.

Wayside Landscape Services

Andrew or Marsha White
49 Old Farm School Rd
Asheville NC 28805-
(828) 298-4599

Wayside Landscape Services, Inc. is a nationally recognized, award winning landscape design/build company offering consultation, design, and construction.

God has cared for these trees,
saved them from drought, dis-
ease, avalanches and a thousand
tempests and floods. But He
cannot save them from fools.

- John Muir

**LANDSCAPE
SUPPLIES**

Elk Mountain Nursery

P.O.Box 599
Asheville NC 28802-
(828) 251-9622
Website www.elk-mountain.com

Good Earth Organics

Jim Smith
721 Gap Creek Rd
Marietta SC 29661-
(864) 836-6226
Email geearth@bellsouth.net
Good Earth Organics provide organic fertilizer and amendments throughout Western North Carolina and mountains of South Carolina. We also provide organically grown vegetable and flower starts and small nut and fruit trees. Our business also includes landscape design using edible plants and the maintenance of existing landscapes. We also do consultation on organic farming methods and landscaping. A healthy soil means a healthy planet.

Laurel Springs Nursery

401 Regal Street
Hendersonville NC
28792-
(828) 891-1264

Mountain Organic Materials

Keith Warren
1544 Smoky Park Hwy,
PO Box 2440
Candler NC 28715-
(828) 665-9899
Mountain Organic Materials (MOM) began as an environmentally sound alternative to burning wood waste to generate electricity. Grinding the bark material for mulch they opened in March of '98 selling three specialty bark mulches. Mixing the sawdust with dairy manure and placing the material in patented aerated bins produces high-quality compost. The compost produced from this process is excellent for lawns, gardens, new flowerbeds, etc. They are developing a compost-based potting soil, as well.

Reems Creek Valley Nursery
70 Monticello Road
Weaverville NC 28787-
(828) 645-3937
Website www.reemscreek.com

The Parking Place
Dan Cheek
6734-E Whitney Rd
Graham NC 27253-
(800) 716-7239
Fax (336) 376-9950
Website
www.theparkingplaceinc.com
The Parking Place is a distributor
of recycled rubber parking curbs
and speed bumps.

LIGHTING

Shelter Ecology
Cindy Meehan-Patton
43 Pine Ridge Dr
Asheville NC 28804-
(828) 251-5888
Fax (828) 258-0408
Email sheltereco@earthlink.net
Website
www.shelterecology.com
Shelter Ecology provides mail orders, Internet orders and pick up orders for TCP Compact Fluorescent light bulbs. TCP bulbs have a brighter light and longer life than mass marketed CF bulbs. They are the twist style with a rounded ballast so they fit all standard floor, table, pendant and fanlights. They dim to 40%. When the bulb burns out (7-year life) you remove the bulb from the ballast and reuse it with a new bulb.

MASTICS & ADHESIVES

Shelter Ecology
Cindy Meehan-Patton
43 Pine Ridge Dr
Asheville NC 28804-
(828) 251-5888
Fax (828) 258-0408
Email sheltereco@earthlink.net
Website
www.shelterecology.com
Shelter Ecology provides mail orders, internet orders and pick up orders for 4 environmentally safe mastic/glue lines for interior and building including: AFM's (water based / solvent free) DynoFlex duct work mastic and Caulking Com-

ound (for interior use only); Gorilla PVC Glue- the most environmentally safe PVC glue on the market and AFM's 3 in 1 Adhesive for horizontal and vertical flooring and wall treatments of all kinds.

MECHANICAL & HVAC

Air Craftsman Heating and Cooling, Inc.

George Willis
P.O. Box 19170
Asheville NC 28814-
(828) 299-1809
Fax (828) 299-1676
Email aircraftsman@aol.com
Air Craftsman Heating and Cooling Inc. is committed to safe and comfortable indoor environments. Their American Standard equipment was rated #1 by May 2001 Consumer Reports, and offers some of the highest S.E.E.R. ratings available (17.35). Their new Envirowise equipment will use the new R410A refrigerant. These high efficiency units offer some of the lowest operating costs and lowest impact on the environment.

Correct Heating and Cooling

Dan Garvy
10 Tanglewood
Swannanoa NC 28778-
(828) 686-4968
Dan Garvy is able to customize HVAC systems for allergy sensitive individuals. He specializes in residential and light commercial, new construction, additions, unit replacements and custom ductwork needs.

Renaissance-Works, Inc.

PO Box 1118
Asheville NC 28711-
(828) 669-1125
Email lifemountain@yahoo.com
Renaissance-Works has provided energy conservation products, services, consultation and installation for over 11 years in North Carolina. Work areas include residential, commercial and micro systems.

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WNC Green Building Directory

Shelter Technology

Heidi Zedniu
2 Elliot St, Suite E
Asheville NC 28803-
(828) 254-1635
Fax 254-4888

Website www.shelbertech.com
Shelter Technology specializes in custom designing high quality hydronic radiant floor heating systems. We approach each project with the whole house envelope in mind, paying attention to air leakage, air quality control and the health of the residents. Shelter Technology designed and built the central radiant heat and hot water system for Westwood Cohousing Community, a 24 dwelling community in Asheville. Westwood's central system is integrated with a large-scale solar system.

Thermacraft

Beach Barrett
PO Box 819
Horseshoe NC 28742-
(828) 891-5707
Fax (828) 891-6019
Email Thermacraft@aol.com

Website www.therma-craft.com
Thermacraft designs and installs radiant floor heating systems. The heat source for these systems can be internally or externally mounted gas boilers, solar collectors, wood fired boilers, ground source heat pumps and electric boilers. Thermacraft also installs solar systems for domestic hot water.

Vestra Masonary Stove

Tom Trout
373 Old Seven Mile Ridge Road
Burnsville NC 28714-
(800) 473-5240
Fax (828) 675-0634

White & Williams Heating and Cooling

Roger Sales
550 Haywood Rd
Asheville NC 28801-
(828) 252-8604
Fax (828) 258-2486

Email rogersales@ioa.com
White and Williams has been a HVAC contractor since 1955. We provide duct cleaning and general maintenance on heating and cooling equipment. We install high efficient equipment , up to 96% afue gas, 83% afue oil, and 16 SEER heat pumps. Puron refrigerant (chlorine free and non-ozone depleting) is available in heat pumps and air conditioning units.

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Terminix Service

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PO Box 5281
Asheville NC 28805-
(828) 253-3816

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International Kitchen & Bath

Wren London
32 Broadway
Asheville NC 28801-
(800) 828-3028
Fax (828) 271-1991
Email wrenlondon@hotmail.com
International Kitchen and Bath (IKB) is a leading resource for the latest design trends and manufacturer information. IKB is a supplier for specialty plumbing fixtures, fittings, and accessories. All of the faucets and toilets we carry meet and exceed the water conservation

"Crafting Comfort thru Quality Installation & Service"



Air Craftsman Heating and Cooling, Inc.
George Willis, President

P.O. Box 19170	Phone: 828-299-1809
55 Dillingham Road	Fax: 828-299-1676
Asheville, NC 28815	Toll Free: 800-299-1829

code. A number of the manufacturers IKB works with have eliminated ozone-depleting materials in the manufacturing process. IKB and its suppliers are dedicated to water conservation and energy efficiency.

Just Parts

210 Haywood Road
Asheville NC 28806-
(828) 253-6100
Fax (828) 253-6107

Just Parts supplies hard-to-find plumbing repair parts and flow restrictors for faucets and showerheads. Replacement parts in stock for fixtures manufactured in early 1900's. Over 9,000 individual parts in inventory.

Shelter Ecology

Cindy Meehan-Patton
43 Pine Ridge Dr
Asheville NC 28804-
(828) 251-5888
Fax (828) 258-0408

Email sheltereco@earthlink.net
Website

www.shelterecology.com

Shelter Ecology provides mail orders, Internet orders and pick up orders for WaterCleen water filtration units. WaterCleen uses a triple filtration process containing a new state of the art Bacteriostatic KDF filter medium, granulated activated carbon and Porex, a post filter membrane. WaterCleen filters up to 96% of parasites, bacteria, viruses, fluoride, chloride, chemicals, organics, all heavy metals (except copper) and Pesticides. Countertop, undercounter and shower filters are available. WaterCleen is not a Reverse Osmosis system.

RESOURCES

Appalachian State U, Dept of Technology

Dennis Scanlin
Appalachian State University
Boone NC 28608-
(828) 262-6361
Fax (828) 265-8696

Email scanlindm@appstate.edu
Appalachian State University has offered courses and workshops on green building technologies since 1978. The following courses are currently being offered: Solar Thermal Technology, Renewable Electricity Technology, Sustainable

Building Design and Construction, Building Science, Contemporary Problems in Appropriate Technology, Sustainable Transportation, and Sustainable Resource Management. Workshops or special courses on any of the above topics can be arranged. Architectural Drafting and Design courses, Construction Technology and Management programs are also offered. Bachelor and Master's degrees are offered.

Waste Reduction Partners

Terry Albrecht, P.E.
25 Heritage Drive
Asheville NC 28806-1998
(828) 251-6622

Fax (828) 251-6353
Email wrp@landofsky.org

Website

www.landofsky.org/wrp

Waste Reduction Partners (WRP), a team of highly experienced volunteers engineers, architects, and scientists, provides WNC business and industry with waste and energy reduction assessments and technical assistance. WRP assessment services include: water efficiency, solid waste reduction, energy efficiency, ISO14001, and pollution prevention. The program is governmental non-profit administered by the Land-of-Sky Regional Council, which works in special partnership with the NC Division of Pollution Prevention and World Resources Institute.

World Resources Institute

Nancy Kiefer
10 G Street, NE Suite 800
Washington DC 20002-
(202) 729-7680
Fax (202) 729-7686

Email nancy@wri.org

Website

<http://wri.org/wri/>

World Resources Institute (WRI) is a Washington DC-based center for policy, research, and technical assistance that provides objective information and practical proposals for policy changes that will foster environmentally sound development. WRI works with institutions in more than 50 countries to bring the insight of scientific research, economic analysis, and practical experience to political, business, and NGO leaders around the world. WRI's relocation in 1999 presented an opportunity to create an office environment that expresses its mission in tangible terms, through environmentally friendly design, facilities, and technology.

SALVAGE- ARCHITECTURAL

Asheville Recyclers

Bradley Barrett
19 Biltmore Ave
Asheville NC 28801-
(828) 254-5700

Asheville Recyclers is an architectural salvage business that specializes in antique doors, windows and lumber. We also offer deconstruction service of old barns and homes.

Biltmore Exchange Architectural Consignment

14 Sweeten Creek Road
Asheville, NC
(828) 274-4613

Preservation Hall Architectural Salvage

55 North Main Street, PO Box 977
Weaverville, NC 28787
(828) 645-1047

Preservation Hall Architectural Salvage and Antiques has been serving WNC for over a decade with salvaged architectural elements for every application. The reuse of salvaged items saves resources and landfill need. Quality Materials from earlier times add beauty and history to one's project.

SOLAR & ALTERNATIVE ENERGY

Ampla Apex, Inc.

Jeff Stilber
6050 Asheville Hwy, Suite 1
Hendersonville NC
28791-
(828) 687-1266

Email amplaapex@earthlink.net
Ampla Apex is an electrical contractor that works with low voltage system integration and alternative energy sourcing.

International Solar Energy Society

Villa Tannheim
Wiesentalstrasse 50
Freiburg Germany
79115-

Website www.ises.org
ISES is the world's largest organi-

zation in the field of the use and promotion of Renewable Energy. It is recognized by the United Nations as a consulting, non-governmental organization (NGO) and is a member of the United Nations Economic & Social Committee (ECOSOC). Founded in 1954 as an international, non-profit organization, the International Solar Energy Society promotes the use of solar and renewable energy worldwide. It has some 30,000 members in more than 110 countries.

National Center for Appropriate Technology

Tracy Mumma
3040 Continental Drive
Butte MT 59702-
(800) 275-6228
Fax (406) 494-4572
Email info@ncat.org
Website www.ncat.org

The National Center for Appropriate Technology (NCAT) champions sustainable technologies and community-based approaches that protect natural resources and assist people, especially disadvantaged, in becoming more self-reliant. NCAT operates programs in sustainable energy, sustainable communities, and sustainable agriculture and rural development. NCAT's Center for Resourceful Building Technology project promotes environmentally responsible practices in construction. The Guide to Resource Efficient Building Elements, a directory of recycled and environmentally friendly building products, is online at www.crbt.org

- 82% of **sulfur dioxide** emissions are from coal-burning electricity plants, 13% from factories, 2% from vehicles, and 3% from other

- 45% of **NOx** come from electricity plants, 30% from cars and trucks, 18% from non-highway mobile, 6% from factories, and 1% from other.

- 65% of **mercury** comes from power plants, 22% from factories, 7% from medical waste incineration, and 6% from municipal waste combustion.

NC Solar Center

Ann Young
Box 7401
Raleigh NC 27695-7401
(919) 515-3480
Fax (919) 515-5778
Email ncsun@ncsu.edu
Website www.ncsc.ncsu.edu
Sponsored by the State Energy Office, NC Department of Administration, in cooperation with NC State University, the N.C. Solar Center serves as the state's clearinghouse for solar energy programs and resources in North Carolina. Headquartered at the NCSU Solar House, a demonstration facility that is open daily and Sunday for public tour, the Solar Center conducts workshops for consumers and building professionals in NC, operates a toll-free hot line for solar related inquiries, publishes and distributes solar publications, operates a lending and reference library, provides technical assistance to consumers and professionals, provides design reviews, strives to build renewable energy infrastructure in NC, offers a referral service to a network of 250 professionals, and offers tours and educational materials for teachers and students.

Solar Guys

Arthur Dougherty
PO Box 18384
Asheville NC 28814-
(800) 614-1484
Fax (828) 251-2256
Email Kurt@solarguys.com
Website www.solarguys.com
The Solar Guys do renewable energy systems for residential and

commercial customers, including photovoltaics, hydropower, wind power, and hot water heating for domestic water and space heating. Call for a free energy audit and/or site survey in the WNC area and surrounding states.

Sundance Power Systems

Trish DeGroot
925 Beauty Spot Cove
Mars Hill NC 28754-
(828) 689-2080
Fax 689-4190
Email sundancepower@mindspring.com
Website www.sundancepower.com
Sundance is the front-runner in the field or renewable energy. As Master Craftsmen, Sundance specializes in custom engineered solar, wind and water powered systems for homes and businesses. We design and install high efficiency radiant floor and hydronic heating systems and are regional dealers for super high-efficiency appliances. Additionally, we specialize in energy audits to improve the overall efficiency of your home or business.

Sun Stuff of Asheville

Peter Phelps
1636 Hendersonville Rd
Asheville NC 28803-
(828) 277-8557
Email Peter@sunstuff.com
Website www.sunstuff.com
Sun Stuff specializes in solar domestic water heating systems, solar electric heating systems and solar pool heating systems.


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90% of all building failures are moisture related
American Society of Heating Refrigerating, and Air-conditioning Engineers

WINDOWS & DOORS

Carolina Building Services

Chuck Deyton
872 Riverside Dr
Asheville NC 28806-
(828) 253-2646
Fax (828) 252-1359
Email cbsashvl@bellsouth.net

The firm offers high quality wood windows and doors with insulated glass. Wood is a natural insulator and America's renewable resource. Carolina Building Services also offers high quality all vinyl windows and doors with insulated glass. All vinyl allows anyone to afford a top quality energy efficient product. Salespeople will come to you at your convenience.

Pella Window and Door Company

Jorg Ronke
1293 Hendersonville Rd
Asheville NC 28803-
(828) 684-3389
Fax (828) 684-8397
Email

wncpella@mindspring.com
The primary building block in the manufacture of Pella windows and doors is wood, one of the earth's few renewable resources. Seventy-five percent of the material used in the manufacture of Pella products consists of wood, glass and aluminum. A majority of the glass and aluminum that go into new Pella products is produced from recycled materials. Pella is firmly committed to minimizing the environmental impact of its operations and its products.

Window and Door Specialties, Inc.

Bud Hadley
311 Linda Vista Drive
Hendersonville NC
28792-
(828) 693-1135
Fax (828) 693-1774

Window and Door Specialties carries triple glaze, low E windows and provides consulting service on sunroom designs.

Window Planning Center

Bob Ballard
4 Vaughn Circle
Fletcher NC 28732-
(828) 684-4873
Fax (828) 684-1981
Email
bballad@windowplanningcenter.com
Website

www.windowplanningcenter.com
Window Planning Center offers Hurd, Vetter & Willmar windows, Woodharbor interior doors, wood or fiberglass entry doors, glass or acrylic block windows, and skylights. Hurd's Heat Mirror products provide maximum R-factor and solar control, reducing the cost of heating and cooling a home by 25 to 40% while blocking over 99.5% of ultraviolet light, the major cause of fading in fabrics, floors and furniture.

WOOD & ENGINEERED LUMBER

Appalachian Sustainable Development

Dennis Desmond, Program
Manager
(276)-623-1121
Fax (276) 623-1353

When you purchase Sustainable Woods, kiln-dried lumber from ASD, we guarantee that your wood comes from well-managed forests. We source our wood from forests managed and harvested under a rigorous set of standards designed to ensure long-term bio-diversity, conservation, water protection, and timber production. Our wood comes from private forest lands within the Central Appalachian region of SW Virginia and NE Tennessee. The logs are processed into quality kiln-dried lumber at our Sustainable Woods Processing Center in Russell Co. Virginia, using solar and wood-waste heat. We process a wide variety of hardwood species and grades, including well-known and under-utilized species.

Asheville Hardwood

554-B Riverside Dr
Asheville, NC 253-0610
(828) 253-0310
Fax 253-0610

Earthaven Forestry Cooperative

Brandon Greenstein
 1025 Camp Elliot Rd
 Black Mountain NC
 28711-
 (828) 664-1732
 Fax (828) 669-8879
 Email
 forestrycooperative@earthaven.org
 Website

www.earthaven.org/fc/fc.htm
 The Earthaven Forestry Cooperative has brought together wood lot management and low-impact felling and skidding with custom milling, site planning, natural home design and construction. Earthaven FC specializes in systems that use small timber and non-toxic materials like unique timber frames with natural insulation and earthen plasters. Milling and innovative designs allows the company to minimize waste and maximize efficiency, while providing a beautiful, responsible product at an affordable price.

Full Cycle Woodworks, Inc

Elaine Highsmith
 1600 Hwy 70 North
 Rogersville TN 37857-
 (828) 423-2726
 Fax (423) 272-5554
 Email
 fullcycle@sustainablelumber.com
 Website

www.sustainablelumber.com
 Full Cycle Woodworks sustainably harvests forest products using "best management practices." Full Cycle uses erosion control, avoids streams and does not "high-grade" harvest. The company is a leader in value-added wood products. As a fully integrated forest product manufacture, Full Cycle combines conscientious use of natural resources with social consciousness.

Mountain Lumber

Patricia Boden
 PO Box 289
 Ruckersville VA 22968-9510
 (804) 985-3646

Mountain Lumber provides Heart Pine, Oak and Chestnut rescued from century old buildings slated for demolition. Timbers are remilled into wide plank flooring, ornamental and structural beams, stair parts, mantels, cabinetry and millwork.

Powell Industries

Jonathan Creek
 Waynesville NC 28786-
 (828) 926-0848
 Fax 926-9117

Quality Forest Products

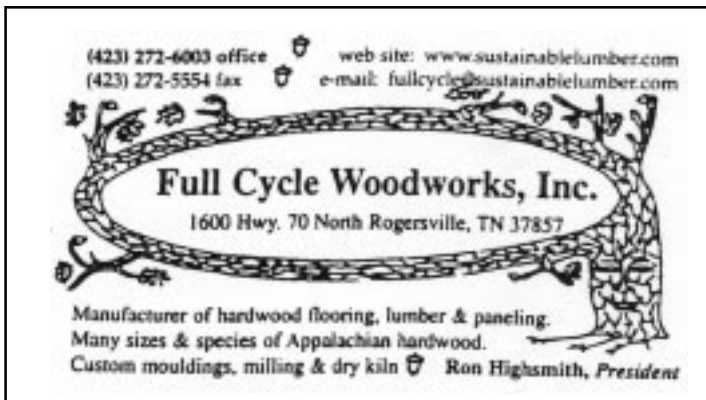
Bill Eure
 21144 Highway 301 S.
 Enfield NC 27823-
 (252) 445-2113
 Fax (252) 445-2896
 Email beure@qualityforest.com
 Website

www.qualityforest.com
 Quality Forest Products provides ACQ Preserve-pressure treated southern yellow pine lumber that contains no arsenic and no chromium. It is the most environmentally advanced pressure treated lumber sold in the USA and offers a limited lifetime warranty.

Smokey Mountain Lumber

Lynn Fidler
 PO Box 8427
 Asheville NC 28814-
 (828) 298-3958
 Fax (828) 298-6315

Smokey Mountain Lumber is a manufacturer of exterior and interior trim for the housing market. We use some recycled building materials that the client brings to



us to shape for their use. Our operation does reuse metal strapping and recycle pallets we collect from various sources in the area. The wood shavings we generate do go to local horse farms. Some of our customers who are building a home get the trees sawed for lumber that comes from their lot and we produce interior millwork for their home. The edging strips from the lumber we use is sent to a site where it is ground into mulch.

Smokey Mountain Portable Saw Mill Co

3598 Cullowhee Mountain Rd
Cullowhee NC 28723-
(828) 293-5784
Fax (828) 293-5784

The Carpenter's Saw Mill

David Houser
429 Pond Road
Spruce Pine NC 28777-
(828) 765-0362
Fax 298-6315
Email
dahouser@mitchell.main.nc.us
The Carpenter's Saw Mill provides custom, on-site milling of logs into


lumber using a thin kerf Wood-Mizer band saw mill. We serve Mitchell, Yancey, Avery and McDowell counties primarily. Products may include framing lumber, boards, post and beam material, mantels, porch decking and log cabin beams cut from any local species.

Whole Log Lumber

Jim Stowell
Rt. 1 Box 304-A
Zirconia NC 28790-
(828) 697-0357
Fax 696-2938

Whole Log Lumber has been processing antique timbers from demolition projects around the country, into flooring, paneling, stair parts and custom cut timbers for 15 years. Our major product is heart pine flooring made from long leaf pine timbers from the old factories of the Industrial Revolution. Recycling this wood is not only environmentally sound, the rich patina of the old growth is unmatched by new wood. Other products often available are, chestnut, antique cypress, antique redwood and antique oak.

So little lies between you and the earth. One look and you know that simply to survive is a great triumph that every possible resource is needed, every possible ally – even the most humble insect or reptile.
– Leslie Marmon Silko



GLAZER ARCHITECTURE, PA
7810 Patton Avenue, Asheville, NC 28801
828.254.5853

ARTICLES

Energy Efficiency: An Overview

By Claudia Cady, Cady/Guyton Construction

Because energy use is both the single most important resource-efficiency issue in home building and the broadest in its scope, the topic is broken down into the following three content areas:

- 1. Building Envelope** - Walls, ceilings, windows, doors and foundations play a major role in heat loss and gain.
- 2. Mechanical systems** - HVAC systems, water heating systems, and related delivery systems (ducting and plumbing) determine home energy consumption.
- 3. Appliances and Lighting** - Appliance and lighting options in today's homes are almost limitless but choices have a large impact on home energy consumption.

1. Building Envelope

We can improve the energy efficiency of the building envelope through the design of the building, care and method of installation, and the choice of materials. We can do this through passive solar design, insulation, and addressing air leakage. Let's examine these.

Passive Solar Design

(also see page 41 for more information on passive solar design)

Designing a home to optimize solar gain can significantly reduce mechanical heating and cooling requirements in most climates. Even the cloudiest and coldest regions can incorporate many of the items listed below. Most of the components of a passive system are an integral part of the building itself; however, site features such as trees can play an important role. In very general terms, passive solar design relies upon the following components:

1. Glazing - to maximize winter, and minimize summer solar gain.
2. Masonry or water - for storage of thermal radiation.
3. Fans/pumps/natural convection - for delivery of warm (cool) air.
4. Overhangs/awnings - for shading.
5. Site Features - for solar access, shading, building orientation.

Individual elements of passive solar design can be employed without necessarily moving to a full-blown passive solar design. Green builders can use the principles and techniques as site, design, and customer requirements allow.

Skylights, if not carefully oriented, can add significantly to the cooling loads in homes, and must generally be considered as an energy penalty. Light tubes are small skylights in the form of tubes with reflective interior surfaces. They are typically designed to be installed between framing 16" or 24" on center, and to extend from roof to ceiling; hence they require no structural modification and no separately framed well or shaft. Light tubes may reduce unwanted summer heat gain and winter heat loss when compared to conventional skylights of similar lighting performance. There is some evidence supporting the lighting energy saved with light tubes but no research has been conducted that includes heat loss/gain as well as lighting savings.

Insulation

In general, the higher the total R-value of a floor, wall or roof assembly, the better the heating and cooling performance. Total R-value refers to the insulating value of all the layers of materials, including insulation, masonry, sheathing, siding, etc., and the effects of solid structural members on overall performance. Proper installation is critical to the performance of all insulation systems. A gap between any insulating material and adjacent surfaces will reduce the overall performance of any system.



Foundation: Typical R-values for foundation insulation range from 4 to 13. Energy savings for foundation wall insulation decrease as the depth below grade increases

Some codes require crawl spaces to be vented to the outdoors. Building researchers are increasingly taking the position that it makes sense, from a moisture control and thermal performance point of view, to treat crawl spaces as conditioned space. In this case, crawl space walls would be insulated, as are basement walls and no insulation would be used in the joists between basement and first floor.

Walls: Wall R-values typically range from R-15 to about R-23. Increasing the R-value by, say 15%, can often be done using some combination of foam sheathing, higher density insulation between studs, and reduced framing.

Ceilings: As with above grade walls, the energy efficiency of a ceiling is a function of insulating R-value, air leakage, and material characteristics in absorbing, transmitting, and emitting solar radiation. R-values for ceiling insulation should be a minimum of R-30.

Air Leakage

Air leakage through the exterior envelope and airflows within building cavities can be a significant source of energy loss. As much as 30-40% of a building's energy load can be attributed to infiltration in some climates. Infiltration occurs at gaps and joints between insulation and framing materials, penetrations within the structural envelope itself such as holes drilled for plumbing and wiring, and at cracks around doors and windows. In addition, infiltration affects indoor humidity levels and thus, comfort.

2. Mechanical systems

In most climates, energy use for space heating and cooling and water heating will comprise over half of a home's energy consumption. There is no one heating system that is best in all situations. We must look at the availability and cost of fuels and the lifestyle of the homeowner.

Radiant Floor Heating- Most radiant floor heating is hydronic with water-filled tubing run in a concrete slab or under a wood floor. Advantages include even heat distribution and energy savings.

Geothermal Heat Pumps - are heat pumps that use the thermal mass of the earth as a source of heat in the winter and as a sink for waste heat in the summer. Because Geo thermal units rely on relatively constant ground temperatures of 45-50F, they provide greater heating and cooling capacity during periods of extreme temperature, and generally should require less supplemental electric resistance heating during cold winter conditions as compared to air-source heat pumps.

Active Solar Space Heating- this refers to the use of solar collectors to gather heat for the home. Generally, single glazed flat plate collector's with a black selective coating collect heat via an air or water-glycol medium. The heated air or liquid is then transferred directly to the living space or to a storage area via a fan or pump.

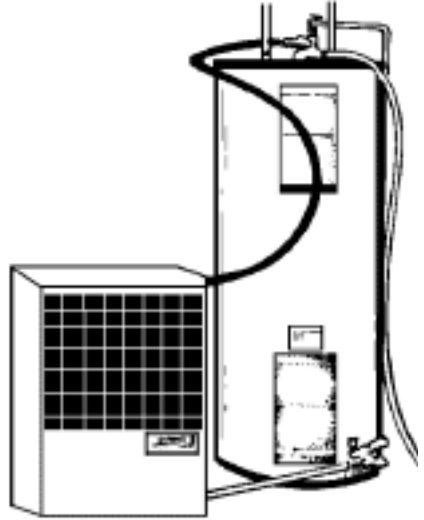
Whole House Ventilation-These can reduce air conditioning loads by taking cool air from outside at night and using it to cool the house.

Ceiling Fans- These do not inherently reduce energy consumption but make the air feel cooler and destratify layers of warm and cool air. Also note, more fan blades do not equal more air movement.

HVAC equipment is typically selected based on an estimated maximum heating or cooling load. Under sizing can lead to comfort problems and over sizing can lead to poor energy efficiency as well as comfort problems. Oversize equipment will tend to cycle on and off more frequently. In cooling, frequent cycling leads to less dehumidification, which can be a source of poor comfort.

Ducts placed in unconditioned areas including attics, crawlspaces and garages have been shown to significantly degrade HVAC system performance due to air leakage and conductive loss. Losses of 25% are common for duct systems outside the thermal envelope. If it isn't practical to place all ducting inside the envelope, insulating and sealing air ducts can mitigate losses. Flexible ductwork can have pressure losses five times greater than metal and should be used minimally.

Central air conditioning system efficiencies are referred to as SEER ratings or Seasonal Energy Efficiency Ratio. This is the system of seasonal energy output to energy input. Federal standards establish a minimum



SEER rating of 10. Efficiency upgrades are available up to 18 SEER. Some programs offer credit for these increases. By 2006 minimum SEER ratings will be 13.

Water Heating- Water heater efficiency is described by the “Energy Factor”. Gas heaters range from .42-.86 and electric from .81-.96. Higher efficiencies are achieved through increased tank insulation and locating the unit as close to kitchen, bath and laundry, as possible.

Alternative water heating units might include solar and on-demand systems. A typical solar water heater can meet 40-60% of hot water demand in a home. On-demand systems heat the water as needed eliminating the need to keep a tank of water hot at all times.

Drainwater heat recovery systems reclaim heat from waste hot water to preheat incoming cold water before it enters the water heater.

3. Appliances and Lighting

Refrigerators- As one of the largest energy users in the home it pays to choose one carefully. A side-by-side model uses more energy than one with a top compartment freezer. Ice makers and through-the door dispensers also use more energy. All EPA Energy Star appliances exceed the federal minimum standard for energy use by at least 20%.

Dishwashers- A booster-heater on a dishwasher increases the temperature to 140-145 F. This feature allows you to turn down the water heater thermostat to 120 F. A “light wash” setting can reduce the amount of water used by 50% and selecting the no-heat dry option eliminates the use of an electric heating element to dry the dishes. Energy Star models use 13% less than the federal minimum standard.

Horizontal Axis Washers - These use less water than conventional machines. Some models use 40% less water and since heating water accounts for about 90% of a washer’s use, this yields significant savings.

Gas Dryers /Ranges - Typically, gas appliances are less expensive to operate than electric.

Lighting- Tube and compact fluorescent lighting uses 50-70% less energy than incandescent. Although more expensive than incandescent bulbs they will last 10 times as long.

All recessed lighting should be “IC” type, which means they are rated for contact with insulation.

Motion detectors can save with outdoor lighting by turning lights on only when needed and solar powered lights that charge during the day are a good alternative to electric.



Compiled from [A Guide to developing Green Builder Programs](#)

Resource Efficiency

*By Boone Guyton,
Cady/Guyton Construction*

Resource efficiency accomplishes more with less. Its goal is to make a structure that is sustainable from its inception through its demise and reduces the pressure that construction places on natural resources. Constructing and operating buildings consumes more materials and energy than any other single activity in the United States. Increased consumer demand, combined with the growth of human population, is reducing our worldwide natural resource base even as technological innovation creates new possibilities. Resource efficiency should be considered in the design of the building and its systems, the choice of materials and equipment included in the building, and the effect of the building on its setting.

The most important resource to be considered is the energy use during the lifetime of the structure. This will have the greatest overall impact on the environment. An energy efficient house can save 60% or more in its operation. Conserving energy reduces demand on power plants and reduces harmful emissions.

In designing a building, resources can be saved by the following:

- 1) Keeping the size small and using the space efficiently
- 2) Simplifying the buildings geometry
- 3) Using 2 and 4 foot increments in the design to reduce waste

Efficient framing also saves resources when components that are appropriate to the structural functions are used. For example:

- Greater than 16" center member spacing
- Two stud corners
- Single top plates
- Reduced cripples and jacks
- Headers sized for each opening
- 1X backing at partition walls intersections

Material selection can reduce resource demand through:

- Using recycled content materials, especially post-consumer recycled content
- Using products that can be reused or recycled at the end of their life cycle
- Choosing renewable resources like wood that are naturally recycled and renewed
- Selecting materials that are durable and maintenance free in their application
- Buying locally grown or produced products which reduces transportation costs and impact
- Selecting materials that produce the least pollution during their manufacture

Recycling or reuse of job waste is an obvious but frequently overlooked component of efficiency. (For example, chipping any wood waste to be used as mulch, having a centralized cutting area to have the drops available for

use, or simply separating metal, cardboard, and wood so they can be recycled off site).

There are many engineered products and systems that are available now that reduce the environmental impact of construction such as:

-**Structural Insulated Panels** (SIP's): provide high R-value for walls and ceilings. These structural components use less wood than traditional materials.

-**Insulated Concrete Forms** for poured concrete walls: remain in place after the concrete is set. These have high insulation value as well as thermal mass within the building envelope, which also helps with energy efficiency in many climates. They are durable and quieter than traditional framed walls. Some brands are also made from recycled wood waste.

-**Engineered wood products** including I-joists, laminated beams, and roof trusses, which use less wood than dimensional lumber to provide equal structural work.

Natural materials such as straw bales, cob, slipstraw, and rammed earth have the double advantage of being minimally processed (acquiring little embodied energy in their preparation) and are usually found locally which means little transportation energy is involved.

Preserving the resources that are initially found at the construction site is also important to resource efficiency. There is less need to bring in topsoil and landscaping plants at the end of the job when on-site topsoil and native plants are preserved. Native plants used in landscaping are better adapted to the area and generally need less water for their maintenance. They also tend to provide better wildlife habitat for indigenous animals than exotic varieties.

Other conservation measures should also be considered when building a new structure. Reusing old buildings can reduce the use of new land and building materials. Locating buildings convenient to public transportation and services can reduce automobile use and pollution.

In general, resource efficient buildings will provide comfortable, healthy, and durable places to live while reducing the demand on scarce resources. They will be energy efficient, producing less pollution in their operation and causing less disruption within the habitat of native animals and plants.

Much of the information was compiled from [A Guide To Developing Green Builder Programs](#) by NAHB Research Center.

U. S. consumers utilize greater resources per capita than any other people world wide. We use about 20,000 pounds (10 tons) per person per year of "active" materials. These include virgin forest products, fuels, steel, glass, cement and plastics. An astounding 90 percent of these materials becomes "waste" in less than one year according to a 1992 study by the US Office of Technology Assessment (OTA). The study also reports that residential construction processes are still fairly inefficient compared to other industries.

Fuel Cell Technology: A brief primer for the homeowner

By Larry Weissman

What is a fuel cell, you ask? Fuel cell technology has been around for a long time. We used it in our first explorations of the moon with the Apollo program, and continue to use it today on all spacecraft. Industry has also embraced its use for some time now. So what is it you ask? Simply put, a fuel cell is a power generation device that uses some basic chemical reactions to produce electricity. Unlike a battery, a fuel cell never runs out of power so long as a few parameters are kept in check, and with the added benefit of producing “almost clean, emission free” power.

How does it work? Chemical reactions are at the heart of a fuel cell. There are two reactions happening at once in a fuel cell. The first of these reactions serves to disassociate a Hydrogen molecule into an electron and a proton through the interaction with a platinum catalyst. The electron is then allowed to provide power to an electric circuit and the proton is allowed to migrate across a membrane where it combines with the returning electron from the circuit and oxygen from the air to produce water and heat. Essentially this part of the system is environmentally clean, with no pollutants produced. A fuel processor is used to provide hydrogen to the system. The fuel processor uses raw materials such as methane, propane, or natural gas to produce hydrogen and CO₂. The CO₂ is the only contaminant produced by a fuel cell system. Heat from the system can be incorporated into home heating or other uses.

What are the benefits of using a fuel cell? Systems are now being developed to provide power for home use. These systems can provide up to 10 KW of power at a cost of under \$10,000 to the homeowner. The costs of these systems are going down as the technology improves and demand increases. Specific benefits include: conversion efficiency - mechanically delivering power over power lines and/or through a generator at the home is not as efficient as a chemically driven fuel cell; grid independence and grid connection - a fuel cell can supply “power on demand”; environmental advantages - almost no emissions, greater efficiency of electrical energy generated, and low noise; fuel flexibility - if the fuel has hydrogen in it (all do) then a fuel cell can use it; Ease of maintenance - very simple to maintain and operate.

What are the drawbacks of using a fuel cell? Cost; Unproven technology; Parasitic loads - a fuel cell is constantly on at full power. This can actually reduce the overall efficiency of the fuel cell by up to 10%, by having this power readily available whether needed or not.

Fuel cell technology has the potential to carry our energy needs far into the future. Perhaps one of the great benefits aside from powering our homes, will be its ability to power our automobile well into the 21st century...Fusion power is next!

Passive Solar Homes

Passive solar homes have these common elements:

Collection- To collect solar energy, double paned, insulated windows are used on the south facing side of the house. The glazing triggers the greenhouse effect, trapping solar energy.

Storage- After the sun's energy has been collected, some heat is immediately used in the living spaces and some is stored for later use. The storage, called thermal mass, is usually built into the floors and/or interior walls. Mass is characterized by its ability to absorb heat, store it, and release it slowly as the temperature inside the house falls. Concrete, stone, brick and water can be used as thermal mass.

Distribution- Heat stored in floors and walls is slowly released to the living spaces by radiation, convection and conduction. Open floor plans, stairwells, windows and doors allow the heat to convect throughout the house. In a hybrid system, fans, vents, and blowers may be used to distribute the heat.

Solar Access - The longest wall of the home should face within 15 degrees of true south to receive maximum heat gain in winter and minimum summer heat gain. There should be no obstructions to the south from 9a.m. to 3p.m. in the winter.

Size south-facing windows and thermal mass appropriately.

In houses with no internal mass this means approximately 7% of floor area. Direct gain systems can be up to 12% of the floor area of south-facing windows. A rule of thumb is that for every 1 square foot of south-facing glass over 7% of floor area, there must be an additional 5 square feet of 4-inch thick masonry or the equivalent.

Sunspaces should include only vertical glass as sloped glazing can cause serious overheating.

Minimize east and west windows.

During the summer the east and west sides of the house are exposed to the sun's rays at a low angle for long periods of the day. Reducing windows on these sides can greatly decrease summer heat gain and will reduce heat loss through the glass in winter.

Size overhangs properly to block summer sun and still allow winter sun. At this latitude 16 inches to 2 feet is a good bet. Overhangs should typically allow maximum light into the building between the sun angles of 36° and 73°.

Climate Factors of Asheville, North Carolina

Latitude: 35°

Avg. Yearly Degree Days: 4042

Avg. January Degree Days: 784

Avg. Winter Temperature: 46.7°F



Western North Carolina Million Solar Roofs Initiative

What is The Million Solar Roofs Initiative?

On June 26, 1997, in a speech before the United Nations, President Clinton announced the creation of the Million Solar Roofs Initiative (MSRI), an effort to combat global climate change by installing one million solar system on America's rooftops by 2010. Just two years following the announcement of this new initiative, over 40 communities and states had joined as Partners in the MSRI. Together, their initial pledges totalled over 950,000 solar energy systems.

In 1999, North Carolina became a State Partner in the MSRI, providing an avenue for communities throughout the state to participate in the program. North Carolina has established a goal of obtaining 20% of its energy from renewable resources by 2010. The key to reaching this goal and obtaining a cleaner environment, a reduction in global warming, and enhanced economic development will be the actions that are taken at a local effort. The participating Local Partners within North Carolina are Watauga and Guilford counties, the town of Chapel Hill, and most recently Western North Carolina.

With their similar goals, The Million Solar Roofs and The WNC Green Building Council (WNCGBC) are natural partners in the drive for a more sustainable energy future. The WNCGBC has committed to lead and coordinate solar outreach efforts to a four county region, including Buncombe, Haywood, Henderson, and Madison counties. Through this Local Partnership, the Green Building Council has committed Western North Carolina to a goal of 500 new solar installations by the year 2010.

WNC's Action Plan

The aim of the WNC Million Solar Roofs Initiative is to create a model program to spread awareness and develop cooperation for a regional approach to renewable energy and appropriate economic development. To understand what strategies will be most compatible with the conditions in our region, we first need to identify the human and environmental parameters, such as the existing public awareness of renewable energy. A key aspect of this is to compile a database of **existing local solar systems**, involve those with expertise in our cooperative efforts, then be able to track the efforts/results on a continuing basis. The creation/maintenance of a website which will function as an educational tool and meeting ground for those wishing to discuss projects and learn more about solar applications from others in the region is one of the primary short term goals of the Initiative.

This web site will provide:

- access to the MSRI local calendar of events, information on local economic incentives, as well as solar resources
- statistics derived from a database of all systems registered in the WNC MSRI region, as well as a registration form for new installations.
- a solar bulletin board for discussing solar projects, sharing personal solar success stories, announcing local workshops, etc...

Another crucial short-term goal of our local initiative is to inform the local government of MSRI and the need for cooperation between pertinent departments and those seeking to implement solar. Providing presentation seminars and solar tours for the public and related professional fields will serve as a primary form of education. We hope you will join us in this cooperative movement!



Western North Carolina Million Solar Roofs Initiative

North Carolina's New Renewable Tax Credits

In 1999, the N.C. General Assembly unanimously approved a revised and greatly enhanced set of solar and renewable energy tax credits for the state's citizens, business and industry. As a group, they are the most generous and comprehensive set of tax incentives offered by any state in the U.S. for users of renewable energy systems. Sponsored by Reps. Joe Hackney, Paul Luebke, and Danny McComas House Bill 1472 became effective on January 1, 2000. The new law includes these provisions:

- 35% Tax Credit for all renewable energy technologies (solar, wind, biomass, small hydro)
- 35% Tax Credit for residential, commercial, and industrial sectors
- Maximum Credit of \$10,500 for residential photovoltaic, wind, hydro and bio-mass systems
- Maximum Credit of \$3,500 for residential active and passive solar space heating
- Maximum Credit of \$1,400 for residential solar water heating
- Maximum Credit of \$250,000 for commercial and industrial renewable energy applications*

*Federal tax incentives also apply to selected solar and renewable energy technologies in the commercial and industrial sectors.

please photo copy and send to address below

Join Our Community Effort!

Name	<input type="text"/>	Phone #	<input type="text"/>
Address	<input type="text"/>	Fax #	<input type="text"/>
	<input type="text"/>	Email	<input type="text"/>

- I would like to receive more information about WNC's MSRI
- I currently have a working solar application
- I am interested in seminars on passive solar applications
- I am interested in seminars on active solar applications
- I am interested in attending a Solar Home Tour
- I would like to be included on MSRI mailing lists
- I would like to volunteer at solar related events
- I am interested in applying solar technology to my home/office

WNC Green Building Council / MSRI
PO Box 8427
Asheville, NC 28814
www.wncgbc.org

Solar Energy: Photovoltaics

Ned Ryan Doyle, Back Home Magazine



Photovoltaics, the direct conversion of sunlight into electricity, is perhaps the most practical, environmentally sustainable energy technology for today and the future. Solar photovoltaic panels have provided abundant, pollution-free electricity for decades with proven operating life spans of twenty years or more. Photovoltaic (P.V.) systems are used on spacecraft, in remote locations, along

highways, in calculators, on homes and businesses, and in massive arrays for community use. Energy produced by P.V.'s offers long term economic and environmental benefits, such as zero noise pollution, zero greenhouse gas emissions, minimal environmental impacts, extremely low maintenance, long operating lifetimes for investment payback, and zero fuel costs. With no moving parts and minimal maintenance, a P.V. system can produce electricity for an energy-efficient home or business.

The basic P.V. system consists of :

- 1.) The P.V. solar panels which produce electricity from sunlight
- 2.) A battery bank to store the electricity
- 3.) A system controller to regulate and monitor the flow of electricity.

P.V. solar panels can be installed onto rooftops, adjacent to homes in their yards, or even incorporated into the building itself, such as P.V. solar shingles. Each P.V. panel typically produces about 100 watts (outputs vary) and by adding more panels, the total power production capacity can be increased. However, it is more cost effective today to efficiently utilize the solar electricity than it is to simply add more panels. For example, it may require only three P.V. panels to operate your stereo, computer, T.V. and a few lights, but producing enough electricity for an electric stove could require an additional dozen (or more!) P.V. panels, plus battery capacity. (Cooking with gas is much more energy efficient.)

A battery bank is commonly used to store the solar electricity for later use, or for peak loads, or for periods of little sunlight. Large capacity lead-acid batteries, such as golf cart batteries, telephone substation batteries and solar storage batteries, are the most commonly used. However, research into more advanced batteries such as Ni-Cads, gel cell batteries, and AGM batteries offers much promise for P.V. systems.

A system controller is just that, with many purposes and jobs. It monitors the charge on the battery bank, provides the correct voltage to the batteries, protects individual components of the system from damage and generally offers a display of system conditions, like voltage, amp draw and percent of charge.

Indoor Air Quality and Green Building

By Ashley Featherstone, WNC Regional Air Quality Agency

Indoor Air Quality, or IAQ, is an important issue in office buildings, schools, and homes because people spend at least 90% of their time indoors. The US EPA recently reported that IAQ problems cost businesses \$60 billion dollars a year. In fact, the EPA has consistently ranked indoor air pollution among the top five environmental risks to public health. Children, the elderly, and those not in good health are most at risk for the effects of indoor air quality problems, and these groups also spend most of their time indoors. IAQ is not directly regulated. The EPA regulates outdoor but not indoor air. OSHA regulates indoor air in the work place.



Sick Building Syndrome

Indoor air pollution can lead to “sick building syndrome,” in which a large percentage of a building’s occupants experience health related symptoms but often no one factor can be singled out as the cause (Godish, 1995). According to the World Health Organization (WHO), sick building syndrome involves many symptoms that are common in the general population, but which occur at high levels in certain

buildings. Building-related symptoms often go away when people leave the building for holidays and weekends. Poor indoor air quality often causes problems in the upper and lower respiratory system or the skin. Common symptoms associated with sick building syndrome include: nose, throat, and eye irritation, skin erythema, dizziness, headache, tiredness, nausea, coughing, wheezing, and unspecified hypersensitivity. Asthma has also been associated with this problem (WHO, 1990).

Many IAQ problems are the result of inadequate ventilation, environmental tobacco smoke, biological pollutants resulting from moisture and water damage, chemical agents, volatile organic compounds, and/or combustion products. Cost cutting policies that use more chemicals, synthetics, and machinery may be partly to blame (Henley, 1996). The fresh air exchange is very important for diluting contaminants in the indoor environment (WHO, 1990). It has been suggested that indoor air quality problems may be associated with the increase in allergic diseases in children (NIPH, 1994).

Construction practices have changed a great deal in modern times. In the past, houses were built from native materials such as wood or stone. Glass and metal have also been used for centuries. Today, common building materials include fiberglass insulation, plywood, wall-to-wall carpeting, and treated lumber, all of which have been linked to health problems in build-

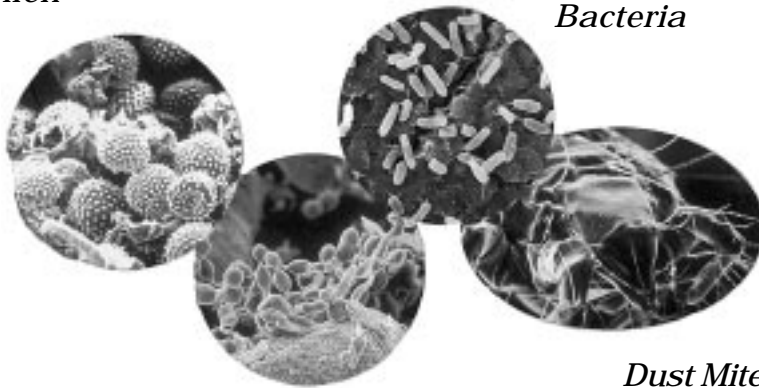
ing occupants. Plywood and particleboard emit formaldehyde, a known carcinogen. Other problematic materials include synthetic plastics, synthetic paints, synthetic carpeting, caulking and foam insulation (Bower, 1997).

Volatile organic compounds (VOC's) are emitted from natural and man-made materials. Some VOC's are harmless and others are significant indoor air pollutants. There are many VOC's that are emitted from synthetic materials. In addition to formaldehyde, other pollutants regularly emitted from building materials are xylene, toluene, ethyl benzene, benzene, and styrene. Other common indoor pollutants include radon, asbestos, smoke, particulate matter, lead, combustion gases, biological pollutants, ozone, and electromagnetic fields (Bower, 1997).

There are many naturally occurring and man-made pollutants in the air inside our homes today. Many are found in small concentrations and only cause subtle health effects. Many synthetic materials have not been around long enough to be studied adequately with respect to health effects. More and more synthetic materials are being manufactured every day. The implications of these pollutants on human health is largely unknown. However, some information is available. Many people have been sensitized by chemicals such as formaldehyde. When these people are exposed to even very low concentrations of many different chemicals, their bodies react. Multiple chemical sensitivity is becoming more common in the general population (Bower, 1997).

Pollen

Bacteria



Fungus

Dust Mites

Green Building and IAQ

The good news is that alternative building materials that are less toxic do exist. Low emitting paints, glues, carpets, and finishes are available. Less toxic insulation, as well as insulation made from recycled materials, are also available. The market for these alternative materials is growing and they are becoming more widespread in the marketplace.

Green building practices are sustainable. Sustainability has been defined as a process that can be continued indefinitely without degrading the environment. This approach provides a framework for environmental and health conscious decisions throughout the design and construction of a building. Green buildings are energy efficient and incorporate least toxic building materials, resulting in improved indoor air quality. Green building products often include recycled, renewable, and natural materials.

Green building and healthy building are now synonymous. Architects, engineers, and environmental consultants, or those trained in IAQ issues can work together in the initial phases of remodeling and construction to prevent conditions that can lead to poor IAQ (Moseley, 1990). That is exactly what the school administrators, school board, and building committee did when they constructed a new school in Stillwater, Minnesota. They hired an environmental consultant to review all building specifications. No carpet was used and building materials were properly selected based on low emissions. All materials and construction practices from site work to finishing were reviewed. The use of synthetic materials was minimized and products and construction methods were chosen to reduce the growth of microbes. A careful evaluation of the HVAC system was performed. Fresh air requirements were increased in science lab rooms. Ductwork was designed to minimize buildup of moisture and dust, and access areas were provided for later inspection and cleaning. The administration recognized that the initial higher costs of a healthier school would be offset by later savings in the operation and maintenance of the building, avoiding legal problems, and expensive retrofits (Oetzel, M., 1994).

Incorporating green and healthy building practices during the design and construction phases of building represents a proactive approach to maintaining acceptable indoor air quality. Sustainable building techniques also minimize the effects of construction on the environment, through the use of best management practices and renewable and recycled resources. Green building promotes a healthy lifestyle and a healthy environment.

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Caution: Hot – Lighting for a New Century

A commentary by John Senechal

I'm standing in a museum in the future, looking at a display of the "Edison *Incan-*descent Light bulb". The placard says, "Elegantly simple, this device was central to the early development and expansion of artificial lighting. Its use was, by the end of the twentieth century, nearly universal in the civilized world. *In-*candescent technology was replaced in the early twenty-first century by the electronic compact fluorescent bulb."



In the present, my dictionary defines *incandescence* as "heated to glowing". The fact is, a common incandescent bulb wastes 90% of its power making heat. To make matters worse, electricity that comes to your house has already lost about 75% of its energy through mechanical conversion and transmission losses. Put another way, the Edison light bulb is only 10% efficient, using a power source that itself is only 25% efficient, for a net efficiency of 2.5%.

There is a railroad crossing in Biltmore where one can get snarled in traffic and count the coal cars as they pass. Our local power plant uses about 100 carloads of coal every 3 days. For every 100 car trainloads of coal that passes through Biltmore headed for the power plant, in terms of lighting by incandescent bulbs, only 2 ½ carloads will be effectively used. If you factor in the extravagant and the unnecessary uses of electric lighting that are common today, then the figure goes even lower.

Who claims that we as a species are sentient? Enter the electronic compact fluorescent (CF) light bulb. If mankind has ever invented a good thing, this would be it, rated on par with fresh bread and flush toilets. With little fanfare and much stumbling, this little invention has, so far, fooled the world into indifference. And yet we see the beginnings of wisdom, which will rise up and smite us, and save us from ourselves.

Ten years ago, I started giving electronic compact fluorescent (CF) bulbs as gifts at Christmas. They cost about \$22.00 per bulb, and they made sense then. Now they are commonly at \$12.00, and sometimes lower. They use less power, typically 1/4 the electricity. And they last a lot longer, averaging 10,000 hours, compared to 1,500 hours for the incandescent bulb. If you figure the power savings over the lifetime of a CF bulb, and the cost of power, it suddenly hits you in the forehead: these new bulbs will pay for themselves in just a few years. The return on investment is much higher than the stock market. One light bulb changed might seem like a drop in the bucket, but as the scale gets larger, so do the savings and so does the environmental impact.

In fact, the environmental cost of incandescent bulbs should give anybody reason to pause and consider. According to Amory Lovins and the Rocky Mountain Institute, replacing one single (average) incandescent bulb with one compact fluorescent bulb will save about 130 pounds of carbon dioxide annually from being dumped into the atmosphere by your local coal burning power plant. Think in terms of CO₂ emissions next time you string your house with tiny incandescent bulbs for Xmas. Santa cringes when he flies over, seeing the landscape lit up all night long with incandescent

'heated to glowing' light strings. Where can I buy a reindeer nose that glows?

Natural light from the sun is hard to duplicate. Artificial light is considered good when it is comparable to sunlight. As our technology becomes more sophisticated, we are more able to imitate daylight. There are several factors to consider. Straight tube fluorescent lighting has a bad reputation for flickering. The older fixtures that I grew up under were all magnetically ballasted at 60 cycles per second. You can see the flicker if you look for it. A ballast is a small transformer that boosts electricity to a voltage high enough to make a spark jump from one end of a gas filled tube to the other. Electronic ballasts avoid the flicker by operating faster, much faster. Sunlight, of course, has no flicker at all. Early CF bulb manufacturers like GE thought they could capture the market with magnetic CF bulbs because they were cheap. The magnetic CF bulbs gave a poor reputation to all CF bulbs, which was not exactly fair to the electronic CF bulbs. Philips has been the electronic leader with an excellent variety of electronic CF bulbs. Philips' bulbs are nicer and have sold better than GE's magnetic bulbs. So GE is finally making a comeback with electronic CF bulbs; and now electronic CF bulbs are rapidly becoming the standard for all brands. Some makers, however, do not reveal on their packaging what kind of ballast is incorporated in their bulbs. Magnetic bulbs are heavier, though, that's the giveaway. Or if a package says, "flicker free" you'll know that it is electronic.

...replacing one single (average) incandescent bulb with one compact fluorescent bulb will save about 130 pounds of carbon dioxide annually from being dumped into the atmosphere by your local coal burning power plant.

With the larger straight tube commercial fixtures, you can get electronic ballasts with a wide range of tube styles. When ordering and installing those fixtures, you must specify electronic ballasts, or you will get the old default magnetic ballasts. There are many styles of tubes available with different color balances and varying in quality. Straight fluorescent tubes sometimes have a poor reputation for light quality because of cheap tubes, whereas better quality tubes matched with electronic ballasts can give a superior high quality light.

Color is not a factor with compact fluorescent bulbs. They are typically all color balanced the same, imitating the standard warm color given off by incandescent bulbs. There are full spectrum bulbs available through specialty retailers.

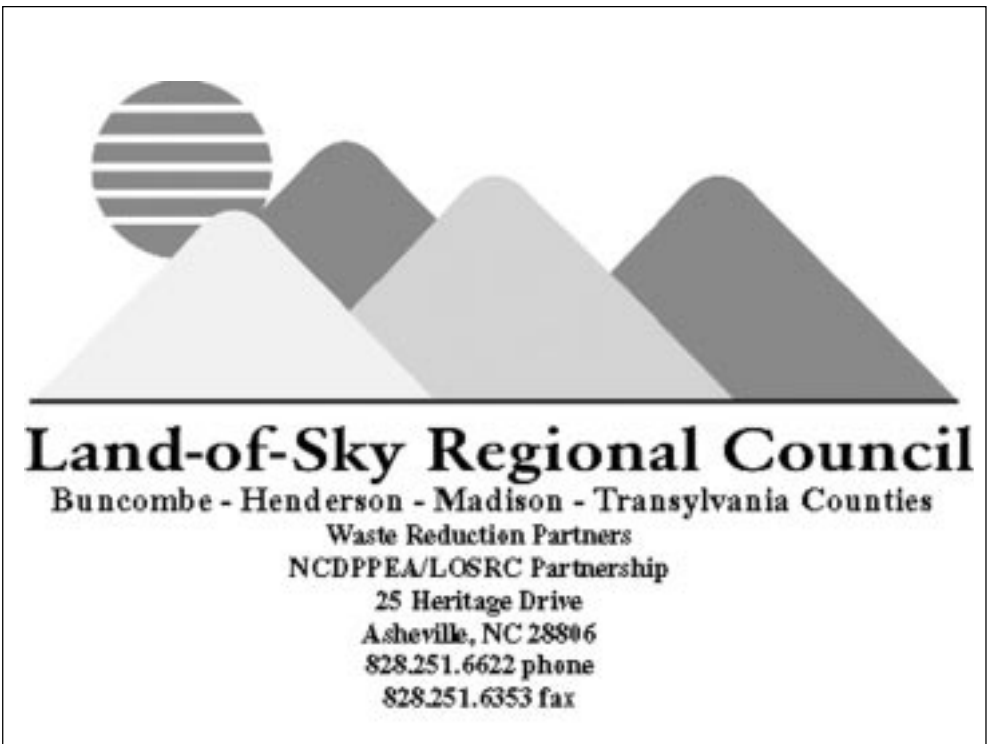
My own house has been converted to electronic CF light bulbs for about 10 years now. The whole house is changed over, except the refrigerator and microwave, which require special size bulbs. I have regular CF bulbs in lamps and fixtures, in the 15-22 watt range, that are equivalent to incandescent 60-100 watt bulbs. I use 3-way bulbs for reading rated at 15-22-30 watts, ceiling fixtures with built in 30-watt bulb-and-ballast, and a 17-watt bug-away porch light. I also have two light pipes that bring light from the roof to the dark center of the house, that use daylight only. And then there are the LED lights. Light Emitting Diodes (LED) use almost no power and last nearly forever. They are available in stores as nightlights. A specialty company called Ledtronics makes a cluster bulb that is brighter, but is not yet bright enough to compete with CF bulbs.

So here we are in the new century already, and the Edison incan-

descent light bulb still dominates the shelves in the local grocery store. The stores, of course, stock what people demand. I can think of only two reasons why electronic CF bulbs have not taken over: cost and inertia. Cost would be a real issue if you have no money. Say you're a gypsy hobo, or living on the edge from day to day, and maybe driving an old clunker for a car or have no car at all. Then you have a good excuse for using old fashioned, cheap incandescent bulbs (even though they cost more in the long run). But if you have money in the bank, a nice car, buy things in bulk to save money, or have investments, there is no good excuse to hide behind. Think of the future. Of course, if you have any concern at all for our long-term sustainability on this planet, then you should run out right now and replace some bulbs. Question: how many children-of-the-light does it take to change a compact fluorescent bulb? Answer: I don't know; I've never had one burn out.

Ten pages in my Webster's separate the words "incandescent" and "inertia". Inertia is described in one usage as "indisposition to motion, exertion, or change". Ignorance is a big part of inertia in this case. Force is generally required to overcome inertia. As with automobile pollution and appliance efficiency, our governments may one day get involved to push for higher lighting efficiency. It shouldn't be hard, because a superior bulb is already mass-produced and is sitting on shelves. The ubiquitous incandescent light bulb, which some consider to be timeless, will indeed disappear. They will be relegated to museums as relics of primitive times, alongside whale oil lamps and typewriters and slide rules.

In that future museum, I hope to be standing and contemplating the past. I may even be writing the placards. I'll put one in front of the 'Edison Incandescent Light Bulb' that says "**Caution: Hot**" to warn children who won't know that a light bulb can burn fingers.





Water Efficiency in the Home

*Compiled by Terry Albrecht,
Waste Reduction Partners*

The average American uses 69 gallons per day. Typical uses of water in the home include: toilets, clothes washers, showers, faucets (kitchen & bathroom), leaks, baths, and dishwashers. Outdoor water use can account for a sizable percentage of overall water use depending on landscaping practices and lot size.

Almost all of the plumbing fixtures that one finds on the market today are already water efficient. The Energy Policy Act of 1992 established water efficiency plumbing standards for a number of plumbing devices.

These standards have been in full effect since 1997. The American Waste Works Association estimates that nationwide saving of 6.5 billion gallons of water per day will be achieved by the year 2025 through these standards.

Going “Beyond-the-Code”

For new construction and renovations, the new plumbing standards offer substantial water and utility cost savings over the pre-1994 plumbing standards.

Additional “beyond code” savings can be made in areas of lower flow faucets, showerhead, dishwashers, clothes washers, and improved landscape practices.

Bathroom lavatory faucets can perform well in the 1.0 – 1.5 gallon per minute (gpm) range, which is well below the current 2.5 gpm standard. Faucet aerators can be installed simply and very inexpensively – less than \$5-\$10.

Showerheads are available in flow rates down to 1.5 gpm, but should be tested for performance satisfaction. Appliances can consume approximately one quarter of your entire home water use. Carefully review water use information when buying new clothes washers and dishwasher (also see Article on Energy Efficiency: An Overview). New high-efficiency clothes washers will use an average of 30% less water and 40-50% less energy than other on the market.

Much water savings can be achieved through behavior changes - “the way we use water” and maintenance. The following water saving tips are listed below:



Check for Leaks

Studies show that dripping faucets and leaking toilets account for as much as 14% of all indoor water use, equivalent to 10 gallons per person of water lost per day. Use your water meter to check for leaks in your home. Start by turning off all faucets and water-using appliances and make sure no one uses water during the testing period. Take a reading on your water meter, wait for about 30 minutes, then take a second reading. If the dial has moved, you have a leak.

Toilets



Older toilets (installed prior to 1994) use 3.5 to 7 gallons of water per flush and as much as 20 gallons per person per day. Replacing an old toilet with a new model can save the typical household 7,900 to 21,700 gallons of water per year, cutting both your water and wastewater bills

- Install an ultra low-flow toilet that requires only 1.6 gallons per flush.
- To ensure optimal performance, when installing a low-flow toilet in areas with a low drainage gradient (such as basements), consider a pressurized model.
- Check toilets periodically for leaks and repair them promptly. Check toilets for leaks by placing a few drops of food coloring in the tank. If after 15 minutes the dye shows up in the bowl, the toilet has a leak. Leaky toilets can usually be repaired inexpensively by replacing the flapper.
- Reduce the amount of water used by an older toilet by placing a one gallon plastic jug of water, or two one quart bottles, in the tank to displace toilet flows. Or you can install a "dam" that partitions off a section of the tank so it can't fill with water. These methods can save over 1,000 gallons of water per person per year.
- Don't use the toilet as a trash can

"You'll never miss the water 'til the well runs dry."

-"Father of the Blues" Alabamian W.C. Handy



Showers and Faucets

- Take a quick shower rather than a bath and save an average of 20 gallons of water.
- Install a water-efficient showerhead with a flow rate of less than 2.5 gallons per minute. (Replace an existing showerhead if a one-gallon bucket placed under the flow takes less than 20 seconds to fill.)



- Install aerators on your kitchen and bathroom faucets to reduce indoor water use by as much as 4%.
 - Check toilets for leaks by placing a few drops of food coloring in the tank. If after 15 minutes the dye shows up in the bowl, the toilet has a leak. Leaky toilets can usually be repaired inexpensively by replacing the flapper.
 - Turn off the water when brushing your teeth or shaving and save more than 5 gallons per day.
 - Clean vegetables in a sink or pan partially filled with water rather than running water from the tap.
 - Re-use the water that vegetables are washed in for watering houseplants or for cleaning.
- If you wash dishes by hand, rinse them in a sink partially filled with clean water instead of under running water.
- Instead of waiting for tap water to get cold enough for drinking, keep a bottle of water in the refrigerator.
 - Whenever possible, compost food scraps or dispose of them in the garbage rather than a garbage disposal.

Major Appliances

Clothes washers can use as much as 30-35 gallons of water per cycle and dishwashers as much as 25 gallons per cycle. A full dishwasher is more water efficient than washing the same load by hand. Energy efficient appliances are usually water efficient too.

Dishwashers

- Only run your dishwasher when it is full to make the best use of water, energy and detergent.
- Cut down on the amount of rinsing you do before loading the dishwasher. Most modern dishwashers do an excellent job of cleaning dishes, pots and pans all by themselves.
- When purchasing a new appliance, look for one offering several different cycles. This will allow you to select more energy and water efficient cycles when heavy duty cleaning is not required.

Clothes Washers

- Wait till you have a full load of laundry before running the machine to save both water and energy. If you can't wait for a full load, use the right water level to match the size of the load.

Other Opportunities

- Insulate your hot water pipes and your electric water heater. Insulation will reduce the amount of time it takes for hot water to reach the tap, saving water and energy.
- If in the market for a new water softener, consider one with a "hardness sensor" that will automatically trigger regeneration as needed. This type of softener will make the most efficient use of both water and salt.

Landscaping

Landscaping accounts for 20-50% of all residential water use and provides the best opportunity for water conservation at home. (See Article, "Creating a Sustainable Residential Landscape" For xeriscaping and rainwater harvesting ideas that can reduce water use.)

Graywater Reuse

"Graywater" is the term for bathing, dishwashing, and laundry water than that goes down the drain. More than half of your indoor water use is "graywater," and this water can be reused for outdoor landscaping purposes where allowed by local building codes. Graywater systems can help reduce water and sewer costs while helping you to "drought-proof" your landscape during times of water-use restrictions. Graywater systems are designed in conjunction with landscaping watering installations such as subsurface leach fields or subsurface drip irrigation. Typical system components include, plumbing (dedicated pipes and valves bring graywater out of the house), a surge tank (to temporarily hold large drain flow for bathtubs and washing machines), a filter (to remove particle that could clog the irrigation system), a pump (to move water from surge tank to the irrigation field), and the irrigation system (to deliver the water to plants). For more information, see http://www.dpla.water.ca.gov/urban/land/graywater_guide_book.pdf

For more Internet resources, see: www.waterwiser.org and www.p2pays.org

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Communities and Sustainability

By Elana Kann

The growing demand for green construction methods is an encouraging trend, with potentially positive effects on both the environment and the livability of the structures we build.

A broad perspective of green design and construction includes more than a closer look at each individual building. It includes how we tie our buildings to each other—how we integrate our housing, our work, and our social and recreational lives. The approach we take can encourage neighbors and co-workers to share and save more valuable resources than they can with only individual initiative.

Imagine picking up several dozen houses on individual lots (of whatever size), putting them on big trucks, moving them to a new site, and placing them close together in clusters—either as single family houses rubbing elbows or meshing walls to turn them into townhouses. Let's work on the house structures to make them more energy efficient and quieter—increase insulation, reduce air leakage, beef up soundproofing on shared walls.

There isn't room any more for street grids and attached garages, so we'll put a parking lot at the edge of the property. If everyone parks there and walks home, the traffic hazard for children and pedestrians is gone, it gets very quiet around the houses, and everyone gets a little exercise. We'd better add some carts for carrying groceries, etc. between car and house.

Now let's add a large Community Building within easy walking distance of every house, for all residents to use. The main space is a big dining room or two and a working kitchen, so residents can eat meals together a few times a week if they want to, taking turns cooking and cleaning. They may also fold the furniture up and dance together. Let's add a playroom and adjoining outside tot lot for the young children; a teen room for teens to hang out with each other yet be near family; a lounge for adults to talk or read; a laundry room with several good commercial quality washers and dryers may stay in the central building rather than in homes.

Suddenly the people living in these houses have a lot more options in their daily lives. If they like the shared meals, they can simplify their kitchens and their shopping because they are preparing fewer single-family-only meals. If they like to dance, they don't have to double the size of their rec. rooms or go out all the time to clubs. The children have places to get to know the neighbor families and do interesting things together, without relying all the time on their own parents. Parents too aren't isolated, and don't have to drive to meet other families. They find it easy to arrange childcare trades. Childless folks or retirees who like children can get to know the young neighbors. Perhaps people share subscriptions to newspapers and magazines and sit in the central lounge to read them. With the central laundry, some people decide they don't need their own washers/dryers, and use the space for something else instead. If their guests like using the community guest rooms, some residents decide to turn private guest rooms into offices and work from home, or rent out spare rooms for extra income. Or maybe they decide to actually eliminate the extra rooms

and reduce the size of their houses-less maintenance and cleaning, lower heat bills, and less property tax due.

Let's say the site still has open green space left, and we turn that into shared property for all the residents. Hmm, the possibilities are endless - big playground or play lot, gardens, orchards, volleyball court, woods with walking trails. We can add underground cisterns to catch rainwater from parking lot and roofs, and irrigate the gardens with this free water while reducing wasteful runoff. Details would depend on the site. Residents now need to pitch in to do site maintenance work, and/or contribute money each month to hire someone to do it. If they want to grow more food, create more shade or privacy, or just have interesting plant shapes and colors all around them, they might eliminate most of the grass. Whatever grass is left can be mowed with one mower. By now residents are throwing a joint garage sale to get rid of unneeded washers, dryers, lawnmowers and other tools they are sharing.

Now let's make one last bold move, our most radical contribution to green-ing up this place. We rip out all the individual furnaces, ducts, hot water heaters, and water meters in all the houses. We install solar collectors on the Community Building's roof and add a mechanical room in the lowest level. With the right piping, the solar collectors now heat water in a big tank in the mechanical room. We add a few large commercial natural gas water heaters as backup. We dig trenches between the central building and the house clusters (hopefully before the orchards are planted!), lay conduit, and pipe both cold and hot water to every house. More house space that had been devoted to individual heating and water systems is freed up. The tubing connections and pumps can pop up into a narrow exterior closet on each house, about 2' deep by 5' wide. The heat can no longer be forced air, so we'll change it to radiant heat using warm water tubing-either in the floors or in wall radiators in every room. Ah, no more drafts or dust blowing around, just quiet even heat like the sun pumps out.

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These last changes mean more central maintenance of the new central systems, with shared costs among all the residents. The equipment and materials are of such high quality that the overall maintenance is much less than when every homeowner was responsible for his or her own house's systems. And adding a central backup generator can insure that in a power outage the buildings on the entire community will stay warm.

By this time, many of the houses are probably much smaller than when they arrived by truck, as more residents use the central facilities more often and need less space in their private dwellings. People have gotten rid of their energy-guzzling appliances and light fixtures and replaced them with highly energy-efficient ones. Even with the shared costs of the Community Building, central mechanical systems, and the grounds, monthly energy bills are much lower. On-site cultural and recreational events are frequent. Children play with their almost-sibling neighbors every day. It's rare that anyone hires a babysitter. More people are working on-site, either in spare rooms in houses or in nearby craft studios. As people get to know each other, they figure out ways to ride-share or walk or ride bikes instead of driving, and the number of commuting trips per person drops. There is food to pick and eat all over the site now as the gardens and orchards mature.

Of course, a more likely way to create this scene is to build it from scratch rather than moving houses from other sites and cutting off pieces of them! One neighborhood in the Asheville area incorporates these ideas. Westwood Cohousing Community in West Asheville, a 4½-acre, 24-townhouse community completed in 1998, recently received a Smart Growth award in the Green Building category from Smart Growth Partners of WNC.

Neighborhood Design/Build, currently developer whose partners developed Westwood, borrowed ideas from European towns' centralized heat/water systems; solar engineering; Danish cohousing "village" architectural principles; basic "smart growth," "green," and "sustainable" concepts; and Permaculture design. ND/B's architect/engineer/ permaculture design team integrated these ideas to create these two cooperative neighborhoods.



For more information, see ND/B's website, www.ndbweb.com.

Community is the gift of myself that I give in endless participation with my world.

David Spangler

THE LEED GREEN BUILDING RATING SYSTEM



THE LEED GREEN BUILDING RATING System™ has been around only a year or so, but it is already being used as a framework for green design of hundreds of projects. It is officially referenced in the building guidelines of several local governments and federal agencies, and unofficially used by many more. What is this system that has generated such interest, and how does it work?

What LEED Is

LEED stands for Leadership in Energy and Environmental Design. The LEED Rating System is a method for providing standardization and independent oversight to claims of environmental performance for nonresidential buildings. Its checklist of green performance goals and measures has 69 possible points—a building that can document compliance with 26 or more points can be LEED-certified.

LEED is a project of the U.S. Green Building Council (USGBC), a nonprofit organization of architects, construction companies, product manufacturers, engineers, consultants, and many others. Of the various initiatives and programs that have emerged from the Council since it was founded in 1993, LEED is by far the most significant in terms of the interest it has generated.

How LEED Certification Works

The first step in certifying a building under LEED is to register the project with the USGBC. The registration fee (\$350 for Council members, \$500 for non-members) gets you access to the online reference materials and up to two free “credit interpretations.” All credit interpretations will be posted with the *LEED 2.0 Reference Guide* on the Web, so that subsequent projects have the benefit of all prior interpretations. Interpretation requests are submitted online, and a two-week turnaround is promised. Should more than two interpretations be needed, additional requests are handled for \$220 each.

Once the building is complete, the owner or designer must submit a checklist showing which credits are being claimed, along with the documentation needed for those credits and a fee of \$1,200 (\$1,500 for nonmembers). The certification committee then reviews the project and, if documentation is in order, awards the appropriate rating. Certified projects receive a certificate and brass plaque, along with a media kit and the promise of exposure on the Council Web site and in the trade press.

In addition to these direct costs, projects that intend to be LEED-certified will have to budget some additional time for the design and construction team to monitor and document compliance with the credits. Actual documentation requirements are still being worked out, so it is too early to estimate what these costs will be, but they will not be insignificant.

Recognizing that the LEED ratings are based on a building’s design rather than its actual operation, the Council has determined that a LEED rating will be considered valid for five years. At that time, the building will have to

undergo recertification under a yet-to-be-developed LEED Operations and Maintenance Rating System to retain its rating. There will likely also be the possibility that the building's rating might be adjusted up or down at that time, according to Watson.

The Credits

At LEED's core is the checklist of credits that determine available points for various green measures. The entire detailed checklist is available free as the *LEED Green Building Rating System™*, an Adobe Acrobat™ file that can be downloaded from the USGBC's Web site (registration is required to download the file). This 25-page document lists every available credit, describing the intent, the requirements, and some sample technologies or strategies for meeting the requirement. *EBN* readers with interest in LEED are strongly encouraged to get this document, as it is the only official guide to the LEED system.

Looking Ahead and Looking Back

The US Green Building Council has committed to a three-year cycle for revisions to the LEED Rating System, so the review process will begin again soon. Meanwhile, the success of LEED has spurred members to create complementary programs for projects not covered by LEED. LEED Interiors, now in its second draft, is being developed by a Committee chaired by interior designer Penny Bonda of Burt Hill Kosar Rittelmann's Washington, D.C. office. Formulation of LEED Residential is just beginning with a large committee under the leadership of Marc Richmond of the Austin, Texas Green Building Program. And LEED for Operations and Management has not yet been initiated in any official way, but the Council is aware that it will be needed by 2005 to provide ongoing certification of existing buildings.

Meanwhile, other organizations are building on the LEED system as they reference it for their own purposes. For example, the City of Seattle has established a policy that all municipal buildings must meet the LEED Silver rating. In addition, the City has its own guidelines about how some of the credits are to be calculated and is requiring that certain credits be achieved (in effect, adding more prerequisites).

So how good is LEED? The market has spoken, and the enormous interest expressed suggests that LEED is good enough for many people excited about the potential of an independent rating for their buildings. While the system has weaknesses, they are inevitable in a new venture of this sort; by getting the system into circulation, these weaknesses can be resolved and LEED can be made more robust. LEED 2.0 as currently published is really just the framework for a Rating System—it will become a full system once the Committee, through the *Reference Guide* and early users, has fleshed out the details of how a project is measured and documented for each credit. The relatively short, three-year revision cycle will encourage quick evolution.

While LEED has great potential to move the building industry toward greener practice, a rating system cannot do everything. There are some inherent problems with any system that encourages a design-by-checklist approach. For example, once a designer or team has determined that they will not be able to achieve a certain credit, the system provides no incentive to at least do what they can in that direction. Similarly, once the threshold for a credit is met, there is no incentive to try to do even better.

As checklists go, however, LEED is remarkably sophisticated, having ben-

edited from countless hours of work (mostly volunteer) from leading green architects, engineers, contractors, and other professionals. Inclusion of the innovation credits option, while adding more work for application reviewers, greatly enhances the flexibility of the system. The cost of certification and the time required to prepare an application will be a barrier for some—as a result, for every project that gets certified, there will likely be many others just using the system internally. Either way, the Council's mission of promoting green buildings will have been advanced, and meaningful criteria for energy- and resource-efficiency fully detailed. If the Committee continues to work out the implementation details with the same level of energy and attention that went into LEED 2.0, we will see many more green buildings.

For more information:

Download the official LEED 2.0 document from the U.S Green Building Council: www.leadbuilding.org. Registration is required. Council members can also download additional documents about the LEED development process.

Information compiled from Environmental Building News

Every product we buy, every car or plane we ride, every item we dispose of affects the environment.

— Norman Dean, President, Green Seal



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Creating a Sustainable Residential Landscape

By David Tuch, Equinox Environmental

It's relatively easy to create an environmentally friendly landscape. By following a few or all of the following 5 steps of sustainable design, the homeowner can make a difference by creating a landscape that improves water quality, lowers energy and resource consumption, reduces waste, provides wildlife habitat, and produces food.

STEP 1: USE NATIVE PLANTS

Native plants are those that naturally occur in an area and have not been introduced through human actions since settlement. The Southern Appalachian Mountain region contains a diversity of native plant species, which are some of the most beautiful native plants found throughout the entire country. The **benefits** of landscaping with native plants are as follows:

- Provides habitat for wildlife
- Requires less water usage once established
- Helps lower maintenance costs
- Does not require application of fertilizers once established
- Provides a "sense of place" and inspires a sense of pride in the Southern Appalachian Mountain community

STEP 2: REDUCE THE AMOUNT OF LAWN

There are many alternatives to using or reducing the amount of lawn in the home landscape, such as creating a wildflower meadow for a sunny location or a woodland garden for a shady location. As desirable as some lawns may appear, they tend to be very resource and energy consumptive. The **benefits** of reducing the amount of lawn are as follows:

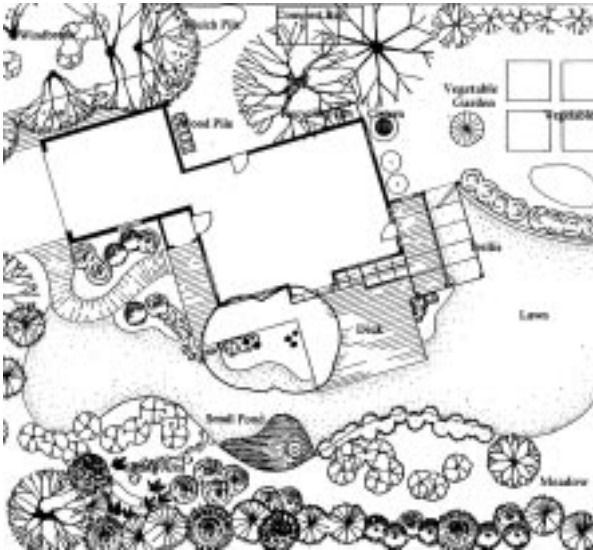
- Reduces air pollution-due to the reduced use of power mowers for maintenance
- Reduces runoff from pesticides and fertilizers that are typically used to keep the lawn clean and green
- Reduces water usage (lawns often require supplemental watering)
- Reduces yard waste (lawn clippings)

STEP 3: PROVIDE WILDLIFE HABITAT

By reducing the amount of lawn and using native plants the landscape is already more hospitable to wildlife. To attract even more wildlife into the home landscape there are four basic needs that wildlife require: food, water, shelter, and places to reproduce and rear young. To **attract** wildlife into your landscape:

- Provide a water feature such as a pond or bog garden
- Plant native plants with wildlife value (such as plants with berries, nectar producing flowers or plants that provide materials for nesting and shelter).

- Provide protective cover (include trees to create overlapping canopies, densely branched shrubs, fallen trees, brush piles, evergreens, and/or a wildflower meadow).
- Plant in masses and create “shrub islands” and/or “tree thickets”

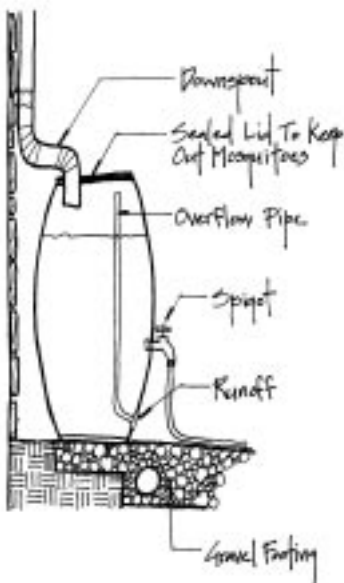


Improving Wildlife Habitat: Notice the massing of trees and shrubs for shelter and places to rear young, the meadow for a source of food, and the pond for source of water.

STEP 4: PROVIDE FOR THE THREE “R’s”

The three “R’s” - Reduce, Reuse, and Recycle is a basic concept of sustainable residential design. Water harvesting and recycling can provide drinking water and water for irrigation. “Greywater” from washing machines, dishwashers, and kitchen sinks can be collected to use in the garden while rainwater collected from the roof can provide additional sources of water for irrigation, as well as drinking water, if properly filtered. Any residential landscape striving to become a sustainable landscape should include:

- A compost bin to compost plant residuals and leaves
- Recycling bins- to recycle household waste
- Rain barrels or cisterns to collect rainwater



Rain barrels or cisterns can be used to collect rainwater from the roof and can be used to irrigate the landscape through a drip irrigation system.

STEP 5: SITE PLANTS TO HELP CONSERVE ENERGY

Energy conscious design can reduce the consumption of potentially limited natural resources, reduce heating and cooling costs, and create comfortable environments that are buffered against harsh weather. Plants can be located so they allow the maximum amount of sunlight to reach the house in the winter and screen the house from the sun during the summer. Plants can also be used to block winter winds or funnel cool summer breezes towards the house.

Solar Use:

- Placing large deciduous trees close to the south and southwest facing sides of the house can block up to 96% of the hot summer sun’s direct rays.
- During winter the same deciduous trees loose their leaves, allowing approximately 50% of the sun’s rays through to heat the house.

Controlling Airflow:

- A dense mix of evergreen and deciduous trees and shrubs placed on the north, northwest side of the house can cut winter winds roughly in half.
- Trees planted on the southwest portion of the property can be located to collect and funnel summer breezes towards the house.

Plans to protect air and water, wilderness and wildlife are
in fact plans to protect man
– Stuart Udall

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A True Application of the Definition: □Sustainable Communities□

By Cindy Meehan-Patton,
Shelter Ecology

When it comes to the critical meeting place of economic growth and sustainable growth for Western North Carolina communities, Becky Anderson, president of HandMade In America, is one of the most inspiring people you will ever meet. She knows where this meeting place really is.

The purpose of HandMade in America is to make WNC the geographic center of handmade objects in the nation. If you really think about it - what a great opportunity for sustainable economic development this goal offers for all of us. What better way for small, rural economies to grow than to work together as a community to build on their assets, which in this case happens to be the vast diversity of local artisans, known as the “invisible industry”.

HandMade has created a set of twenty-year goals aimed at creating long-term regional (WNC) growth through this invisible industry. These goals focus on creating sustainable economic development opportunities that maintain the regions rural quality of life, providing business and financial support for craftspeople and reinforcing a positive image of the region’s craft culture through public relations and education.

To quote Becky Anderson: One of our strategies centers around heritage tourism- the growing trend to preserve what is indigenous rather than imported. Unlike traditional tourism, which is often created by outside developers, heritage tourism is based on two main elements. First the community defines its assets—what they want visitors to see, and where they don’t want them to go. This is crucial! Whatever is deemed sacred is considered off limits to developers.” Communities have a right to determine these things”, explains Anderson. “Second, in heritage tourism everything has to be authentic. We set very tough criteria and stick to it!”

“What’s different with our approach is that we work from the inside out. The community determines its needs first. Then we work together to make things happen”, states Anderson. A fine example of this approach can be seen in the transformation of the Mitchell / Yancy county landfill. It has become a national model as it continues the transition from mounds of dirt-covered trash—to an exquisite six acres supporting artists studios, green houses and crafts gardens.

Artisans from this part of the county; Jon Ellenbogan and Becky Plumber of The Barking Spider Pottery (Penland), now also run a non-profit organization, EnergyXChange that is helping to create this transformation - resulting in “green power” demo projects.

How does this work? The Mitchell/Yancy county landfill (and hundreds of other small landfills that have shut down across the U.S.) is steadily burping methane into the atmosphere from the decomposing trash. Methane is a greenhouse gas, which is 20 times more potent than carbon dioxide. Normally, gas recovery projects of this type are only successful with larger

landfill facilities, due to the capacity of methane that is required to create enough gas to power something big- like a lumber mill. So, Becky Anderson and Ellenbogen of Energy Xchange decided to pursue the smaller gas recovery opportunities they had by using the methane to power their greenhouses and studios.

This is one of many examples that HandMade in America has defined by action, the true meaning of sustainable growth. Western North Carolina is now home to over 4,000 artisans whose work contributes over \$122 million dollars to the local economies. This is such a commendable effort! We should all learn from this example by really looking at what assets we could provide our world without creating environmental degradation as a result.

Plans to protect air and water,
wilderness and wildlife are in fact
plans to protect man
– Stuart Udall

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If future generations are to remember us with gratitude rather than contempt, we must leave them more than the miracles of technology. We must leave them a glimpse of the world as it was in the beginning, not just after we got through with it.

–President Lyndon B. Johnson

Conservation Resource Design for Residential Communities

By David Tuch, Equinox Environmental

Over the past 22 years, North Carolina has lost approximately 16% of its farmland and almost 10% of its forestland while urban areas have grown by 88%. As the southern Appalachian region continues to be ranked as a top location to live, play, and work in the United States, development pressures on the natural resources of our mountains are only expected to increase. As more and more people move to this region in pursuit of the natural resources that provide such a high “quality of life”, the protection of these natural resources becomes imperative for economic, environmental, and social vitality. *Conservation Resource Design* offers a tool by which we can protect the special character and resources of the Appalachian Mountain landscape while meeting residential needs.



Traditional Residential Development

While *Conservation Resource Design* for residential areas can contribute to the protection of natural resources, *Traditional Residential Development* contributes to sprawl and does not utilize design concepts that minimize disturbance or alterations to the surrounding landscape. In *Traditional Residential Design* all of the land is utilized and divided into streets or house

lots. In this type of development all the land has been cut up and parceled out to individual lot owners, devoid of any land which can be set aside to protect significant natural areas for open space or for wildlife habitat. In the *Traditional Residential Development* the patches of vegetation, corridors and other important areas that provide ecological function and habitat for wildlife are cleared and replaced with impervious surfaces, lawns, and non-native plants.

On the other hand, *Conservation Resource Design* for residential communities involves the identification of the most significant natural lands in order to set this land aside as a common green space, which is not to be developed. This common area serves as the community’s “park” or “nature preserve” and provides valuable wildlife habitat and retains the landscapes character or “sense of place” of the site.

In addition lot sizes are typically smaller so homes can be clustered together in order to avoid disturbance of important natural elements. By using smaller lot sizes the *Conservation Resource Design* approach can still provide the same number of lots as a *Traditional Residential Design*. This allows developers to provide the same number of houses on the property while protecting the areas ecological significance.

Based on the principles of landscape ecology the most significant natural areas to protect in order of importance are as follows; large circular patches of natural vegetation, smaller patches of natural vegetation which act as stepping stones to the larger patches, corridors connecting large patches to each other such as hedgerows, streams or drainage corridors, and nodes which include areas of high diversity or intersections of multiple resources such as a stream corridor intersecting with a patch of evergreen trees. As a general rule, the greater the diversity of natural landscape elements protected the greater the conservation value of the landscape.

The identification of the landscape ecological patterns is the central step in a five-step process in *Conservation Resource Design*. The additional steps are briefly listed but will not be addressed in depth. They are as follows:

1. Identify site's natural and cultural resources
2. Determine the opportunities for conservation, site development, and recreation
3. Design street alignments and trails
4. Locate housing sites
5. Draw lot lines



Conservation Resource Development

This approach offers the ability to create new developments while protecting the significant lands on which they are built.

When subdivisions are designed based on the protection of natural areas the potential to create an integrated network of connected ecological systems becomes possible. *Conservation Resource Design* enables us to protect one of the most important assets of the Southern Appalachian Mountains, the natural resources.

Consume less. Share more. Enjoy life.

□ Penny Kemp and Derek Wall, A Green Manifesto for the 1990s

Your *Inside* Air – You Are What You Breathe

By Cindy Meehan–Patton, Shelter Ecology

Contrary to previous decades, breeze flowing in through your open windows is no longer a healthy option in WNC. Asheville's air has been rated as one of the ten most polluted in the United States. Yes, we are right up there with Los Angeles! The healthiest choice for clean air indoors is to close your windows, run your air conditioner (or some kind of cooling system) or dehumidifier and filter your air.

As we build our homes tighter and more energy efficient, we can trap outdoor and indoor toxins. Older homes, on the other hand are too leaky, allowing mold and moisture to penetrate the structure and infiltrate our indoor air. Therefore, any structural envelope requires clean indoor air quality to optimize our health and productivity. Filtration is a very essential part of maintaining non-polluted indoor air.

A good air filtration system, when hooked up to your HVAC (Heating Ventilation and Air Conditioning) will provide 5 air changes per hour per room. You can typically buy the following air filters from your HVAC company:

HEPA— or High Efficiency Particulate Arresting filters were developed by the US Atomic Energy Commission to filter out sub-micron particles. All true HEPA is laser-tested and must remove a minimum of 99.97% of all particles greater than 0.3 microns in size. A human hair, for example, is 300 times too large to penetrate a HEPA filter.

Panel Filters—are the most common furnace type filters. They are made from spun glass or fiberglass and are washable. They are inexpensive and actually improve their filtering capability as they get dirty. This also restricts the airflow, which is a costly expense. Therefore, they should be changed every 1-3 months.

Electrostatic Air Cleaners—also rely on electric charges to clean the air, and when clean, are very efficient. They are inexpensive and do not produce ozone. While these units are less effective at capturing smaller particles, they are better than panel filters and do a reasonable job at capturing larger particles (>10 microns)—such as mold spores and pollen. This in combination with HEPA on a HVAC system makes for a thorough filtration combination (depending on what your main pollutants are that you are trying to filter.)

Proper HVAC sizing, design, and installation is key to creating clean indoor air quality. The filtration options mentioned above enhance clean indoor air if your HVAC system is doing its job to begin with.

There are also portable air filtration units available for those who cannot afford to or do not have a ducted HVAC system. They include:

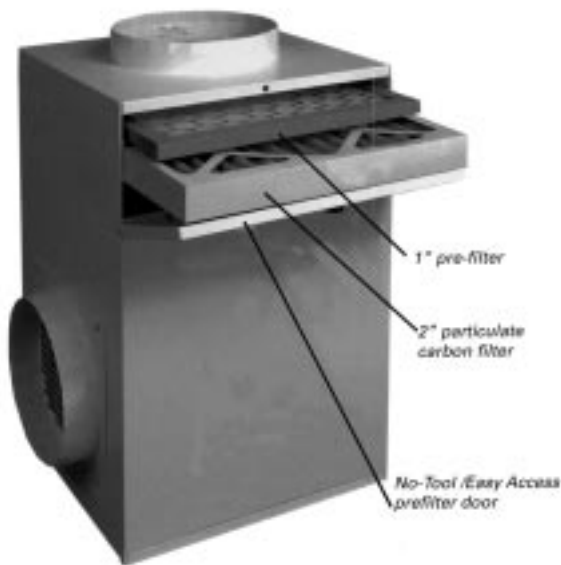
-Electrostatic Precipitators and Ionizers deliver a negative electrical charge to particles that pass through them. The particles are attracted to a posi-

tively charged collector that must be cleaned frequently. These units are 95-99 percent efficient and have low energy and filter costs. Because they emit a low level of ozone, they should not be used while you are in the space, due to the long term and immediate effects ozone can have on the immune system. Ozone generators— can also be put in this category. Ozone generators can be effective at killing organic particulates that accumulate in a space, like mold spores. However, ozone is a toxic gas that should not be used while you, your family, your employees or your animals are occupying the space. The space should also be aired out thoroughly after ozonating and before preoccupying the space.

- Austin Air Filters are one of the most effective portable air cleaners. It offers a four-stage filtration including a HEPA filter (see above description) combined with activated carbon and zeolite—which help remove formaldehyde, ammonia and other chemical toxins. A Prefilter traps larger dust particles, organic and inorganic.

Note: There are other portable type air cleaners and filters on the market. Look for unites that filter organic and inorganic particulates along with chemical toxins.

According to the EPA, the air within our homes and offices is more polluted than outdoor air. Since we spend more than 90% of our time indoors, it is essential that we keep our air clean. Air filtration and cleaning is an essential part of your first aid package for you and your home or office.



Typical in-line hepa filter system for home style airhandlers

Steel or Wood – Which Is More “Green”?

By Robin Raines Elliott

In the past century, wood frame construction was almost an unchallenged norm for residential building. However, as the century came to a close, steel framing was making its mark on the residential market. Volatile prices and environmental concerns became easy excuses for builders to consider steel frame. Steel's quick and easy substitution for wood framing has given it a leg up on other wood alternatives. The learning curve in from wood to steel is almost non-existent. But, how does steel really compare with wood's environmental impact?

Steel has dimensional properties and stability that cannot be achieved by wood. However, unless the proposed wood comes from old-growth forests, it can be argued that builders are quite familiar with the movements in wood frame. Thin gauge steel is cheap, efficient, and an over all good deal. Wood cannot always compete with the price of steel.

Wood insulates well. Steel framing's greatest fault is the problem of thermal bridging. Steel is more than 400 times more conductive of heat than wood. This causes severe energy loss whenever steel spans from the inside to the outside of the building envelope. Material costs are paid for once, while energy costs are paid for on a



yearly basis. Over a number of years, the environmental impacts of heating and cooling will outway the material manufacturing costs. The energy costs (and losses) must be considered an important factor in the decision to use steel. One potential solution to this problem is to use steel in a different framing configuration instead of a piece-for-piece replacement of wood framing. Its strength suggests fewer framing member, spaced farther apart. Thermal bridging can also be overcome with a 2" or more foam sheathing on the outside of the studs. This may present other problems unless synthetic stucco, which has its own set of drawbacks, is added directly to the foam.

Steel does not need to be treated in order to resist insects and should always be used in place of wood treated with arsenic preservatives. Wood treated with borate preservatives are safe. Neither product seems to cause problems with indoor air quality, excluding termite soil treatments for wood.

Inappropriate lumber extraction practices can lead to habitat destruction, loss of biodiversity, and siltation of streams. Alternately, with good forest management practices, extraction may have very little impact. With low energy requirements for processing and minimal pollution, wood has large advantages over steel. Enough iron ore remains for several centuries, but mining costs have risen, leading to an increasing fraction of ore imported from Venezuela and Brazil. The earth's surface is completely disrupted by open mining and pre-existing ecosystems are destroyed. Leaching metals and minerals have harmed water systems.

Logs must be debarked, sawn, planed, and dried in a kiln to form dimensional lumber. The kiln drying is the most energy-intensive part of the process. Fuel is often bark and scraps from the milling operation. Except for treated wood, the energy concerns are relatively minor. Steel is one of the most energy-intensive industrial materials. Even with improvements, environmental impacts are still significant. Steel production generates pollution and waste from each stage of the process including coking coal, purifying iron, and galvanizing.

Both products are easily recyclable at the end of their use. A magnet



separates steel; contamination is never an issue. Steel is often praised for its recycled content, but the levels are often exaggerated. Wood is not only biodegradable, if not treated, but the market for recycled waste wood is growing. Even with this growing market, efforts to promote recycling of wood waste are not very effective in most areas.

So with each product having a number of pros and cons, which is best to use? Preserving our forests is an important task. If we can serve this task while still producing lumber from these forests, wood is an environmentally sound material to use. However, if we choose to replace wood with steel, we must take advantages of the properties of steel. We can't treat it as a wood substitute and expect to reap the benefits of the material, either physically or environmentally.

Information based on an article by Environmental Building News, Steel or Wood Framing: Which Way Should We Go? EBN Volume 3, No. 4 - July August 1994

Ecological design begins with the intimate knowledge of a particular place. Therefore, it is small-scale and direct, responsive to both local conditions and local people. If we are sensitive to the nuances of place, we can inhabit without destroying.

Sim Van der Ryn

Recycling

By Aaron Johnstone, Constructive Designs

Reducing waste is a fundamental aspect of green building, approaching construction with the intention to create buildings that are integrated with the environment. Our ability to reduce the scale of our ecological footprint when we create our habitation is dramatically improved by making a concerted effort to eliminate wastefulness. By changing our attitudes about what constitutes waste and including resourcefulness and resource efficiency as criteria in the valuation of our building projects, it is possible to alter the conventional approach to construction that can be so wasteful. In this new context, where our impact on our environment and resources is a main consideration, recycling becomes a highly valuable approach to both reducing waste and increasing resource efficiency.

According to the North Carolina Co-Op Extension Service website, it is estimated that North Carolina produces nearly twice the national average of daily waste. While members of state government have shown a concern for reducing state waste production, legislation has yet to be passed that adequately addresses the issue by providing incentives and mandating certain practices for reducing and recycling what otherwise ends up in landfills within the state and further afield. While resistance to recycling is often the result of fears of incurring heavy expenses and little economic benefit, there are in fact many economic advantages to reducing waste and recycling.

As landfills across the country are reaching maximum capacity and the siting of new landfills becomes a thornier issue, tipping fees for disposing of waste have increased rapidly in recent years. The ability to dramatically reduce the waste going into landfills is one of the first ways to see an economic benefit to recycling, in the form of lower waste disposal costs. As the recycling industry becomes stronger and more extensive, costs associated with recycling will also be reduced and the means to recycle will be more widely available, resulting also in more access to recycled products. (And buying recycled products provides further demand for re-



cycled materials, further reducing costs of recycling.) According to the N.C. Co-Op Service, 33 jobs are created for every 10,000 tons of materials recycled, as opposed to only 7 jobs for the same quantity of material that goes into landfills. Obviously this suggests that the economic impact of recycling can be far ranging and carry over into many sectors of the larger economy.

It is no secret that the construction industry is one of the biggest producers of waste that ends up in landfills. Yet some experts predict that nearly 90% of construction waste could be eliminated by reducing waste produced and by recycling (N.C. Co-Op Ext. Website). There are several recommendations for reducing waste and recycling in construction, as provided by the Extension Service. These include:

- Design dimensions to accommodate standard material sizes (like 4x8 sheathing) so as to reduce time and labor and waste in making cut-downs

- Ask subcontractors to include cost of waste removal in their bids, providing incentives to reduce waste

- Leftover masonry and rubble can be crushed for use as fill, bedding material in driveways or as an aggregate in non-structural applications

- Gypsum drywall can be ground-up for soil amendments and as a lime substitute

- Asphalt shingles can be used in paving and pothole repair

- Glass can be recycled as fiberglass or as substitute for sand in paving materials

- Scrap lumber and sawdust can be converted into mulch and compost for landscaping, animal bedding, boiler fuel, or engineered building products

Approaching design and building with the efficient use or reuse of materials in mind is an important first step to reducing waste. Simply understanding the process of a building project from start to finish can help to create awareness of what scraps and leftovers can be reused later and mistakes that are caused by not realizing the next step of the project can be eliminated. This means good communication and careful planning. By enacting a recycling program, contractors can also influence the subcontractors they do business with by encouraging or even requiring some joint efforts in recycling and reducing waste. Local salvage companies can be contacted to reclaim leftover materials, old doors and fixtures from demolition and remodeling, and often other usable building materials can be salvaged too. Currently there are at least three construction by-products that can be recycled easily in Western North Carolina. These three are cardboard, scrap metals, and waste wood, all of which can be collected on-site and removed to the recycling sites for fees comparable to waste removal charges. Concrete recycling, drywall, and shingles are being recycled in other parts of the state but apparently have not yet been adopted by any businesses in Western North Carolina. Hopefully with increased interest and action by local construction companies, these services will become available and economically viable.

Recycling Contacts

General

- N.C. Office of Waste Reduction, John Blaisdell (919) 715-6522
www.p2pays.org-markets directory for recycling construction waste.
Information on recycling and grants for recycling projects also available.
- City of Asheville - 259-5547
- Buncombe County - 232-4158
- Trash Away, South Carolina contact: Gary Seymore (864) 269-3548
A waste company developing a comprehensive construction waste recycling operation.

Cardboard

- Curbside Management Inc., Asheville 252-2532 contact: Stan
Provides curbside recycling, residential and commercial, for the Asheville and Hendersonville area. Recycling dumpsters will soon be available.
- Asheville Waste Paper Co., Inc., contact: Cam Pace, 252-6963
Paper and cardboard recycling
- Waste Management, Asheville contact: Randy Blankenship, 253-5364
Recycling dumpsters and removal, including waste wood or brush.
- GDS Inc., Asheville 253-3929 contact: April
Recycling dumpster rental and removal, including scrap metals.

Metals

- Biltmore Iron and Metal Co., Inc., 1 Meadow Road, Asheville 253-9317
contact: Jeff
Recycler of scrap metals: light copper, copper, and brass, aluminum, insulated copper, steel, and insulated electrical wire. Scrap metal removal available.
- Blue Ridge Metal Recycling Inc.,
254-2840, Swannanoa River Rd., Asheville
- Western Carolina Recycling, 1430 Riverside Dr., Woodfin 252-1689
Scrap metal recycling.

Wood

- Henson's Mulch and More, Inc., 116 Pond Rd., Asheville, 665-0200
Any size scrap plus pallets and brush.
- Waste Management, 253-5364
Provide container service to Henson's for same rental and hauling costs as dumpsters heading to the landfill
* for more wood recycling check the N.C. Office of Waste Reduction webpage: www.p2pays.org

Salvage

- Yesterday's Windows,
327 Haywood Rd. , Asheville, contact Don Payne 259-9936
All building materials that can be refurbished, hardware, electrical fixtures, recycling wood into flooring
- Greene's Building Supply and Salvage, 216 Old Chimney Rock Rd., Hendersonville, 693-1609
New materials that are leftover, mainly doors, windows, cabinets
- Salvage Hunters, 3524 Asheville Highway, Hendersonville, 696-8950

a few recycling stats,

from the Office of Waste Reduction Web site:

-energy saved in producing from recycling:

aluminum cans-90%; newspaper-40%; steel-60%

-in 1999, N.C. recycled 967,000 tons of materials, saving 5.2 trillion BTUs of energy, enough to provide the electrical needs of 113,000 households

-recycling steel reduces energy use 74%, air pollution 86%, water use 40%, and mining wastes 97%

-recycling aluminum reduces water and energy use and air pollution by 95%

-amount of waste disposed in N.C. increased from 6.8 million tons in 1991 to 9.2 million tons in 1999, but recycling jobs did increase 12% in the last 5 yrs.

-without recycling, U.S. timber harvest would have to increase 80% to meet demand, paper is about 40% of the total waste stream in the U.S.



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CASE STUDIES

Shelter Ecology Showroom, Store and Office Asheville, NC

Dr. Patrick and Cindy Meehan-Patton

The main goal in the building process was to make the lowest impact possible on the earth and ourselves. Therefore, the following materials were used which are either recycled, toxin-free, environmentally safe, low toxic or natural. Believe it or not, all these categories have slightly different meanings and can make for a very creative, unique space with all the benefits of green building.



Building Materials:

1. Finger jointed studs- cost about the same as conventional studs, but are recycled; they were used in the addition only. The existing house was already framed.
2. Structurally Integrated Panels-were placed on the roof of the addition. A local architect and friend of Cindy's represents the AFM company of SIP's we chose.
3. Icynene Insulation- is a CFC and HCFC free spray in poly-icynene foam, applied by a local installer. This fantastic foam created our energy efficient envelope throughout the existing walls/roof and addition walls. This product is certified as environmentally safe.
4. Rub-R -Wall- was applied on the outside of our foundation wall (which was very minimal) to eliminate the opportunity for moisture to penetrate the block and come up through the concrete slab, installed by a local supplier.
5. Fly ash- was added to our concrete slab pours, to cut down on the amount of concrete used.
6. MicroLam- an engineered wood beam (made partially from recycled wood chips), was used to carry the load of the house. This big beam was obtained locally.

7. ACQ (Ammonium Copper Quat) treated wood- was used for the sill plates and interior wall bases throughout the house. Shipped in from a regional distributor, this is a less toxic alternative to standard CCA pressure treated wood (Chromium Copper Arsenate).
8. Malta Low E, Argon Fill windows- were integrated into the addition to compliment the existing house windows which are similar in style visually.
9. Salvaged doors- were used on all exterior (4 total) and most interior openings. Some were taken from the Pattons previous home and others were gathered through friends and family. All doors were stripped down to their original wood. New hinges, thresholds and doorknobs were applied.
10. Hardi-Plank- a smooth lap fiber cement siding and Hardi-panel were chosen for a part of the exterior shell due to its durability, some recycled content and low to no maintenance.
11. 3-coat cementitious stucco- and low toxic paint were integrated into the final coat and chosen for the majority of the exterior sheathing due to the clean, contemporary aesthetic, no maintenance and durability.
12. E-Coat Recycled paint- was applied to the Hardi-plank and Hardi-panel.



Interior Design Materials:

1. Radiant Floor Heat (in the addition) and a Hydro-electric kick space heater (in the existing space)- create enough heat in the colder temperatures of Western North Carolina. The super energy efficient Point of Use Seahorse propane heating unit- which is located on the outside wall of the home, heats all the water via a lowboy 30-gallon electric water heater. Propane gas is kept out of the indoor air quality completely. The electric water heater acts mainly as a holding tank for all the water used in the home. "It is great to be able to run a load of laundry, wash the dishes and take a shower all at one time and not run out of hot water!" If the power should go out, a centrally located Jotul wood stove heats 800-900 square feet.
2. Bamboo flooring- was shipped in from the Northeast and laid by a local installer. The 2-ply engineered tongue and groove floor (not laminated) was chosen primarily because it meant using less trees. Bamboo is a renewable grass.
3. Cork- tiles cover the bathroom floor and were chosen because of cork's

renewable nature and because it creates a thermal cushion that ceramic tile does not. It also looks beautiful against the bamboo! The 12" x 24" tiles were shipped in from a Southeast distributor.

4. 100% Recycled Plastic countertops- were chosen in the kitchen for many reasons. This product is not only mold and moisture resistant, but it can be molded as a solid surface to almost any shape, size or thickness. The 14 color choices, give you a playful, creative and extremely functional surface. This one had to be shipped in from the Midwest.
5. 100% Wheat Straw Panels- were used for our kitchen cabinet doors and cabinet crown molding. It was chosen for its renewable properties and for its earthy aesthetic. It smells like a hay field and machines like wood. This product was probably the only real transportation burden, not to mention the expense of the product itself. Now available locally through Shelter Ecology.
6. Formaldehyde free Medium Density Fiberboard (MDF)- ended up being a great source for the interior shelves and casework of our kitchen cabinets. Fortunately, we had enough left over for our clothes closet shelf and laundry shelves. This is great cabinet and shelf grade material; it is very strong and has virtually no smell. This was obtained regionally and is cost competitive with other standard MDF's made with formaldehyde based glues.
7. Ceramic Tile - made from over 60% recycled automobile windshield glass was used for our bath shower.
8. 100% Compressed Sunflower Hulls & Agricultural Flour- make up the bathroom toiletry shelves and lower cabinet which holds all our clockwork for the radiant floor and domestic water heating. It also serves as the desktop in Cindy's office.
9. Recycled (old) Cypress- makes up all the interior trim details. This Cypress was deconstructed from an old aqueduct in Tryon, NC, which had water running through it for over 100 years. It is beautiful!
10. Recycled (old) Redwood- was milled into the floor joists for our loft. This redwood was deconstructed from a World War II ammunition holding tank. Prior to that the tree had been standing for over 1000 years.
11. Recycled (old) Oak and Heart Pine- was used in our loft ladder, handrail, posts and balusters. Both woods are at least 100 years old.
12. Recycled Oak tongue and groove flooring- was chosen for the loft. It required a good cleaning followed by a light coat of water based, low toxic AFM Durostain on the underneath sides of the boards which are exposed to the spaces below the loft.
13. Environmentally safe/low-toxic, water based finishes were used throughout the house including almost the entire AFM (American Formulating and Manufacturing) line. They are:
 - 3 in 1 *Adhesive*- used to glue down all flooring and ceramic tile.
 - Safe Seal*- used on all plywood surfaces to lock out harmful chemicals like formaldehyde.
 - Cembond Masonry Paint* - used on the exterior stone/mortar wall as a primer coat for the exterior recycled paint.
 - Flat, Eggshell, and Semi-Gloss Paints*- used through out the house.
 - Durostain*- used on all the furniture, which started out as solid, unfinished wood.
 - Acrylac*- a replacement for solvent-based lacquer was used as a top-coat on all the furnishings.
 - Polyureaseal BP* - used as a replacement for oil based polyurethane on the bamboo flooring, the recycled doors, the wheatboard cabinets and all shelving.
 - Grout Sealer* was used on the shower tile.



In 2001, Pat decided he wanted to conduct his practice through our home as well. So, Cindy took seven months to design their addition of 1,500 square feet which houses Pat's office, waiting room, reception office, and bath; a master bed/bath upstairs and a climate controlled basement to store Cindy's products and exercise equipment. This allowed the main house to serve as 2 guest sleeping areas, kitchen, bath, living room and dining room. The structures are separated by a walkway and deck. Cindy chose to use seven new environmentally safe, low toxic and/or natural materials in this part of their home. There is a lot accomplished in 2,400 square feet.



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Cady/Guyton Residence Alexander, NC

Claudia Cady and Boone Guyton

The Cady and Guyton Home is built into a south facing hill that allows for a passive solar design with an earth bermed first floor (daylight basement). There is also a woodshop and a small solar greenhouse.

The features that are green are:



The House- 1550 sq ft

1 solar orientation- passive solar – Main floor – 1160 square feet- 120 square feet of south glazing (aprox. 10%) with a 2 ½ inch poured concrete floor for mass as well as a brick partition wall between the living area and the kitchen. The daylight basement has 390 square feet of living space. It has 60 sq ft of glazing (aprox. 15%) and a 4 inch insulated slab that supplies mass as does the insulated 10 inch poured concrete walls.

2 The trees that were cleared for the house site were Virginia or Jack pine. The tops were chipped for landscape mulch.

3 ACQ treated lumber or local locust was used for all deck framing and sill plates.

4 The termite treatment was boron, a fairly benign, though somewhat limited, naturally occurring element.

5 The foundation is insulated with 3 inches of rigid Styrofoam and is bermed on three sides. It houses the mechanical room, storage area and a bedroom and bath in the southeast corner.

6 The insulation in the upper floor is recycled cellulose blown in the walls and the ceiling. The framing is 2x6 on 2-foot centers with a half-inch of rigid insulation on the inside of the studs as a thermal brake and added insulation. This provides R-23 in the walls and R-38 in the ceiling.

7 The heating system is a radiant floor in concrete poured on grade in the first floor with 2inch rigid foam underneath and 1 inch on the perimeter. On the second floor the radiant pipe is in 2 and a half inch concrete on top of the tongue and groove OSB sub floor. It remains as the finished floor with Kemiko stain and sealer. This also works as thermal mass for the passive solar gain. The heating equipment is a 50 gallon direct vent gas water heater that also supplies the domestic hot water. Radiant floors are efficient due to lower operating temperature and less stratification of heat. An active solar hot water system assists the domestic hot water and the radiant floor. It consists of two 3 by 13 foot flat plate collectors and a 150 gallon storage tank. There is a soapstone wood stove for back up.

8 The front entrance has local bamboo for pickets in the railing and the bamboo was also used in several trellis around the house.

9. Recycled wood, some from a torn down house and some from pallets, is used as trim and in office cabinets .

10. Tile on kitchen counters are scrap marble embedded in a binder-preconsumer recycling.

11 Compact fluorescent lighting is located where lights are left on for any extended periods.

12 Very little framing over 2x6 dimension, which is generally from fast growing plantation trees. Roof is trussed and joists are engineered Trus Joist Macmillan I-joists.

13 The roofing material is 40 year warranted architectural asphalt shingles.

14 The refrigerator is an efficient Maytag- plus.

15. The windows are efficient Golden- Low E with Argon gas

16. Warm window night curtains on most windows adds R7 insulative value

17. The interior paint is recycled, E-coat paint, purchased through Shelter Ecology.

18.The exterior siding is traditional wire lath stucco.



**The Wood Shop-
600 sq. ft.**

·3 walls are Faswall form blocks- recycled wood fiber insulating forms. Made from recycled and mineralized wood chips mixed with cement. These are poured solid with concrete to make an R-19 wall with thermal mass.

- The shop is bermed into a hill on 2 sides which gives added temperature stability.
- The roof is a living roof system made with engineered joists and $\frac{3}{4}$ OSB decking, a waterproof membrane (Bituthene) and a drainage mat. 5 inches of Topsoil and compost from Nothing Wasted is the final layer with a cover crop growing for the vegetation and soil improvement. It will later be planted in a perennial drought tolerant mix.

The Greenhouse

- The north wall and half of the east are bermed , Faswall form blocks with poured concrete.
- The 7/12 roof is sloped toward the south with a 2 layer Polycarbonate glazing as well as 6 feet of enameled metal roof that holds the solar collectors for the active hot water system.
- Thermal mass is provided by 7, 55 gallon metal drums of water painted flat black and placed along the north wall. A concrete and stone floor and planter also add to the mass.
- Additional heating is gained through the solar heated water from the collectors on the roof that pass through the greenhouse as it circulates to the house.
- It has maintained above freezing temperatures without supplemental heat through the winter.

Steve Arpin House Asheville, NC

John Senechal

Steve wanted a place to live that was warm and free from subtle toxic elements. Working with John Senechal of Bald Mountain Homes, he designed a comfortable small house that meets his needs and looks good.

It started with a search for a nice used house near a bus line, so Steve could take advantage of public transportation. It evolved into a dome kit on a lot in West Asheville. Concerns about the Styrofoam core and contact adhesives used in the kit terminated the dome idea. But the floor plan of the dome was good, so the basic layout of the dome kit was saved, but the house was constructed using frame construction techniques. The result

was a compact house that fits in with the neighborhood like a dome wouldn't.



The lot is $\frac{1}{2}$ acre, large enough for terraced permaculture gardens on the south side of the house. Steve used broken concrete from sidewalks to construct the terrace walls about two feet high. The finished wall looks

much like the highly fashionable split face block that sells for a premium price at Metromont, the local block supplier.

Heat for the house and for domestic hot water is collected by five solar panels located next to a powerhouse by the driveway. Water is stored in the powerhouse, then pumped to the house, and circulated through a radiant heat slab floor. An auxiliary gas heater backs up the solar heater for when the sun doesn't shine enough. The gas heater is outside the house and downwind to keep the house clear of exhaust fumes.

Insulation is important, but it is hard to find the perfect kind that is non-toxic and effective. One of the best choices is cellulose, made of recycled newspaper, which makes an excellent thermal barrier when it is wet sprayed into the wall cavities. MWB R-Pro from Black Mountain installed it in the Arpin house.

Modern materials rely heavily on glues, which are slightly toxic. When a house is finished and tightened up, the indoor air quality suffers. The sheathing applied to the outside is gypsum, the exterior kind that is used under stucco. The roof deck was sheathed with 1x8 lumber, just like every house that was built before about 1940. The enamel coated steel ribbed roofing that graces the top, is long lasting and attractive.

Steve wants good indoor air quality year round, of course. In the winter, an air-to-air heat exchanger strips outgoing air of its heat, to warm the fresh incoming air. Interior paints and sealers were made by AFM, Livos, and Auro, three manufacturers of high quality non-toxic finishes. Cabinets were built in place by hand to ensure that no particleboard was used. Particleboard is made with formaldehyde based glues, and is most often used in cabinets and flooring underlayment. Where smooth underlayment boards

were needed, wheatstraw boards were used. Floor covering for the slab and the second floor bathroom is Forbo linoleum, the old style stuff made of linseed oil, wood dust, and pine resin. It is available by special order through Biltmore Commercial Flooring.

The trim around doors, windows, and floors was supplied by Red Hills Lumber from their certified sustainably harvested forests in Georgia. The upper level flooring is the same yellow pine certified wood. The kitchen cabinets were handcrafted from that lumber also.

Some concerns about subtle effects of magnetic fields motivated a few changes from ordinary wiring techniques. All wires were installed in flexible metal conduit and grounded metal boxes, as it is done in commercial buildings. The household appliances like refrigerator, ventilator, freezer, and the main electric panel were all housed in one corner to free the rest of the house from their noise and magnetic fields. Bedrooms are wired with double pole switches to lights and receptacles so that rooms can be turned off completely (positive and negative wires). Two switches by each bedroom door control lights and plugs for that room only.

A greenhouse attached to the south side gathers heat all year around. In the winter when heat is abundant during the day, Steve opens the French doors to let heat in. Closing the doors at night traps the heat. In summer, the greenhouse is not needed and is left closed to keep from overheating the house, while light still comes through. Daylight flows through the entire house all year round. Operable low-E windows throughout the house were made by Malta Windows.

Graywater is wash water that can be used again in the garden. In this house, separate lines were run to the outside for graywater and blackwater. Both were hooked in to the city sewer system, but the graywater line has a valve that allows the resident to fill a tank, and use the graywater for watering the garden in drainfield style trenches.

The owner is sensitive to mold, and also to the mold killing chemicals in paint. So the house was carefully designed to protect the space from mold. The house was built with plenty of ventilation and light in every room, because mold likes dark, moisture, and stale air. The closets have no doors to keep air from being trapped. Leaks and condensation were minimized by tight insulation and metal roofing. Plumbing was centralized to reduce the damage if any leaks occurred there.

Daylight is provided for every room. Artificial lighting at night uses special fixtures and bulbs. Compact fluorescent bulbs are a good choice for energy savings, with electronic ballasts to eliminate the flicker. In the kitchen daylight bulbs were used in four foot long electronically ballasted fluorescent fixtures. In the bedrooms, electronic fluorescent circle bulbs shine brightly in ordinary looking fixtures made by Lights of America.

Electric power for the house is supplied by eight 120 watt photovoltaic solar panels and one Trace sine wave inverter. Conservation is essential when using photovoltaic (PV) power, so the first step is always to use efficient appliances and lights. A Sunfrost refrigerator in the kitchen uses very little electricity. A Vestfrost chest freezer in the utility area does the same. Steve has several Sun ovens that he uses to cook during the daytime when the sun shines. And then, when PV power is low in winter, utility power is used to supplement the load.

For decorating, Steve likes to use hemp fabrics. Hemp is one miracle plant whose fibers have been used for thousands of years. It is resource efficient, hardy, and tough, and it is now legal to grow in several states. Steve likes to support people who are making a difference on the cutting edge of change. The cutting edge is still the edge. The support is greatly appreciated.

RESOURCES

NATIONAL RESOURCES:

American Council for an Energy-Efficient Economy

1001 Connecticut Avenue, NW,
Suite 801, Washington, D.C.
20036
(202) 429-0063
www.aceee.org

Austin Green Building Program

City of Austin
P.O. Box 1088
Austin, TX 78701
(512) 974-2000
[www.ci.austin.tx.us/
greenbuilder/](http://www.ci.austin.tx.us/greenbuilder/)

Energy Star Program

<http://www.energystar.gov/>

Energy and Environmental Building Association

10740 Lyndale Avenue South,
Suite 10W
Bloomington, MN 55420-5615
952.881.1098
fax: 952.881.3048
email: info@eeba.org
<http://www.eeba.org/>

Environmental Building news

Environmental Building News -
BuildingGreen, Inc.
122 Birge Street Suite 30
Brattleboro, VT 05301
Phone: (802) 257-7300
Fax: (802) 257-7304
<http://www.buildinggreen.com/>

Forest Stewardship Council

Forest Stewardship Council
Avenida Hidalgo 502
68000 Oaxaca, México
Email: member@fscoax.org
Tel: 52 951 5146905
Fax: 52 951 5162110
www.fscoax.org

Green Seal

1001 Connecticut Avenue, NW
Suite 827
Washington, DC 20036-5525
Phone: 202-872-6400
Fax: 202-872-4324
Email: green seal@green seal.org
<http://www.green seal.org>

Home Energy Magazine

2124 Kittredge St., #95
Berkeley, CA 94704
(510) 524-5405
contact@homeenergy.org
homeenergy.org

Million Solar Roofs Initiative

[http://www.eren.doe.gov/
millionroofs/](http://www.eren.doe.gov/millionroofs/)

NCAT National Center for Appropriate Technology

Center for Resourceful Building
Technology,
Post Office Box 100 Missoula,
Montana 59806
Phone: (406) 549-7678
Fax: (406) 549-4100
E-Mail: crbt@ncat.org
<http://www.crbt.org/>

Oikos

online greenbuilding sources
<http://www.oikos.com/>

Recycler's World

RecycleNet Corporation
P.O. Box 24017, Guelph, Ontario
Canada, N1E 6V8
<http://www.recycle.net/>

Residential Energy Services Network's

P.O. Box 4561
Oceanside, CA 92052-4561
(760) 806-3448
info@natresnet.org
natresnet.org

Smartwood Certification Program

Goodwin-Baker Building
61 Millet St.
Richmond, VT 05477
Tel: 802-434-5491
Fax: 802-434-3116
<http://www.smartwood.org/>

Sustainable Architecture Building and Culture

Roy Prince, Architect
Sustainable ABC
P.O. Box 30085
Santa Barbara, CA 93130
(805) 898-9660 Voice
(805) 898-9199 FAX
royprince@sustainableabc.com
<http://www.sustainableabc.com/>

Sustainable Buildings Industry Council

1331 H Street, N.W., Ste. 1000,
Washington, DC 20005
Phone: (202) 628-7400
Fax: (202) 393-5043
email: SBIC@SBICouncil.org
www.sbicouncil.org

US Green Building Council

LEED, Leadership in Energy and
Environmental Design
1015 18th Street, NW, Suite 805
Washington, DC 20036
Phone: 202/82-USGBC (828-7422)
Fax: 202-828-5110
<http://www.usgbc.org/>

REGIONAL RESOURCES:**Carolina Recycling Association**

North Carolina Green Building
Program
PO Box 1578 Pittsboro, NC 27312
919-545-9050 voice
919-545-9060 fax
[http://www.cra-recycle.org/
index.htm](http://www.cra-recycle.org/index.htm)

North Carolina Solar Energy Association

P.O. Box 6465
Raleigh, NC 27628
P: (919) 832-7601
e-mail: ncsea@mindspring.com
web site: www.ncsolar.org

NC Solar Center

Box 7401
North Carolina State University
Raleigh, NC 27695-7401
Phone: (919) 515-5666
Toll-free in North Carolina:
1-800-33-NC SUN
Fax: (919) 515-5778
Email: ncsun@ncsu.edu
<http://www.ncsc.ncsu.edu/>

Smart Growth Partners of Western North Carolina

P.O. Box 8563
Asheville, North Carolina 28814
Phone (828)236-1282
director@smartgrowth-wnc.org
<http://www.smartgrowth-wnc.org/>

Southern Alliance for Clean Energy

PO Box 1842
Knoxville, TN 37901-1842
865-637-6055
865-524-4479 fax
Email info@cleanenergy.org
<http://www.cleanenergy.org/>

South Face Energy Institute

241 Pine Street
Atlanta, Georgia 30308
Phone: (404) 872-3549
Fax: (404) 872-5009
<http://www.southface.org/>

Western North Carolina Green Building Council

PO Box 8427
Asheville, NC 28814
www.wncgbc.org

WNC Alliance

Main Office
70 Woodfin Place Suite 326
Asheville, NC 28801
Phone (828)258-8737
Fax (828)258-9141
e-mail asheville@wnca.org
<http://www.main.nc.us/wnca/>

**For additional resources,
including books, videos, and
periodicals, see our web
page: www.wncgbc.org**

WNC Green Building Council

Terry Albrecht, Waste Reduction Partners
James Anthony, Jr., Balsam Mountain Preserve
Appropriate Building Solutions
Peter Boggs, American Speedy Printing
H.M. Boniske
Emily Boyd
Patricia Brezney
Kitty Brown, Sky People Design Studio
Claudia Cady
Chuck Cambell, Carolina Colortones
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Alice Dodson
Dick Van Dyke, Indoor Air Services
Shane Elliott, Mathews Architecture
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Warren Gresham
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Sam Zimmerman, Sunny Day Homes
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Shelter Ecology, Cindy Meehan-Patton
Benjamin Moore, Johnnie Elliot
AFM, American Formulating and Manufacturing
Robert C. Pew**

Western North Carolina
Green Building Council
P.O. Box 8427
Asheville, NC 28814
www.wncgbc.org

This Directory is dedicated to the memory of Bob Flora, a good friend and green builder