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I. Mission

The EcoDorm is a working model home for ecological and social sustainability. The EcoDorm provides a living laboratory and discussion space for residents and the surrounding community.

“The EcoDorm will create citizens who, after Warren Wilson, will understand concepts on a much deeper level and take them elsewhere. The ripple effect. That’s where it will really be valuable.”

—Olya Milenkaya ‘04, Student Member of EcoDorm Committee

II. Introduction

In 1998, the decision to increase student enrollment at Warren Wilson led to the construction of new dormitories. Led by students, who wanted at least one of the new buildings to be a “green dorm,” a group including faculty, administration, and architects came together to form the EcoDorm Committee. [See VII, History, for details of student inspiration and organization.]

With formal meetings beginning in the fall of 2001, the Committee set four priorities: energy efficiency, water conservation, healthy indoor air quality, and use of local and highly recyclable materials. The building, completed in summer 2003, includes features such as photovoltaic panels, radiant heat preheated in a solar collector, natural ventilation systems, composting toilets, rainwater collection, recycled and recyclable steel for roof, exterior siding of local wood, interior woodwork recycled from campus buildings and fences, flooring tiles from 100% recycled material, efficient insulation, permaculture landscaping, and products with no/least volatile organic compounds (VOCs) to keep indoor air quality high. [Complete list in *EcoDorm Features* section.]



The EcoDorm Committee set four priorities:
Energy Efficiency
Water Conservation
Healthy indoor air quality
Use of Local and highly Recyclable Materials

To complete the project, Warren Wilson work crews harvested trees, milled lumber, installed fiber optics and a telephone system, crafted cabinets and other woodwork, painted inside and out, built stone walls and walkways, and planted trees. Students on the EcoDorm Committee learned a great deal about sustainable building design, construction, and materials. The architects saw them as a research body. Their work included extensive research on possible types of construction, including straw bale and other non-traditional structures. Later this research guided the purchase of ecological interior materials and appliances.

Since two main sustainability concerns in the Western North Carolina region are water and air quality, the EcoDorm has set the precedent for action in these areas, recycling water and using locally-produced electricity. Even though local building codes did not allow for some desired technologies, such as graywater use, the EcoDorm represents a big step in getting new and alternative principles into the world as a model for others to follow.

III. EcoDorm Community and Student Life

Goals of the EcoDorm

- To foster awareness of the many problems facing the environment today
- To promote discussion of environmental issues and their possible solutions
- To provide a model of environmental design and sustainable resource use
- To encourage ourselves and others to be the best environmental citizens
- To stimulate mindfulness among residents regarding food sustainability through the cultivation and harvesting of foods grown in the permaculture landscaping and by the sharing of local food
- To be a community that values the individual as well as the whole community
- To provide a model for social sustainability
- To respect the living space and the people who are engaged with the space
- To support wellness, natural health care, and alternative methods of healing so as to sustain ourselves as well as the environment
- To provide the subject matter for independent studies and research

The EcoDorm Residents

Students who choose to live in the EcoDorm are environmentally minded and community-oriented. EcoDorm residents are inquisitive and caring, willing to learn and share ideas and knowledge to better the natural and human world.

Students who choose to live in the EcoDorm are also choosing to adopt a lifestyle. The EcoDorm concept is as much an experiment in sustainable community living as it is an example of intelligent building design and construction. Students residing here must incorporate a lifestyle that sacrifices some conveniences to fit the constraints of an energy-efficient structure, such as foregoing the use of personal refrigerators. And since this living laboratory generates interest from the outside world, frequent tours, visitors, and events put the EcoDorm and its residents somewhat in the spotlight. EcoDorm residents learn about the merits and challenges of their community and help others to do the same.



EcoDorm Residents 2005-2006

Residency Agreement

A community must cooperate to function sustainably. EcoDorm residents participate in weekly chores to keep their home clean and welcoming. In addition to indoor chores, residents maintain the composting toilets, food compost, and permaculture landscaping. The food harvested is shared within the community. Residents join together in monthly potlucks and brunches to share local foods and build community. Residents hold periodic meetings to address concerns, share information, and make cooperative decisions regarding events open to the wider community. To reflect the environmental focus of the dorm, during these meetings EcoDorm residents plan events with sustainability in mind, using and purchasing reusable materials and low-impact products rather than wasteful products. By holding environmentally mindful events, the EcoDorm community serves as a model for sustainable living. The EcoDorm residents agree not to use excessively energy-consuming items, including personal refrigerators, halogen lights, and hair dryers. EcoDorm residents sign a contract agreeing to the above upon moving into the dorm.

III. EcoDorm Community and Student Life, continued

Resident Director

The Resident Director of the EcoDorm has the following responsibilities:

- to build a climate of respect within the EcoDorm
- to create a caring and comfortable home
- to make an effort to know each resident individually
- to facilitate communication and coordination among residents
- to oversee the general upkeep and aesthetic of the EcoDorm, inside and out
- to promote environmentally and socially sustainable practices
- to hold monthly potlucks for community-building
- to oversee the Resident Assistant/Eco Crew
- to facilitate a tour of the EcoDorm for current and prospective residents and other interested community members
- to coordinate harvesting, preserving, and cooking of the edible landscaping with the Landscaper and Resident Assistant/Eco Crew
- to lead field and service trips and provide outreach to other green buildings, dorms, and communities
- to organize workshops and events that further residents' knowledge and understanding of environmental issues and their solutions
- to organize and lead in-dorm projects to advance social and ecological sustainability
- to provide a calendar of events and workshops related to the EcoDorm and sustainability in general
- to survey the dorm on the functionality of the chores, the landscaping, and dorm life so as to constantly improve upon the structure of the community
- to hold informational sessions and/or interviews for prospective residents to review the EcoDorm Residency Agreement and other issues related to the dorm prior to the room lottery
- to conduct the EcoDorm room lottery, which is held separate from the general room lottery

Ideas for EcoDorm activities:

- compost
- food preservation
- solar ovens
- calculate individual's environmental foot print, carbon dioxide emissions with residents
- plant identification and use
- arts and crafts such as natural dying, tie-dye, batiking, mosaics, etc
- organize art projects and decoration of the dorm
- hold an open house to educate the community
- promote local, fair trade, organic, and salvaged food through discussion and food sharing
- promote biking, walking, bussing, carpooling
- foster awareness of environmentally and socially sustainable products
- periodic energy fasts/competitions (use monitoring system)
- waste reduction competition (carry around all your trash for a week and see who has the least)
- field trips (see *Resources*)



EcoDorm RDs: Liana Johannaber '05-'06, Marc Williams '03-'04, Amber Boles '04-'05, Chris Cleveland '06-'07

III. EcoDorm Community and Student Life, continued

Resident Assistant

In addition to the normal Resident Assistant duties, the EcoDorm RA has the following responsibilities:

- to assist the RD, especially in programming
- to help the EcoDorm forge connections with other students as well as staff and faculty (invite to events, hold open houses, etc)
- to oversee and positively reinforce the chore program (including creation of a chorewheel or similar organizational device, notification of residents of their current chore via dry erase board)

EcoDorm Crew

Because of the unique nature of the EcoDorm, a one-person, part-time crew provides the EcoDorm with additional support. The RA can fill the position or another EcoDorm resident interested in the functions and upkeep of the EcoDorm can apply to the RD and the Work Program Office.

EcoDorm Crew responsibilities:

- to launder and line-dry kitchen and cleaning towels
- to scrub the upper portion of the composting toilet and oversee maintenance
- to vacuum couches
- to clean refrigerators
- to water plants
- to help and support the Landscaper
- to support and assist Residential Staff with programming



April Nabholz, EcoDorm Crew founder and RA spring 2006 with brother Joe Nabholz, RA '06-'07

Landscaper

The Landscaper is a member of the Landscaping Crew and preferably a resident of the EcoDorm. The Landscaper is in charge of the permaculture landscaping surrounding the EcoDorm. The Landscaper is responsible for educating the EcoDorm residents about the plants and the proper harvesting procedures and timetable for the edible landscaping. Through the bulletin board, the Landscaper communicates with the community about the status of the plants. The Landscaper works with the RD and RA to facilitate the harvesting and preserving, canning, or preparing of the produce from the landscape. [See *Maintenance, Appendix, Resources*]

EcoDorm Landscapers, clockwise from right: Rachel Williamson '05-'06, Sage Brodersen and Jenny Caldwell '06-'07, and Katherine Webb '04-'05



IV. EcoDorm Features

Please see next section, Maintenance, for operating/care instructions and other details

OUTSIDE:

Eco-Friendly Construction

- **Wood from the Warren Wilson forests.** The siding comes from our own trees that were falling victim to pine-beetle kill. This choice optimized healthy forest management. Harvesting campus wood reduces unnecessary logging and the transportation costs of non-local wood.
- **SIPs (structural insulated panels) system of insulation.** This consists of expanded polystyrene (EPS) sandwiched between two layers of oriented strand board (OSB). Because the SIPs system creates a nearly seamless building envelope that reduces air infiltration and can lower energy costs by 50 percent or more, the non-local Michigan factory for SIPs was deemed worth the impact of transportation. SIPs can be recycled, and they are pre-cut to fit the structure, thus minimizing on-site waste.
- **Eco-friendly roofing.** The roof is made of steel, which is much longer lasting than asphalt shingles. The steel roof includes recycled steel and will be recyclable.

Electricity & Energy Efficiency

- **Photovoltaic Panels.** A 1.4-kilowatt array of photovoltaic cells shades the dorm as overhangs above the front windows, providing a portion of the electricity for the EcoDorm during daylight hours. Battery storage of energy causes energy loss during storage and release, so the system was grid-tied to conserve energy. An inverter converts the power to a form usable for appliances. If more energy is produced than needed by the dorm, the excess energy will be used by the neighboring Ballfield dorms.
- **Solar Hot Water Panels.** An array of solar panels behind the building collects solar heat to preheat water in the storage tanks, which is then further heated as needed by high-efficiency (92-percent) boilers. A preliminary analysis indicated that the EcoDorm could save up to 1,600 therms and 6,500 kilowatt-hours per year on water heating costs compared to a conventional system.
- **Future Possibility:** a fuel cell could be installed to provide electricity for the dorm when the technology becomes available.

Water Conservation

- **Rainwater System.** Rainwater from the roof is held in a 10,000 gallon cistern (a salvaged train tanker car) buried in the front yard, before being pumped into the dorm, where it gets pressurized and is used to flush toilets and for the outside gardening spigots.



During construction of the EcoDorm, approximately 2,000 pounds of waste was diverted from the landfill.



Structurally Insulated Panels (SIPs) can reduce energy costs by 50 percent or more, and are also recyclable.



The steel roof is more effective at cooling than asphalt shingles, and the paint on the exterior is made with ceramic for better heat reflection.

IV. EcoDorm Features, continued

OUTSIDE:

Permaculture

- **Edible Landscaping.** The area surrounding the EcoDorm is a permaculture landscape. “Permaculture aims to foster healthy ecosystem interactions...each individual organism placed in this garden, or ‘foodscape,’ serves multiple functions.” [See Notes, Appendix.]
- **Landscaper:** A Landscaping crewmember, who is, ideally, also a resident of the EcoDorm, manages the EcoDorm landscaping, providing information to residents and visitors through plant walks and posted information on the bulletin board located by the front entrance to the EcoDorm.
- **Harvesting:** Residents are welcome to harvest and eat the produce from the landscaping while respecting the plants. The Landscaper will inform residents through the community bulletin board about produce that is ripe and ready to harvest and plants that are over-harvested. A map of beds as well as drawings of weeds and edible plants (also available in the Appendix) are posted on the bulletin board.
- **Food Compost.** Both kitchens are equipped with compost buckets for food scraps. A compost bin for the EcoDorm (built by the EcoDorm Crew 2004-2005) is located behind the dorm. The three sections of the bin hold compost at different stages, and the final product is used as a natural fertilizer for the permaculture landscape.



Landscapers Rachel Williamson and Emily Dignan

INSIDE:

Local, Recycled Materials

- Interior trim was made from pines that were damaged by beetle-kill.
- The glued laminated beams for the door headers of the EcoDorm were salvaged from campus deconstruction.
- EcoDorm’s desks, chairs, bed frames, and dressers are made with environmentally farmed beech and rubber wood.
- The rubber base of the EcoDorm contains up to 80% recycled content.
- The concrete floors of the EcoDorm contain 24% fly ash, a byproduct of coal burning. This not only makes use of a waste material but also reduces the demand for cement production.
- The drywall of the EcoDorm is made with 95% recycled content [flue gas desulfurization (FGD) gypsum, made from calcium sulfite, a coal-burning by product].
- The green and gray tiles in the EcoDorm kitchens and common rooms are from a factory in Tennessee that recycles tiles broken in the factory. The gray tiles are 100% post-industrial recycled content, and the green are 50%, the other 50% of unrecycled content is necessary to maintain color.
- The above-slab water pipes in the EcoDorm are 90% recycled cast iron.
- Bathroom countertops and partitions contain a minimum of 10% recycled plastic (HDPE).



Beams for the trellis and stair supports are salvaged steel



Cabinetry and wainscoting were constructed by students using oak (downstairs) that was recovered from old farm fences on campus and pine (upstairs) from the deconstructed Early Learning center.

IV. EcoDorm Features, continued

Heating/Indoor Air Quality

- **Radiant, In-Floor Heat.** Underneath the floors (cement downstairs; tile upstairs) a circular pump moves heated water through plastic tubing to create hydromatic (radiant hot water) floor heat. The water is preheated in a solar collector, making the system as much as 40% more efficient than conventional heating. When the solar panels are not working or are not preheating the water to a high enough temperature, 92% efficient Munchkin gas boilers are used to heat water for space heating as well as domestic use. When the **red light** on the ceiling in the control room is on, *gas is being burned to heat the building or domestic water.*
- **Cooling.** To keep the dorm cool, a variety of energy-efficient techniques are used. The overhangs, as well as the deciduous Muscadine grape vines growing on an arbor, provide shade for the dorm during warmer months. Insulation keeps the space comfortably cool with the help of a heat exchange ventilation system and de-stratifying ceiling fans, rather than artificially cooled air. Windows are low-emittance, argon filled, and of high-efficiency design. All windows to the outside, even those placed high to bring in light, can be opened to allow heat to escape.
- **Indoor Air Quality (IAQ).** Mechanically controlled fresh air is available via heat recovery ventilators [See Appendix] and efficient ceiling fans in every student room and living space. The indoor environment is further enhanced by the use of non-toxic materials for framing, paints, and sealers. Another aspect of air quality is light. Throughout the dorm, daylighting design allows sunlight to reach interior and rear rooms of the building. Plants in the common rooms provide both a pleasant atmosphere and better air. Many plants are especially useful for improving air quality, including peace lily, mums, English ivy, golden pothos, spider plants, and gerbera daisies.

Energy Efficient Appliances

- **Kitchen.** Appliances in the kitchen areas on both levels are Energy Star qualified. The kitchens are equipped with natural gas stoves, a more efficient manner of cooking than electric stoves [see Appendix and Maintenance]. Once a month, the kitchen is the setting for potlucks with much food from the college farm and garden and local producers; the kitchen is also a place for canning vegetables and drying herbs.
- **Laundry.** The Maytag Neptune washing machines, also Energy Star qualified, use 67% less water and spin clothes drier than the average machine, affecting a 55% saving of energy.

Energy Efficient Fixtures

- **Lighting.** Daylight enters the building through glass transoms above all doors and clerestory windows in second-floor hallway and both kitchens and common rooms. Fluorescent lighting minimizes electricity consumption. Sensors in the bathrooms and laundry rooms turn off lights when rooms are unoccupied (ultrasonic devices detect sound). The emergency lights are also fluorescent, unlike most emergency light systems, which are incandescent and use more energy. Exit signs use light emitting capacitors (LEC), which are maintenance-free and use a quarter-watt of electricity, less than LED and 240 times more efficient than an incandescent bulb.
- **Bathroom Features.** Fans will be automatically shut off when the room is unoccupied. A manual override allows residents to turn the fan off when not needed. Highly efficient Xlerator® electric hand-dryers use 80% less energy than paper towels.



During the power outage of the Fall 2004 Hurricanes, the EcoDorm's emergency lights lasted the longest of any dorm on campus!

IV. EcoDorm Features, continued

Water Conservation Features

- **Faucets and showerheads** are equipped with switches to turn off the water during toothbrushing and face, hand, and dish washing, while maintaining the same flow and temperature. The showerheads have pressure compensators to create a comfortable pressure while using only 1.75 gallons per minute (gpm), compared to the average 2.5 - 3.0 gpm. The faucets are aerated for minimal water usage and comfortable pressure. The bathroom faucets use 1.0 gpm and the kitchen faucets use 2.5 gpm.



Water-saving switch

- **Flush toilets.** All the flush toilets are low-flow, using 1.6 gallons per flush, and urinals are flushless.

- **Laundry appliances.** The Maytag washing machines use 67% less water than the average machine.

- **Composting Toilets.** There are two composting toilets located on the second floor of the EcoDorm. These toilets are a responsible way of disposing of human waste. No water is used; the only input other than human waste is softwood mulch or shavings (a light mist may be occasionally sprayed to keep the material the appropriate texture, though this is rarely needed). The waste is decomposed into a fertilizing soil by aerobic (oxygen-using) soil organisms such as bacteria and molds. The waste material is collected in a storage cradle accessible through an outside door on the backside of the dorm. *[For more details, see Appendix.]*



The Composting Toilet

- **Future Possibility: Graywater Treatment System.** The graywater and blackwater in the EcoDorm are piped separately for the option of a graywater treatment system. *[See Appendix for more information.]*

Monitoring the EcoDorm

Direct Digital Controls (DDC) on EcoDorm utilities allow for monitoring the daily, weekly, monthly and yearly utility consumption of the building. The following features are monitored:

- All equipment involved in the heating system
- Solar hot water panels
- Photovoltaic electricity production
- Grid electricity used
- City water
- Rainwater – amount used and amount present in cistern
- Natural gas

The performance of the EcoDorm may be monitored online through a website. A computer monitor located in the common room allows residents and visitors to view the performance statistics online. The data will be used to compare anticipated performance to actual performance. Regression analyses can be performed to incorporate the number of residents and degree-days into calculations to determine if the EcoDorm is functioning optimally. *[See Maintenance, Resources]*

V. User Information and Maintenance

OUTSIDE:

Edible Permaculture Landscaping *[See Features and Resources]*

Who Is Responsible: **Landscaper, RD, RA, EcoDorm Crew and EcoDorm Residents**

Residents are welcome to harvest and eat the produce from the landscaping while respecting the plants. The Landscaper will inform residents through the community bulletin about produce that is ripe and ready to harvest, as well as plants that are being over-harvested. Please be careful of the plants and walk on the paths!

Food Compost *[See Features]*

Who Is Responsible: **Landscaper, EcoDorm Crew and Residents**

Buckets located in the kitchens are for food compost. **Acceptable compost items:** vegetables, fruit, egg shells, coffee grounds, and bread. **Do not put meat, plastic, oil or excessively greasy foods in the compost**, this system is not capable of safely breaking down these materials. **EcoDorm residents** are responsible for emptying the kitchen compost buckets into the appropriate section of the compost bin located in the backyard. **Please wash out bucket with hose or laundry-room sink after emptying!** The section on the far left of the bin is for fresh compost, the far right of the bin is for near-finished compost, and the middle section is for the intermediate stage. **Leaves, straw, or other carbon-rich material should be used to cover the fresh compost at the time a bucket is emptied.** The **EcoDorm Landscaper and EcoDorm Crew** are responsible for organizing the maintenance of the compost in the bin. This may be done through the chore system or by the crewmembers themselves with the help of residents.



Rachel Williamson checks the compost

Rainwater System

[See Features and Appendix for more details]

Who Is Responsible:

Plumbing Crew

A salvaged milk car holds rainwater collected from the roof. During dry periods, the rainwater may be used up, at which point **the Plumbing Crew will add city water to the tank** by manually turning on a faucet to fill the tank through an open drainpipe behind the dorm. An automatic system will be programmed to add water to the tank as needed.



Rainwater is collected in a salvaged milk train car buried in the front yard

V. User Information and Maintenance, continued

Solar Hot Water Panels [See Features and Appendix for more details]

Who Is Responsible: HVAC Crew and Electric Crew

During the summer when there is little draw for hot water from the panels, the HVAC Crew will cover the panels to prevent all the fluid from steaming off.

When power goes down on a sunny day, the pump that brings the fluid through the tanks shuts down. The pressure on the fluid and the temperature of the fluid will rise to the boiling point so that a release valve on the panels will open and the fluid will steam away. This is known as losing the “charge.” To fix this problem, the pump may, in the future, be connected to a photovoltaic panel so that if power goes down on a sunny day, the pump will continue to function and the fluid will not steam away. The **Electric Crew** will be responsible for maintaining and repairing the photovoltaic power to the pump as needed.

Photovoltaic Panels [See Features for more details]

Who Is Responsible: Electric Crew

The Electric Crew will periodically wash the photovoltaic panels on the front of the EcoDorm to keep them free of dirt and dust, which reduce the amount of electricity produced by blocking sunlight.

INSIDE:

Lighting and Personal Energy Use

Who Is Concerned: EcoDorm Residents

- To conserve energy, **turn off unneeded lights**
- Glass transoms (panes) above doors allow the sun to naturally light up most of the building; with this knowledge residents are advised to **leave the transoms uncovered** or cover with only translucent materials.
- **Turn off stove and bathroom ventilating fans** within 20 minutes after you are done cooking or bathing to retain heated air and save energy.
- **Turn off computers and stereos when not in use and switch off the power strip or unplug appliances** because these machines use energy even when shut down. Computers use the same amount of energy to start up as they use when they are on for about two seconds. Because most PCs become obsolete due to advances in technology long before the effects of being switched on and off have a negative impact on their service life, there is no reason not to turn off computers when not in use (Source: Department of Energy). To save energy during brief idle periods, **enable your monitor to shut off automatically when idle for more than a few minutes.** (On a PC: right click Desktop, select Properties, and access controls through Power Settings under Screen Saver. On a Mac, go to Control Panels, select Energy Saver and click on the Sleep Setup tab.)



A preliminary analysis indicated that the EcoDorm could save up to 1,600 therms and 6,500 kilowatt-hours per year using the solar hot water system.



Photovoltaic panels provide electricity while shading windows from summer sun.

V. User Information and Maintenance, continued

Recycling

Who Is Concerned: **EcoDorm Residents**

A space was built into the EcoDorm to contain recycling bins. Below is a list of recyclable items. Please put all recyclables in their appropriate bin! Cardboard should be broken down and set to the side.

Standard Recyclables (a bin for each)

Glass: Brown, Green and Clear.

Plastic: #1 and #2 containers. Opening of container must be smaller than the body of the container.

Paper: All colors and types except waxed or paper that has been in contact with food

Cardboard: Everything except wax coated cardboard.

Steel: All types of steel.

Aluminum: All cans, pie tins, foil etc...

Miscellaneous Recyclables: (one bin for all)

Packing peanuts, tires, floppy disks, all types of batteries, computer parts, circuit boards, laptops, monitors, TV's, stereos, any electrical appliance, cell phones, CDs and DVDs, tapes, CD and tape cases, fluorescent lights, printer cartridges, wood, old text books. **Clothes and perfectly decent and functioning items should be placed in the Free Box in the laundry room and taken to the Free Store when enough items have accumulated.**



Composting Toilets [See Features and Appendix for more details]

Who Is Responsible: **EcoDorm Crew and Residents** (leaders designated each semester) with the help and consultation of the Plumbing Crew and Clivus Multrum

- **All users** of the composting toilet must drop an equivalent amount of wood shavings (must be softwood) as stools down the chute each time the toilet is used. Warren Wilson College wood shavings are supplied.
- **Designated EcoDorm residents** rake the top 8-10 inches of the composting material every two weeks and check the level of liquid in the storage cradle to assure that the pump is working and visible above the liquid. If the pump is submerged, the **Plumbing Crew** must be notified immediately. The storage cradle is accessible through a door on the backside of the building.
- The compost must stay in the cradle for at least a year; the **Plumbing Crew** disposes of the compost in a manner acceptable to the county.
- If the composting toilet fan malfunctions or the lights in the maintenance room go out, notify the **Electric Crew**.

Bathroom Features

Who Is Concerned: **EcoDorm Residents**

When set to auto, fans will automatically shut off after a period of when the room is unoccupied. **A manual override allows residents to turn the fan off immediately when not needed.** Highly efficient Xlerator Electric hand-dryers use little energy and save trees by eliminating the need for paper towels. However, **the hand-dryers are rather loud so residents may choose to use hand towels, which save energy and do not disturb** sleeping and studying residents.

Contact Information:

Plumbing Crew: x3078

Electric (fan and lights): x3081

Clivus Multrum, Inc.:

978-725-5591 or 800-425-4887

donmills@clivusmultrum.com



V. User Information and Maintenance, continued

Laundry

Who Is Concerned: EcoDorm Residents

The Maytag Neptune washing machines are Energy Star-rated and **use 67% less water** by spinning clothes drier in and out of a smaller amount of water than the average machine, affecting a 55% saving of energy. **Washing clothes with cold water (the color setting) reduces energy use by half.**

Use the clotheslines out back and save even more energy! A semester of line-drying clothes once per week will save you \$16 and prevent the release of 131 pounds of carbon dioxide.

Ventilation [See *Features and Appendix for information on the Heat Recovery Ventilation System*]

Who Is Concerned and Responsible: EcoDorm Residents and HVAC Crew

- Anything put into the air will circulate through the ventilation system and end up in the filters. If there should be an excess of dust, sawdust, etc stirred up, HVAC can turn off the system for a period of time.
- The air exchange system contains a box through which inside and outside air are mixed to reduce heating and cooling loads. This box is cleaned by HVAC once per year.
- High windows can be opened with a crank stored in the control room, accessible by the RD. Residents and staff should make sure to open and close these windows as needed.

Natural Gas Kitchen Stoves [See *Appendix for more details*]

Who is Responsible: EcoDorm Crew and Residents

The EcoDorm kitchens are equipped with natural gas stoves, a more efficient manner of cooking than electric stoves. Gas ranges must be operated in a different manner than electric stoves; residents must be trained in the proper procedures for safely using the stoves. **Stovetop and oven must be locked when not in use to prevent accidental release of gas.** To lock or unlock stove, hold down the buttons marked with the lock symbol and range symbol for approximately five seconds, until a beep indicates the stove is locked or unlocked. The stove, including range, igniters, and oven must be inspected and cleaned weekly. To operate the stove, turn the knob to the “lite” position, listen for the clicking sound, and wait for stove to ignite. If the gas does not light, turn the knob to the off position, hang a danger tag, and notify the RD of the malfunction. **If you hear or smell a gas leak after the range has been unattended, do not turn top burner knobs to the off position, as the knob will pass the “lite” position and ignite the gas, causing an explosion.** You must pull the fire alarm and leave the building immediately; then go to the nearest phone and call 911. After calling 911, call Public Safety at ext. 4357.

Tips for Saving Energy While Cooking

- Match pan size to burner size
- Keep lid on pan to retain heat
- Turn down heat after food steams
- Cook with minimal water
- Turn off heat earlier than ready and keep lid on to let food finish cooking
- When using oven, cook most or all foods in oven as well
- Keep oven door closed – use a timer and monitor through window to avoid heat loss

For information and help concerning the dryers, ventilation system, gas stoves, or heating system, contact HVAC at x3076 or FMST at x3074.

V. User Information and Maintenance, continued

Radiant In-Floor Heat [See Appendix for more details]

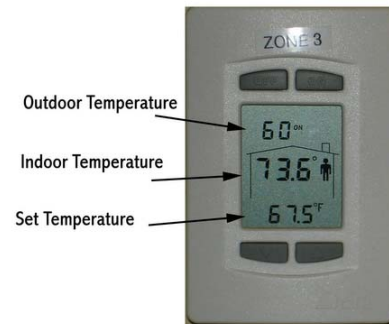
Who is Concerned and Responsible: EcoDorm Residents and the HVAC Crew

Do not puncture the floor or ceiling; a pipe could be punctured and the heating system destroyed!

Water circulates through the floors in tubes, radiating heat upwards. **Residents can adjust thermostats between 60-70°F** with the arrow buttons. On the screen, the bottom temperature reads the setting, the middle reads the room temperature, and the top reads the outside temperature.

If the heat is turned off on student thermostats for several days, **the tubing and floor will get cold** and when the temperature suddenly drops, it will **take up to 8 hours** for the tubing and slab to warm up enough for a noticeable warming. The temperature can be adjusted and controlled online or in the control room by HVAC.

Rooms with Thermostats:	Control These Rooms:
104	104, 105, 107, 109
111	111, 112, 113
120	120, Showers, Mechanical Room
124	121, 122, 124, 125
203	201, 203, 204, 206
208	209, 209, 210
214	214, 216, 217
221	218, 219, 221, 222,



Radiant in-floor heating systems are up to 40% more efficient than a conventional heating system. Efficiency levels depend on **human behavior**, so residents should communicate with each other to make the system run smoothly at a level comfortable to all.

Monitoring the EcoDorm [See Resources]

Who Is Concerned and Responsible: EcoDorm Residents, FMTS, Campus Greening Crew

The performance of the EcoDorm may be monitored online through a website. A computer monitor located in the common room allows residents and visitors to view the performance statistics online. The data will be used to compare anticipated performance to actual performance. Regression analyses can be performed to incorporate the number of residents and degree-days into calculations to determine if the EcoDorm is functioning optimally.

Direct Digital Controls (DDC) on EcoDorm utilities allow for monitoring the usage and function of the following:

- All equipment involved in the heating system
- Solar hot water panels
- Photovoltaic electricity production
- Grid electricity used
- City water
- Rainwater – amount used and amount present in cistern
- Natural gas

At press time, specific instructions on the monitoring system were not available.

VI. Resources

Manuals & Information:

- Clivus Composting Toilet Manual
- Direct Digital Controls Manual
- EcoDorm Edible Landscaping Management Manual by Katherine Webb (2005)
- Sunny Boy Solar Power Monitoring Manual
- The Green Walkabout Primer: The Story of Sustainability at Warren Wilson College. The Environmental Leadership Center of Warren Wilson College (2005).
- Department of Energy: Energy Saving Tips: <http://www.doe.gov/energysavingtips.htm>

Places to visit:

- Earthaven EcoVillage: 828-669-3937
www.earthaven.org / info@earthaven.org
1025 Camp Elliott Road, Black Mountain, NC 28711
- Long Branch Environmental Education Center: 828-683-3662
www.longbrancheec.org / P.O. Box 369 Leicester, NC 28748
Paul Gallimore, Director paulg@buncombe.main.nc.us
- Black Mountain Community Garden: Contact the Service Learning Office at x3065
- Blue Ridge Biofuels: 828-253-1034
109 Roberts Street Asheville NC 28801
www.blueridgebiofuels.com / info@blueridgebiofuels.com
- EnergyXchange Renewable Energy Center: 828-675-5541
www.energyxchange.org / energy@yancey.main.nc.us
66 EnergyXchange Dr. Burnsville NC 28714
- Catawba College Center for the Environment: 704-637-4727
www.centerfortheenvironment.com
2300 W. Innes St., Salisbury, NC 28144
- Berea College Ecovillage: 859-985-3593
www.berea.edu/sens/ecovillage
- Oberlin College Adam J. Lewis Center for Environmental Studies:
www.oberlin.edu/ajlc
cheryl.wolfe@oberlin.edu
122 Elm Street, Oberlin, OH
- Buffalo Mountain Energy Center (wind turbines and solar) - Invenergy TN LLC:
(865) 633-6785 ext. 66
1980 Windrock Road P.O. Box 153 Oliver Springs, TN 37840
http://www.invenergyllc.com/wind_html/buffalo.html

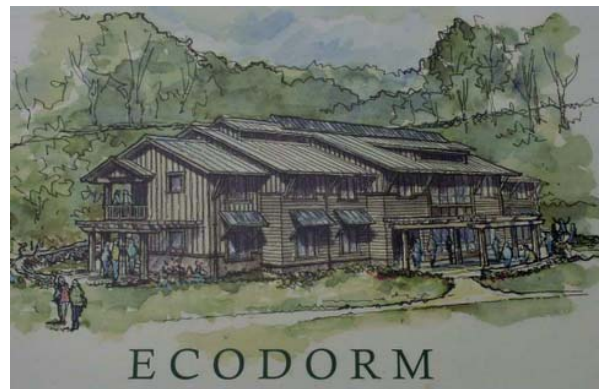
VII. History

In 1998, the decision to increase Warren Wilson student enrollment to 800 brought with it the need for four new dormitories. And it brought controversy, since some students were opposed to growth. They turned their protest into positive action: the call for an environmentally friendly dorm.

Two students, Jessica Lehmann and Steve Yokim, spearheaded early efforts, including careful research. After a spate of stops and starts as enrollment dropped, then rose again, an EcoDorm Committee formed. The committee was comprised of students, administrators (represented chiefly by Larry Modlin, Vice President for Business), staff, and two architects from Samsel Architects in Asheville, a firm dedicated to green building for over twenty years. The committee's membership also included student Marc Williams, who became the dorm director of EcoDorm for the opening year.

For over a year, beginning in the fall of 2001, the EcoDorm Committee met every Monday night. The architects had an agenda for each meeting—one week, paint; another wallcovering or flooring. Speakers were invited to express their opinions on materials, and students went away with research assignments. Larry Modlin, with a budget to consider, also realized that this project was not about building as cheaply as possible but about building the best, and building “smart.” As it turned out, according to Larry, the cost of the EcoDorm was \$180 per square foot, compared to \$120 per square foot for adjacent dormitories built earlier by Samsel. The EcoDorm was, everyone agreed, a project that would not necessarily demonstrate saving money—its purpose was to showcase technology and, in doing so, to model an environmentally friendly building that people would want to live in.

Early on, led by student concerns, the EcoDorm Committee set four priorities: energy efficiency, water conservation, healthy indoor air quality, and use of local and highly recyclable materials. These priorities, which became the official “project goals,” drove all decisions. There was, however, as with all projects involving many voices, the occasional call for compromise.



The earliest vision of the dorm had been, according to student Olya Milenkaya, “really radical, like straw bale or cob, alternative stuff.” But Olya, who joined the EcoDorm Committee beginning in her sophomore year (the fall of 2001), soon realized the difficulties of dreaming off the grid. The Samsel architects in charge of the project, Duncan McPherson and Bud Hart, pointed out the limitations of construction such as straw bale, especially in meeting code requirements for two-story institutional housing of the size and type proposed. As alternatives, the architects asked the committee to look at concrete-form construction, which is lightweight concrete block with air bubbles pumped inside, but there was concern about enough expertise in the area to work with that material.

Other possibilities were proposed, and the other committee members would do their research and come back with something different. All ideas were entertained. Duncan recalls, “There was a continuous stream of discussion about construction, maybe not always specifically about our building but about what’s happening in general with green building. They challenged us about why we do what we do.” Bud adds, “We saw them as a research body. They kept us on our toes, doing our due diligence with materials and design.”

VII. History, continued

The research and discussion led to a key decision: structural insulated panels (SIPs) would be the material for the walls and ceiling of the EcoDorm. The possible use of SIPs, which consists of expanded polystyrene (EPS) sandwiched between two layers of oriented strand board (OSB), had come up early in the EcoDorm meetings and there had been debate: the panels come from a factory in Michigan, and hauling materials great distances was in direct conflict with the mission of the EcoDorm. On the other hand, the SIP system creates a nearly seamless building envelope that reduces air infiltration and can lower energy costs by 50 percent or more. Furthermore, the material is highly recyclable, and the architects stipulated that the panels be pre-cut to fit the structure, thus minimizing on-site waste. With all these advantages stacking up in the SIPs corner, the concern about using non-local materials was temporarily a lost cause.

When the time came to do the interior framing, however, the cause reasserted itself. The contractor had ordered Canadian fir, the preferred material for framing since it does not tend to warp. But Canada is hardly local, and the wood was sent back to the local distributor. The framing was done instead with yellow pine from the nearby mountains. This choice was environmentally friendly, but had its own set of drawbacks. Yellow pine twists and turns as much as 180 degrees, pulls out of the plates, and creates the necessity of putting blocks between the studs every five feet. All of this made putting the sheetrock on difficult. Duncan, who is Vice President and a founder of the Western North Carolina Green Building Council, was sanguine about this construction challenge. What mattered was that “Larry and the students said ‘This is important to us.’ ”

Listening to the students was at the heart of every committee meeting, and never more than when the subject was quality of life. Larry comments, “While we wanted the EcoDorm to be environmentally friendly, we also wanted it to be user-friendly. We debated making the rooms smaller with lower ceilings, less glass—more of a monks’-cell feeling—but we ended up not doing that. The EcoDorm is ‘environmental,’ and it’s also comfortable and beautiful.” And communal. The students wanted the dorm, which houses a maximum of 38 students including a dorm director, to contain two kitchens, one for each floor. Although every other dorm on campus has only one kitchen, students wanted the EcoDorm to model community, with food preparation and consumption at its center.

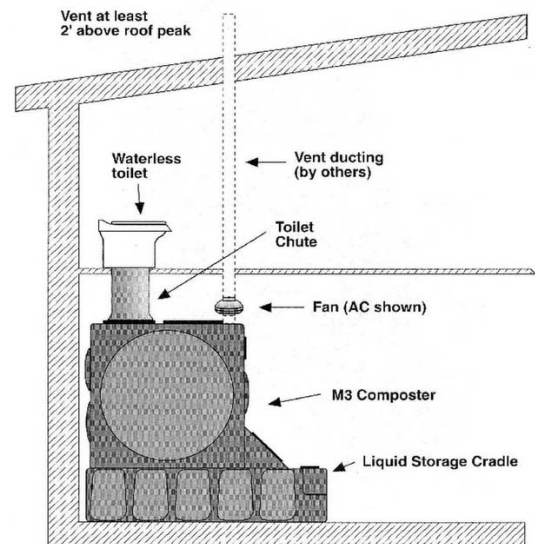
The EcoDorm, as a microcosm of community, is also a magnet for the wider community spirit of the College. Although the contractor, Blue Ridge Energy Systems, continued to oversee the project, its role was reduced during the final seven months, and the students stepped in. Warren Wilson Work Crews harvested trees, milled lumber, installed fiber optics and a telephone system, crafted cabinets and other woodwork, painted inside and out, built stone walls and walks, and planted trees. The construction of the EcoDorm ended as it began—with students taking a hand, literally and figuratively, in getting it off the ground.

VIII. EcoDorm Manual Appendix

Composting Toilet

There are two composting toilets located on the second floor of the EcoDorm. Composting toilets are a responsible way of disposing of human waste. No water is used in composting toilets; the only input other than human waste is softwood mulch or shavings (a light mist may be occasionally sprayed to keep the material the appropriate texture, though this is rarely needed). The waste is decomposed into a fertilizing soil by aerobic (oxygen-using) soil organisms such as bacteria and molds. The temperature rarely rises above 90°F, but disease-causing organisms do not survive because conditions are not favorable to their growth, and the decomposing bacteria that thrive on the compost consume any other microorganisms present. Drain flies and other pests are only a problem if the composting toilet is not properly maintained so that pools or urine form and allow pests to breed.

The composting toilet is ventilated by a fan that pulls air into the compost chamber. The ventilation system simultaneously provides needed air to the decomposition organisms, prevents odors from escaping into the toilet room, and is the withdrawal system for the overall dorm ventilation system. [See *Ventilation, below*]. The waste material is collected in a storage cradle accessible through an outside door on the backside of the dorm. The toilets must be located upstairs so that the storage cradle can be located at ground level. Human waste falls into the back of the tank, which slopes downwards towards to front. Leaving some nutrients behind, liquid waste moves downwards through the compost material and into the liquid storage cradle located at the foot of the tank. The urine undergoes nitrification to become a compost “tea” that will be used as a potent fertilizer when regulations permit. At present, the liquid is pumped into the sewage system because the county prohibits the use of the compost due to lack of regulations by the government.



Natural Gas – used in stoves and water boilers

Natural gas is more efficient because it is burned to provide heat on-site, whereas electric heat involved the burning of coal, conversion to electricity, and conversion back to heat, creating a large amount of wasted heat and energy. Natural gas is also a cleaner burning fuel, emitting less carbon monoxide, carbon dioxide, particulates, nitrogen oxides, sulfur dioxide, and mercury than coal or oil.

Ventilation

The EcoDorm has a Heat-Recovery Ventilator (HRV), a ventilation system that simultaneously brings in fresh air (needed for such a tightly insulated building) and takes out stale indoor air. When air is drawn in, it is heated or cooled by the outgoing air in a heat-exchange box.

Fresh air intakes located on the south side of the building connect to the HRV system to bring fresh air in, and then eventually old air is sent out through the composting toilets. A ventilation system is necessary for the composting toilets. To minimize penetrations in the building and reduce duplicate fans and systems (and therefore energy use), the composting toilet ventilation system does double duty of acting as the exhausts for the bathrooms, and eventually all the air withdrawn from the building.



The HRV system can save 75% or more energy by preheating or cooling incoming air through heat exchange.

VIII. EcoDorm Manual Appendix, continued

Rainwater System

The rain that runs off the steel roof of the EcoDorm is collected in a 10,000 gallon salvaged milk railroad tank car buried in the front yard. This water is filtered and pumped to flush the conventional toilets in the dorm. Outdoor faucets provide rainwater for irrigation of the Permaculture landscaping surrounding the dorm. The water is legally “non potable,” as signified by the signs above the toilets and outdoor faucets. During dry periods, the rainwater may be used up before it is filled, at which point city water can be added to the tank by manually turning on a faucet to fill the tank through an open drainpipe behind the dorm; (Plumbing Crew is in charge of this task). The pump that controls the pressure for the rainwater system is located in the control room, and there is a flow meter on the system that will determine the amount of rainwater used as compared to city water when connected to a monitoring system. The rainwater tank was built with a flotation device to monitor the level of rainwater left in the system, but the monitoring device was never completed. To solve the problem of the tank running dry, a monitoring system should be set up to alert the Plumbing Crew when the rainwater is low. It is important to have the tank refilled manually rather than automatically because an automated system would not take into account the weather; the tank could be filled with city water and a rainstorm immediately afterwards would provide a large amount of water for a full tank, causing the excess water to overflow into a drain. The rainwater would be wasted and city water used needlessly.

Solar Hot Water Panels

An array of solar panels behind the building preheats water, which is then piped inside for further heating by high-efficiency (92-percent) boilers. A preliminary analysis indicated that the EcoDorm could save up to 1,600 therms and 6,500 kilowatt-hours per year. These panels preheat domestic water using heat gained from the sun. Fluid runs through the panels and into the control room, where it circulates through the water storage tanks. The fluid in the panels is a 50/50 mixture of water and propylene glycol (antifreeze), a non-toxic liquid that broadens the liquid phase of the solution by lowering the freezing point to -26°F and raising the boiling point to 259° F. If the domestic water in storage drops 10° F below the set temperature, fluid from the solar panels circulates in a loop through the storage tanks. There are 3 storage tanks; the boiler heats only the first 2. The solar fluid circulates through them all. The third tank is necessary to dissipate all the heat from the fluid.

Heat and Energy Conservation in Building Design

The EcoDorm is oriented ten degrees of true south for the highest collection of passive solar energy. The high capacity of solar energy is trapped with low-emission, argon-filled windows. Overhangs above the windows on the south side provide 36 degrees of the sun in winter, but provide enough shade to stay cool in the summer. To trap the maximum heat of the sun, the first floor is cement, which maintains heat well. The building is insulated with SIPs (structured insulated panels), which reduce air infiltration and can reduce energy costs by over 50 percent.

Future Possibility: Graywater Treatment System

Water used to flush toilets and for irrigation in the EcoDorm is rainwater. When water is flushed through a toilet, it becomes blackwater. The water that comes through sinks, showers, and washing machines in the EcoDorm is city water. The water that passes out of these fixtures is called graywater. The graywater and blackwater in the EcoDorm are piped separately to keep open the option of a graywater treatment system. Graywater can be biologically treated to return it to a potable state. (Rainwater could also be made potable by the use of filters). Treatments could include a wetland system with specific plants, animals, and microorganisms that purify water.

VIII. EcoDorm Manual Appendix, continued

Landscaping - Edible Plants

Nutritious and Delicious Weeds in Your Garden

Rachel Williamson. Spring 2006



Stellaria media
Chickweed

Delicious salad or cooked like spinach.
High in vitamin C, iron and phosphorus.
Cleanses kidneys and urinary tract.



Cichorium intybus
Chicory

Spring green raw or cooked. Coffee substitute
from roots chopped and roasted at 300 until
they smell delicious. Blood cleanser.



Plantago major/lanceolata
Plantain, common/lanceate

Crushed leaves heal poison ivy, stings, bites,
rashes & cuts.



Galium aparine
Cleavers

Roasted seed coffee, leaf tea or juice for lymph
cleanser, diuretic, cancer treatment & gall stones.



Chenopodium album
Lambsquarters

Delicious leaves, raw or cooked. Cooked
seeds have 16% protein.



Alliaria officinalis
Garlic Mustard

Springtime favorite in salad, soup or stirfry.
Smell for garlic to differentiate from *Senecio*.

VIII. EcoDorm Manual Appendix, continued

Landscaping - Edible Plants

Nutritious and Delicious Weeds in Your Garden



Portulaca oleracea
Purslane

Lemony salad or cooked like okra in soup. Salt replacement. Leaves have Omega-3 Fatty acids - prevent heart attacks, strengthen immune system.



Oxalis stricta
Wood Sorrel

Nice lemony addition to salads, but oxalic acid consumed in large quantities will weaken bones and nutrition. Treats nausea. Yellow dye.



Rumex acetosella
Sheep sorrel

See above on *Oxalis stricta*. Can aggravate kidney and arthritis. Eat with dairy or other calcium source.



Verbascum thapsus
Mullein

Leaf and flower tea for treatment of diarrhea and treatment of bronchial congestion. Poultice on wounds.



Trifolium pratense
Red Clover

Young leaves in salads or cooked - 4% protein. Flowers raw or dried for tea. Tonic, anti-cancer, skin complaints, blood purifier. Nitrogen fixing green-manure.



Taraxacum officinale
Dandelion

Very nutritious raw or cooked leaves and flowers. High calcium and potassium. Roasted root coffee. Treatment of gall, urinary tract, eczema, acne, etc.

VIII. EcoDorm Manual Appendix, continued

Landscaping - Weeds to Pull

Have an extra minute?

Wanna pull some weeds?

Some weeds are quite nice to eat and make medicine from. Some weeds, such as these, take over the garden. Weeding in the garden after a long day at school is quite relaxing and grounding. Please stand on the paths so you don't step on new sprouts.



Ranunculus uncinatus
Butter cup



Ambrosia artemisiifolia
Ragweed



Polygonum persicaria
Lady'sthumb/ Knotweed



Coronilla vicia L.
Vetch



Lamium Purpureum
Purple deadnettle



Cerastium fontanum
Mouse-eared Chickweed



Geranium meculatum
Wild Geranium



Galinsoga quadriradiata
Quick-weed



Rumex crispus
Yellow dock (dig)

Acknowledgements

EcoDorm Staff, clockwise from left:

Christopher Cleveland, RD '06-'07; Sage Brodersen and Jenny Caldwell, EcoDorm Landscapers '06-'07, Liina Laufer, EcoDorm Manual writer and photographer (Campus Greening Crew) '05-'07; Joe Nabholz, RA '06-'07; and April Nabholz, RA spring '06.



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I would like to give many thanks to the EcoDorm staff pictured above, former RDs Liana Johannaber and Marc Williams, and former EcoDorm Landscapers Rachel Williamson and Kat Webb for contributing to the EcoDorm community and the EcoDorm Manual. Thanks to Green Walkabout Primer author Elizabeth Lutyens for her help and contributions to the writing of the manual. Thanks to FMTS director Paul Braese, and supervisors Hoyt Barnes, John Griffith, Christopher Hanson, and Tom LaMuraglia for their helpful information. Thanks to the staff of the Environmental Leadership Center, Student Life, and the Administration for supporting this project.

Sincerely,

Liina Laufer, January 2007