

Grinnell EcoHouse:

A Proposal for Sustainable Living



Free The Planet
Grinnell College,
Grinnell, IA
February, 2008

Sustainable Development:
"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
- The World Commission on Environment and Development (the Brundtland Commission)

Contributors and Acknowledgements

Contributors:

- Sam Calisch '10
- Sarah Casson '11
- Ami Freeberg '10
- Jacob Gjesdahl '10
- Christine Grummon '11
- Ethan Heppner '11
- Hart Ford-Hodges '10
- Leah Imlay '10
- Caroline Kory '10
- Victoria Mercer '10
- Eric Nost '09
- Nathan Pavlovic '10
- Alex Reich '11
- Jordan Scheibel '10
- Felicity Slater '11
- Mark Sullivan '10
- Caitlin Vaughan '10
- Neal Wepking '10
- Matt Zmudka '11

Acknowledgements

This proposal would not have been possible without input from enthusiasts from all fields. Thank you to Jen Krohn, Dean for Student Life; Rick Whitney, Associate Director of Facilities Management; and Chris Bair, Environmental and Safety Coordinator. We would also like to thank Professor Jon Andelson of Grinnell and Professor Lonnie Gamble of Maharishi University of Management in Fairfield, Iowa. Additionally, we would like to thank our editors including Henry Reich '09 and Claire Doods '10. Finally, we would like to thank all the Grinnell students who contributed to the proposal, including the authors, editors and peers who provided their comments and opinions. This has been a joint project and will continue to be so.

Table of Contents

I. Summary.....	4
II. Introduction.....	5
III. Proposal	
a. Timeline.....	7
i. Phase 1.....	7
ii. Phase 2.....	7
iii. Phase 3.....	7
b. Governance.....	9
c. Academics.....	11
d. Project Components	
i. Energy	13
ii. Water	16
iii. Food.....	17
iv. Built Environment.....	18
v. Landscape.....	19
vi. Waste.....	20
e. Funding.....	22
f. Outreach.....	23
i. Campus.....	23
ii. Community.....	23
IV. Conclusion.....	25
V. Appendix A – Potential Collaborators.....	26
VI. Appendix B – Resources.....	27
VII. Appendix C – Example Project Houses.....	29
VIII. Appendix D – Potential Funding Sources.....	30
IX. Appendix E – Grinnell Building Guidelines.....	31
X. Appendix F – Emmisions Reduction Commitment.....	33

Summary

We set forth this proposal to establish an “EcoHouse” on or near the Grinnell College campus to explore the nature of sustainability and find ways to lessen the college’s footprint on the earth. EcoHouse will be devoted to the experiential examination and practice of sustainability. We hope that the impact of EcoHouse will transcend both the physical building and its residents to serve as a laboratory of sustainability for the campus and town community. By engaging in outreach activities and integrating the house into the academic curriculum, EcoHouse will become an important part of the college’s commitment to environmental and social justice. The following pages explore the ways in which we would renovate a house, improve energy efficiency, reduce waste, and conserve water resources. Furthermore, we outline our intent to eat sustainably and landscape in a way that will provide fresh produce for inhabitants, in addition to showcasing Iowa’s natural prairie landscape. We would like to invite Grinnell College administrators and faculty into a constructive dialogue to make EcoHouse a reality.

Introduction

Of the many opportunities our society faces today, improving our use of renewable energy sources and living sustainably are some of the most pertinent. The current human impact on the environment jeopardizes the ability of this and future generations to live on the earth. While major political and economic decisions will need to occur to dramatically reduce our society's reliance on environmentally degrading practices, we know that change can start, quite literally, at home. Basic renovations to buildings and simple lifestyle changes have the capacity to significantly reduce energy consumption and waste production for the average household.

Out of concern for these issues, we have formed into a group of students dedicated to actively engaging the campus and community. Members have been drawn from a diverse body of campus organizations, including Free The Planet (FTP), the Student Environmental Committee (SEC), EcoCampus, The Community Garden, and others. Grinnell College and the surrounding community are representative of a society that consumes more energy and water than necessary and does not effectively manage the long-term environmental, social, and economic impacts of the citizens' lifestyle choices. **We propose to address this issue by working with Grinnell College students and administration to establish an "ecohouse" on or near the Grinnell College campus devoted to experiential examination and practice of sustainability, and serving as an example of sustainable living for the Grinnell College campus and the wider community.** This project will embody the Grinnell College Statement of Environmental Responsibility:

"Grinnell College believes that as a liberal arts institution with a strong social commitment, we have a duty to the environment, society, and future generations to be leaders in environmental stewardship, education, and policy. Grinnell College is therefore committed to incorporating environmental responsibility into policies, decisions, and daily life on campus."

Adopted: March 15, 2006¹

Many other colleges, including Oberlin, Denison, and Macalester, have created similar houses to great success, both environmental and economic (see Appendix B). From a financial standpoint, Grinnell College would benefit from increasing the efficiency of its buildings, as lower energy use and water consumption results in lower operational costs. EcoHouse would serve as a laboratory or proving ground for green renovations, and once a certain measure is determined to be efficient and feasible in EcoHouse, the college can more confidently invest in the same renovations in other buildings. The extensive trial and error that occurs in EcoHouse will serve as a research and development stage for the college's efficiency programs. In addition to creating change in the college community, we hope to show that it is cost-effective in the long run for a homeowner to improve the efficiency of their home, which will not only benefit the environment but will also put money back in their pockets. Ideally, EcoHouse will not be unique; it will become the model for all houses in the Grinnell community.

¹Environmental Responsibility at Grinnell College: Adopted Policies
<http://www.grinnell.edu/etal/green/policy/>

We believe Grinnell College and its student body should act as agents of change, committing not only to living environmentally friendly lifestyles but also to educating and working with the community. Now is the time to start exploring and investing in sustainable design. The remainder of this proposal will consider our detailed plans and ideas for EcoHouse.

Timeline

Having a clear timeline of action is of primary importance in planning and carrying out a project that requires considerable time and collaboration throughout the Grinnell community. We therefore suggest implementing the EcoHouse plan in two main phases, and additionally offer an optional intermediate phase.

Phase 1: Research and Development

Timeline: December 2007 – August 2008

During Phase 1, the concept of EcoHouse will be fully developed, resulting in a final proposal outlining the possibilities for developing environmental stewardship and community awareness in Grinnell and the surrounding areas. The plan will describe a diverse set of feasible and effective strategies which will be implemented over a three year period to achieve the goals of EcoHouse. Phase 1 will also be devoted to communicating with professors, administrators, and the campus and community to maximize the success of the project.

Formulation of the final proposal will require working closely with a number of parties. Important collaborators will include:

- Jonathan Andelson, Professor of Anthropology
- Chris Bair, Campus Environmental Coordinator
- Rich Dana, Cultural Engineer of Imagine Grinnell
- Lonnie Gamble, Visiting Professor of Sustainable Living
- Jen Krohn, Dean of Student Life
- Richard Whitney, Associate Director of Facilities Management
- EcoCampus Committee
- SGA Housing Committee

The current opportunity to collaborate with visiting professor Lonnie Gamble and his Renewable Energy course is of special interest; students will have the opportunity to examine energy systems and develop an independent renewable energy project. To ensure the long-term success of the operation of EcoHouse, we will work closely with Facilities Management (FM) and Student Affairs in the planning process because these groups will be heavily involved in maintaining the project.

Phase 2 (Optional): Project House

Timeline: August 2008 – May 2009

If a permanent house cannot be procured for the 2008-2009 academic year, students will apply for a project house to serve as a staging point from which to further develop ideas outlined in Phase 1. Phase 2 would be a pilot project, determining the feasibility of implementing our ideas in a permanent house. Over the summer, we would ideally work with FM and Student Affairs to make basic structural adaptations to make the house more efficient. This option is attractive because the interim project house could serve as a think tank to plan for future EcoHouse plans. However, we feel that to truly create a green dwelling, EcoHouse should be a permanent structure in which long-term technologies can be implemented and garden landscaping can be established. The transience of a rotating project house would prevent this kind of development.

Phase 3: Permanent House

Timeline: August 2008 – Indefinite

In the final phase of the project, we foresee EcoHouse as an established institution on campus with a governing body and an integrated academic program. Though the exact timeframe for implementation will depend on numerous factors, including student support, FM approval, funding, and scope of the project, we hope this proposal gives some idea of the possibilities for EcoHouse, as well as the impediments facing each aspect of the project.

A number of options are available for establishing a permanent house. The most desirable option would be to designate a current college owned house to become a permanent EcoHouse, in the same vein as the current language houses. The permanency of the dwelling would enable its inhabitants and FM to invest in long-term green technology for the house and allow students to more fully landscape the area. Over time, the house would become a hub for anyone interested in sustainability on campus or in the community.

A second option is to work outside the college system and rent a property in Grinnell. This scenario would separate EcoHouse from the college and would prevent it from effectively serving as a part of the campus community. Additionally, it would be difficult to find a renter willing to have such significant changes made to the house, and use of a rental property would exclude many underclassmen according to current college housing policies. Finally, if EcoHouse were located off-campus, the college would lose a valuable opportunity to invest in green technology on a micro level.

We have also considered the construction of a new structure in Grinnell. To optimize the efficiency and sustainability of a house, many factors, such as location and orientation, must be taken into account before the structure is ever built. In this respect, constructing a new house would be ideal. However, building an entirely new house is not an option for most community members, and therefore our lessons would not apply to them. Furthermore, ignoring stable pre-existing structures in favor of building a new house would be wasteful. This option would be the most costly and the least time efficient.

For these reasons, we strongly support designating a current off-campus college-owned house as a permanent EcoHouse.

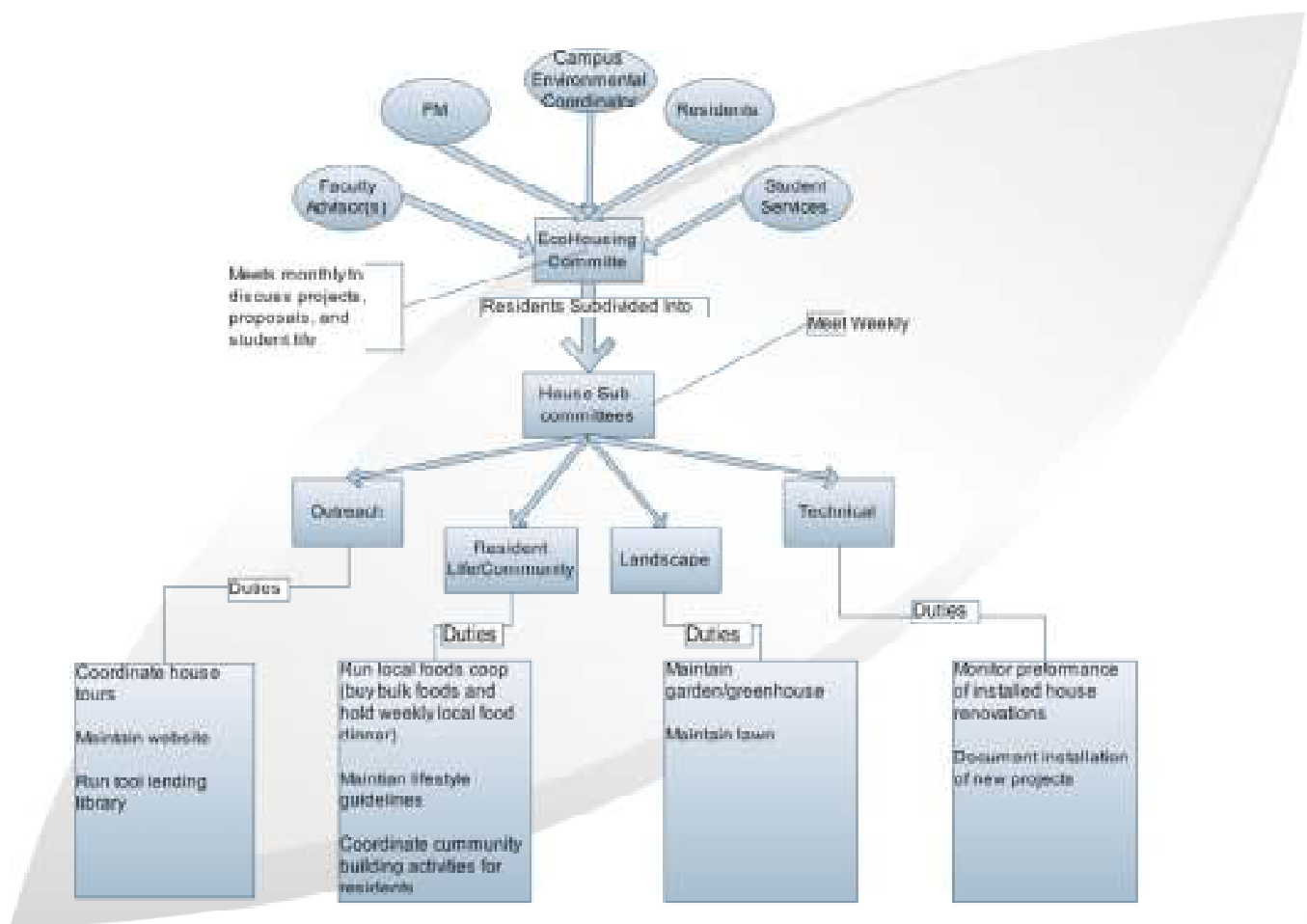
Governance

To make EcoHouse a permanent structure on campus, we propose to work with a faculty adviser throughout the process and to establish an EcoHousing committee, comprised of students, faculty advisers, the campus environmental coordinator, representatives from facilities management, and representatives from the residence life department. The EcoHouse Committee Structure diagram on this page shows the proposed structure of the committee.

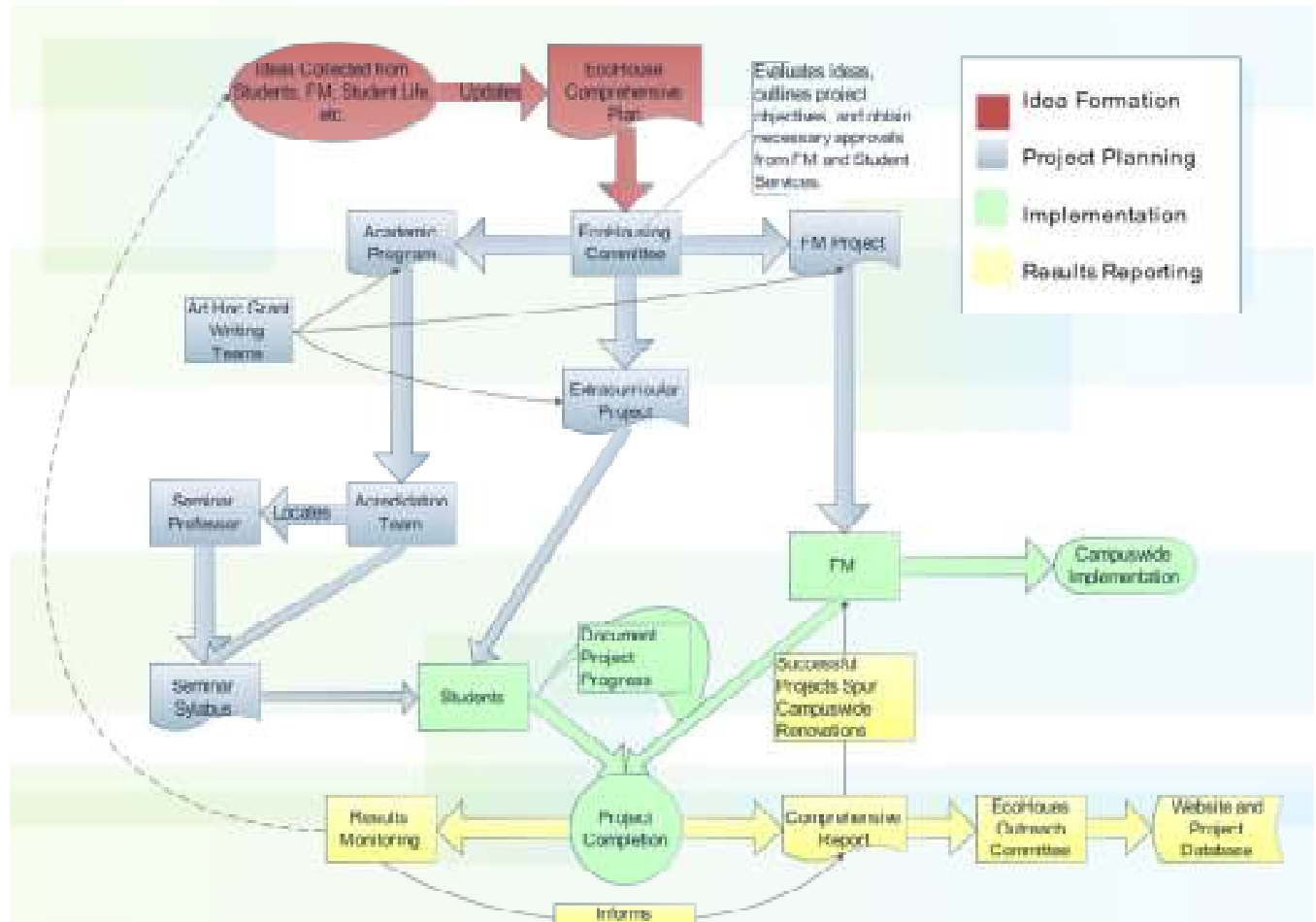
Duties of EcoHousing Committee

The committee would meet monthly to hear and evaluate proposals for improvements to the house, obtain approval from FM and student affairs for large-scale changes, and write up detailed project plans and grant proposals. The process by which proposals will proceed to fruition is shown in the Project Proposal Flow on the following page. The committee would work with the students living in the house to coordinate daily life for residents, and house subcommittees would be formed as needed, meeting weekly to carry out the objectives of EcoHouse. Furthermore, the committee would establish lifestyle guidelines for residents on an ongoing basis.

EcoHouse Committee Structure



Project Proposal Flow



Academics

We firmly believe that EcoHouse will provide an academic opportunity for interdisciplinary learning and student research. It will be place for students to recognize the connections between public policy, personal practice, and technology. This supports the goals presented in the “Expanding Knowledge Initiative” to offer interdisciplinary experiences that “model the kinds of connections that we currently ask students to build as part of their liberal arts education.”² From our understanding the initiative (EKI) fully supports the mission of EcoHouse, which will develop liberal arts problem-solving and analysis skills with real-world applications. EcoHouse will teach students to examine, change, and improve the environmental practices.

Interdepartmental courses

In Spring 2006, students in a “Local Foods and Grinnell College Dining Services” course prepared and presented a report for the Grinnell community; Dining Services is implementing portions of their plan. In a similar vein, another special course could assess energy use at Grinnell College. Although dorms are difficult to sub-meter, EcoHouse provides an opportunity to easily gather detailed data about energy usage. Energy monitoring will allow students to analyze the performance of energy-efficient technologies and behaviors. This will create Mentored Advanced Project (MAP) opportunities for students in several fields, including statistics, anthropology, economics, and physics. As with the Local Foods project, EcoHouse-related research will be presented to the Grinnell campus and community. Ideally, this will result in recommendations and suggestions that can be applied to wider Grinnell practices.

EcoHouse would fit nicely into the proposed Living Sustainably in Place (LiSiP) academic program as well as established Prairie Studies and Environmental Studies programs. By doing and living what they are learning, students will be intimately connected to the academic concepts. Sustainable living is rooted in science, but is not solely a scientific endeavor; the house presents an integrated approach to real problems that affect the world and would provide an excellent case study and example for all departments at Grinnell. Additionally, the work done by EcoHouse residents could be broadened into an academic resource for the entire campus community. Interested students and community members will come to EcoHouse to learn about alternative energy systems, taste local foods, and work in the gardens.

Environmental Projects

Along with its academic focus, EcoHouse can be integrated into other environmental projects. By living in EcoHouse, the Grinnell Area Local Foods Alliance (GALFA) intern, sponsored by GrinnellLink, will experience a space that integrates the lessons learned with daily life. The GALFA intern will maintain the house and practice its values. EcoHouse will also act as a bridge between the college and the town. Opportunities for collaboration exist with city and county governments, Imagine Grinnell, and utility providers. For example, as an extension of topics covered in Lonnie Gamble’s Renewable Energy course; students would work with the Chamber of Commerce to spread awareness of free energy audits and energy efficient renovation rebates offered by Alliant Energy. This project would not only make Grinnell homes more green but would also put money back in the pockets of community members.

EcoHouse and academic support

We feel a faculty advisor will be an essential component to maintain the educational focus of EcoHouse. He or she will facilitate communication with administration and assist in the students in structuring both academic and extracurricular activities. We have already worked extensively with Prof. Jon Andelson and believe that academic support, especially from the proposed LiSiP program, has been and will continue to be helpful. From the administration’s perspective, a faculty advisor will ensure future generations of students live up to this proposal’s

² “Expanding Knowledge Initiative and Re-engaging in the Liberal Arts”. Grinnell College Board of Trustees. April 18, 2005, <http://www.grinnell.edu/offices/Dean/eki/includes/EKIProposal.pdf>.

expectations. We realize a permanent project house is a privilege that demands the continual respect and dedication of students. .

Eventually, EcoHouse could incorporate a one- or two-credit seminar which would be suggested for residents but open to other interested students as well. Students could meet regularly with faculty to discuss projects and readings related to sustainability. This education will keep students—and Grinnell College—at the forefront of emerging technologies

Energy

While we often think of the physical structure of a house or building as an isolated entity, we ignore the vital and constant flow of energy into and out of the house. With EcoHouse we hope to minimize energy wasted through many forms of inefficiency. At the same time, we hope to source the remaining necessary energy from locally generated renewables. 21.2% of energy use in the United States and 19.1% in Iowa come from residential sources³. EcoHouse will be a testing ground for energy efficient renovations on campus.

Many other colleges, including Oberlin, Denison, and Macalester have created similar houses to great success. Ideally, EcoHouse will not be unique; instead it will become a model for all houses owned by Grinnell College. Once it is determined whether a certain measure is efficient and feasible in EcoHouse, the college can more confidently invest in the same renovations in other buildings. In addition to creating change in the college community, we hope to show that it is cost-effective in the long term for the homeowner to improve the energy efficiency of their house.

Feasibility

The specifics of what can be done to increase the energy efficiency of a single home are dependent upon the individual characteristics of the building, but some general principles can be followed to make a building more energy efficient. Starting with a free home energy audit from a local energy company is a great way to start. These include blower door tests, appliance assessments, heating system checkups, etc. Additionally, non-traditional audits such as those typically done by Martha Norbeck, a beyond-sustainable building designer from Iowa City, can lead to innovative and effective renovations.⁴

To fully appreciate the intricacies of home energy renovations, the residents of EcoHouse would play an active role in the investigative and implementation stages. This can include studying the blueprints of the house, personally testing the efficiency of the house, and implementing the actual physical changes. Even when the energy conservation renovations are too complex or dangerous for the residents to do without liabilities or intensive training, they can still take part by observing and recording the process. In this type of situation FM or professional contractors, electricians, etc. could be brought in to assist with the project.

Monitoring

To understand EcoHouse's impact and efficiency, we feel that it is vitally important to monitor our energy usage. By installing an energy monitoring system, the residents will be able to see first hand the implications of their actions in terms of energy usage. Software packages can track and display the real time specifics of home energy consumption and its cost. An energy monitor, placed in a central area, can provide important data concerning seasonal differences in energy consumption and allow for further improvements in energy efficiency. Up to date information on energy consumption will not only help EcoHouse residents understand the intricacies of energy usage, but will also give the college and community crucial statistics about how efficient the any house can become with some basic green renovations.

Heating & Cooling

Over half the energy used in the typical home goes towards heating and cooling, which makes these systems the ones that can benefit most from energy improvements.⁵ The most cost-effective renovations that can be done are improving insulation and controlling air leaks around windows and doors; and increasing the efficiency of heating

³ http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/rank_use.pdf

⁴ <http://www.biggreensummer.com/BigGreenSummer2007/Scholarships>

⁵ Xcel Energy Guide to Home Energy Savings Booklet

systems. We can also look into utilizing efficient hot water heaters such as rooftop solar hot water heaters or heat exchangers.⁶

During the summer months, central air conditioning accounts for 30% of total energy consumption in a typical home⁷. For this reason we will avoid using air-conditioning as much as possible. Instead we will use efficient and environmentally friendly options. Simple daily acts such as opening the windows at night and closing them during the day can make a big difference. Additionally, a whole-house fan could draw cool air through the windows and the lower levels of the house and force warmed air out through attic vents. Ceiling fans placed in bedrooms and other rooms can effectively cool down individual rooms.

Energy Sources

Solar

The sun's energy can be harvested for domestic use in numerous ways. For example, passive solar heating can supplement the house's heating system by letting in sunlight through south facing windows. Additionally, using natural light rather than from light bulbs during the day saves electricity. Although most houses have not been designed with passive solar in mind, there are ways to adapt a preexisting house for higher efficiency and heat retention. Also, the most efficient type of solar panel is solar water heaters, which have the ability to greatly improve the hot water heaters efficiency. The alternate and more expensive photovoltaic panels can send electricity back through the house and, on low-demand sunny days, might be used to heat water. The major drawback of solar energy is its day-to-day variability.

Wind

If the house that becomes EcoHouse is on the college grid, the wind turbines planned by Grinnell College could at some point provide some of the electricity for EcoHouse. Additionally, a small-scale turbine could be built out of recycled components, like the one present at the Maharishi University of Management in Fairfield, IA. Building such a turbine would be an innovative way to power the house and would further the administration's commitment to wind energy.

Geothermal

Geothermal heat transfer is an excellent example of a sustainable technology that can be used throughout the world. It relies on transferring heat from the upper six feet of the soil, where the temperature generally stays between 50 and 60 degrees Fahrenheit, regardless of climate. By transferring heat from the ground into the house, the heating and cooling costs would decrease dramatically. However, the addition of this system would be a major renovation and may not be feasible for a residence the size of EcoHouse.

Biofuels

Biofuels are a burgeoning technology that innovatively utilizes biological waste streams to efficiently produce a combustible fuel. There are two main methods of generating biofuels that could recover energy from waste streams from the Grinnell College campus:

1) An **Anaerobic Digester** would not only provide a source for biogas, but it would also be an outlet for food and other organic waste. Biogas is methane produced when organic wastes are broken down without oxygen. This gas could then be used for cooking in an oven or stove, or burned for heating the building. Another byproduct of this anaerobic digestion is the waste solids that collect. This material is prized as a natural fertilizer with a higher than average nitrogen content and is perfect for gardening.

⁶ http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-2_39041_40258-426-5_538_983-0,00.html

⁷ http://www.sdge.com/residential/res_energygoes.shtml

2) **Diesel engines** would utilize the waste vegetable oil from the campus and possibly the community. The simplest method of utilizing this oil is a diesel generator equipped to burn straight vegetable oil for excess power and heating. The more advanced method would involve converting the waste oil into biodiesel. This fuel could then be given to the campus community, including students, FM, or a cooperative.

Energy Uses

The feasibility of generating our own renewable energy is contingent upon modifying how we use that energy. For example, solar panels are not effective as a power source for a 50" plasma screen, but would be effective for smaller scale, less energy intensive appliances and technologies. Living in EcoHouse would require lessening our dependence on energy inefficient practices and living a simpler life.

Appliances

A home using appliances awarded with the Energy Star, a rating awarded by a government program that evaluates the energy efficiency of appliances, can substantially decrease annual energy costs. Energy Star qualified appliances use 10–50% less energy and water than standard models.⁸ Energy Star evaluates appliances ranging from clothes washers and dryers to televisions and light fixtures. Whenever buying new appliances we would try to buy Energy Star. However, we would try to find non-electric means to meet our needs, such as drying clothes on a line rather than using a clothes dryer on warm, dry days.

⁸ http://www.energystar.gov/index.cfm?c=appliances.pr_appliances

Water

Water, a vital resource to all living creatures, is quickly becoming a rare and precious resource⁹. In 2006, Grinnell College alone consumed over 6 million gallons; each Grinnell student consumed over 94 thousand gallons¹⁰. In the proposed EcoHouse we plan to implement changes to reduce water consumption. Ranging from rainwater collection to efficient water heating to the disposal of used water, conservation must be considered at all levels.

Source

By capturing and using run-off and rainwater, we can ensure healthier, more environmentally friendly, and relatively inexpensive access to water. The necessary components in such a project would be water collection bins, purifiers, and a pumping system for the water. When residents collect their own water, there will be a heightened awareness of conservation. We recognize, however, that Grinnell College is in a region where rainwater is not always available, especially during the winter or times of drought. In these cases, the municipal water will be used as a supplement, while of course keeping the ideals of conservation in mind. With a water monitoring device, the residents will be able to self-monitor their water usage as a household

Heating

We plan to heat the water we use in an energy efficient manner. Three methods have been found to work well: solar heaters, biofuels, and excess electricity. Active solar heaters (direct circulation systems or indirect circulation systems) and passive solar heaters (integral collector-storage passive systems or Thermosyphon systems) have the smallest environmental impact, but in winter they may need to be supplemented by the other methods. While passive solar heaters are often cheaper than active solar heaters, they also tend to be less efficient. The type of water heater will be decided during the research period.

Efficiency

Water use can be reduced through a number of efficiency measures in EcoHouse. Efficient toilets as well as low-flow faucets and shower heads will reduce each resident's water use. Furthermore, systems that reroute water from sinks to toilets can be implemented in EcoHouse, allowing each unit of water to be used more effectively.

The lessons we learn from EcoHouse's water conservation efforts can be applied to other buildings, both on campus and in the community. By simply understanding the extent of personal water consumption or by implementing small changes like switching to low-flow showerheads, one can make a difference in reducing overall water use. When such changes are proved feasible within EcoHouse, it will not be a large step to create such changes on the campus and in the community.

⁹ UNESCO's World Water Development Report - http://www.unesco.org/water/wwap/wwdr1/table_contents/index.shtml

¹⁰ Grinnell College Environmental Indicators - <http://www.grinnell.edu/etal/green/indicators/>

Food

As our culture moves into the fast lane we eat only to refuel our bodies without considering how our choices can nourish, or damage, our community and environment. By consciously choosing to eat sustainable, locally produced foods, we support organic agricultural practices, lower carbon emissions, and connect with our neighbors in the local economy. We want to support small-scale farmers who grow a diverse array of crops, maintain biodiversity and enrich their soils with compost and other natural soil amendments. Responsible farmers in the Grinnell area, such as Andy Dunham and Ann Brau, strive for a closed loop system that relies on land instead of imported nutrients. In contrast, large-scale monocultures must apply chemical pesticides and fertilizers to artificially combat pests, soil depletion, and erosion. This system is not only expensive for the farmer, but also inflicts long-term costs on our environment by polluting water and soil systems. Furthermore, sourcing food from small-scale, local farms cuts carbon emissions; instead of trucking our food 1500 miles, we transport it from within our neighborhoods and regions. Aside from the environmental and economic concerns, however, local food offers an opportunity to nurture the close, interdependent community that, according to Robert Putnam, we have lost over the past few decades.

Although it will not be feasible to eat food only produced within 100 miles of Grinnell throughout the year, students in EcoHouse will make a conscious, focused effort to source our food locally and connect personally with the farmers who provide it. As part of this education, EcoHouse will include a small garden and attached greenhouse. Echoing the experiences that Barbara Kingsolver described in her recent book, *Animal, Vegetable, Miracle*, the students will learn first-hand about the energy and love required to nurture one's food from the seed to the table.

The Built Environment

An important aspect of the remodeling and operation of EcoHouse will be the removal or reduction of toxic and unsustainable products. Renovations will focus on flooring, paint, carpeting, and counter-tops. EcoHouse will also employ the use of non-toxic and natural cleaners to maintain these surfaces.

Flooring

For hard surface floors in the bathrooms and kitchen one option is natural linoleum, such as Marmoleum, a non-toxic and biodegradable product. Such products are also easy to clean and withstand moisture and abuse. Other options for hard surface flooring are sustainably harvested natural cork, bamboo, or local woods.

Carpet

Conventional carpeting is manufactured in a resource and energy intensive fashion. Such carpeting also abrades toxic particles, reducing the quality of indoor air. EcoHouse will invest in more environmentally sound options such as recycled and recyclable, non-toxic or natural wool carpeting.¹¹ (The latter, however, may not be the best alternative because of allergies).

Paint

EcoHouse will use safe, non-toxic paint that will not produce hazardous chemicals such as VOCs and Solvents.

Counter-tops

Sustainable options for counter-tops include bamboo, natural linoleum, and other natural and recycled materials. More information on different products and methods is available from Green Building Supply, a provider of environmentally friendly construction products, located in Fairfield, Iowa. When renovating, EcoHouse would do its best to ensure old materials being removed were recycled or disposed of in a safe manner, while trying hard to reuse as many old materials from the old design in the new one.

¹¹ <http://www.ecobydesign.com/shop/carpet/>

Landscape

EcoHouse is meant to be a showcase of various alternatives to standard environmentally degrading practices, so our landscape will contain both native prairie landscaping and food production as an alternative to soil degrading grass lawns and distant food sources. Food production will include both an outdoor garden and a greenhouse that may or may not be attached to the main house. Prairie landscaping will feature a small reconstruction of tallgrass prairie as well as a more formally designed area around the house featuring native perennial beds and a small lawn of two native species.

Native Landscaping

The small lawn will include path rush (*Juncus tenuis*) and Scribner's panicgrass (*Dicanthelium oligosanthos*), which are resistant to trampling and mowing. Path rush has its main growth period in the spring and summer whereas panicgrass is a cool season grass like Kentucky bluegrass. Having the two species thus means that the lawn will stay green all year round, as opposed to bluegrass, which senesces in the summer. Like the prairie plantings around campus, our prairie reconstruction will connect students and community members to the nearly extinct ecosystem that once covered most of Iowa. Unlike the three-inch roots of standard Kentucky bluegrass sod, prairie roots extend four to eight feet into the soil. Due to these extensive root systems, prairie plants decrease runoff, increase the fertility of the soil, and require no inputs of fertilizers, herbicides, or water.

Garden

Along with natural landscaping, EcoHouse could grow vegetables in an attached greenhouse and an outdoor garden, complimenting the larger space in the campus Community Garden. With sustainable, socially responsible food production as a part of our living space, the ecological footprint of our diets will shrink dramatically; instead of buying groceries shipped from Chile, we will harvest them from the backyard. During the growing season, vegetables from the outdoor garden will supplement fresh produce bought from local farmers. With season extension structures, such as cold frames and hoop houses, we will be able to eat greens and root vegetables from the outdoor gardens until late November. The greenhouse will remain warm enough in winter to allow us to continue harvesting hardy vegetables like Swiss chard, kale, and spinach. The garden and greenhouse will not only produce food, but will also provide an opportunity to recycle outputs from other systems. Runoff from the roof as well as the grey water from showers and sinks will provide water for irrigation. Food scraps will be composted to enrich the soil instead of adding to another landfill. The vegetable garden, greenhouse, and prairie landscaping will serve as a model for other students and community members, demonstrating several beautiful, useful, and ecologically friendly alternatives to traditional landscaping.

Waste

“Waste equals Food”

-William McDonough

In nature, resources move in cycles: the waste of one system serves as food for another. Wise and sustainable design of human systems aims to emulate this cycle, recognizing that whatever must be thrown away is a loss to society and a burden on the planet. EcoHouse will implement waste management programs that first reduce, and then work to eliminate our waste. Our effort will focus on four main areas: food, water, refuse, and renovation.

Food Waste

The scraps that we cannot use to nurture our bodies will be composted to nurture our soils. Vegetable peelings, egg shells, moldy bread, and dairy products will be turned into an outdoor compost heap or added to an indoor worm bin. Every three to four weeks, we will have enough finished compost to spread throughout our gardens. Unlike water-soluble fertilizers that contribute only to plant growth, compost enriches the soil over the long term by incorporating water-retentive organic matter and inoculating it with beneficial micro-organisms.

Alternatively, EcoHouse could use a methane converter to dispose of food waste and heat the house. A methane converter uses bacteria that process food waste into methane, which can then be burned as fuel for heating. In conjunction with efficient insulation, this system might eliminate the need for fossil fuels to heat the house.

Waste Water

Water waste can be divided into two categories: grey water, or the water from sinks and showers, and black water, or sewage. Grey water is a relatively clean form of waste, containing nothing more than a few soap suds or food particles. Instead of wasting grey water by mixing it with black water and pumping it into the sewers, we can put grey water to use in a number of household activities. For instance, grey water can be used to water lawns and gardens or to flush the toilet. Such practices can greatly reduce a house’s demand for water and eliminate needless waste.

Although black water poses a more complicated problem, other institutions, including Oberlin College have employed “Living Machines” that process sewage on a smaller, more ecologically sensitive scale. Living Machines are successful yet under-utilized alternatives to centralized facilities that depend on harsh chemicals. This decentralized, human-scale model processes waste in a series of connected aquarium-like tanks with unique communities of micro-organisms, plants, algae, and even fish. It is a beautiful, greenhouse-like space instead of a noxious environment. This purified water can safely be released into wetlands and prairie plantings. Such a system could conceivably be implemented at EcoHouse

Refuse

With modern society’s emphasis on convenience, many products are packaged in petroleum-based materials that can only be thrown away. Although EcoHouse alone cannot reverse this trend, we can commit ourselves to socially responsible consumerism. We will choose products with minimal packaging that is reusable, biodegradable, and recyclable. Food such as grains, peanut butter, beans and rice can be purchased in bulk, preferably from local or organic sources. For more detailed information, see the Food section. Ultimately, we hope that our model will inspire students and community members to collectively reconsider their contributions to our disposable culture. By working together, we could emulate Seattle’s model¹² and encourage local stores to offer significant rebates to consumers who shop with re-usable bags or eliminate plastic bags all together.

¹² “Under proposal grocery stores would ditch plastic bags,” *Seattle Times*,
http://seattletimes.nwsourc.com/html/localnews/2004127604_grocerybags16.html

Renovation

As we renovate EcoHouse, we will focus on minimizing the quantity of waste created in the process. We will donate the high-quality discards to an organization like Habitat for Humanity's Restore, bring the low-quality discards to a recycling facility and creatively brainstorm ways to meaningfully reuse the rest. We will research sources for recycled, local, and sustainably-produced materials. As we work through this process we will confer with Martha Norbeck, an ecologically sensitive builder based in Fairfield, Iowa, who will guide us by sharing her experiences designing and building Cypress Villages, a sustainable living community.

Funding

Renovations and implementations such as those discussed above will undoubtedly be a costly venture. However, some of the money will be recouped through savings on electricity and water bills. We propose the following options for financing EcoHouse's startup costs. See Appendix C for additional government incentive programs.

College

We hope to work closely with FM to implement changes on the house, allowing technologies to disseminate across campus following implementation within EcoHouse. Therefore, we hope that some portion of the funding for projects will come from FM. A startup grant from the college at large, perhaps approved by the trustees, could also help us fund the upfront costs we will face.

Outside Grants

We also expect to apply for funding from outside sources. For instance, Alliant Energy offers Residential Conservation Programs to provide assistance to households for purchasing efficient appliances and lower their energy use. Additionally, the newly created Iowa Power Fund may provide a funding source for energy efficiency projects.

Tax Credits

A number of tax credits for efficiency projects exist or will be enacted in the near future, reducing the cost of many of the EcoHouse projects. For instance, a 30% tax credit up to \$2000 for solar technology will be in place through 2008, significantly increasing the feasibility of solar installations. See Appendix C for more information. However, it is presently unclear whether Grinnell will be eligible for these credits and rebates.

Outreach

While the physical presence of EcoHouse alone will demonstrate both the environmental and economic rewards of sustainable living, the residents of EcoHouse must actively engage in demonstrating the social rewards. We plan on not only being an example for the community, but also engaging the campus and community in ways that will link with environmental justice

Campus Outreach

The changes that can be made to EcoHouse will have positive environmental impact, but the larger change will come from the constructive influence of EcoHouse on the rest of the campus. To “green” an individual house is a token gesture of environmental awareness, but to use that house as a laboratory and testing ground for future changes to the Grinnell College campus will result in tangible sustainable change.

Inculcating Green Behavior

Raising awareness of the easy steps that can be taken to make a residence more environmentally friendly will be a main objective of EcoHouse. Tours of the house will provide students an opportunity to see first-hand the changes made to EcoHouse and will encourage them to make similar changes in their own houses and lives.

College Network

Many of Grinnell's peer institutions are implementing similar improvements on their own campuses. Creating an information-sharing network among the Colleges and Universities could provide students a locale for environmental ingenuity and the means to collaborate with students of similar thought and enthusiasm. This network, whatever form it may take, could be created and maintained by Grinnell students living in EcoHouse.

Campus Events

Additionally, the Local and Vegan Food Co-ops could use EcoHouse as a place of gathering and food distribution. In addition to co-ops, environmental fairs could be organized by the residents of EcoHouse to raise awareness and bring the community together in fun, environmentally conscious ways.

Community Outreach

Showing the greater Grinnell community what can be done to make a home more environmentally sound will be a main goal of EcoHouse. We feel that if homeowners were shown definitively the viability and economic sense of home efficiency, they would be more likely to make changes to their own houses.

Tours

Scheduled tours of the house will provide visitors to Grinnell College an opportunity to see first-hand the changes made to EcoHouse: they will see what works and what doesn't. Guests can put their hand on a solar hot water tank and *feel* the heat collected on a cloudy day. Displays around the house will explain how a particular system works and lay out the costs and investment returns to an average consumer. Visitors to the house would leave with a cursory understanding of the options available to them and an example of their success; ready to make changes in their own homes.

Website

As an alternative to tours, EcoHouse would maintain a website showing the status of house projects and the results achieved by the environmentally friendly practices. Displays of energy and water use (already in place at

CERA¹⁰) could compare the performance of EcoHouse to the average Grinnell home. Running counters could track the energy saved by EcoHouse's green appliances. Students will post detailed records of cost-benefit analyses for house projects, including contacts and sources of materials. The website would be a wealth of practical information for anyone considering implementing the changes.

Audits

Even the most well-intentioned homeowners may not follow through with making changes if they do not know where to start. Alliant energy provides free energy audits, but people rarely sign up for them. We hope to help increase awareness and use of this service by providing a liaison between energy companies and community members. Students at EcoHouse can train themselves in the energy auditing paperwork and help community members sort through this process. If for some reason homeowners are ineligible for Alliant's audit, EcoHouse could also train a group to perform basic energy analyses on houses in the Grinnell community. Training students to perform full-blow audits may not be possible, since there would almost certainly be issues surrounding insurance and the student's ability.

Conclusion

EcoHouse will provide an innovative opportunity for Grinnell College to explore ways to live sustainably. The project will serve as a laboratory for environmental change on campus and provide an example for students and community members who want to lessen their footprint on this earth. Furthermore, the house will extend the college's burgeoning commitment to environmental consciousness and allow Grinnell to serve as a beacon of sustainability amongst our peer institutions and within Iowa. Iowa Governor Chet Culver has recently announced his desire to make the state the national capital of renewable energy. By sponsoring environmentally positive initiatives on campus, Grinnell would be partaking in a statewide movement to improve sustainability.

Now is the time to start exploring the possibilities of sustainable living. If the college embraces EcoHouse, it will, by extension, be supporting a movement toward implementing more efficient and more sustainable practices across campus. Further, EcoHouse will be a pilot project for the college and would eventually spur other campus buildings to adopt similar technology and become more efficient. Embracing the EcoHouse proposal will help the Grinnell community join in a critically important statewide and national dialogue about the sustainability of our world.

Appendix A: Potential Collaborators and Important People

Grinnell Faculty and Staff

- Richard Whitney, Associate Director of FM
- Chris Bair, Campus Environmental Coordinator
- Jen Krohn, Dean of Student Life
- Lonnie Gamble, Visiting Professor of Sustainable Living
- Eco Campus Committee
- Jonathan Andelson, Professor of Anthropology
- Mike Burt, Associate Director - Grounds, Landscape & Hauling
- Trustees

Grinnell Students

- SGA Housing Committee
- SGA
 - Student Initiative - STIFund
 - Joint Board Resolution
- Free the Planet
- Community Meal
- Vegan Coop
- S&B Cribz
- KDIC

Other Institutions

- Macalester College EcoHouse
- Oberlin SEED House
- Alliant Energy

Community Members

- Rich Dana, Cultural Engineer, Imagine Grinnell
- Duane Neff, Director of Building and Planning, City of Grinnell
- GALFA
- Andy Dunham, Local Farmer
- Compass Plant CSA
- Larry Goodrich, Chamber of Commerce

Appendix B: Resources

Overall Sustainability Sites

The Eco Gateway:

<http://www.ecoiq.com/onlineresources/>

EcoHouse, Green Venture, Ontario:

<http://new.greenventure.ca/>

The Energy and Environmental Building Association:

<http://eeba.org/index.html>

Green Campuses

A Coalition of Pre-K to 12th Grade Schools

<http://www.greenschoolsalliance.org/index.html>

ClimateChallenge.org's List of Participating Groups, with links to websites detailing their aims and actions

<http://www.climatechallenge.org/groups>

Harvard's Green Campus Initiative Website

<http://www.greencampus.harvard.edu/>

Philips Exeter's Website for Eastern Independent School's Green Cup Challenge

http://www.exeter.edu/comm/866_4265.aspx

Technology

Building Green, an amazing directory of green products:

<http://www.buildinggreen.com/>

Campus Center for Appropriate Technology, Humboldt University:

<http://www.humboldt.edu/~ccat/drupal-5/?q=node/9>

Chicago Green Homes Program

http://egov.cityofchicago.org/webportal/COCWebPortal/COC_EDITORIAL/CGHGuidev1.1.pdf

Energy Plus Energy Simulation Software, US Department of Energy:

<http://www.eere.energy.gov/buildings/energyplus/>

Energy Star:

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

GreenBean, A Chicago Based Sustainability Site:

<http://greenbean.typepad.com/>

Green Home Remodeling Series, Chicago Department of the Environment:

http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?BV_SessionID=@@@@1762527581.1199055481@@@@&BV_EngineID=cccfaaddmmdgjmgefecelldffhdfgn.0&contentOID=536962455&contentTypeName=COC_EDITORIAL&topChannelName=Dept&blockName=Environment%2FChicago+Green+Homes%2FI+Want+To&context=dept&channelId=0&programId=0&entityName=Environment&deptMainCategoryOID=-536887205

Habitat for Humanity's Restore:

<http://www.ivhfh.org/restore.main.cfm>

Xcel Energy Guide to Home Energy Savings Booklet

Appendix C: Example Project Houses

Ad Astra House, Kansas University:

<http://www.kansan.com/stories/2007/may/09/cooperative/>

EcoHouse, Berkeley, CA:

<http://www.ecologycenter.org/EcoHouse/EcoHouse.html>

EcoHouse, Carleton College:

<http://serc.carleton.edu/introgeo/campusbased/examples/EcoHouse.html>

EcoHouse, Macalester College:

<http://macalester.edu/EcoHouse/index.htm>

The Homestead, Denison University:

<http://student-orgs.denison.edu/homestead/>

Project Living Proof, Metropolitan Energy Center, Kansas City:

<http://www.kcenergy.org/plp/index.htm>

SEED House, Oberlin College

<http://www.cs.oberlin.edu/~jbarnard/csci100/seed/>

Appendix D: Potential Sources of Funding

Residential

Alternate Energy Revolving Loan Program: Loan for 50% of cost for project (up to \$250,000) that is paid back (zero interest) for up to 20 years:

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=IA06F&state=IA&CurrentPageID=1&RE=1&EE=1

Low Interest Energy Efficiency Financing: (\$1,500-\$25,000; 0-60 months at interest rate of 0% to 6.9%)

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=IA27F&state=IA&CurrentPageID=1&RE=1&EE=1

Residential Energy Efficiency Rebate Programs:

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=IA25F&state=IA&CurrentPageID=1&RE=1&EE=1

Institutional

Iowa Energy Bank:

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=IA05F&state=IA&CurrentPageID=1&RE=1&EE=1

Iowa Energy Center Grant:

<http://www.energy.iastate.edu/Funding/GrantProgram.htm>

Appendix E:

Grinnell College Environmentally Responsible Building Guidelines

Adopted: April 28, 2006

Grinnell College recognizes that environmentally responsible design should minimize the environmental impact and lifetime operational costs of college owned buildings. Building designs that are environmentally responsible promote energy efficiency, land stewardship and resource conservation, which, in turn, preserve the natural resources of the Grinnell community and the surrounding region. Financially, building design that incorporates life cycle cost analysis is important to responsible long-term fiscal planning for the College.

To the extent that their implementation is consistent with the mission of Grinnell College and incurs reasonable expenses, the set of building principles described below collectively provide the framework for all new major construction and major renovation of buildings on campus. Architects, contractors, engineers, landscape architects, and all others involved in building projects on Grinnell's campus are expected to follow these guidelines.

Grinnell College expects those involved in building projects on campus to:

- Design buildings to meet the “certified” standard of the United States Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) rating system. Each building project will be evaluated individually for pursuing LEED ratings beyond the “certified” level. Projects do not need to be certified through the USGBC, but must display the ability to earn the necessary points to meet certification standards. Architects and contractors should sustain a dialogue with college representatives when choosing which LEED points (i.e. environmentally responsible features) to pursue.
- Include an architect on the design team with environmentally responsible design experience. LEED Accredited Professionals are desirable. Architects with these credentials provide experience with the LEED certification process and facilitate efficient incorporation of environmentally responsible technology into building design.
- Evaluate a building’s lifecycle costs in addition to initial construction costs. Grinnell College will own and use newly constructed and renovated facilities continuously for decades. As such, the total cost of ownership, and not simply the initial cost, must be evaluated for all major building projects. Architects and engineers are expected to provide life cycle cost estimates of building systems during the earliest phase of building design. The college is particularly interested in receiving lifecycle cost estimates throughout the design process for the building envelope as well as the HVAC, lighting, and water systems.
- Use appropriate resource conservation technology to improve water and energy efficiency beyond industry baseline.

- Present for consideration building features which reduce environmental impact even if they have no economic payback. The college is willing to consider building features impacts that have no direct economic payback but reduce the negative environmental impact of the building. Examples of this type of building feature include native landscaping, using building materials made of recycled content and limiting storm water runoff.
- Use innovative technology only when a particular technology has proven itself reliable in the Midwestern climate. The college assumes all liabilities for campus buildings and seeks to limit the risks associated with ownership by using only reliable technologies specific to the college's situation.
- Recycle construction debris from both new construction and remodeling projects in an effort to minimize the waste that is sent to the landfill. All construction contractors must have plans for reducing construction waste.
- Conduct commissioning of the building energy systems throughout the design and construction process to ensure optimal efficiency.

Appendix F:

Grinnell College Emissions Reduction Commitment October 5, 2007

Grinnell College's commitment to the environment is expressed, among other things, in its statement on Environmental Responsibility and Environmentally Responsible Building Guidelines, in the sustainable design of its newest buildings, in the construction of a 50 kilowatt wind turbine, in a long-standing policy of improving the energy efficiency of its existing facilities, in developing prairie plantings and minimizing the use of fertilizers and herbicides, in the expansion of the use of local foods in our dining hall, and in programs to minimize waste. Recently, Grinnell College received the first gold LEED certification in Iowa for an academic building and LEED certification for our new dormitories. LEED certification for two other buildings is pending. More information on Grinnell College's commitment to environmental responsibility can be found at <http://www.grinnell.edu/etal/green/>.

Rather than resting on these accomplishments, we intend to take important further measures in environmental responsibility by making a commitment to reduce Grinnell College's carbon emissions 20% below anticipated 2010 levels. Eschewing indirect reductions through the purchase of carbon offsets ("green tags"), we intend to commit ourselves to directly reducing carbon emissions through on-going renovations and retrofits of existing facilities, efforts to inculcate "green" behavior on campus, important environmental initiatives linked to new buildings, and the construction of a utility scale wind turbine project. Implementing the above items would reduce carbon emission by at least 20%. The first two actions are important aspects of environmentally responsible behavior among members of the college community. The second two actions can deliver truly significant reductions in carbon emissions.

Carbon Emissions at Grinnell College

The two largest sources of emissions are electricity and direct natural gas consumption. We estimate that current electricity consumption emits roughly 37 million pounds of carbon dioxide accounting for 66% of campus emissions. Natural gas contributes almost 18 million pounds of carbon dioxide accounting for 32% of campus emissions. Table 1 is a summary of our estimated emissions from FY2006. With new construction occurring through 2010, an increase of approximately 8 % is anticipated.

Table 1 Estimated CO2 Emissions for 2007/08 CO2(lbs.) %

Total 58,239,383

Emissions from gasoline 584,095 1

Emissions from diesel 206,142 .4

Emissions from burning of natural gas 17,999,526 32

Emissions from electricity production 39,449,620 66

Actions to Reduce Carbon Emissions by 20%**Action Item #1:** On-going renovations and retrofits

Goal: To continually increase the efficiencies of existing buildings

Practices:

- Convert existing pneumatic temperature controls to direct digital control to allow for accurate set point control in order to adhere to college temperature policy
- Upgrade lighting fixtures
- Increase control of lighting via motion sensors, daylighting control and scheduled control
- Install high reflectance membrane on flat roofs
- Convert existing chillers to variable speed compressors
- Improve efficiency of exterior lighting (pole and building mounted)
- Install vending misers on vending machines
- Window retrofits
- Improve steam line insulation
- Install photovoltaic panels on existing buildings
- Replace residential furnace and air conditioning units with high efficiency units
- Continue to evaluate emerging technologies i.e. fuel cells

Impact on emissions: As buildings age, efficiency is often reduced. At the very least, such renovations will help maintain emission levels, but improvements in technologies should lead to emission reductions.

Action Item #2: Efforts to inculcate green behavior on campus

Goal: To continue to educate the campus community about environmental responsibility and what individuals can do to lessen energy use (as well as lessen the production of waste and promote health).

Practices:

- Expand the Dorm Environmental Coordinator Program to provide in-house point person to provide information and feedback about recycling and waste issues
- Create a dorm by dorm study break program where the Environmental and Safety Coordinator and the Dorm Environmental Coordinators educate students about efforts to reduce environmental impacts, as well as the role students can play
- Create a “Green Grinnell” “publication” that points out environmentally friendly technologies on campus
- Pursue the possibility of expanding electricity and water sub-metering to allow for real-time data collection of consumption, especially in dorms
- Continue to explore curricular links to local and on-campus environmental issues

Recent practices have included adjusting thermostat set points where appropriate.

Action Item #3: Install energy efficiency measures for Athletics Phase II and demolish the Physical Education Complex

Goal: Limit increase in or reduce energy consumption due to new construction.

Practices:

- Install ground source heat pump to heat, cool, and dehumidify natatorium
- Increase insulation in building envelope
- Install high-reflectance roof
- Utilize high efficiency windows
- Utilize air-to-air heat recovery technology
- Install extensive lighting controls
- Install high efficiency light fixtures
- Demolish the PEC

Impact on Emissions: Reduction of approximately 7% of campus emissions. Geothermal will reduce emissions from Athletics Phase 2 by approximately 12%, or 2% of total campus emissions. Demolition of the PEC will reduce building footage in 2010 by 5% with a resultant reduction in emissions related to this energy-inefficient building of at least 5%.

Action Item #4: Construct a utility scale wind turbine project

Goal: Replace 30% of campus electricity consumption with renewable wind energy.

Practices:

- Install approximately 3 to 4 Megawatts of wind generation
- Install an electric boiler to consume excess electricity generated and offset natural gas emissions

Impact on emissions: Such an installation should reduce carbon dioxide emissions by at least 25%.