FSU/SESEC presents: theOGZEB

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**Purpose of the Project**

The Off-Grid Zero Emission Building (OGZEB) is a prototype for buildings that will meet the needs of our current lifestyle while also protecting our environment. This project involves the design, construction and operation of a completely solar-powered building that achieves Leadership in Energy and Environmental Design-New Construction (LEED-NC) platinum certification. The OGZEB will be a combination of staff offices and living quarters for graduate students, providing a real world testing scenario for alternative energy and green technologies.

Designed by local professionals and Florida State University (FSU) faculty and graduate students, the OGZEB is the ideal combination of cutting edge technology and occupant livability. It was the goal of the design team to create a building that is completely environmentally friendly, while ensuring the comfort of the people living and working in the building. The OGZEB not only serves as an accomplishment in green building but also serves as a tool for educating the public and developing new and innovative technologies.

Each system in the house will be monitored to determine its cost-benefit ratio which will allow companies to optimize their technologies from real world data. This data will allow companies to provide economically viable products that best serve the consumer. The house is an incubator for the technologies that will make green housing affordable. The OGZEB is an opportunity to show the world that we can protect our planet without sacrificing our current way of life; the ability to combine comfort and environmental innovation is not only desired but a reality.

**Project Description**

The sun is the primary source of energy on the earth: the sun provides energy for the earth’s plants, winds, water currents, and thermal patterns. This project mimics the natural patterns of the earth by relying on the sun’s energy to power all aspects of a home and office combination.

Since the sun’s energy is not consistent throughout the entire day, excess energy produced by the sun during daylight hours will need to be stored to provide energy to the house during non-daylight hours. The typical solution to this problem is the use of high efficiency batteries for energy storage. However, high efficiency batteries are extremely expensive, use harsh chemicals and they have a limited lifetime.

The OGZEB will use the excess energy produced by the photovoltaic (PV) panels, also known as solar panels, to produce hydrogen. This hydrogen will be produced using a highly efficient water electrolysis device that is currently being developed at the Sustainable Energy Science and Engineering Center (SESEC). It will be stored until energy is required by the house, at which time the hydrogen will be fed to an innovative fuel cell, which is also being developed at SESEC. The fuel cell will convert the hydrogen to the energy that the house needs. This project will not be the first to use hydrogen as an energy storage medium, but it will be the first to employ innovative and affordable hydrogen technologies that are being developed at FSU and not currently commercially available.

The OGZEB, being a test bed for alternative energy and environmentally friendly appliances and building practices, will be used by numerous companies for development and
testing of hydrogen technology. Some of the companies that have partnered with SESEC for hydrogen research are Solaire, Rinnai, Pure Choice, Johnson Controls, Haskel International and solarenergy.com. Other companies, both local and international, are supporting this project by donating products and services. Some of these are PBS&J, Water Furnace, Lumber Liquidators, TLC Engineering, Renew Aire, Eco-Smart, Mad Dog Design and Construction Company, and Gilchrist, Ross and Crowe Architects. Unlike other testing methods for hydrogen technology, the OGZEB will provide real results by monitoring every aspect of the house while the house is being lived in.

One of the largest consumers of energy in the house is water heating. Hot water will be generated through the use of an on-demand hot water heater that will be modified to use hydrogen as its working gas. The use of hydrogen to meet these needs is unique to this project.

High efficiency electronics and lighting, along with excellent insulation, will greatly reduce the energy needed to make the atmosphere in the building comfortable. The OGZEB will include low energy, spectrally selective windows, LED lighting, low air infiltration, extensive use of passive solar heating and day lighting practices.

Environmental consciousness is also considered during the design and construction of the OGZEB. Every attempt will be made to build the home with recycled and recyclable materials that are not detrimental to the environment during their creation and use. In fact, the design and construction of the OGZEB will be guided by the LEED Green Building Rating System, which has been developed by the United States Green Building Council (USGBC/www.usgbc.org). The LEED system is based on well-founded scientific standards and emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. There are four levels of certification in the LEED rating system: Certified, Silver, Gold and Platinum. Platinum LEED-NC will be pursued for the OGZEB which will make it the first such building in Florida.

The students and faculty of SESEC, in close collaboration with local architects and engineers, have designed the OGZEB so that it meets all of the above-mentioned goals, as well as all federal, state, local and university building codes. Construction on the OGZEB is anticipated to begin during the summer of 2007 with project completion during the fall of 2008.

Conclusion

The successful completion of the OGZEB will accomplish a number of goals. First, it will provide SESEC with a test bed for the further development of alternative energy based technologies that can be implemented in residential and commercial applications. This will allow SESEC to develop cost effective alternative energy solutions. Second, it will show that a building can be constructed that will exceed the needs of its occupants without burdening the local utility system or damaging our world during construction and operation. Due to its unique nature, it is expected that the OGZEB will attract a number of people for tours and garner positive national attention. It will also provide the faculty and students of SESEC with the experience required to be competitive in the Solar Decathlon 2009, the proposals for which must be submitted during Fall 2007. Lastly, and possibly most important, the OGZEB will expose the world to the benefits of sustainable, “green” building and engineering, as well as alternative energy sources through tours, presentations, and an online interactive website. The website will provide a comprehensive view of each system and product used in the house. It will educate design and construction professionals, as well as the public, to the pros, cons, and cost of each of the technologies used in the house. Individuals and professionals can pick and choose from the items they learn about to design a green building within their means. It is SESEC’s goal to use the OGZEB to develop affordable green housing, allowing the allure of green to be within everyone’s grasp. This type of exposure is necessary to change public opinion and overcome some of the negative stereotypes that have been promulgated regarding these types of technologies.
Special Features of the OGZEB:

- Hydrogen Appliances – (Burn hydrogen rather than natural gas, cleaner)
  - Water Heater
  - Stove/Oven
  - HVAC
- Rain Water Collection
  - Store water for irrigation purposes
  - Manage storm water run off
- High Efficiency Water Use
  - Low flow fixtures
  - Recycle grey water
- High Efficiency Lighting
  - LEDs
    - Reduce power consumed
    - Reduce heat emitted by lights
  - Passive Solar Skylights
    - Harness sun light efficiently
    - Our Design reduces heat transfer
  - Reduce Light Pollution
    - Prevent light from escaping building and effecting the environment
- Completely Solar Powered
  - Solar Cells provide electricity
  - Collectors Concentrating Solar Provide
    - Hot water
    - Solar Heat Powered HVAC
- Hydrogen Production and Use
  - New electrolyzer developed by SESEC
  - New fuel cell developed by SESEC
- Construction Waste Management and Reuse
  - Design the building based on available materials to reduce building waste
  - Reuse when at all possible
- Regional Materials
  - Utilize materials within a 500 mi radius of Tallahassee
- Rapidly Renewable Materials
  - Use materials that take under 10 yrs to grow
  - Easy to replace and less detrimental to the environment
- Data Collection
  - Collected data
    - Inside conditions
    - Outdoor air used in house
    - Ventilation and emissions
    - Lighting effectiveness
- Platinum Certification from the United States Green Building Council
  - Highest Level of Certification
  - One of only 20 buildings with this level of certification
Who is the USGBC?

Core Purpose

The U.S. Green Building Council’s core purpose is to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life.

Who is the U.S. Green Building Council?

The U.S. Green Building Council (USGBC) is the nation’s foremost coalition of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. Our more than 6,000 member organizations work together to develop a variety of programs and services, and forge strategic alliances with key industry and research organizations and federal, state and local government agencies. Our collective power is leading the transformation of the building industry and market to sustainability. Council programs are Committee-Based, Member-Driven, and Consensus-Focused. Click on the links below to learn more about:

- The LEED® Green Building Rating System™
- The annual Greenbuild International Conference and Expo
- Educational offerings, including LEED workshops and the LEED Professional Accreditation program
- Tools for federal, state and local government agencies
- Green building research and publications
- Local and regional advocacy and education

What is the LEED Certification?

The LEED (Leadership in Energy and Environmental Design) Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. USGBC’s members, representing every sector of the building industry, developed and continue to refine LEED. LEED standards include:

- LEED-NC: New commercial construction and major renovation projects
- LEED-EB: Existing building operations
- LEED-CI: Commercial interiors projects
- LEED-CS: Core and shell projects
- LEED-H: Homes
- LEED-ND: Neighborhood development
- LEED Application Guides: Retail (currently in pilot), Multiple Buildings/Campuses, Schools, Healthcare, Laboratories, Lodging

Product Manufacturers and Service Providers: Learn how you can get involved with USGBC and LEED.

LEED was created to:

- define “green building” by establishing a common standard of measurement
- promote integrated, whole-building design practices
- recognize environmental leadership in the building industry
- stimulate green competition
- raise consumer awareness of green building benefits
- transform the building market

LEED provides a complete framework for assessing building performance and meeting sustainability goals. Based on well-founded scientific standards, LEED emphasizes state of the art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED recognizes achievements and promotes expertise in green building through a comprehensive system offering project certification, professional accreditation, training and practical resources. Click below to view the LEED Foundations documents:

- LEED Committee Charters - describes the purpose and scope of each LEED Committee
- LEED Foundations Policy Manual - describes USGBC policy for consensus based development of the LEED family of products
- LEED Product Development Handbook - describes the operating procedures for management and administration of LEED Products
Supporting the Sustainable Design Project

For more information on:

The OGZEB:

Justin Kramer
(850) 445-3432
jkramer@sesec.fsu.edu

How to make a donation:

John Gerhm
(850) 410-6600
jgerhm@foundation.fsu.edu

In making a gift:

Make Checks Payable to:
Florida State University Foundation
For: College of Engineering Sustainable Design Project

Mail To: John Gehrm
FSU Foundation
2010 Levy Avenue
Building B, Suite 300
Tallahassee, FL 32306-2739
Appendix A:
OGZEB Budget
<table>
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Appendix B: Energy System
OGZEB Energy System

Solar Panels

Daytime Electrical Needs

Hydrogen Production (water electrolysis)

Fuel Cell (for nighttime electrical needs)

Appliances
- On-Demand Hot Water
- Range
- Refrigerator

HVAC (absorption-based)
Appendix C: Design Plans
FSU Zero Emission House
SESEC
Sustainable Energy and Engineering Center
Florida State University
Construction Documents
May 04, 2007
46'-2 1/4" 13'-11 1/4" 18'-3" 14'-0"

FLASHING EXTENSION AT WINDOW SHOWN

AWNING WINDOWS

FLASHING

FIXED CLERSTORY BEYOND

PRESSURE TREATED WOOD STAIR AND RAIL AND RAIL

SOLAR PANELS BEYOND PROVIDED BY OWNER INSTALLED BY GC

LIGHT SHELF

8" SIPS ROOF PANEL

METAL ROOF PANELS OVER WP UNDERLAYMENT

PLANTER RAIL SYSTEM TYPICAL

PRESSURE TREATED WOOD STAIR AND RAIL AND RAIL

CONT WOOD FASCIA

WOOD TRIM

LIGHT BEYOND

EXTENSION WINDOW SHOWN

LIGHT BEYOND

LIGHT BEYOND

PLANET RAIL SYSTEM TYPICAL

8'-6" CHAIN LINK FENCE

6'-0" CHAIN LINK FENCE

HEAVY DUTY
Appendix D:
United States
Green Building Council
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Map of the Nation's Platinum and Gold LEED® Certified Buildings

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Current as of 04/11/06