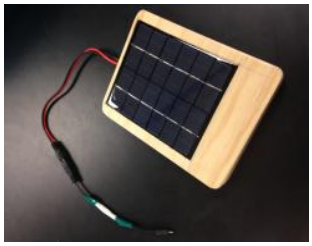
3rd Annual Elizabethtown College Sustainability Symposium

April 15th, 2014 Gibble Auditorium

Moderators / Organizers:
Dr. Tomás Estrada, Dr. Joseph Wunderlich

12:50pm

DEVELOPMENT OF AN ENGINEERED DRAINAGE TILE FOR NITROGEN MANAGEMENT
Daniel Gresh, Anthony Fraccica
Mentor: Dr. Brenda L Read-Daily

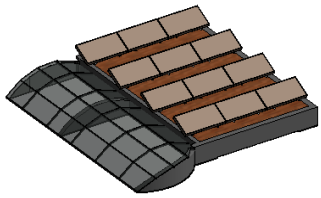


1:10 pm

RECHARGING THE GAMBIA: RESEARCH AND DEVELOPMENT
Anthony Fraccica, Joshua Frey, Tuyen Le, Courtney Warlick
Mentor: Dr. Kurt DeGoede

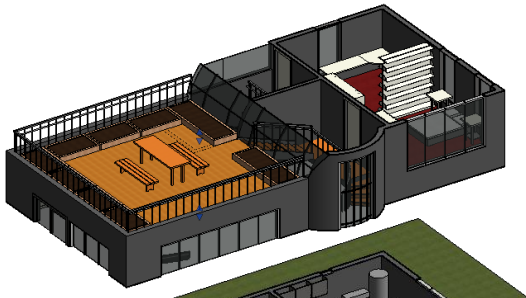
1:30pm

FUTURE ENERGIES AND SUSTAINABLE TECHNOLOGIES (FEAST) CLUB PROJECTS
Jack Hess, Matthew Klempa, Kimberly Kim
Mentor: Dr. Tomás Estrada



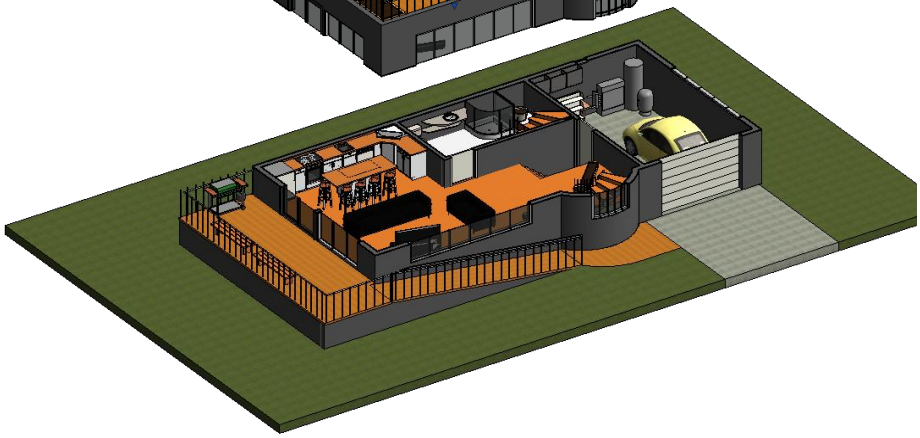
1:50 pm

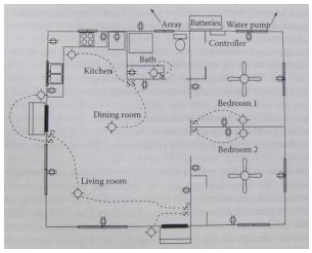
HIGH-TECH SMART HOUSE
Vaclav Hasik, Kaylee Werner
Mentor: Dr. Joseph Wunderlich



2:10pm

OFF-GRID PHOTOVOLTAIC SYSTEM DESIGN
David Boretti Mentor: Dr. Kurt DeGoede





2:30 pm

DESIGN OF A RAINWATER COLLECTION AND PURIFICATION SYSTEM
Andrew Fetterman, Vaclav Hasik, Jack Hess
Mentor:
Dr. Brenda L Read-Daily

2:50pm

ROBOTICS AND MACHINE INTELLIGENCE
Alexander Barrow, Kelvin Jerry, Omar Zabala, Christian Peeters
Mentor: Dr. Joseph Wunderlich, Design and Technology-Transfer Studio

3rd Annual Elizabethtown College Sustainability Symposium

Tuesday, April 15th, 2014 Gibble Auditorium Moderators / Organizers: Dr. Tomás Estrada and Dr. Joseph Wunderlich

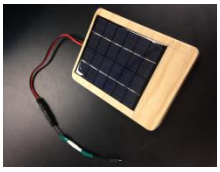
12:50pm **DEVELOPMENT OF AN ENGINEERED DRAINAGE TILE FOR NITROGEN MANAGEMENT** #201

Daniel Gresh, Anthony Fraccica Mentor: Dr. Brenda L Read-Daily

Nitrogen pollution due to agricultural runoff threatens aquatic ecosystems across the nation. The use of drainage tile exacerbates this problem. Drainage tile improves soil condition by removing excess groundwater which is essential for successful crop yields, yet it provides an efficient conduit for nitrates to reach receiving waters. This research focused on developing an engineered drainage tile containing elemental sulfur that would provide efficient drainage but also promote denitrification. The sulfur serves as a location for sulfur-based denitrifying bacterial communities to grow while also supplying the necessary electron donor for denitrification. Two alternative prototypes were developed with an additional control drainage tile. We used small sections of perforated polyethylene tubing inside containers later filled with soil. The engineered drainage tiles contained a layer of elemental sulfur particles, which were layered within a drainage sleeve and within another larger drainage tile. To mimic rainfall, a pump delivered water to gutters with drilled holes that sit on top of the plastic containers to drip water to the soil. Outflow was collected and measured. We tested the three configurations by measuring the outflow as a function of time under low and high flowrate scenarios, resulting in flowrates statistically similar for each of the tiles meaning that the engineered tiles essentially perform the same as a traditional tile. Future research will explore the engineered drainage tile's capacity to remove nitrates. We will supply the systems with nitrate-containing water and measure the nitrate removal rates of the engineered drainage tiles.

1:10 pm **RECHARGING THE GAMBIA: RESEARCH AND DEVELOPMENT** #202

Anthony Fraccica, Joshua Frey, Tuyen Le, Courtney Warlick Mentor: Dr. Kurt DeGoede



The Gambia is a West African country of very small proportions. Work is scarce, the economy is poor, and electricity is very unreliable. A small group of engineers have taken on the challenge of making life a little simpler for the people of The Gambia by implementing cost efficient sustainable energy appliances. As a continuation of last year's progress, our group has worked to finalize a cell phone charger that is solar powered and is compatible with many common cell phones used by the people of The Gambia. Field testing of the prototypes is currently being underway in The Gambia. Our group has also started to design a device that uses a falling weight to generate enough electricity to power lights for a residential home for use at night. This will give individuals the ability to complete activities after the sun sets, without need for costly and often unreliable batteries. We are looking into using this design as a charger as well, to charge phones and other devices when the grid and solar power options are not available.

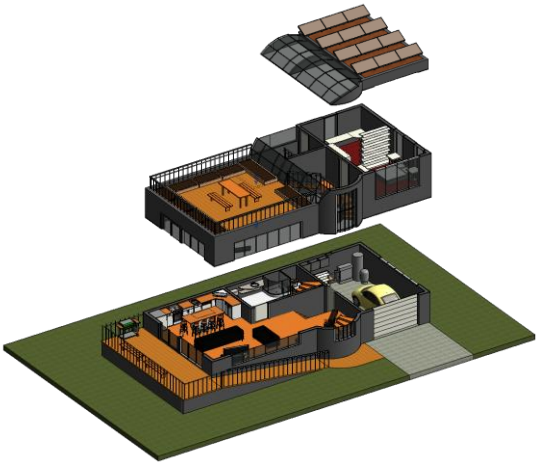
1:30pm **FUTURE ENERGIES AND SUSTAINABLE TECHNOLOGIES (FEAST) CLUB PROJECTS** #203

Jack Hess, Matthew Klempa, Kimberly Kim Mentor: Dr. Tomás Estrada

Members of the FEAST club present updates on the club's activities, including past (history, mission, and motivation), present (current projects), and future (projects for new students to become involved in).

1:50 pm **HIGH-TECH SMART HOUSE** #205

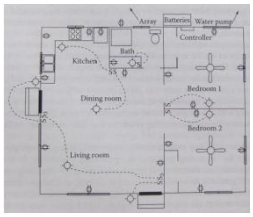
Vaclav Hasik, Kaylee Werner Mentor: Dr. Joseph Wunderlich



The High-Tech Smart House project is an initial step in the vision of Elizabethtown College entering the Solar Decathlon competition. This competition encourages students to design sustainable living units able to supply all of its needed energy. We specifically focused on implementing advanced technologies in order to create a smarter and more efficient house. Elements that were the focus to this design included the environmental/ecological impact, psychological and physical advantages, and advanced technologies for innovations. An Artificial Neural Network was considered for our central control system that was in charge of sustaining and tracking the green technology and energy utilizations. We considered a vast range of internal systems to implement into our design, which touched on all the main components in house plans.

2:10pm **OFF-GRID PHOTOVOLTAIC SYSTEM DESIGN** #204

David Boretti Mentor: Dr. Kurt DeGoede



For this project a technical report was prepared appropriate for obtaining permitting and working with an electrical contractor for installation for an off-grid PV power system. The system is for a two bedroom cabin located near Sault Sainte Marie, Michigan. The customer only uses the cabin between the months of March and October. The cabin is their full-time residence between March and October. The system also pumps needed water with PV power. They use a pellet stove for heat and use propane for the range/oven, clothes dryer, and hot water heater. There are two separate systems involved in the overall design of this project. The first system is the water system, which involves a water pump, a tank, and a solar panel. The second system involves all of the electrical loads that the cabin will need. This includes loads such as the lights, fans, appliances, bathroom, and a small surplus of additional receptacles for miscellaneous items. The design for this system includes an array of solar panels, an inverter, batteries for storage of the energy, and a charge controller. The final piece of this project was a back-up generator, which was recommended for emergency back-up power.

2:30 pm **DESIGN OF A RAINWATER COLLECTION AND PURIFICATION SYSTEM** #206

Andrew Fetterman, Vaclav Hasik, Jack Hess Mentor: Dr. Brenda L Read-Daily

Our task is to design and construct a rainwater collection and purification system to provide drinking water for the Engineering and Physics department. Our installation in the Solar Cabin is also a concept model for a village hub in a developing country. Water is the most important substance for life on earth, and is likely to become much scarcer in the future due to climate change and population booms. Currently, many houses and shelters divert storm water off of the roof of the building and away from the foundation when this water could be collected and used. Our proposed system will allow the department to supplement water use to simultaneously save money and lower its environmental footprint. The system is able to hold enough drinking water to supply the department for up to three weeks. The system should cost less than $600, including the installation costs. In addition our system can be modified to function year round in a variety of climates. The system will have three main components: collection, filtration, and storage. Frequency, length, and intensity of storms all play an important role in determining how much water can be collected and stored. Filtration should rid the water of sediment, toxins, and microbes in order to ensure the health and safety of the consumers. All of these features should be designed to minimize cost and maintenance. With the completed system, the department will more efficiently access the water in the hydrologic cycle, reducing its environmental footprint as well as water costs.

2:50pm **ROBOTICS AND MACHINE INTELLIGENCE CLUB** #207

Alexander Barrow, Kelvin Jerry, Omar Zabala, Christian Peeters

Mentor: Dr. Joseph Wunderlich, Design and Technology-Transfer Studio