IPRO 337 Project Plan
Spring 2008

Zero Energy Lab

Advisor: Nancy Governale-Hamill

1.0 Objectives

The IPRO 337 team's objectives for this semester is to make further progress in updating the top floor of Machinery Hall into a lab for future energy and lighting technology research and for the space itself to be able to be as sustainable as possible throughout research this semester. Since the end goal is a rather ambitious one, a more realistic goal is to have an energy plan for following IPRO's to work off of and to have the space cleared so that the developed plan can be tested. The team hopes to generate willingness in its members to establish an environment conducive to team-oriented goals, as outlined in the objectives below. Successful completion of the goals presented here will require each participant to gain useful experience and knowledge regarding teamwork, inter-professional skills and specifically sustainable energy systems. For this fall semester, the team has set forth the following objectives:

- Research office utilities that consume low amounts of energy, and investigate how to improve the efficiency of current utilities.
- Research and test various energy efficient lighting solutions.
- Research environmentally friendly floor, wall, and ceiling finishes along with necessary office furniture.
- Develop a website to display the development progress of the Zero-Energy Lab and provide information regarding "green technology"
- Clean and prepare the 6,000 ft^2 space for future inhabitants.
- Using the research, develop a program proposal for the Zero-Energy Lab.

2.0 Background

IPRO 337: Zero Energy Lab is a project dedicated to devising a comprehensive zero energy solution for the Zero Energy Lab atop Machinery Hall. Last semester, the IPRO team investigated potential technologies and methodologies including the use of photovoltaic arrays and wind turbines for power generation, battery systems for energy storage, passive cooling and heating systems, desiccant systems, and various devices native to the laboratory environment. These technologies presented unique challenges and issues to the team, as many of the systems that were to be put into use were (and still are) either experimental or have not been used in this fashion. Several things came out of the last IPRO, including a proposed solar cell / hydrogen fuel cell hybrid system to supply energy to the Zero Energy Lab, a passive climate control system, and the idea that the Zero Energy Lab could be a place where individuals from all aspects of science and engineering could come together, collaborate, and educate one another.

This semester, the goal for the Zero Energy Lab is to create testing mechanisms for various renewable and green technologies and methodologies. Different groups will investigate different aspects of these technologies and methodologies and will be divided into various categories such as lighting, technology, and furnishings. By the end of the semester, the team hopes to have all of the groups come together and integrate their findings into a comprehensive package which will be implemented into the Zero Energy Lab.

3.0 Methodology

A. Design and implement an overall energy-efficient lighting solution for an office space using power supplied by a photovoltaic system or another found system that more efficiently saves energy in the space. Although an energy-efficient lighting system was our main starting point, a complete energy-efficient space encompassing all systems, i.e., HVAC, plumbing, etc., is the problem that we will attempt to solve.

B. In order to accomplish the problem set forth in part A, the team will conduct all group meetings on the site where the renovation is to take place in order to acquaint new team members with the space and provide inspiration. After a brief presentation of prior work and research conducted during last semester's IPRO, the team will then determine the next phase of the project. As a team, it is agreed upon that we will to research energy efficient technologies and ecologically friendly building materials for the space and while also displaying the status of the project via a website. Therefore, the team will be divided into 4 sub-teams to further investigate lighting techniques, energy efficient office technologies, “green” interior finishings, and web site development.
The first team will continue researching lighting techniques and schemes that will provide adequate light for all occupants of the space, while remaining energy efficient. The second sub-team will continue to investigate energy friendly office appliances and manners in which the efficiency of existing appliances can be improved. A third sub-team will research ecologically friendly interior finishes that will provide a welcoming and learning atmosphere. The fourth sub-team will develop and launch a website to display the progress of the zero energy lab and present the data collected by the other sub-teams. Once sufficient data has been collected by each sub-team we will then regroup and redefine tasks within the IPRO. During the ongoing research we will have scheduled visits to lighting warehouses and showrooms where we can get ideas about how to light the space. We will also have guest speakers come in to lecture us about LEDs, and other energy-efficient ways to light a space. We will visit other sites that have implemented energy-saving solutions and we will look at how much energy they save and see how we can do the same with our site. We will then develop a detailed program describing how renovate the space into an energy efficient and environmentally friendly zero energy lab.

C. In order to test possible solutions we will order sample products from different manufacturers and a mock up will be set up in order to test the solutions using the sample products. Each sub-team will develop a testing procedure to examine pertinent features of each product to be used in the lab. Using this procedure each sub-team will then test each product in a testing environment and record their findings, which will initially be posted on IGROUPS and finally on the zero energy lab website.

D. Each sub-team will carefully document their research and post it to IGROUPS so that the information is readily available to all members of the team. During field trips and guest speaker visits, notes and pictures will be taken by a designated member of the

IPRO team and will be uploaded to IGROUPS. During the mock-up stage, each sub-team will keep note of the energy usage differences with and without the systems we decided to test. Pictures will also be taken and all notes will be posted to IGROUPS.

E. Analysis of the test results will be conducted based off of the average amount of energy used by current products today and the amount of energy we save with the systems we implement. In addition to a side by side product analysis.

F. IPRO deliverable reports will be headed by two individuals from the IPRO team and as needed, those two will summon help from other IPRO team members to help with the IPRO deliverables. All who are responsible for parts will then upload their parts to IGROUPS and the two leaders of the IPRO deliverable reports will combine all parts, revise, and upload a final version to IGROUPS for all team members to review before final submission. This will be the protocol for all IPRO deliverable reports.

G. N/A

4.0 Expected Results

The lighting groups' activities will consist of designing, engineering, and building a room within the Zero Energy Lab, in which proposed lighting and finishes can be tested. The activities that will result from activities in this space will include moving forward with designing a final lighting solution for the Zero Energy Lab space. The website group expects to complete the website by mid semester. With the website complete, the entire IPRO team will be able to add new testing info to the site. The technical team's research will result in the acquiring and testing of claimed "low energy" devices, such as computer monitors, copy machines, and other various office equipment.

We expect our research and testing to result in the generation of a complete program for the Zero Energy Lab. This program will include architectural, construction, and electrical packages that will include costs and in-depth environmental/sustainability information. Potential products, such as lighting fixtures, could result from lighting design and testing. Continued research into a sustainable electrical energy system, as an extension from last semester, could result in potential patents.

The website could potentially evolve into a sustainability technology blog fueled by research done in the lab. The long term expectations for the lab is to become a place for interdisciplinary research into sustainability.

We plan to have the website available for viewing during the midterm report. We also hope to have the space cleaned and undergoing finishing by the end of the semester.

IPRO 337's main goal is to renovate the Zero Energy Lab space located on the top floor of machinery hall. With this goal in mind we believe that all goals we have set are fundamental to the labs development.

All research and testing of sustainable and environmentally friendly materials and products will help to develop the final package for the Zero Energy Lab and will subsequently be incorporated into the building of the space. We hope the development and maintenance of the website will lead to refining the website and evolve its purpose thereby increasing the Zero Energy Lab's presence on the web and in the sustainable community.

5.0 Project Budget

Item	Price	QTY	Price	Purpose
Florescent lights	$25.00	50	$1,250.00	To light Machinery Hall 400
60 bright LED bulb	$29.99	1	$29.99	Testing
18 bright LED bulb	$14.95	1	$14.95	Testing
Electrical Tape	$3.99	1	$3.99	Connecting wires
Wire nuts	$10.99	3	$32.97	Connecting wires
LED rope lighting	$17.99	2	$35.98	Testing
Motion Heat Sensors	$100.00	3	$300.00	Testing
Light Testing Box	$300.00	1	$300.00	
Sheet metal materials	$350.00	1	$350.00	Light reflectors
IPRO day	$150.00	1	$150.00	Poster and Presentation materials
Paint & supplies	$500.00	1	$500.00	Painting the interior of machinery hall.
TOTAL:			**$2,967.88**	

6.0 Schedule of Tasks and Milestone Events

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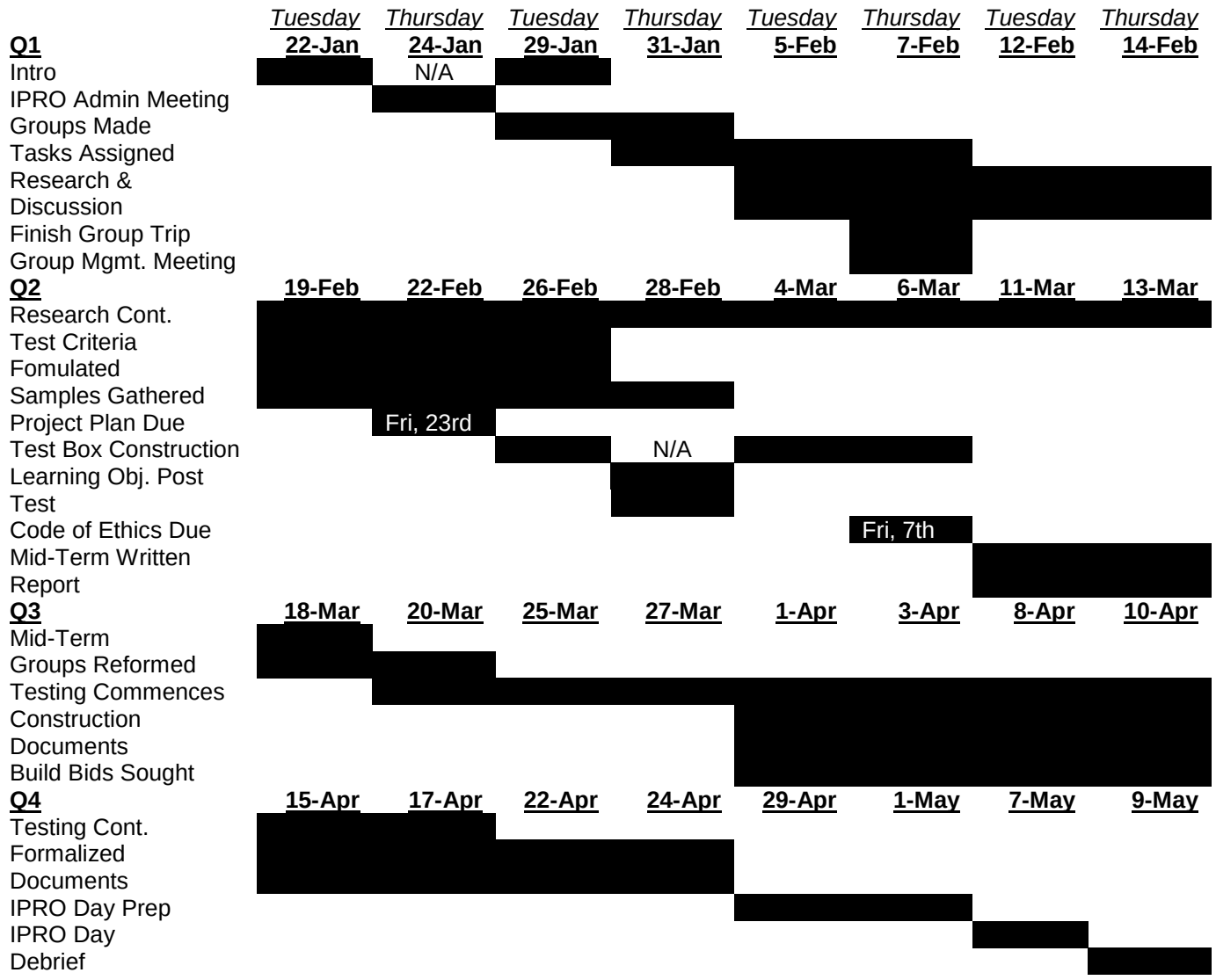

7.0 Individual Team Member Assignments

Name: Chris Mayers (Team Leader, Lighting Group)
- Year: 4th
- Major: EE
- Experience, Skills, Strengths: Electrical circuit design and implementation. Electronics, electrical and computer engineering, Circuit modeling/ analysis
- Role and Responsibilities: Lead team/ research

Name: Jonathan Sibley (Sub Team Leader, Lighting Group)
- Year: 4th
- Major: EE
- Experience, Skills, Strengths: Formula Hybrid racing, Power Electronics. Researching, coding, project management
- Role and Responsibilities: Lighting Research and Testing, Code of Ethics

Name: Max Irishfrazin (Team Member, Lighting Group)
- Year: 3rd
- Major: EE
- Experience, Skills, Strengths: Technology hunting, Electrical & Computer Engineering
- Role and Responsibilities: Research and implement new power source

Name: Anthony Wachniak (Team Member, Lighting Group)
- Year: 5th
- Major: Architecture
- Experience, Skills, Strengths: Architectural Computing & Programming, and Design Build.
- Role and Responsibilities: Program the space and research the needs of similar spaces.

Name: Daniel Sirotzke (Sub Team Leader, Web Group)
- Year: 2nd Year
- Major: Computer Science
- Experience, Skills, Strengths: Previously created simple webpage's - for a Lit. class and now upkeep the site for Illinois Tech Robotics. HTML, CSS, JavaScript
- Role and Responsibilities: Create/Design Website & Website Framework. Basically make it simpler for others to upkeep in future semesters.

Name: Daniel Mathus (Team Member, Web Group)
- Year: 3rd
- Major: Electrical & Computer Engineering
- Experience, Skills, Strengths: Zero Energy Lab team member Fall '07, CS and Electrical, Human Computer Interaction (HCI)
- Role and Responsibilities: Master Scheduling Assistant. General Website mapping, final content control, layout and appearance

Name: Kyle Stachowiak (Team Member, Web Group)
- Year: 2nd
- Major: Computer Science
- Experience, Skills, Strengths: programming, photoshop, webpage layout design, Illinois Tech. Robotics.
- Role and Responsibilities: Compiling the project plan and helping the team with website development.

Name: Suni Smith (Team Member, Web Group)
- Year: 4th
- Major: EE
- Experience, Skills, Strengths: FDTD Simulations, High performance computing, Complex networks. Java, C/C++, Pascal Matlab, FORTRAN. I have a vision about how the best website should look.
- Role and Responsibilities: Help the team build a website.

Name: Sandeep Sadasivuni (Sub Team Leader, Finishing Group)
- Year: 4th
- Major: Computer Engineering
- Experience, Skills, Strengths: Teaching Assistant for IIT's Computer Science Dept. (Aug 05-Present). Excellent communication skills, team player.
- Role and Responsibilities: Research locations which have used bamboo flooring and low VOC paints for a while now. Talk to contractors and get an estimate of how much it would cost to get concrete polishing/bamboo flooring/soda blasting done to the lab. Try and get a descent look to the zero energy lab interiors by sticking to minimal cost amounts.

Name: Brian Rojas (Team Member, Finishing Group)
- Year: 2nd Year
- Major: Aerospace Engineering
- Experience, Skills, Strengths: Illinois Tech. Robotics. Analyzing data, calculating numerical data, finding information, proposing ideas, listening to others, thinking in a logical manner
- Role and Responsibilities: Determine flooring, wall paint, and anything dealing with the renovation of the top floor of Machinery Hall.

Name: Jennifer Gambrell (Team Member, Finishing Group)
- Year: Fourth year
- Major: Architecture
- Experience, Skills, Strengths: Model shop worker, Tutoring, CAD drafter, Model shop work, hand drafting, 3D modeling, Photoshop/Illustrator, basic math tutoring.
- Role and Responsibilities: Determine flooring, wall paint, furnishings of the space, and anything dealing with the renovation of the top floor of Machinery Hall

Name: Loren Bo (Sub Team Leader, Technology Group)

- Year: 4th
- Major: Architecture
- Experience, Skills, Strengths: AutoCAD, Sketch-Up, Illustrator, Photoshop, Model Making
- Role and Responsibilities: Test office appliances to achieve most efficient office set-up

Name: Kaye Palomo (Team Member, Technology Group)

- Year: 3rd
- Major: Architectural Engineer
- Experience, Skills, Strengths: AutoCAD and MathCAD. Good with areas dealing with building systems.
- Role and Responsibilities: testing the electronics to find out its energy efficiency and the amount of heat it releases

Name: Kunal Patel (Team Member, Technology Group)

- Year: 3rd
- Major: Computer Engineer
- Experience, Skills, Strengths: Electronics. Computer Hardware. Operating Systems. Analyzing electronic power consumption and optimizing Operating System power plan.
- Role and Responsibilities: Testing of power consumption by electronics and computers.

8.0 Designation of Roles

A. Assign Meeting Roles

a. Minute Taker: Anthony Wachniak
b. Agenda Maker: Chris Mayers
c. Time Keeper: Max Irishfrazin & Jennifer Gambrell

B. Assign Status Roles

a. Weekly Timesheet Collector/Summarizer: None. As a group, we decided that we each will do out part to keep the project moving smoothly and we don't need timesheets to keep track of our work. We will keep track within our own sub groups and then update each other so that everyone is moving in the same direction and towards the same goal.
b. Master Schedule Maker: Kunal Patel
c. iGroups: Sandeep Sadasivuni & Jonathan Sibley
d. Project manager: Chris Mayers
e. Deliverables manager: Kunal Patel