IPRO 338: Web Application for Electrical Contractors for LEED Building Projects

Sponsor: Electrical Contractors' Association of the City of Chicago

IPRO 338 Team Members

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1 Introduction

The following report highlights the methodologies, accomplishments of IPRO 338, Web Application for Electrical Contractors for LEED Building Projects at Illinois Institute of Technology during the spring semester of 2009. The IPRO team divided into three sub teams featuring each member's strengths to accomplish the task at hand. The research team was to research LEED information, as well as, green products and the companies that provide those products. The tech team was to maintain the website and add any new information that could be of value to the Contractors Association of the City of Chicago (ECA). The communications team was to maintain in contact with the ECA of any developments of the website. The combination of all three was successful in creating a product that will soon be featured on ECA's website.

1.1 Background

In today's world there is an eminent threat that most do not realize. Buildings around the world account for one sixth of the world's fresh water withdrawals, one quarter of the earth's wood harvest, and finally two-fifths of its energy flow.

In April of 2000 the United States Green Building Council (USGBC) introduced the Leadership in Energy and Environmental Design (LEED) system. LEED is internationally recognized as a system that can evaluate how eco-friendly the construction and daily operation of a building is on the environment. The desire for a LEED certification on a project is continuously growing, and the need for reliable green technology to meet LEED standards is in high demand. Construction firms who do not have access to the necessary information to create an eco-friendly project will see, in the near future, an extreme disadvantage in a very competitive industry.

The ECA is an organization that gives its members an advantage over their competitors by providing tools to better their companies. The ECA provides training opportunities, tracks new legislation that can affect their industry, and strives to give their members quality and cost-effective services for the electrical construction industry. The ECA is aware of the necessity of having green technology being incorporated into project plans, but did not have the resources to aid in these project plans.

1.2 Purpose

The specifications for electrical products are commonly selected by the architects, clients, or general contractors, and typically done without the consultation of electrical contractors. This creates an information gap between the design and construction personnel, which in turn causes many construction redundancies. As of right now, data on green technologies are scattered throughout the internet, without a common source to organize the information in one easy-to-use database.

The purpose of this IPRO was to develop a website to host a user-friendly online database of green technologies information for the Electrical Contractors' Association of the City of Chicago. This website will involve providing data on green electrical products with cut sheets, pricing and distributor information, return on investment projections, and LEED certification facts. The use of this website should help create a well informed transition from industry standard electrical products, to green alternative products, as well as cut down on miscommunication between architects and electrical contractors.

1.3 Goals

Each sub-team of the IPRO had their own individual goals, but there were three major goals that the team has as a whole

- Develop a website to host a user-friendly online database of green technology information for the Electrical Contractors' Association (ECA) of the City of Chicago.
- Review last semester's progress and finish the website by the end of the semester.
- Hand off the website to the ECA so the organization can put the website live once receiving it

1.4 Objectives

The IPRO our team was the last team to work on this project, and for that time was of the essence. In the first few meeting of the IPRO the team came together to discuss what we had hoped to accomplish in the time span given. The following list details what was decided upon to completed before the conclusion of the project.

1. Improve the project from the previous semesters

   This was the final semester of the project, and the team wanted to create a finished product that the ECA would be able to use immediately.

2. Research LEED and how it affects project plans

   The team needed to gain a through background on what LEED was to fully understand what would need to be completed for the project. The information learned assisted in determining what type of products needed to be added to the data base, and what products are best and most easily to incorporated into a project plan.

3. Update products and corporations for the website

   With the market for green technology every growing the team wanted to incorporate as many products out in the market today. Along with the products, the team wanted to have the company's information and background if a contractor was unfamiliar with the corporation.

4. Add a return on investment (ROI) calculator

   The ROI calculator would take the specifications of products and incorporate them into a return on investment calculator. The calculator would show the user how switching to green products will save on electricity bills, which in time, the savings will pay for the products as well begin to create savings for the building.

5. Insure that the website was ready to go live by the end of the semester

   This semester, the team needed to have the website finished so the website could go live once the ECA had full control. The team's goal was even if we weren't able to add all of the ideas we had, we wanted to make sure what was there was in an excellent state. Any of the ideas that were not able to make it to the website we would pass over to them if they wanted to incorporate them on their own time.

6. Give webmaster control to the ECA at the end of the semester

   At the end of the semester, the team needed to give the organization control of the website. This was a major objective, due to the fact that IIT would no longer be working on the site and the ECA would have full control of the website.

2 Methodology

The team worked together very methodically to insure that all aspects of the project were being covered either individually, such as deliverables, or by a team, i.e. LEED research. The work was set out for everyone, and every team member knew what was expected of them.

Include with this report is an updated Gantt chart highlighting what was completed over the semester.

2.1 IPRO Timeline

Team Briefing	1d	Tue 2/3/09	Tue 2/3/09
Develop Project Scope	7d	Thu 2/5/09	Fri 2/13/09
Meeting with Sponsor	1d	Thu 2/5/09	Thu 2/5/09
Develop Project Plan	5d	Tue 2/10/09	Mon 2/16/09
Submit Project Plan	1d	Mon 2/16/09	Tue 2/17/09
Site Visit	1d	Thu 3/5/09	Thu 3/5/09
Develop Research Teams	45d	Tue 2/10/09	Mon 4/13/09
LEED Certification	45d	Tue 2/10/09	Mon 4/13/09
Power Distribution	45d	Tue 2/10/09	Mon 4/13/09

Lighting Systems	45d	Tue 2/10/09	Mon 4/13/09
HVAC Systems	45d	Tue 2/10/09	Mon 4/13/09
Compile Mid-Term Presentation	7d	Mon 3/2/09	Tue 3/10/09
Submit Mid-Term Presentation	0d	Thu 3/12/09	Thu 3/12/09
Begin Formatting Information	11d	Tue 3/17/09	Tue 3/31/09
Update/Enhance Website	34d	Tue 3/10/09	Sun 4/26/09
Develop Presentation Team	26d	Thu 3/26/09	Thu 4/30/09
Design Poster/Handout	4d	Wed 4/22/09	Mon 4/27/09
Website	8d	Mon 4/27/09	Wed 5/6/09
Prepare Presentation	6d	Thu 4/23/09	Thu 4/30/09
Presentation Due	0d	Thu 4/30/09	Thu 4/30/09
Prepare Final Report	7d	Fri 5/1/09	Mon 5/11/09
IPRO Day	0d	Fri 5/1/09	Fri 5/1/09
Final Report	0d	Mon 5/11/09	Mon 5/11/09
Deliverables CD	0d	Mon 5/11/09	Mon 5/11/09

There were slight changes from the original Gantt chart due to the fact information for products and manufacturers were always coming in through out the semester. The deadlines for IPRO deliverable remained unchanged for the fact that deliverable due dates did not change. All the deadlines for the project were relative, due to the fact that the team continued to enhance the website whenever idea was agreed to be an excellent addition to the website.

2.2 IPRO Team Approach

The first step in the process was to establish the scope of the work. In order to accomplish this, the team spoke to Tim Taylor, a member of the ECA, to gain knowledge of the industry and to learn what the ECA wanted for the website. This included adjustments they wanted to see of the current website and what they wanted to see added to the website. The team took in the information gained in this meeting and applied it to the project immediately. In the end, the website was going to be a part of our sponsor's current website and it needed to meet their expectations.

Once the team established the goals we wanted to meet, the next step was to determine how were going to meet those goals. The team as a whole decided it would be best to break into three different teams to play to our individual strengths in finishing the project. These teams were Tech, Research, and Communications. From there the research team divided the required research into teams of LEED, Lighting and Power Distribution, and Heating, Ventilation and Air Conditioning (HVAC). They were to research information about how LEED affects project plans, update the product information currently on the website, and add new products to the current product database. The Tech team was to maintain the website and add any new updates to the website. The Communications team was to contact current companies on the website and retrieve more information about the company, add new companies to the database, and maintain a constant communication the IPRO team and the ECA.

The team wanted to do more research of what contractors are currently using in LEED certified buildings. The team took a site visit to 155 N Wacker and learned about what the contractors have all ready implemented into their project plans and it gave a team on how contractors decide what to implement into construction design. Using what was learned on the site visit; products seen on the construction site were researched and were incorporated into the website project.

2.3 Research Team Approach

This team was responsible for gathering all the information that would ultimately go on the website. The process of finding and disseminating all the information available on green products is the primary focus of this project. With the speed at which new technologies are developed this will most certainly be a continuing effort, throughout the lifespan of the website.

The initial four research teams and their primary area of concern are as follows:

LEED

- Investigate the LEED system
- Determine which points are achievable by electrical systems and related areas
- Effectively communicate the LEED principles and requirements to class.

Lighting and Power Distribution

- Find product and manufacturer information for lighting systems that contribute to meeting LEED standards
- Discover how these systems contribute to meeting LEED standards
- Investigate price of systems
- Find methods of reducing power consumption
- Find any products that contribute to lower power consumption in power distribution system s, and include manufacturer information
- Discover how specific products contribute to meeting LEED standards
- Investigate pricing of systems and methods

Heating, Ventilation and Air Conditioning (HVAC)

- Find product and manufacturer information for HVAC equipment and systems that contrib ute to meeting LEED standards
- Discover how the products and systems contribute to meeting LEED standards
- Investigate price of products and systems

Water Efficiency

- Investigate how water efficiency in and around a building is effected by products powered by electricity
- Investigate pricing of related products and methods

2.4 Tech Team Approach

The tech team began the semester with implementing a version control system to allow the team to better work together and to allow for easier transfer of control once the semester was over and the website was finalized. The team then proceeded to make aesthetic changes as required by the sponsor, the Electrical Contractors Association of the City of Chicago.

Once the updates and maintenance of the website were complete; we were able to focus on adding increasing available features while making it more user friendly. We added features such as a category filter which would allow users to view products as per their requirement of Lighting, HVAC, Water Efficiency, or Power Distribution. To improve user experience; the team took information collected by the Communications Team about the manufacturers and inserted that information into the database. We also took the information and pictures collected by the Research Team about products and added them into the database.

The most important new feature added is the Return On Investment (ROI) calculator. This feature has the ability to show developers the potential of using green technology. It shows them the investment that may be required for them to become more environmentally friendly while showing them the money they could potentially save by on an annual basis using green technology and the time it would take for them to recoup their initial investment.

Before the end of the semester; the team was able to conduct a demonstration of the website for the ECA and the feedback from them was very positive. In the final week of IPRO, the team transferred the control of the website and the database to the ECA to finish off the semester and the IPRO.

2.5 Communications Team Approach

The communications team began the semester by contacting the ECA and set up a means of communication between the IPRO group and the organization. The team then reviewed what companies were currently on the website and what could be done to make them better than they already were. The group decided to try and develop for each company a direct contact. A representative of the company, so that if any contractor had any questions about a product they could go directly to someone and not a massive corporate email.

Along with the companies currently on the website, the communications team looked into finding new manufacturers that could be added to the website. The team was looking for companies that had a large inventory of environmentally products, and the company had to be an environmentally aware company as well.

Near the end of the semester, the team decided to add company backgrounds to each manufacturer. This was done to inform contractors of what a certain manufacturer were best known for in their inventory. The last task the communications team would have liked to have added to the website were distributors of a certain manufacturer and not simply list only their headquarters. This was goal set a little later in the semester and was unfortunately unable to be attained.

2.6 Team Assignments

Each team member was assigned to a sub team that they felt they could contribute the most to in order to create the strongest teams possible. For each team there was a team leader to facilitate responsibilities and to move their team in the right direction.

- Daniel Shaffer was the Team Leader. He prepared the meetings agendas, presided over each IPRO meeting, and held members responsible for making deadlines that either the team or IPRO had established. He authored the project plan, the original Gantt chart, and co-authored both the midterm and final presentation.
- Gregory Zajac was the Co-Team Leader and Leader of the Communication Team. He was to run meetings if the Team Leader could not attend, help with any IPRO deliverable, and gain company information for the website. He co-authored the midterm presentation and final report.
- Muluken Aulfata was the Team Secretary. He recorded detailed and accurate minutes from each team meeting, insured that the agenda was ready for every meeting and helped any team that may have needed assistance in accomplishing a task. He co-authored the final presentation.
- Casey Bennett was the Leader of the Tech Team. He was responsible of implementing any changes that the team saw necessary. He leaded his team to added new features, checked that all links were properly working, and oversaw the transition of the website from the IIT server to the ECA server.
- Michael Day was the Leader of the Research Team. He researched what LEED was and how it affects contractors' project plans. He also researched lighting options to reach LEED certification. He created the abstract that was handed out at IPRO Day.
- Michael Asher was the NECA Organizer and member of the Communication Team. He founded the NECA organization, an organization that builds ties between engineering students and electrical contractors of Chicago. He assisted the communication team in gaining company information that was included in the ECA website.
- Omair Akbany was a member of the Tech Team. He was able to incorporate the company information into the website, removed all dead links and updated them with correct urls, and assisted with adding the return on investment calculator.
- Woochan Kim was a member of the Research Team. He was in charge of researching how water efficiency played a role in LEED certification. He co-authored the posters for IPRO day.
- Minah Park was a member of the Research Team. She was in charge of researching HVAC and how it plays a role in LEED certification. She co-created the posters for IPRO day.

- Lee Yeseul was a member of the Research Team. She was in charge of researching green lighting products and how it plays a role in LEED certification. She co-created the posters for IPRO day.

2.7 Budget

The original budget of this IPRO was never used. The project was the creation of a website, and the Tech Team did not need any money to create the website. The planned trip to the Smart House at the Museum of Science and Industry never occurred due to schedule conflictions of the team and the museum hours. The total money spent from the IPRO office was zero dollars.

3 Code of Ethics

Overarching standard
To provide a resource in helping Chicagoland electrical contractors meet Leadership in Energy and Environmental Design (LEED) and United States Green Building Council (USGBC) standards.

First Layer: The Law

Pressure
- Meet rules and regulations set forth by LEED and USGBC standards in green technology.
- Meet existing Chicago building codes while remaining environmentally friendly.

Risk
- Ignore Chicago building requirement that will cost the project extra time and money to make green.

Measure
- Follow LEED and Chicago building guidelines, while remaining conscientious of return on investment.
- Provide relevant and accessible incentives for contractors to uphold LEED and USGBC standards.

Canon
- Subscribe to the guidelines of Federal and State laws for green technology.

Second Layer: Contracts and Agreements

Pressure
- Provide everything the customer demands, while keeping within a required budget.

Risk
- Sacrifice required green building technologies and procedures in order to save the customer money.
- Forgo the customer's budget in order to satisfy their every need.

Measure
- Focusing on the demands of ECA while carrying each required component through LEED certification.

Canon
- Responsible in learning the requirements of ECA and find successful way to help electrical constructors meet LEED and USGBC requirements on their site.

The Third Layer: Professional Codes of Ethics

Pressure
- Follow the code of ethics set forth by a LEED and USGBC.

Risk
- Lack of knowledge of the codes of ethics amongst the workers.
- Difficulty to ensure uniform compliance to set code of ethics.

Measure
- Providing LEED certified supervisors and common contractors with the knowledge and tools to ensure uniform compliance and knowledge of code of ethics.

Canon
- Understanding and consistently applying the code of ethics set forth by a LEED and USGBC.

The Fourth Layer: Industry Standards

Pressure

- Following Chicago electrical code and underwriters laboratory (ULC) standards.
- standards.

Risk

- New standards are not proven, and may increase the risk of danger to the customer.

Measure

- Following the electrical industry standards of ECA and developing their own methodology of ensuring new standards are as "tried and true" as the old ones.

Canon

- New methods and standards as appealing as or more desirable than the old standards.

The Fifth Layer: Social Civic and Geographic Communities

Pressure

- Assuming the responsibility as "Stewards of the Planet," for the benefit for future generations.

Risk

- Community may disagree with guidelines set forth by LEED and USGBC.
- High price of environmentally friendly, "trendy" products may make contractors not use them due to their inflated costs.

Measure

- Consider the community's view points on LEED and determine the true value of green products.
- Offering the community substantial knowledge of the advantages to using "green" technologies and procedures, for example long-term return cost as well as benefits for the future environment.

Canon

- Making changes to satisfy the community needs, provide valuable information as reference and motivation to choose a more sustainable products and practices

4 Results

The figure below shows the home page of the completed website for the ECA

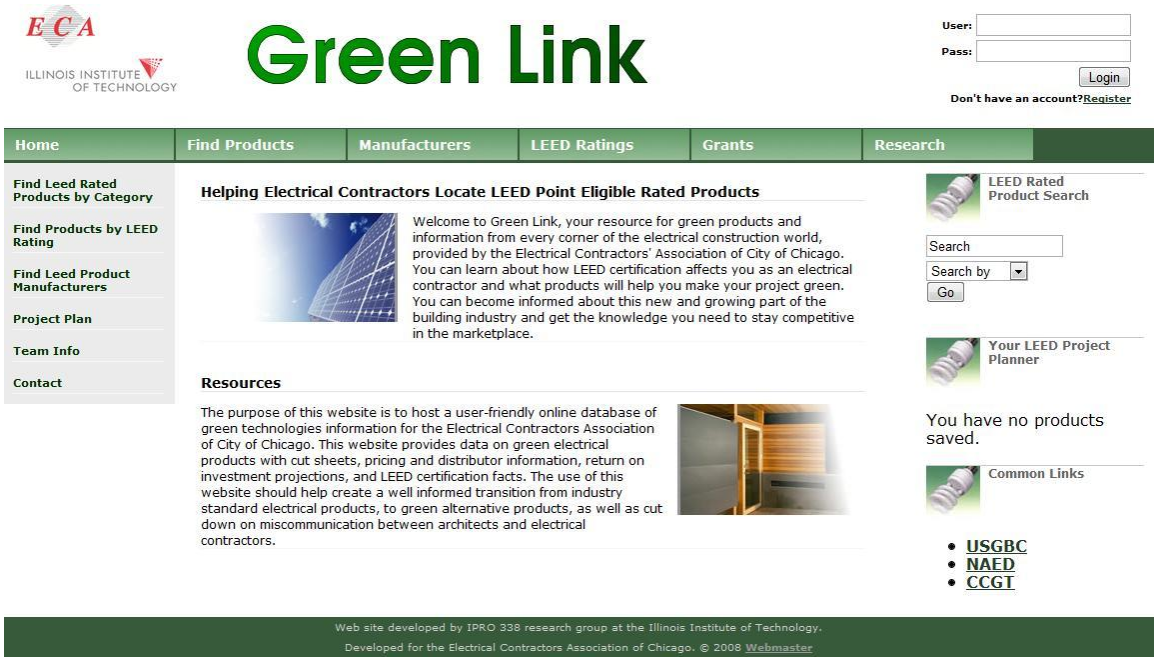

Figure 1: Screen Shot Of Home Page

The main page welcomes the user to the website and gives a brief overview of what the website has to offer. The top right hand corner has a username and password option for the ECA, so if the organization wants to use the website as a place were contractors can store information there is the option.

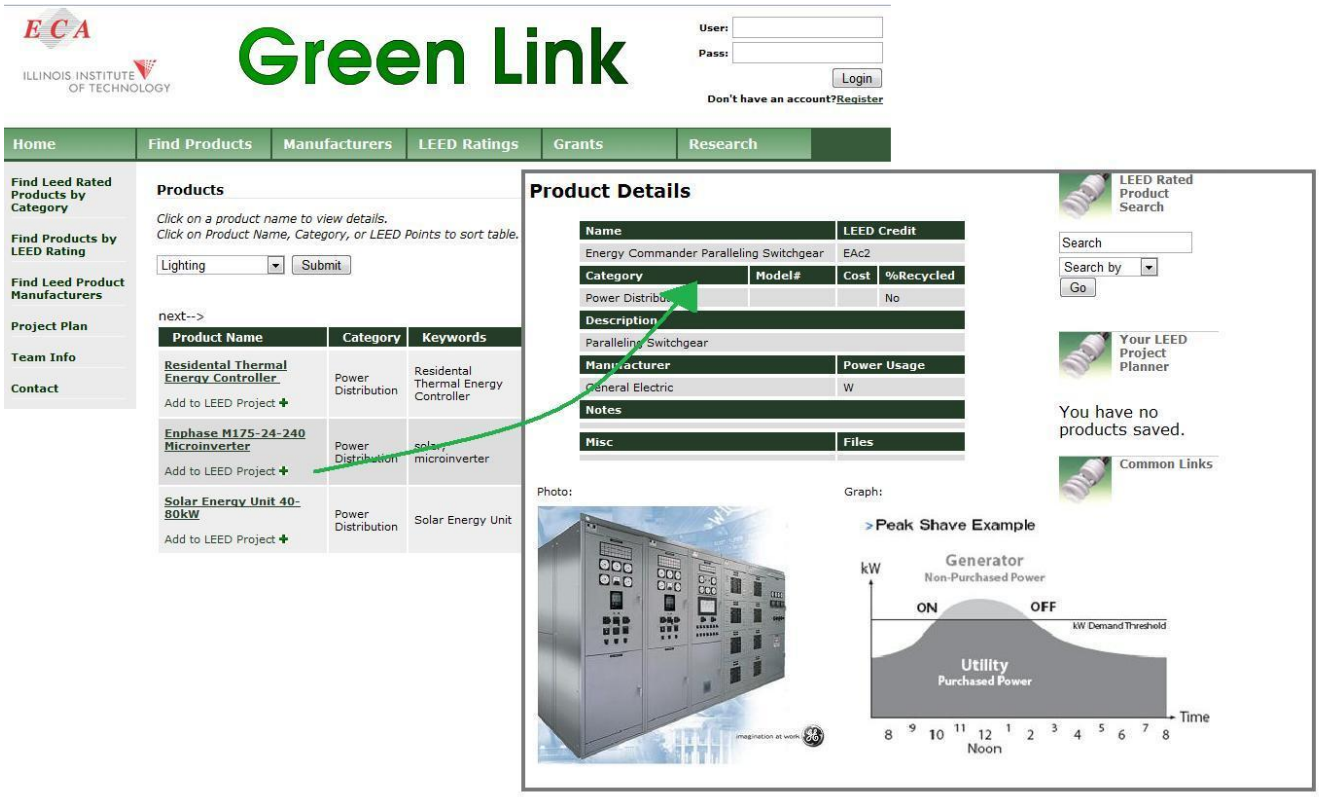

Figure 2: Screen Shot Of Product Page

The products page shown above is what a contractor sees once they choose a certain product. When clicking on the products page, the contractor sees a list of products. Along with the products is what type of product it is, Lighting, HVAC, Power Distribution, or Water Efficiency, what keywords the product falls under, and the how product is ranked in the LEED system.

Once a product is clicked on, the next page gives the user more information about it. The next page shows cost, model number, descriptions, picture of the product, and if available, how power efficient the product is over time.

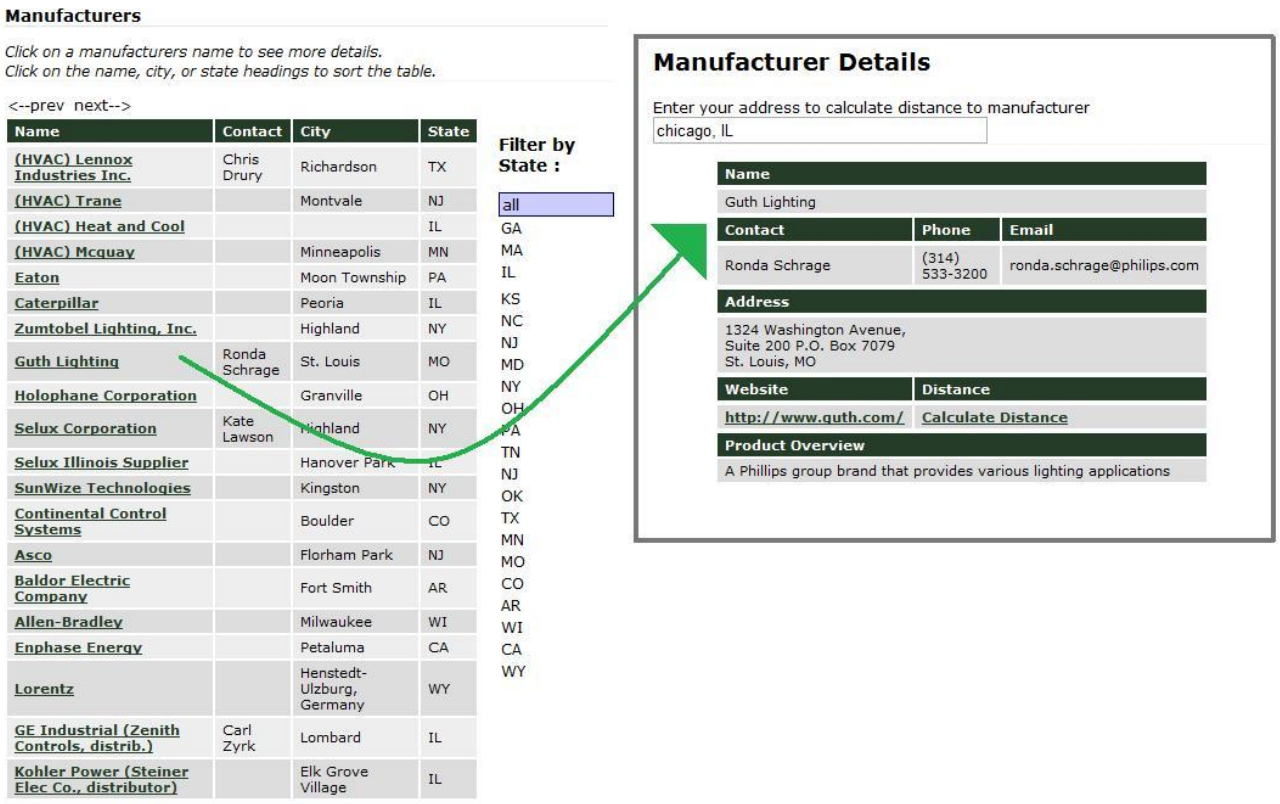

Figure 3: Screen Shot Of Manufacturers Page

The manufacturers page for the project had additional companies added, but the layout for the page remained unchanged. The user can organize the companies by name or by state. When the user clicks on a manufacturer the next screen brings up more information about the company. The page contains the headquarters address, website, and the company's product overview. If the communications team was able to retrieve a contact for the company, the page will also contain the contact's name as well as their direct phone number and email address.

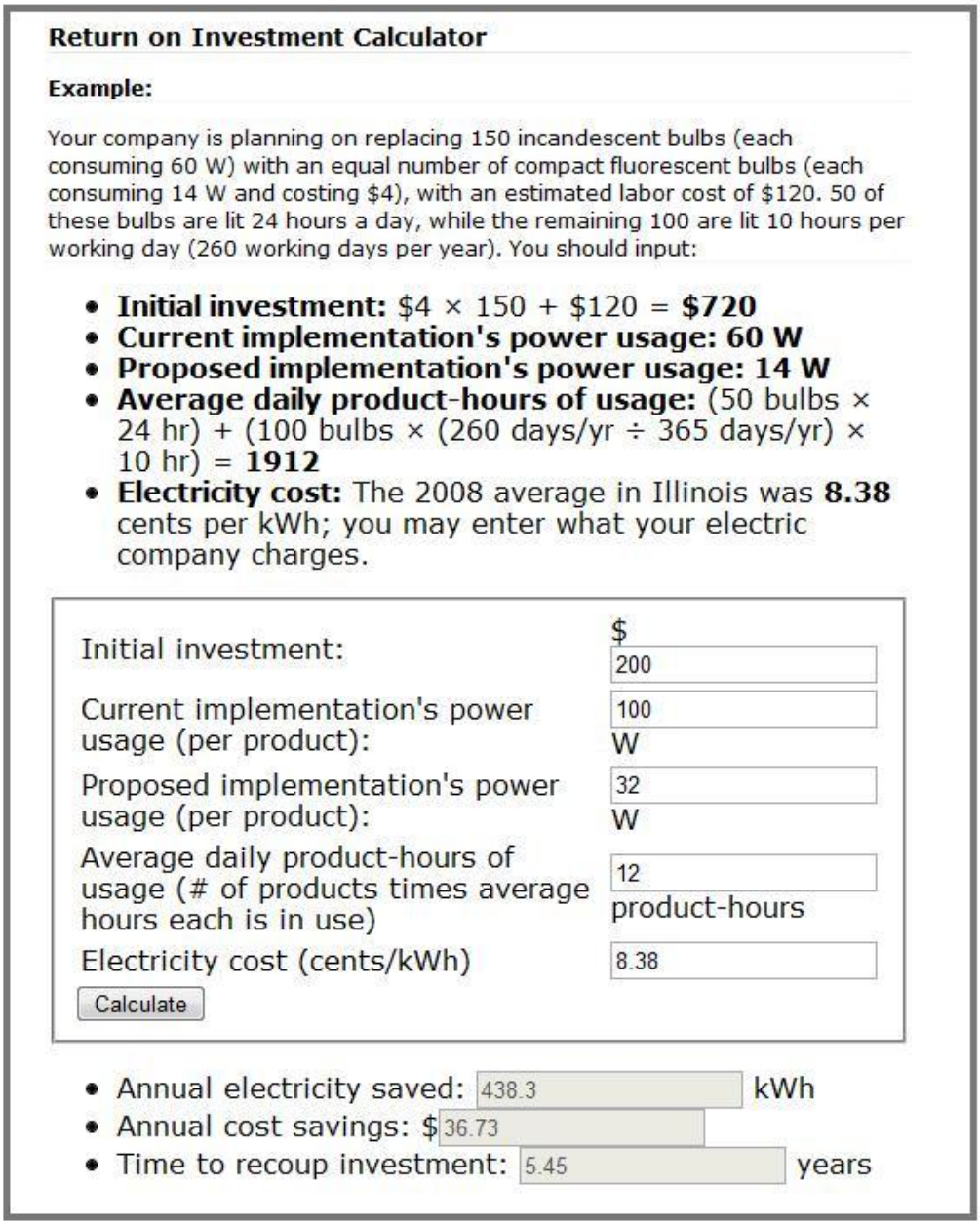

Figure 4: Return on Investment Page

The return on investment page is accessible through the product pages. If the team was able to find the wattage of the product, the product is able to be used in the ROI calculator. The research team found a set of calculations that can be used in determining how much is saved by switching to lower wattage product, such as lighting.

The calculator asks the user how much they plan on spending on the new product, the wattage that is currently used in an older product, the wattage of the product selected is automatically added into the equation, and the cost of electricity in cents per kilowatt hour. The electricity cost of 8.38 is automatically placed into the equation. This value is the cost of electricity in Illinois of 2008. Once the calculate button is selected it shows the savings and how long it will take to earn back the investment.

This calculator is useful in showing how much of an effect products can have, even when the two products differ between a few wattages.

5 Conclusion

The team has had a successful semester. There have been a number of notable achievements made and the ECA is satisfied with the website they have received. The team has assembled a list of the recommendations for the ECA that were mentioned in our final meeting. The list below is the ideas that the team would have liked to pass on to a future IPRO if the IPRO were to continue on to an additional semester.

5.1 Obstacles

With any project there are always unexpected problems, but the team did its best in attempting to foresee the obstacles before they became major setbacks.

One of the goals the team wanted to accomplish was to create a large database for the website. This proved difficult due to the fact that creating a large database takes time, more time than the length of a semester. Often, these products are designed and specified according to the job and then submitted for bid to many possible suppliers. To combat this the team gathered as much information as they could on products that weren't job specific. The IT team left room for expansion of the website for next semester. The main idea is that the next team would design a way to submit job parameters to multiple manufacturers for bid as well as update the website to comply with the soon to be update LEED program.

Another obstacle was to balance the compilation of all of the requirements needed to present the project, while still working on the project itself. These barriers were overcome by working together as a team. Solutions were found together during meetings, much in the same way previous obstacles were overcome. The team members also took responsibility for completing specific tasks thoroughly and efficiently throughout the timeframe of the project.

5.2 Recommendations

This IPRO has concluded at IIT, but the team has ideas that if time allowed would have liked to have incorporated into the website

- Attempt to gain the support of other industry players such as architects, general contractors, other trade organizations, and environmental advocacy groups. This will make the website more comprehensive and create a tool to help the entire construction industry make the transition to more environmentally friendly practices.
- Continue to add more companies, particularly try to find corporate contacts that contractors can go directly to for product questions
- Using the companies currently listed on the website, find out where the company has distributers across the country
- Continue the effort to find competitive pricing and ROI information on green products.
- Continue to expand on the current database of products
- Incorporate new products to use the ROI calculator

6 References

Electrical Contractors' Association of the City of Chicago, Inc.	www.ecachicago.com
Huen Electric Inc.	www.huenelectric.com
Illinois Institute of Technology	www.iit.edu
International Brotherhood of Electrical Workers	www.ibew.org
Lutron Inc.	www.lutron.com

McGraw Hill Companies, Inc.	www.mcgraw-hill.com
McQuay International	www.mcquay.com
National Electrical Contractors' Association	www.necanet.org
Siemens Inc.	www.usa.siemens.com
United States Green Building Council	www.usgbc.org

7 Resources

The money spent through the whole semester was zero dollars. The team was able to work together instantaneously and everyone worked together to complete the project for the sponsor. The table below lists all the team members and the amount of time each student had spent over the semester as well as what they had done over that time. The time and work completed has been taken directly off the iGROUPS website.

Team Member	Hours Spent Working	What Was Accomplished
Omair Akbany	20	• Reviewing Website Code • Setting Up Test Server • Website Updates • Deliverable Review/IPRO Preparation • Tech Team Final Report
Casey Bennett	6	• Familiarization of Code • Bug Fixes • Website Updates
Michael Day	18	• Lighting Research • LEED Research • Creating Abstract • Creating Trifold
Muluken Aulfata	28	• Writing Minutes and Agenda • Group Research • Creating Final Presentation
Minah Park	20.5	• Researching HVAC • Creating HVAC Presentation • Updating Midterm Presentation • Creating Posters
Daniel Shaffer	21.5	• Creating Project Plan • Creating Midterm Presentation • Creating NECA • Uploading Files to iGROUPS • Creating Final Presentation • IPRO Day Presentation
Lee Yeseul	20.5	• Preparing Lighting Information • Working on ROI Calculator • Creating Posters
Gregory Zajac	21	• Emailing Corporations and ECA • Creating Midterm Report • Corporation Research • Compiling Company Information for Website • Writing Final Report
Woochan Kim	21.8	• Research For Project Plan

		Presentation • Researching Water Efficiency Products • Working on ROI Calculator • Researching Lighting Products • Lighting Product Efficiency • Review of Abstract and Final Presentation
Michael Asher	11.5	• Contacting Contractors • Creating NECA Constitution • Collecting Product Information from Manufacturers • Running NECA Meetings

8 Acknowledgements

IPRO 338 would like to give recognition to those who had helped the team throughout our project. We first off thank the Electrical Contractors' Association of the City of Chicago, especially Mr. Tim Taylor. The association donated a changeling and fulfilling project to IIT. The team could have not been happier with their commitment not only to us, but to the university as well. We would also like to thank Dr. Dan Tomal for his guidance and support over the semester.

Appendix A Research Team Findings

HVAC

HVAC stands for "heating, ventilation, and air conditioning" which are based on the principles of thermodynamics, fluid mechanics, and heat transfer. The main criteria for HVAC were to find products that meet and contribute to LEED standards. These products are able to operate more efficiently than their equivalent counterparts and thus reduce the overall power consumption for a customer who is utilizing the products. In addition, the products which use a non CFC based refrigerant (R410A) or Water sources as a fuel are environmentally friendly. These have been categorized into basic component in HVAC system, which are Air Conditioners, Furnaces, Heat Pumps, and Packaged Systems. Buildings pursuing LEED certification need to evaluate many things relating to energy efficiency and indoor environmental quality. Two categories within the LEED-EB rating System, Energy & Atmosphere and Indoor Environmental Quality, offer a number of points that are connected with HVAC systems and operations.

Related to this category, LEED credits can be specifically gained for:

1. Required conditions for LEED credits in HVAC are Minimum level of energy efficiency, Solid waste management, and Outdoor air introduction and exhaust systems. These are prerequisite values for LEED credits.

   Rating Categories: EAC1.1, EAP1, EAP2, MRP1.1, and EQC1.

2. Technology added to Performance Measurement is necessary to provide accurate energy-use information to support energy management and identify opportunities for additional energy savings improvements. The product which has monitoring system could get 3 point.

   Rating Categories: EAC 3.2 - 3.3

3. Emission Reduction Report, all of the significant types of pollutants reduced by energy efficiency. Performance Solutions on the HVAC system can be used to reduce many different pollutants including PM10 and PM2.5 particulate. Available point is 1.
   Rating Categories: EAC 6

4. Technology to Thermal Comfort Monitoring supports the appropriate operations and maintenance of buildings and building systems. A comfortable thermal environment that supports the productivity and well-being of building occupants.
   Rating Categories: EQC 2.3

Water Efficiency

The main goal of this research is finding information of products and manufacturers about water efficiency that are meeting LEED standard. Especially, it is focused on the water efficiency products that are related to energy efficiency and renewable energy.

Among the LEED categories, Water Efficiency credit 1(WE1), 2, 3 and 5 could impact on electrical contractors, so researched products are belong to this categories.

Water Efficiency (WE)

Credit 1. Optimize Energy Performance
Credit 2. On-site renewable Energy
Credit 3. Enhanced Commissioning
Credit 5. Measurement & Verification

1. Solar power product for restroom

a. Using solar power for sensor of product.
b. From using solar power, there is no need to change battery or using electricity.
c. Products which are using solar power is not that expensive than regular products.

W.E.1. Optimize Energy Performance
W.E.2 On-site renewable Energy

2. Solar power water heater

a. Using solar power for heating water
b. Saving electricity for heating : Supplemental water heat from the sun can provide 40-70% of hot water needs
c. Many states are offering rebates and tax incentives for installing solar power products.

W.E.1. Optimize Energy Performance
W.E.2 On-site renewable Energy

3. Solar power water pump

a. No electricity is needed for pumping
b. Effective on the areas that water piping is expensive

W.E.1. Optimize Energy Performance
W.E.2 On-site renewable Energy

Lighting

The main goal for the lighting research was to find product and manufacturers information for lighting systems that contribute to meeting LEED standards. There are 4 LEED criteria which are related to the lighting. Every criteria indicates that the most important factor of applying LEED credit in lighting section is energy saving.

1. Light Pollution Reduction

a. Intention : Minimize light trespass from the building and site.
b. Strategy : To minimize light trespass, focus on lighting fixture, which has full cutoff luminaries, low- reflectance surfaces, and low-angle spotlights.

2. Optimize Energy Performance

a. Intention : Using energy efficient lighting.
b. Strategy : Compare energy performance and identify the most cost saving product by computer simulation. Every different kinds of lamp can apply for this credit.

3. Controllability of systems: Lighting

a. Intention : Provide a high level of lighting system control to individual occupants.
b. Strategy : Integrate lighting systems controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the building. Ballast and sensor which manages control of lighting can apply for this credit.

4. Daylight and Views: Daylight.

a. Intention: Provide a connection between indoor and the outdoors through the introduction of daylight. Maximize interior day lighting.
b. Strategy: Predicts daylight factors via computer simulation of manual calculation. Considering shallow floor plates, increased building perimeter, exterior and interior permanent shading devices, high performance glazing and automatic photocell-based controls, might be helpful to increase day lighting

Power Distribution

The main criterion for power distribution research was to find products that meet and contribute to LEED standards. These products are able to operate more efficiently than their equivalent counterparts and thus

reduce the overall power consumption for a customer who is utilizing the said product. In addition, products such as variable frequency motor drives reduce power consumption by adjusting their power usage based on current work load and extra power demand caused by a motor speeding up or slowing down. Many products in this category pertain to distribution methods related to renewable sources of power generation such as solar and wind power. Products such as parallel switchgear and automatic transfer switches allow for a building's power source to be switched dynamically from grid power to renewable sources, to allow for the greatest efficiency in power use, determined either the occupants or the Building Automation System.

Related to this category, LEED credits can be specifically gained for:

1. Significant portions of the building's energy coming from renewable sources, such as biomass, solar, and wind.
2. Technology added to building to monitor its real energy consumption over time, such as meters capable of running backwards when the building is actually returning power to the grid rather than consuming power, due to on-site renewable energy creation.
3. Technology or operable windows added to allow users to control the thermal and/or lighting conditions of their specific workspace.
4. Use of enhanced commissioning, a process in which the installation of mechanical, renewable energy, and lighting systems is checked for accuracy by a separately contracted Commissioning Agent (CxA) and then support is given to ensure that the required documents and knowledge are imparted to the building owner to ensure that the system can be kept to the high level of operation for which it was design.