

# I PRO 329: Oak Park Energy Efficiency & Carbon Reduction

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Faculty Advisor: Nancy Hamill

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	Michael Muyco	
Dawid Broda	Eric Dexter	Robert Herman
Thiago Jardim	Tae-Hoon Kim	Andrew Kungis
Colin Lakin	Seunggeun Lee	Suk-Hyun Lim
Michael Mocerì	Aurash Mohaimani	Minah Park

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## *1. Executive Summary / Abstract*

Over 69 percent of the commercial and residential dwellings in Oak Park are 80 years of age or older; the vast majority of these units lack modern energy-conserving technologies, such as polystyrene wall cavity insulation—this results in the loss of thousands of dollars per year in energy and heating costs for many Oak Park residents. IPRO 329, Oak Park Energy Efficiency and Carbon Reduction, seeks to facilitate the transformation of Oak Park into a more competitive, appealing, and green community through reducing town-wide energy consumption and carbon emissions by 30 percent. To accomplish this large long-term goal, the team focused on a number of key objectives for the current semester: analysis of Oak Park building typology, compilation of a database covering various aspects for every commercial and residential building in Oak Park, distribution of Oak Park homeowner energy surveys, development of basic energy efficiency packages per Oak Park building type, and initial construction of a website dedicated to educating Oak Park homeowners on the various technologies they can employ to garner significant savings in energy and heating costs over the coming years.

## *2. Purpose and Objectives*

**Problem being addressed:** The Village of Oak Park is looking for a way to dramatically reduce carbon emissions, water usage, and energy usage throughout the village as a whole. Currently Oak Park residents are not well informed on energy saving measures they can take to not only reduce their utility bills but to also reduce their carbon footprint. Once the residents become aware of such measures a second issue of not having the financial recourses required to undertake home improvements arises.

The objective of this IPRO is to analyze the current conditions of the village and to provide baseline information regarding the state of residential and commercial properties as well as potential energy saving measures its residents can either perform themselves or with the assistances of a contractor.

**Sponsor:** Galvin Electricity Initiative

The Galvin Electricity Initiative is leading a campaign to transform our nation's power system into one that truly meets our needs for reliable, efficient, clean electricity service. The imperfect quality of power service today robs each American household of thousands of dollars a year, and the transformation of service quality to 21st century digital standards is critical to resolving the serious economic and environmental threats facing our nation. The Initiative believes that these threats can only be resolved if we shift to a new industry paradigm that is consumer-centric and driven by entrepreneurial innovation and smart technology. Initiative founder Bob Galvin, the former CEO of Motorola and a leader in the application of Six Sigma quality standards, bases this vision on the fact that top quality always produces the lowest cost.<sup>1</sup>

**Community:** The Village of Oak Park

Oak Park, a western bordering suburb of Chicago, is located just 8 miles from the loop. Oak Park grew dramatically after the Fire of 1871 and in 1902 when it formally became Oak Park had a population of nearly 10,000. As of 2008 the Village has a population of 49,557<sup>2</sup>. A large reason for Oak Park's growth and success early in the 20<sup>th</sup> century was the extension of the 'L' out to Harlem. At the time Oak Park was one of only a few suburbs directly connected to the city. Oak Park's historical significance and famed past residents has made it a popular tourist destination in the Chicagoland area. Many people come to see the largest collection of Frank Lloyd Wright homes in the world or to see the birthplace of Ernest Hemmingway.

**Technology:** To gain the necessary baseline information to provide to Oak Park the IPRO used public database information to compile its own database regarding the properties in the Village. Three main databases were used, the Geographical Information System, GIS, the Cook County Assessors web

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<sup>1</sup>Galvin Electricity Initiative, <http://www.galvinpower.org/about-us/galvin-electricity-initiative>

<sup>2</sup> City-Data: Oak Park, Illinois, <http://www.city-data.com/city/Oak-Park-Illinois.html>, Advameg, Inc., Copyright 2003-2010.

database and CUB, the Citizens Utility Board. A fourth resource, a survey for the residents to take created by the IPRO team was used to supplement the database with average energy usage numbers and willingness to partake in energy efficient home renovations.

### *3.0 Organization and Approach*

In order to accomplish our goal and satisfy the sponsor's requirements, IPRO 329 members first had to take a trip to Oak Park to get a better understanding of what they would be dealing with throughout the semester. Information was gathered from the trip by observing the different types of buildings and houses. The members were quickly able to assess that the ages of the houses would be a big factor in their work. The ages of some of the houses reached over one hundred years old. The technology one hundred years ago is nowhere near what technology is today with issues such as insulation or double-pane windows.

The IPRO team met with different employees from the Village of Oak Park. They met with employees in the building department who helped give them a better idea of what Oak Park was hoping to gain from the IPRO team. These employees were also able to give the team more insight into what Oak Park has already accomplished in the area of reducing the carbon footprint of Oak Park. The team also met with the Citizen's Utility Board to gather more information about energy usage in Oak Park to get a better idea of what areas are consuming the most energy.

The IPRO team also constructed a survey that was distributed to Oak Park residents. The survey asked the residents questions about their house so the team could see what areas to focus on for carbon reduction. This gave the residents a direct link to the team to better provide the team with information. The residents were also given the option to provide contact information so that the team could eventually look into possible energy audits for the residents' homes.

A website has been created by the team that Oak Park residents could access. The website is planned to have information for the residents on how they could reduce their carbon footprint and reduce their energy bills.

#### *4. Analysis and Findings*

In order to gain an understanding of the scope of the project, the team was asked to comprise a database of all homes in Oak Park. This task was accomplished mainly through data gathered from the Cook County Tax Assessor's Website and Geographical Information System (GIS) maps. An initial database was gathered through parsing all entries from the Cook County Tax Assessor's Website using MySQL and PHP. The individual addresses gained through this method were then compared to the GIS map and additional addresses were found. In total, over 25,600 unique addresses were found to exist in the village of Oak Park. In addition the team was able to gain over 30 fields of additional information on some addresses such as square footage, construction material, and number of rooms. In addition to the database, additional information was gained through the distribution of an online survey. Nearly one hundred residents took the survey, and through that the team was able to gain an idea of the home's energy usage. This information was then added to the database.

Research was done on emerging technologies that could be potentially used in Oak Park. Some technologies were found to be infeasible due to a long payback period or village conditions. These technologies included geothermal heating and permeable paving. Geothermal heating would require five hundred feet vertical drills to be made, which has a large start-up cost and permeable pavement would have little to no effect due to Oak Park's highly impermeable clay soil. Other technologies like spray insulation and solar water heating were researched and deemed to have a short enough payback period to be used in housing retrofits.

In addition, the database and research was merged to find which homes certain renovations would be best in. The team used the database to split Oak Park into four different housing typologies

based on outer envelope construction, and found the best technologies to use on the certain housing typologies. Research was also done on potential funding sources for the renovations. A list of tax credits, green banks, and rebates was found that could help home owner fund these projects.

#### *5.0 Conclusion and Recommendations*

The team was able to make good progress overall in this semester. Research was done on technologies and funding methods and the complete building count of Oak Park was performed. A website was developed in order to house the information found in this project and act as a hub for Oak Park home owners' to gain ideas of possible energy efficiency retrofits.

However, additional work will have to be done on the website in order for it to reach the full potential the team had envisioned. More energy usage data will have to be gathered as well in the future using the Citizen's Utility Board or other sources available. Once this energy usage information is gathered, it should be added to the GIS map in order to allow the village to use it for their benefit. The future team should also work towards marketing the idea of energy efficiency package better to the Oak Park populace.

## Appendix A. Team Organization

Team Member	Task Accomplished
Michael Muyco Major: Architectural Engineering	Researched Funding Developed Website File Management
Mike Mocerì Major: Architecture	Researched Funding Built Sample Wall Sections Designed Final Posters and Brochures
Eric Dexter Major: Architecture	Researched Spray Foam Insulation and Geothermal Built Sample Wall Sections Designed Final Posters and Brochures
Aurash Mohaimani Major:	Developed Script to build Database Oversaw management of Database Worked on GIS
Colin Lakin Major: Civil Engineering	Worked on GIS Built survey
Robert Herman Major: Electrical Engineering	Built and managed Survey Acted as Liaison with Oak Park Officials
Andrew Kungis Major: Architecture	Built Sample Wall Sections Designed Final Posters and Brochures
Minah Park Major: Architecture	Performed research on Other Communities Worked on writing Case Studies
Dawid Broda Major: ITM	Research Home energy controllers Installed Home Energy Controller at home to use a case study



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Thiago Jardim  
Major: Architecture

Researched Solar Water Heating

Tae-Hoon Kim  
Major: Mechanical Engineering

Researched previous case studies  
Prepared presentation outlines

Seunggeun Lee  
Major: Electrical Engineering

Aided in parsing data from Tax Assessor's website  
Researched Standby Power Monitors

Suk-Hyun Lim  
Major: Electrical Engineering

Researched previous case studies

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#### Appendix B. Budget

Materials for Wall Section Mock Ups	\$124.00
Subscription to Survey Website	\$50.00
Website Domain Name	\$5.00