

I PRO 329

OAK PARK ENERGY EFFICIENCY



The Problem

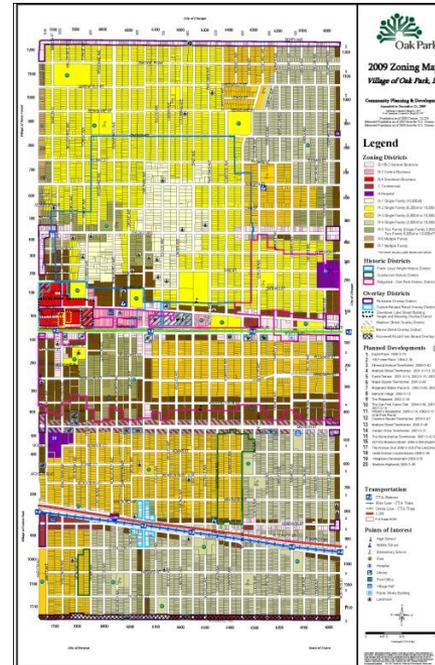
- In order to become a more competitive and appealing community, the Village of Oak Park seeks to become more energy efficient.



- Oak Park seeks to reduce town-wide energy consumption and carbon emissions by 30%

Past Semester

- First semester for IPRO
- Researched history of Oak Park
- Energy audits
- Identified Strategies
 - Passive
 - Active
 - Community-wide



- Develop basic energy efficiency package
- Evaluate Oak Park Building Typology
 - Frame/Stucco/Masonry
 - Age
 - Size
- Compile database of Oak Park building inventory
- Distribute Home Owner Survey
- Develop Website

Team Organization (Research)

The Village of Oak Park

Nancy Hamil Governale
Faculty Advisor

Michael Muyco
Team Leader

Technology Subgroup

- Eric Dexter
- Dawid Broda
- Suk-hyun Lim
- Thiago Jardim

Funding Subgroup

- Michael Muyco
- Andrew Kungis
- Mike Mocerri

Current Usage Subgroup

- Robert Herman
- Colin Lakin
- Tae-Hoon Kim

Case Studies Subgroup

- Minah Park
- Aurash Mohaimani
- Seunggeun Lee

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Website Subgroup

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- Suk-hyun Lim
- Dawid Broda

Energy Audit Subgroup

- Robert Herman
- Colin Lakin
- Tae-Hoon Kim
- Minah Park

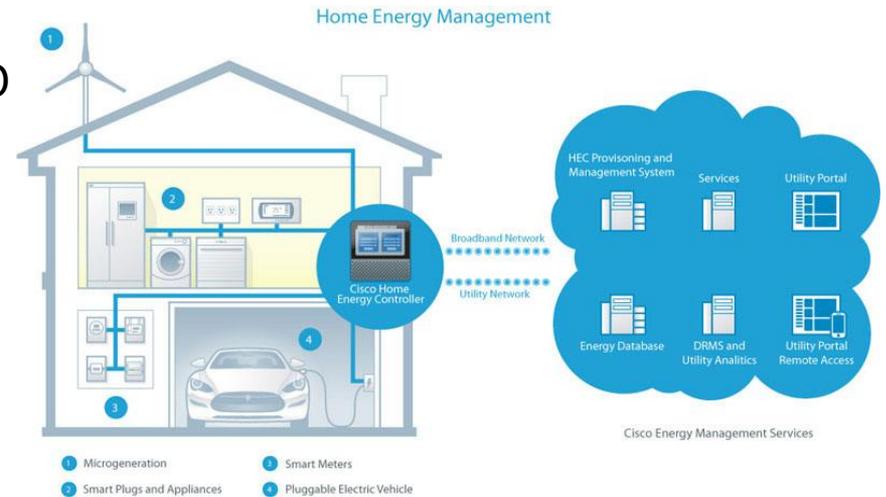
Technology Research

● Funding Methods

- Tax Credits – many credit up to \$1500
- Special Finance Rates – Green Bank

● Potential emerging technologies

- Geothermal
- Solar Heating
- Spray Expandable Foam Insulation
- Home Energy Controllers
- Standby Power Reduction



● Home Energy Controller

- Costs - \$150 - \$1500 per home (dependent on system type)
- Manage energy budget based on real-time energy costs and usage
- Control energy usage for large appliances
- Monitor conditions and remotely adjust heating and cooling
- Cisco, Google, Smart Home, and Microsoft

● Spray Expandable Foam Insulation

- Insulates and Reduces air infiltration
- Acts as a vapor barrier
- Payback in 7-8 years
- BioFoam and Astro Insulation in Chicago



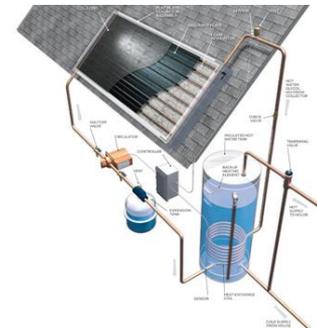
● Standby Power Reduction

- Built-in or aftermarket products available
- Can operate on a timer and turn power off automatically
- Stops electric from being consumed for standby, reducing electric bill
- Relatively low initial cost for aftermarket products



● Solar Heating

- Easily incorporated into a wide variety of heating systems
- Can provide most heating necessary for typical domestic hot water in Illinois homes
- Payback in 3-5 years for individual systems
- Oak Park has favorable weather conditions for Solar Heating
- Installers - Solar Energy of Illinois and Natural Dynamics



● Geothermal

- Energy audits make sizing a system easy for future IPROs
- Systems have been installed and studied
- Systems have been installed in climate similar to Oak Park
 - Hartford, Connecticut and Sandusky, Ohio Case Studies
 - Each used deep wells, saved \$400 - \$500 per year
- Oak Park has several systems installed already
- Ground temperatures in Illinois work well with heating and cooling
- Typical Houses in Oak Park will need 2 tons of cooling & 500' of vertical tubing
- Horizontal Systems are less efficient, but are cheaper
- Vertical Systems are more efficient, but cost more



- Built a database containing details of every residential and commercial building/condominium in Oak Park
- Obtained data from two sources: the Cook County Assessor's Office and Geographic Information System (GIS) inherited from the preceding IPRO group
- Data collection was performed through scripts written in Hypertext Preprocessor (PHP) and MySQL



- Compiled a database table listing every PIN entry from the Cook County Assessor's (CCA) database
- A PHP script accessed the database PIN list to sequentially visit each PIN's webpage to turn its contents into a document object model (DOM)
- Each DOM was pruned and its contents were assigned to variables that were inserted into the fields of another database table

The screenshot shows a web browser window with the address bar displaying "http://cookcounty". The page content includes a table of assessed values, a section for property characteristics, and a photograph of a brick building.

Assessed Value	2009	2010
Land Assessed Value	10,304	10,304
Building Assessed Value	89,541	89,541
Total Assessed Value	99,845	99,845

Property Characteristics

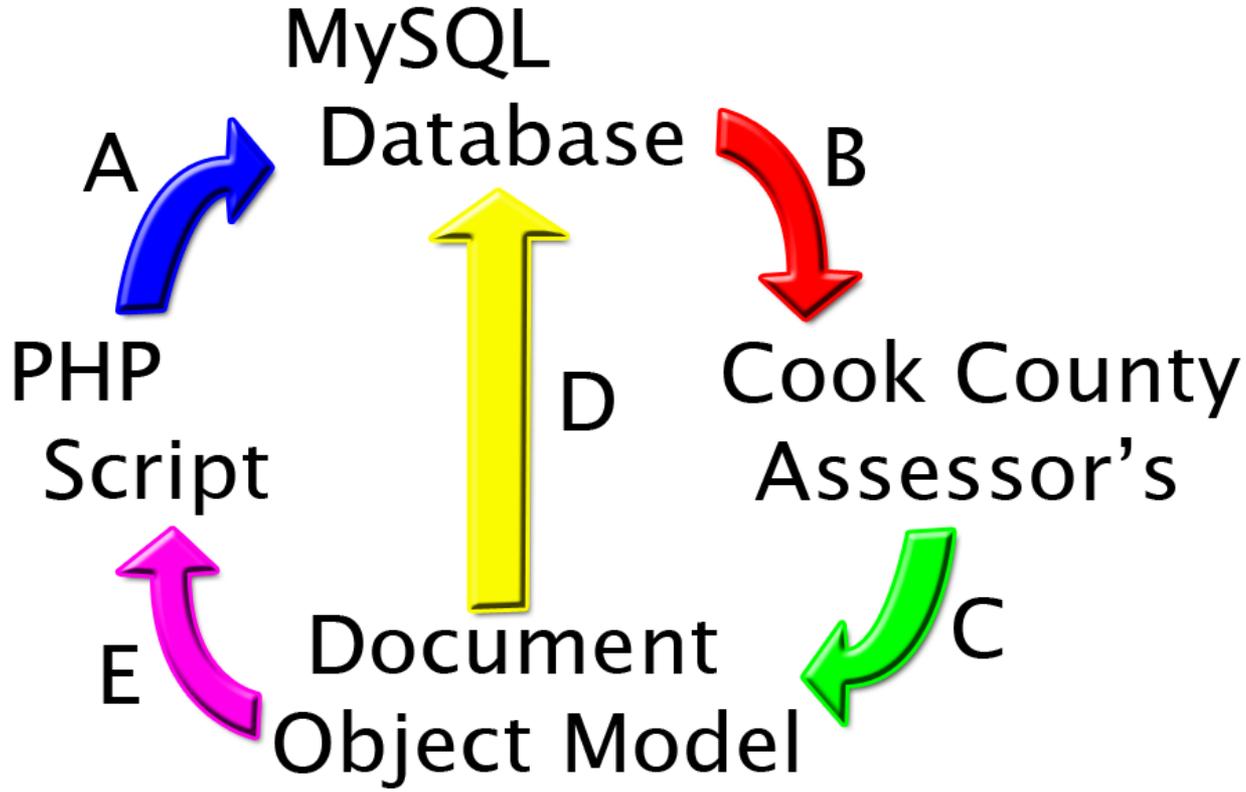
Estimated 2010 Market Value	998,450
Estimated 2009 Market Value	998,450
Description	Two or More Story Residence, Any Age, 5,000 Sq. Ft. & Over
Residence Type	Two Story
Use	Single Family
Apartments	None
Exterior Construction	Masonry
Full Baths	4
Half Baths	0
Basement ¹	Full and Unfinished
Attic	
Central Air	
Number of Fireplaces	
Garage Size/Type	
Age:	
Land Square Foot	
Building Square Foot	
Assessment Pass	

¹ Excluded from building

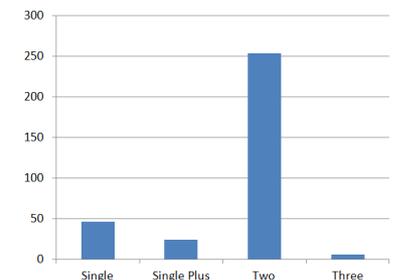
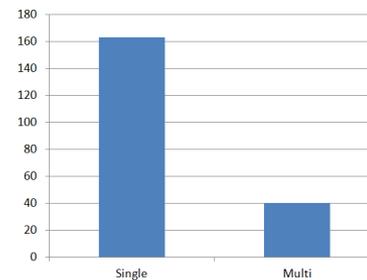
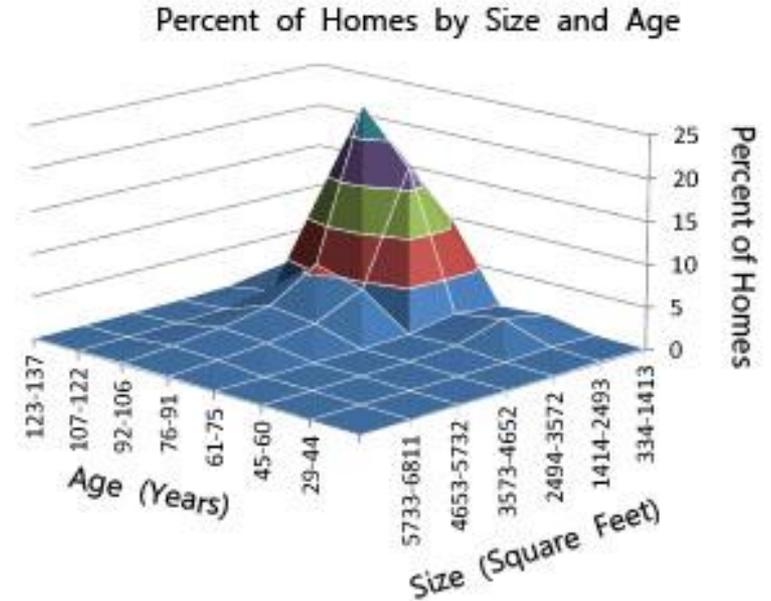
COOK COUNTY ASSESSOR'S OFFICE
Property Search Results

Property Index Number: 16-06-227-001-0000
Address: 950 Columbian Ave
CITY: Oak Park





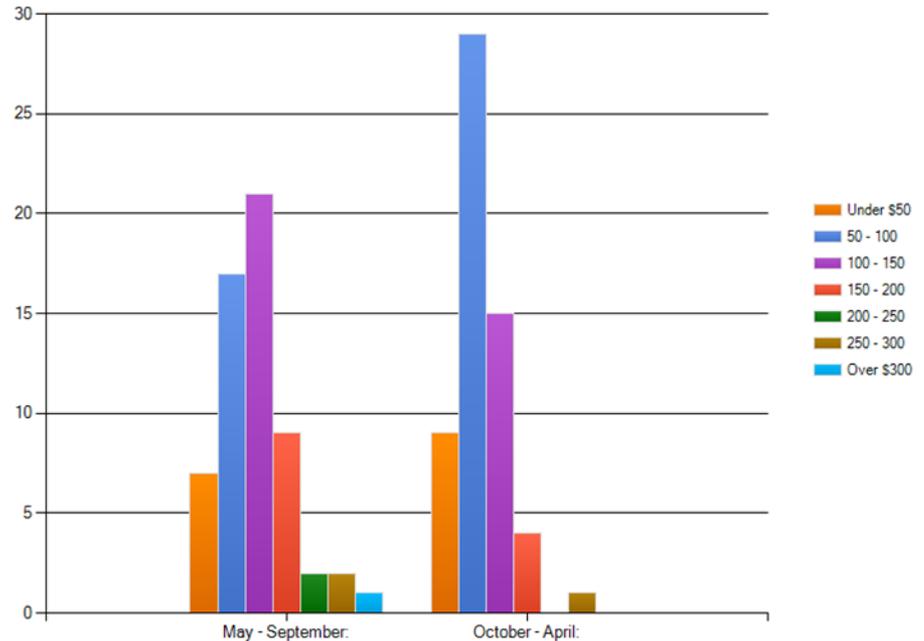
- Database results from the Cook County Assessor's PHP script were exported to Excel workbook format
- Geographic Information System (GIS) data was imported into the MySQL database and cross-referenced with existing CCA data by another PHP script
- Distinct addresses from the CCA & GIS databases were merged, totaling over 25,000 buildings



Home Owner Survey

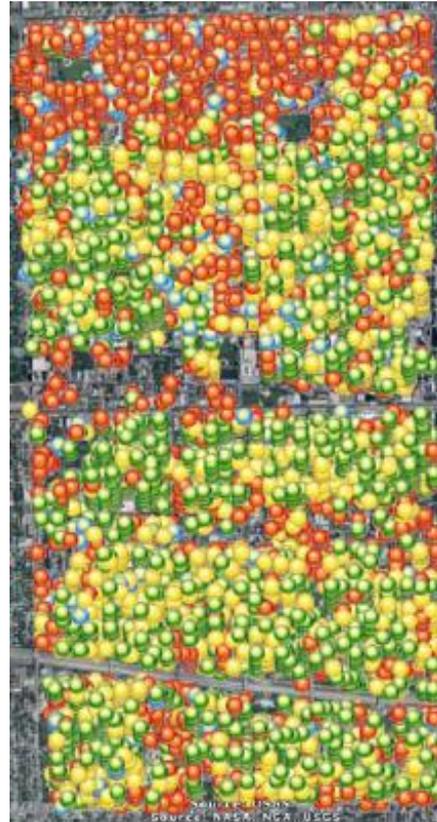
- Continually Build/Update Oak Park Database
- Home Condition
- Monthly Energy Bills
 - Peak & Off-Peak
- Knowledge of Potential Energy Reduction Strategies
 - Interest Level in Retrofits

Based on your monthly electricity bill, please give us a general idea of how costly your monthly bill is during the months listed below:



Geographic Information System (GIS)

- Manual check of housing inventory
- Visual display of housing types/statistics by region
- Capable of housing oak park energy use statistics
 - In real time
 - Next step



Case Studies

- Study of the other communities
 - Research other communities that have similar purpose with our team
 - Provide proven methods to improve the town
- Research of Oak park
 - Identify similar patterns among Oak Park Housing typologies
 - Identify common issues and solutions, especially in historic buildings



- Energy Audit

- Survey of Energy audit reports of typical Oak park houses

- Provide recommendations and Installation methods

- Example

- 1910's Stucco Bungalow

- What type of insulation and how should it be installed



AIR LEAKAGE CHECKLIST AND RECOMMENDED CORRECTIONS
 Leak Severity is ranked High (1), Medium (2), Low (3), or None (N). Priority Action Levels A, B, or C. Check: A-C Only.

AIR LEAKAGE TYPES	Quantity	Location(s)	Correction	Priority
Drop-down stair	1	SW Bedroom	Pre-fit roof of cover @ insulation down top, or fabricate blank top	A
Leak Verts	1	Main Atrc: IF CHOICE not made already	ADD blocking to prevent "wind whistling" at exposed joints	A
Roof Fan		Atrc	REPLACE IT!	A
Weather-Stripping Check for Air Leaks at Other Joints				
Went or Chimney Chase	1	Attic Floor	Seal at attic floor w/ fire rated material, no nails & foam	A
Chases (plumbing, electric, HVAC)	1	Attic Floor	Caulk/foam board & seal edges w/ spray foam. Nails/plastic seal hardware & materials.	A
Floor cavity @ exterior - Base Joint or other joint	1	Basement, Crawlspace	Seal with RTI rigid insulation to fill cavity at exterior seal edges with spray foam	A
Cabinets & Counters	2	W/ corner of kitchen	Seal gaps w/ caulk - use blue tape	A
Pricked Doors	1	2nd Fl Bathroom	Difficult to contact. Try attic, Roof.	A
Floors				
Floor/Wall Junction	1	Throughout 1st and 2nd floors	Remove caulk with wire roller first. Or Caulk with clear silicone, or remove quarter round, seal behind, & replace	A
Wood trim	2	Various windows - 1st fl	Caulk - see blue tape	A
Recessed fixtures - "cove" type	1	Kitchen	Seal behind cover w/ dyed-out AFG and an edge caulk/sealant	A
Recessed fixtures - "cove" type	1	1st fl, 1st fl	No trace of no connection for caulk or 4 inch type, except caulking with track lighting? Hopefully dense pack insulation in the walls will eliminate this leak.	A
Fixture bases, electrical Box	1	Powerline wall light	Caulk, or polymer foam behind & into hole. Check w/ electricity	A
Attic/Chimney				
Accessed Ducts	3	1st fl Living & Dining Rooms	Remove vinyl "roof" tops. Run R-13 batts & mark batts. Seal w/ mastic or UG listed alone tape.	C
Insulated ducts	1	2nd fl Supply and Return @ ceiling	Run Fan & mark batts. Seal w/ mastic or UG listed alone tape.	C

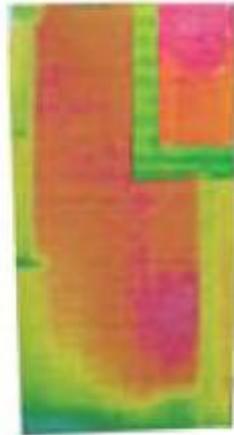
Insulation Conditions and Recommendations

Surface to be Insulated	Location	Insulation Type	Insulation R-Value	Priority	Notes
Pricked Roof - Rafter Gables	Main attic	Min 10"	R-13	A	See notes
Attic Floor - Above Ceiling	Main attic	Min 10"	R-13	A	See notes
Attic Floor - Below Ceiling	1st and 2nd floors	Min 10"	R-13	A	See notes
Floor above basement	2nd fl Bedroom	Min 10"	R-13	A	See notes
Floor above basement	2nd floor porch	Min 10"	R-13	A	See notes
Floor above basement	Basement	Min 10"	R-13	A	See notes
Floor cavity perimeter	Basement	Min 10"	R-13	A	See notes
Floor cavity perimeter	Basement	Min 10"	R-13	A	See notes
Basement wall	Unfinished basement	Min 10"	R-13	A	See notes
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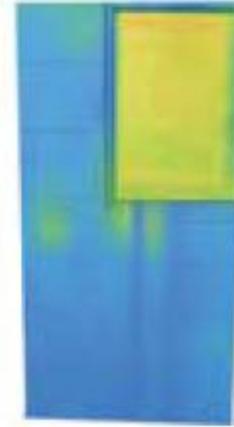


Wall Section Mock Ups

- Gain a better understanding of current state of many homes
- Built two wall sections
 - Insulated with newspaper
 - Foam Insulation
- Used thermal imaging gun to view heat loss through walls

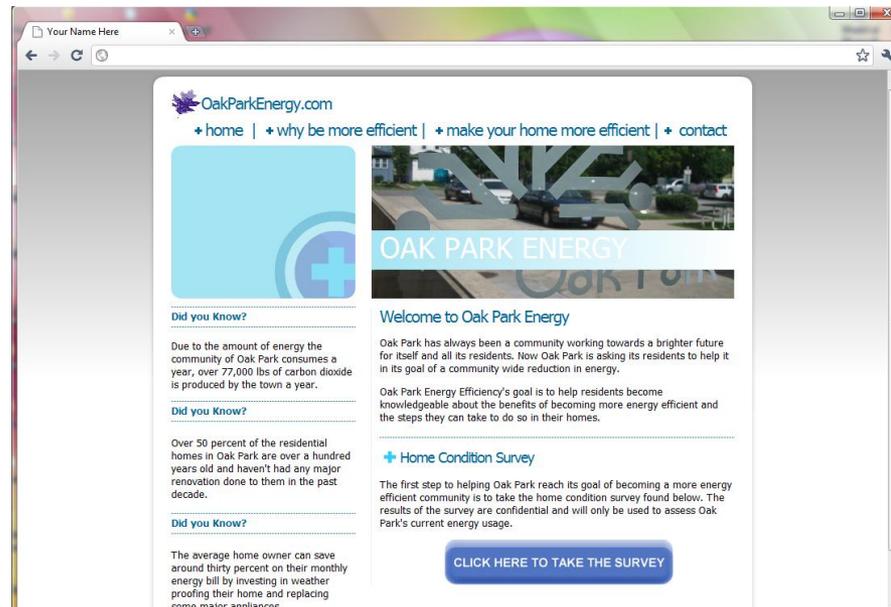


OLD CONSTRUCTION



NEW CONSTRUCTION

- Started development of a website
 - Stores all findings done by IPRO team in accessible format
 - Home improvement hub for Oak Park home owners
 - Help home owners gain ideas and basic knowledge of energy efficiency



The Future: Perfect Power

- Smart Grid System

- Merge electricity with technology

- Real Time Pricing

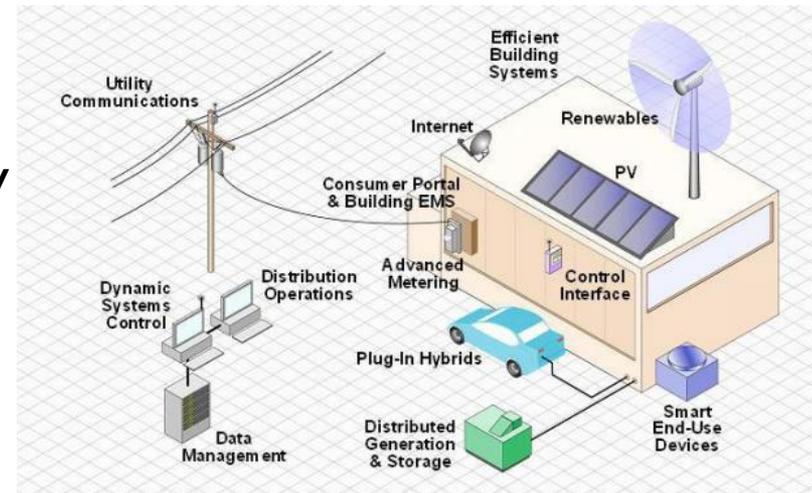
- 70% improvement in reliability

- 50% improvements in energy conservation and carbon emissions.

- In Conjunction with Home Automation Systems

- More conscious energy use

- Lower total use at competitive prices



Ethical Issues

- Case study participants' privacy
- Accuracy and relevance of our information to the Village of Oak Park
- Reliable and accurate source of research materials



Conclusions

- With the current state of many homes in Oak Park, reducing energy usage per home is an important task
- Additional projects will have to be done with the town's energy delivery to reach the desired reduction such as smart grids and home automation



- Continue work on energy efficiency packages for case studies
- Expand database/GIS with more building information
 - Current energy use statistics per house
- Develop a basic home automation solution
- Marketing for Smart Grid system
- Continue work with Citizens Utility Board on generating peak energy graphs

QUESTIONS?

