Re-energizing Illinois

Building Real Demand for Energy Efficiency

A final report

Community Energy Cooperative
2125 W. North Ave
Chicago, IL 60647

March 2007

This report was made possible by funding from:

Illinois Clean Energy community foundation

Ameren

ComEd An Exelon Company

Table of Contents

List of Tables and Figures

Acknowledgments

This work was made possible by a grant from the Illinois Clean Energy Community Foundation, a nonprofit organization that works to improve environmental quality in Illinois. This funding provided the Community Energy Cooperative with the opportunity to examine, in greater depth, how residential consumers think about energy. Quantifying these perceptions will contribute to the process of determining how Illinois can best address the essential goal of developing the policies and programs that will increase Illinois' energy efficiency.

Ameren Illinois Utilities and ComEd, the two largest investor-owned utilities in Illinois, provided additional funding for this project. Both of these utilities are offering real-time pricing to their customers starting in 2007, and we hope this research will contribute to the further development and success of their programs.

The Community Energy Cooperative and Center for Neighborhood Technology staff who contributed to this report are:

Anne Evens
Stephanie Folk
Larry Kotewa
Jose Lara
Luciela Prieto
Ruth Klotz-Chamberlin
Rachel Scheu
Anthony Star
Kathryn Tholin
Belinda Wordlaw
Jill Siegel
Harley Cooper
Peter Haas

We would like to thank Jocelyn Hirshman for statistical analysis, and Edward Friman and Anthony Gianopoulos at Exelon/ComEd for survey development and analysis advice.

Marjorie Isaacson, project coordinator
Chicago, Illinois
February, 2007

Executive Summary

Introduction

The Community Energy Cooperative of the Center for Neighborhood Technology has studied residential electricity consumers in order to identify the information, measures, and messages that would help build demand for energy efficiency in Illinois. The final report contains:

1. The analysis of a survey of ComEd and Ameren Illinois Utilities customers, comparing these northern and southern Illinois customers to participants in the Cooperative's real-time pricing pilot program, the Energy-Smart Pricing Plan[SM]
2. A review of current literature and successful programs in energy efficiency
3. Recommendations for effective policy and programs in Illinois

This research resulted in an energy agenda titled "To Control Costs, Get Smart about Energy Use." These recommendations will provide ancillary benefits for public health and the economy.

The written survey collected data on: appliance and electronic goods ownership, factors that influence appliance purchasing decisions, behaviors related to use of energy and energy conservation, opinions on energy and energy-related issues, interest in using real-time pricing for electrical service, and demographics. An additional telephone interview, administered to a subset of respondents, probed the respondents' opinions and knowledge in more detail.

Key Survey Findings

To achieve a successful real-time pricing program, residential consumers must be willing to choose the rate and be assured that they can effectively utilize the hourly pricing structure. After consumers have enrolled with RTP, they then need to respond "successfully" to the high price hours – i.e., exhibit sufficient elasticity of demand to reduce peak load.

To answer the first question, "will residential consumers choose the variable (RTP) rate?", the Cooperative asked Ameren and ComEd survey respondents if they would prefer a fixed or variable rate, and analyzed the responses. The results showed:

- Nearly one-third of respondents said they would choose the variable (RTP) rate
- People who said they would choose the variable (RTP) rate were:
  - more likely to have larger households (more people in residence),
  - had higher levels of education (college and above),
  - higher incomes,
  - were white,
  - and, owned their own homes.

These same demographic characteristics were associated with ESPP participants, with the additional factor of age (the ESPP program had a higher than average proportion of older participants).

To answer the second question, "which participants are the most successful ESPP participants?" the Cooperative analyzed the data provided from the ESPP participants. The results showed:

- The most "successful" ESPP participants differed from those who chose the variable rate
- The most successful ESPP participants had:
  - lower incomes ($25-$50,000 compared to $50-75,000),
  - a smaller number of people in their households (2.2 compared with 3.2),
  - a smaller average summer kWh consumption (547kWh as compared to 1357kWh).

Ethnicity, or race, was highly significant in type of rate preferences. Non-white respondents were significantly less likely to consider using a variable rate. However, it should be noted that it does not mean these populations will be uninterested in, or unable to successfully utilize, real-time pricing rates, if this option is effectively communicated to them. The ethnic distribution of ESPP respondents includes 26% non-white respondents. This illustrates the importance of utilizing appropriate marketing.

What Works in Energy Efficiency? A literature review

The Cooperative reviewed current literature and programs in the field of energy efficiency in order to identify the most promising directions for new program development in Illinois. The following examples highlight findings of this review.

- **K-12 Energy Efficiency Education:** In Illinois, there is some effort to bring energy efficiency education to K-12 students, but far more could be done.
  - The quality of education must be enhanced by utilizing resources available across the nation. This includes the creation of new programs and the enhancement of those already established.
  - Programs must be thoroughly evaluated (individually) to ensure their quality and validity.

- **Community-Based Energy Programs:** Several positive outcomes can be achieved by taking a community-based approach to implementing energy programs. For example:
  - The ability to get the right programs and offers to the right people
  - A sense among participants of lasting ownership and responsibility
  - The potential to address distribution system constraints in ways that can increase the avoided costs of building new infrastructure.

- **Visual Technology: The "Energy PriceLight":** The Cooperative tested a new tool during 2006, the Energy PriceLight"—a small lamp that receives information through a pager signal and changes color to reflect the current price of electricity. This visual technology may increase demand response and energy efficiency by:
  - Making it easy to know RTP prices at a glance
  - Increasing financial benefits of RTP to customers
  - Helping to keep energy issues "front of mind," due to high visibility of device

- **Real-Time Pricing Policy Implications:** RTP may offer additional benefits than other dynamic residential rate options, as it is more able to link wholesale and retail markets. As Illinois moves forward in implementing RTP for the residential market, the Cooperative recommends the following strategies:

- Solutions for achieving greater energy efficiency cannot come from a rate alone, and cannot come solely from the adoption of new technological devices.
- Energy efficiency strategies that combine technological, behavior and education innovations into comprehensive energy efficiency programming will be the most successful models.
- RTP should fit into an integrated long term, energy efficiency approach in Illinois.

- **Programs Aimed at Hard-to-Reach Communities:** When Illinois policymakers consider new energy efficiency programming, they should make a concerted effort to provide programs and services specifically aimed at hard-to-reach (HTR) residential customers. While this presents a considerable challenge, it is extremely important, as the California Energy Commission cites *changes in consumer behavior* (as opposed to hardware-based efficiency improvements) as the biggest contributor to reductions in energy use during the state's energy crisis in 2001.

- **Strategies for Effective Communication:** Before developing strategies to promote more energy efficient behavior, it is important to understand people's attitudes and knowledge regarding energy efficiency. This information is crucial in developing messages that the audience will find relevant, understandable, and credible.
  - Learn how people use energy and the circumstances that may encourage or discourage energy efficiency behavior.
  - Knowledge of the target audience will allow program planners to identify incentives and barriers and develop effective strategies that address the unique qualities of the targeted community.

- **Evaluating Program Impacts with an "Energy Efficiency Awareness Index":** Traditionally difficult to measure elements, such as changes in customer behavior and attitude, could be usefully evaluated with an index. Conventional benchmarks for evaluating energy programs have been quantitative, "energy-avoided" (measured by kW or kWh saved). A more qualitative evaluation, to study trends in attitude and behavior, would be valuable and represent a marked departure from current evaluation standards in Illinois.

Final Recommendations and Conclusions

The research the Cooperative completed during this year provided numerous examples of programs that could be effectively implemented in Illinois, and result in significant energy savings. But programs and policies are not developed in a vacuum; they are part of political, economic, and social contexts that obviously cannot be controlled. Given this reality, and reviewing the progress that Illinois has made so far in energy efficiency programs, it is apparent that more broad based, fundamental recommendations are necessary.

1. Evaluation and monitoring must be a required component of any program

Effective evaluations address both the process and impact of a project. In a best-case scenario, evaluation should be performed by a third party, with 3-5% of the program budget providing funding for this evaluation. Evaluation should also reach outside internal operations to include stakeholders, whenever possible. Finally, monitoring and evaluation need to be dynamic. Even

the best-running program changes over time, and opportunities to adjust and improve program specifics according to these changes must be identified and incorporated into the program design.

2. Social and behavioral research is essential for designing programs that work
The strict engineering approach to energy efficiency, which holds that technological fixes can eliminate energy inefficiencies, is recognized by most as a valuable but limited perspective. Behavioral conservation activities represent a significant potential source of savings. Understanding people's motivations and behavior is essential for developing effective energy efficiency programs.

3. Effective communication drives program success
Even the most important information will not reach its audience if it is not communicated effectively. The message needs to capture the target audience's interest and be conveyed in an understandable and convincing way, or the communication attempt will fail.

4. Strengthen the relationship between energy efficiency and demand response
Demand response and energy efficiency had previously been viewed as antagonistic, but recent work, including the Cooperative's experience with the Energy-Smart Pricing Plan, has shown that the two can be complementary. Real-time pricing provides participants with a context to examine their energy use, which is an important component of action – simply paying attention to electricity can make a difference in behavior.

The wealth of data that was uncovered in this report exemplifies the fact that we are only beginning to understand the complexity of creating incentives for energy efficiency and demand response. Additional research, particularly work that would establish a baseline for new real-time pricing customers, would be of particular importance.

Funding for this project was provided by the Illinois Clean Energy Community Foundation, ComEd, and Ameren Illinois Utilities.

Introduction

Everyone uses energy, but the implications of energy use – where it comes from, how much is consumed, and what it costs – are rarely part of the average consumer's experience. Yet the impacts of energy use have far-reaching implications that can affect everything from an individual's well-being to international policy. Because energy-related topics are extremely important and complex, energy policies are subjects of intense interest and debate. As such, addressing most any aspect of the energy issue is a daunting challenge. Today in Illinois there is a general consensus among everyone from policy-makers to the general public that something needs to be done about energy, but there is no widespread agreement on the types of comprehensive policies and programs that will result in the desired changes.

However, there is consensus on some basic responses to today's energy issues, which include high costs and supply shortages. Using energy efficiently is recognized as the "quickest, cleanest and cheapest source of new energy" (Nadel, Shipley and Elliot 2004). Energy efficiency is a utility system resource that can mitigate high prices, reduce the need for new energy supplies, and diminish harmful pollutant emissions.

On a national level, the Department of Energy and the Environmental Protection Agency worked with 50 key stakeholder organizations to produce the "National Action Plan for Energy Efficiency" in July 2006. Many individual states (most notably California, but also Wisconsin, New York, Vermont and Minnesota) have made significant progress in implementing real energy efficiency programs for their residents.

Illinois has made less progress. In 1998, the American Council for an Energy Efficiency Economy issued a report detailing how investments in energy efficiency could lead to lower energy costs and new jobs for Illinois (Goldberg et al 1998). In 2003, the ACEEE ranked Illinois 34th, 35th and 37th (on three different selected indicators) in utility and public benefit spending in energy efficiency (York and Kushler 2005a). An Illinois Sustainable Energy Plan was proposed in Governor Blagojevich's 2005 State of the State Address, but progress has stalled. Meanwhile, energy costs and consumption levels continue to increase.

One new opportunity did emerge in 2007. In accordance with state legislation (Senate Bill 1075), Illinois residential consumers can now choose to pay for their electricity using variable, market-based prices. Previously, residential consumers were only offered a standard flat rate. Both ComEd and Ameren Illinois Utilities are providing real-time pricing programs for customers who choose this option. Paying for electricity using real-time pricing can provide financial savings for consumers, and this new rate option is generating considerable interest among Illinois electricity customers who are experiencing the first rate increases in ten years.

Residential consumers are an important part of the energy outlook for Illinois. Residential energy use is increasing rapidly, and that trend is linked to social, cultural, and behavioral factors. Bigger homes, smaller family units, and more energy-intensive equipment and activities contribute to the mix. In surveying Illinois residents about energy in 2001, researchers from American Viewpoint found that 43% of the respondents were "extremely" or "very concerned" that Illinois would experience energy-related problems (Wilson 2001). However, this concern

does not automatically translate into individual actions to reduce energy use, even when it might lower costs. Some of this disconnect is attributable to lack of knowledge about specific actions that individuals can take. Other factors are less obvious, and more difficult to identify and address.

Based on these conditions, the Community Energy Cooperative of the Center for Neighborhood Technology launched a research project entitled *Re-energizing Illinois: Building Real Demand for Energy Efficiency*. One goal of this project was to survey residential electricity consumers in order to identify the information, measures, and messages that would help build demand for energy efficiency. Another element of this study was a detailed analysis of real-time electricity pricing. The Community Energy Cooperative operated a pilot residential real-time pricing program called the Energy-Smart Pricing Plan from 2003 through 2006. This pilot program produced excellent information on how consumers respond to market based pricing and demonstrated the potential benefits such a rate for consumers, the environment, and the electric system. The statewide deployment of this new rate will provide answers to several important questions such as:

- How many consumers will be interested in using the new rate?
- While the Energy-Smart Pricing Plan had proven to be successful in a program pilot, would other participants respond in the same way that the ESPP participants did?

These questions have important, practical implications. For consumers, real-time pricing could provide a way to save money on their electricity costs, but there are no guarantees. These savings are dependent on many variable factors, including consumer knowledge, awareness, individual behavior, and weather. Meanwhile, energy experts throughout the U.S. are closely watching the real-time pricing experiment in Illinois. Their interest is related to the potential of demand response to achieve significant reductions in electricity use, particularly in times of peak demand. The potential for significant system impacts and noticeable reductions in consumption of energy is real. The scale of these impacts will be answered in five years, when the results of fully scaled-up real-time pricing programs are evaluated.

The results of the Community Energy Cooperative's exploration of how to build demand for energy efficiency among Illinois electricity consumers is described in this report, which is divided into three sections:

1. Analysis of a survey of ComEd and Ameren customers, examining their behavior and attitudes toward energy and comparing those findings to data from participants in the Cooperative's real-time pricing pilot program, the Energy-Smart Pricing Plan^{SM}.
2. Review of current literature and successful programs in energy efficiency.
3. Recommendations for effective policy and programs in Illinois, based on the Cooperative's understanding of what works and how consumers are likely to respond.

Reduced electricity use is an achievable goal. The Community Energy Cooperative's Energy-Smart Pricing Plan (ESPP), a real-time pricing program that uses price signals to change consumption behavior, is one successful model. With funding from the Illinois Clean Energy and Community Foundation, ComEd, and Ameren Illinois Utilities, the Cooperative is continuing its

research on real-time pricing and investigating other energy efficiency and demand response programs that can reduce electricity use by residential consumers.

How Illinois households use energy

Illinois residents have an energy profile that reflects their location in what the U.S. Census Bureau refers to as the East North Central (ENC) Division, consisting of those states that border the Great Lakes in the Midwestern United States. The state of Illinois is characterized by cold winters and moderate summers. Space heating of buildings in winter requires a significant amount of energy consumption. Electric consumption is lower compared with the rest of the U.S. due to the typically cooler summer weather, which should reduce the demand for air conditioning.

Statistics from the U.S. Department of Energy's Energy Information Administration (EIA) provide extensive information on energy supply and consumption patterns in residential households throughout the country. The EIA reports that the ENC Division has a relatively older housing stock than elsewhere in the country, which contributes to higher energy use. Because the ENC Division averages 856 cooling degree-days per year compared with the U.S. average of 1,407 cooling degree-days, the demand for air conditioning should be comparatively lower. However, air conditioning penetration is increasing, especially as a standard feature of new housing (EIA 2001).

An examination of the demographics of the state identifies a split between the densely populated northern section, centered in the city of Chicago and the six collar counties, and the less populous southern portion where agricultural resources are predominant. This division corresponds roughly to the division between the service areas of the state's two largest electric utilities: ComEd in the north (serving metropolitan Chicago and its collar counties), and Ameren Illinois Utilities (Ameren) in the south (serving much of central and southern Illinois).

Surveys conducted for this study engaged households and electricity consumers in the ComEd service territory and in the Ameren service territory. Responses from these households were compared with those of participants in the Cooperative's pilot real-time pricing program in order to ascertain whether there are meaningful consumption and awareness differences between the two groups that could inform the development of successful energy efficiency programs.

Additionally, other surveys were used for verification and comparison to this survey data. One such survey was the EIA's Residential Energy Consumption Survey, which is conducted every four years. Limited 2005 results are available, so 2001 results were primarily used. A 2003 study by the Midwest Energy Efficiency Alliance (MEEA) surveyed Illinois households regarding potential energy efficiency improvements included "walk-through audits." A study of the energy efficiency attitudes of California residents (Hagler Bailly 1999) and U.S. Census statistics were also used. Details of the survey process and results are described in the sections that follow.

Section 1: Surveying Illinois Electricity Consumers

1.1 Survey and Analysis Methodologies

Following is a description of the survey development process, data collection process, and statistical analysis that was performed in order to study the ComEd and Ameren customers and the Energy-Smart Pricing Plan participants.

Survey Overview

Three survey instruments were developed for the study of residential electricity customers. Written format (paper) questionnaires were fielded for the ComEd and Ameren Illinois Utility customers, and for ESPP participants. A written format was chosen for the survey instrument primarily because pre-survey testing of the real-time pricing questions indicated that a detailed explanation and figure diagram provided the clearest account of this concept, which would probably be unfamiliar to most respondents. The surveys were also a lengthy eight pages, another factor that made telephone or in-person surveying impractical.

The Ameren and ComEd surveys were essentially identical in content, although each was customized to reference the appropriate utility. Ameren Illinois Utilities also requested that "propane" be added as a possible fuel type in the appliance section. This was an appropriate change that the survey team made for the survey of Ameren customers.

The survey for the ESPP participants contained most of the same content, but differed from the ComEd and Ameren surveys in that the real-time pricing questions were not included. It was determined that the ESPP participants' current and ongoing experiences with real-time pricing would bias their responses. A series of questions relating to the ESPP web tools was substituted for the real-time pricing questions on the ESPP survey. A copy of the written survey (including supplemental ESPP questions) is attached in Appendix 3. Spanish language versions were also produced.

Finally, the Cooperative conducted an additional survey by telephone using a questionnaire and guided conversation. This telephone interview was administered to a subset of respondents from each sample group.

The Cooperative originally planned to provide a $25.00 compensation for completion of the written survey. However, after further research and consultation with marketing professionals, the decision was made to reduce the stipend to $15.00, thus allowing the Cooperative to field surveys to a larger sample and obtain more representative results. The ESPP participants were not offered any compensation for completing the survey. As part of their participation in the ESPP program, these participants had been surveyed on an annual basis, and their response rate had been high. ESPP participants were offered the standard incentive for survey completion: completed surveys were entered in a drawing for three prizes of $100 each. No compensation was provided for the telephone interviews.

The written survey collected data on a variety of items covering several subject areas. These topics included:

a. *Appliance and electronic goods ownership*
Respondents were asked to provide information about kitchen appliances, home entertainment systems, computer equipment, general appliances, rechargeable tools, and air conditioning units.

b. *Factors that influence appliance purchasing decisions*
A five-point Likert Scale was used to determine the importance of various appliance characteristics and purchasing options.

c. *Behaviors related to use of energy and energy conservation*
This section of questions explored knowledge and use of compact fluorescent light bulbs, home improvements related to energy use, summer cooling behaviors, and thermostat settings.

d. *Energy opinions*
This section included a series of statements referencing energy-related behaviors and attitudes related to comfort, economic, and environmental aspects of energy use. Respondent were asked to answer with a version of the Likert Scale.

e. *Energy-related issues*
A series of questions in this section listed five "energy-related problems" and asked the respondent to rate the severity of each problem for Illinois in the next five to 10 years.
.
f.1. *Interest in using real-time pricing for electrical service* (not included for ESPP participants).
This full-page section included a discussion of how fixed and variable rates work, a comparison of the two plans, and a diagram that showed how the variable rate fluctuated during the day. Respondents were asked to indicate their preference for one of the rates and to score their level of interest in that rate. Respondents were also asked to explain why they chose the rate they did and to consider whether a higher projected rate of savings would make a difference in their choice.

f.2. *Questions about the Cooperative's website tools* (For ESPP participants only)

g. *Demographic information*
Topics included a series of demographic questions and others related to type of housing, charitable giving, and other personal practices.

h. *Authorization of release*
An additional component of the Cooperative's analysis was to compare respondents' survey responses to their actual electrical usage. Respondents were advised that they were required to authorize the Cooperative to obtain their usage information from their utility in three places: in the cover letter, in the introduction to the survey, and on the final page where they were asked to provide their electric utility account numbers. Additional contact information for survey follow-up (phone and e-mail) was also requested.

Many of the survey questions were modeled on previously fielded surveys, including the Energy Information Administration's (EIA) Residential Energy Consumption Survey (EIA 2001), the California Board for Energy Efficiency's Baseline Study on Public Awareness and Attitudes toward Energy Efficiency (Hagler Bailly 1999) and a corporate-produced survey of ComEd customers. This use of pre-tested questions contributed to the questions' reliability and facilitated the comparison of data.

The Cooperative fielded telephone interviews to a subset of each sample group. This interview was designed to investigate different areas of the respondents' energy knowledge and behaviors and to provide a greater depth of understanding of their energy attitudes. A copy of the interview format is included in Appendix 4.

Sample Selection

ComEd and Ameren utilities selected and provided two random samples (n=2,000 each) to the Cooperative. Before the samples were drawn, several types of customers were excluded from the selection. These exclusions, such as the removal of customers on the space heat rate, are discussed in Appendix 5. The ESPP survey was sent to all current ESPP participants, n= 1134

The telephone survey was administered to a subset of the sample respondents from each of the three sample groups who had indicated on their written surveys that they would be willing to participate in additional research studies. These respondents were randomly selected.

The Cooperative had originally expected to complete a limited number of in-home interviews to obtain additional verification and measurement details. This plan was revised after a review of the literature revealed a number of excellent studies with content similar to these areas of interest. Omitting site visits also allowed more resources to be committed to the written survey process.

Written Survey Fielding

All surveys were mailed from the Community Energy Cooperative and identified as part of a research study to "analyze consumer electricity use as part of a study funded by the Illinois Clean Energy Community Foundation and supported by [utility name]." The survey package included a personalized cover letter and a business reply mail envelope. Upon completion and return of the survey, respondents were sent $15.00 in compensation. Copies of the cover letters are included in Appendix 3.

The written surveys were fielded from May through July. Response rates were as follows:

Table 1: Survey Response Rates

Sample	Number of Responses	Included in Analysis	Response Rate
Ameren	417	399	21%
ComEd	280	239	14%
ESPP	541	541	48%

These response rates were relatively high for direct mail survey responses, and exceeded the expected responses rates. Only surveys that were substantially completed were included in the analysis. A summary of the survey fielding and response data is attached in Appendix 6. See Appendix 2 for a map of the survey respondents' locations.

Telephone Interview Process

The telephone interviews were initiated four months following the fielding of the written survey. Three random samples were selected from each group of survey respondents (Ameren, ComEd, and ESPP) who had indicated they would be willing to be contacted for other research studies. Seventy-seven telephone surveys were completed (Ameren = 16, ComEd = 27, ESPP = 34).

The potential respondents were sent a postcard or e-mail message reminding them of the survey, and informing them that they would be called in the near future. Surveys of the sample groups were conducted by Community Energy Cooperative staff. Each potential respondent was called three times before the contact was removed from the sample pool and a new contact selected.

The interview consisted of a series of questions addressing the respondents' opinions and knowledge of energy efficiency, appliance replacement, energy efficiency actions and barriers prohibiting those actions, and sources of energy information. Survey respondents were also given the opportunity to ask the interviewer questions. Scripted answers for anticipated questions were provided for the interviewers.

Statistical Analysis

A series of statistical analyses was performed on this data, beginning with the calculation of the basic frequency data or summary numbers and percentages of the data that was provided by the respondents. The Cooperative research team and market research staff at ComEd reviewed these frequencies in order to identify additional data fields that were necessary for additional analysis. This analysis was conducted in SAS version 9.0 (Cary, NC). Data was exported from MS Access into a .cvs format and imported into SAS with no errors. Next, a series of probability analyses was performed.

To investigate the potential for real-time pricing, additional data analysis was performed of ComEd and Ameren survey responses and of the ESPP participant survey responses. This analysis was conducted in SPSS Version 9.0. Standard version. The data was exported from MS Access table survey data, into a .dbf format table. The Access table was copied to a file for analysis called survCAAnal and survESPAnal for manipulation and for analysis. The data was imported into SPSS from the .dbf, 705 records, with no errors. A visual inspection of the dataset

was complete and consistent with the MS Access file. Data frequencies were also conducted and compared with Access data to assure completeness.

A series of statistical analyses was also performed on energy-use data from the real-time pricing participants. The goal of this analysis was to identify metrics that could predict an individual's change in electricity usage in response to pricing, i.e., elasticity. The Cooperative received electrical usage data from the prior two years for Ameren and ComEd respondents, but no analysis results are included here. This was due to the inconsistencies in comparison metrics (notably the element housing square footage) and the difficulties in comparing the interval data from ESPP participants to the simple monthly summary totals.

Limitations in Comparing ESPP Participants with Non-participants

ESPP was promoted in distinct communities within the ComEd service territory. Targeted communities included the Pilsen and Northwest Side neighborhoods of Chicago, as well as the suburbs of Park Forest, Elgin, Aurora, and other Kane County communities with ComEd electricity service. As a result, comparing ESPP participants' responses to those of the general ComEd population will reveal differences between communities previously targeted and the larger ComEd service area. When targeted communities were not representative of the larger service area, the conclusions that could be drawn about the differences between ESPP participants and non-participants were limited. However, 50% of the ESPP participants were from areas outside the targeted communities, resulting in a greater degree of diversity within the ESPP population.

Similar limitations exist in comparing ESPP participants with Ameren customers. Differences between the two groups tended to reflect regional differences rather than differences related to ESPP enrollment.

Despite these limitations, comparing ESPP participants with typical ComEd and Ameren customers is useful for gaining insight into differences between current participants and communities where real-time pricing will become available in the future. Understanding the demographics, attitudes and electricity usage habits common among potential future enrollees will be helpful in shaping a program that will suit these customers' lifestyles.

1.2 Survey Results

The written survey instrument was designed to collect information on ComEd and Ameren customers and compare them with the Energy-Smart Pricing Plan participants using multiple parameters. This analysis addressed the central research topic: identifying which consumers are most likely to participate in and benefit from a real-time pricing program. Identifying consumers' behaviors and attitudes was another important area of inquiry.

The ESPP participants have been studied extensively by the Cooperative and a third-party evaluator, Summit Blue Consulting (Star et al 2005, Isaacson et al 2005, Summit Blue 2004, 2005, 2006). The analyses have included both statistical analyses of the participants' hourly

energy use (which demonstrated that there is a positive link between increasing price and decreasing consumption) and multiple qualitative surveys that examined participants' satisfaction with the program and explored energy-related actions they took as a result of the program.

The Cooperative also compared the findings of this survey with other studies that addressed similar topics. Two primary sources of reference were national data from the 2001 Residential Energy Consumption Survey, collected by the Energy Information Administration (EIA 2001) and data collected in an Illinois study, the Illinois Residential Market Analysis (MEEA 2003), completed in 2002.

Demographic data

ComEd and Ameren respondents and ESPP participants were compared based on a series of standard demographic data. See Appendix 7 for a full listing of results.

Residence and home ownership

Four choices were provided for respondents to report their type of residence: single family detached, single family attached (e.g., duplex or townhouse), apartment or condo with two to four units, and apartment or condo with more than four units. Ameren participants were most likely to live in single family homes (94.9%), followed by ESPP participants (83.2%); compared with the ComEd sample (67.5%). These differences were statistically significant ($p<0.0001$). ESPP participants were also more likely to be homeowners (90%).

Characteristics of household residents

Respondents were asked to classify their race or ethnicity using categories based on U.S. Census classifications. Respondents from the ESPP sample were more likely to be white than ComEd respondents, and an even higher percentage of Ameren respondents were white, while percentages of African-American and other ethnicities were smaller. These differences were statistically significant.

The majority of all surveyed households had two persons in residence. The average household size was 2.6 persons (Ameren, 2.47; ComEd, 2.58; ESPP, 2.63).

Data on the age of the survey respondents and whether or not children under 18 years of age were present in the household were collected. ESPP respondents are significantly older than the respondents in the ComEd and Ameren service territories. The Ameren sample has the largest proportion of residents under 50 and households with children under 18 in residence, these results were statistically significant ($p< 0.001$ level).

The number of Ameren and ComEd respondents who were 65 years of age or older was significantly smaller than the number ESPP respondents in that age group, but larger than the percentage of individuals aged 65 or older in the general population. This metric may be related to a tendency for older individuals to be over-represented as survey respondents, as they are more likely to have the discretionary time to respond to mailings.

ESPP participants had completed the highest levels of education (52.6% had graduated from college or had post-graduate education), and had the lowest proportion of participants with only a high school education (22.2%). The Ameren sample had the highest percentage of respondents who had only a high school education (41.9%). The differences were statistically significant ($p<0.05$).

The average household incomes of ESPP participant were higher than both ComEd and Ameren participants, although only the differences between the ESPP and Ameren samples were statistically significant. More than half of the Ameren respondents were in the middle income range, and 30.6% of ESPP participants were in the over $75K income category, compared with 18.6% of those from Ameren.

These demographic statistics should be considered within the context of overall trends in demographics. Houses are becoming larger, a smaller number of people are living in each household, and those residents are aging.

Appliance and electronic goods ownership

Information on appliances, heating and cooling systems, and other electronic equipment was collected. Additional information about heating systems and types of fuel were collected for Ameren respondents, at the request of Ameren. Selected appliance and equipment information is discussed below. See Appendix 7 for a full listing of these data.

Kitchen Appliances

Kitchen appliances are the single largest component of electricity consumption in the home. Refrigerators, with their 24-hour on cycles, constitute a significant portion of that electricity use; and older refrigerators are particularly inefficient. An average of almost 30% of all three samples groups had refrigerators older than ten years. Respondents from the ComEd sample had the newest refrigerators; with 47% less than six years old, compared to 39% of the ESPP participants and 37% of the Ameren respondents.

Free standing freezers

Separate freezers are fairly common in this part of the U.S. The East North Central Census Division has the second-highest proportion of freezers in the country (present in 35% of households). This survey found even higher proportions: 56% of Ameren respondents and 47% of ESPP participants reported having freezers.

Stoves

The East North Central Census Division has more access to natural gas than any other part of the U.S., so kitchen ranges and stoves that use natural gas are more prevalent here. However, natural gas service is not universally available to all Illinois households. Ameren respondents had a significantly higher percentage of electric stoves (48%) compared with ComEd and ESPP respondents (18% and 15%, respectively). Ameren Utilities had also requested the addition of propane to the fuel type selections in their survey fielding. Four percent of the responding households used propane.

Clothes washers and clothes dryers

Owning a clothes washer and dryer is related to both income level and type of housing. Renters and residents of multi-family housing buildings are less likely to have washers and dryers, and the data reflect that tendency. ComEd respondents, who have the highest proportion of non-homeowners and apartment dwellers, have the lowest proportion of washers and dryers (79% and 77%, compared with more than 90% for Ameren and ESPP respondents).

Heating and cooling equipment
The Illinois climate means winter space heating is a necessity for all residential buildings, while summer air-conditioning is not. However, the number of residences that opt to invest in air-conditioning equipment is steadily increasing. Window air-conditioning units are quickly becoming less prevalent. Census data for 2001 showed that 56% of households had central air, while 24% had individual window units.

Illinois's cold-winter climate and relatively older housing stock means that space heating accounts for much of the energy consumption in households. Most households (more than 90%) used natural gas fueled systems.

This survey did not collect data on primary space heating equipment.

Air conditioning
Over 90% of the households in all of the sample groups had air conditioners (Ameren, 97.7%; ComEd, 90%; ESPP, 90.9%). ESPP participants had the largest percentage of central air conditioners, followed by ComEd, then Ameren. Because some households have both window and central air conditioners, these percentages add up to more than 100%.

Supplemental space heating
The central heating unit is not the only source of space heating used. Through the Cooperative's experience with ESPP participants, we have learned that some households must rely heavily on supplemental space heaters for warmth. An average of 30% of the households in this survey do. These portable freestanding units can consume a significant amount of electricity.

The majority of these units are electrical (ComEd, 96%; ESPP, 97%), but Ameren had the largest proportion of units powered by other fuels (8%), including kerosene, oil, natural gas, and propane.

Other electrical appliances and equipment
Each year, the amount and variety of electric hardware in households increases. The EIA characterizes lighting and home electronics as significant contributors to end energy use. This survey collected data on home entertainment systems including televisions (LCD, plasma, and standard types), VCRs and DVD players, stereos, and video game equipment. The survey also asked about computer equipment (PCs, fax machines, scanners, and printers) and other appliances. A complete listing of the summary data is in Appendix 7.

Apart from the electricity actually used when appliances are on and in use, appliances are increasingly responsible for so-called phantom loads, or standby power, referring to the continual drawing of electricity even when the appliance has been turned off. For example, devices that

use electricity to recharge their batteries continue to draw power when they are not actively in use. These tools or appliances are recharged by plug-in cords with power supplies in plastic boxes, or "wall cubes." Data on rechargeable tools and user's recharging habits were collected.

Factors that influence appliance purchasing decisions

The survey contained a Likert Scale of statements designed to elicit information on which factors were important to consumers when shopping for appliances. The results are summarized in Appendix 7.

Behaviors related to use of energy and energy conservation

The survey asked a series of questions related to how respondents actually use energy in their homes. Information on behaviors such as using compact fluorescent light bulbs and monitoring thermostat settings was collected. The survey also collected data on energy-related home repairs. See Appendix 7 for the complete listing of results.

Compact fluorescent light bulb usage

Using compact fluorescent light bulbs (CFLs) instead of standard incandescent bulbs is one of the most effective ways to save energy. Survey respondents were asked two questions about compact fluorescent use.

In response to the first question ("Do you use compact florescent light bulbs in your lighting fixtures?") ESPP participants are highly more likely to use CFLs in most or some of their lighting fixtures, and very few are unfamiliar with CFLs. There is a statistically significant difference between ESPP respondents and Ameren and ComEd respondents, and no significant difference between the Ameren and ComEd samples with regard to reported CFL use.

In answering the second question ("If you do not use compact fluorescent light bulbs, why not?"), Ameren respondents were more likely to choose "too expensive" as the reason they do not use CFLs, whereas ComEd respondents were more likely to state that the bulbs did not fit their fixtures.

Turning out lights

Turning off lights that are not in use is a well-established energy-saving practice that doesn't require adopting new technology and involves no financial outlay. Response rates in each of the categories were very similar across sample groups, with a majority of respondents (more than 60% in all three samples, and 66% in the Ameren sample) reporting that they "almost always" turned off the lights when not in use. However, it should be noted that this question is probably subject to the positive response bias effect.

Home improvements to improve energy efficiency
Survey respondents were asked about improvements that had been made in the past five years to improve the energy efficiency of their homes. The responses provided for the survey respondents included replacing windows with energy-efficient windows, installing storm windows, adding weather stripping, upgrading insulation, replacing the furnace with a more efficient model, and installing a more efficient air conditioner. There was also space for respondents to write in an answer (for data frequencies, see Appendix 7). The responses for all three samples, in relation to one another, were consistent across all elements. The ESPP group had the largest percentages of each improvement, followed by Ameren, with the ComEd group reporting the lowest percentage of each improvement type.

Perspectives on energy

Energy attitudes
Survey respondents were asked to respond to a series of statements related to energy use and energy attitudes. These statements were designed to elicit attitudes and opinions and, if possible, identify factors that were highly correlated with ESPP participants. Responses were categorized on a Lickert-type scale (possible responses: strongly disagree, somewhat disagree, somewhat agree, strongly agree, and no opinion).

The statements also reflected different values. For example, some addressed price-related concepts. Others were designed to address environmental issues or comfort-driven attitudes, e.g., "saving energy means being uncomfortable or giving up things I enjoy."

ComEd and Ameren respondents were compared with the ESPP participants using a Chi-square test for significance. Statistically significant differences between the sample populations were found in a number of instances. These results are discussed below.

Statements from the "Your energy opinions" matrix
a. *I always shop for the lowest prices, even if it takes more time and effort.*
A majority of respondents in each sample (more than 80%) somewhat or strongly agreed with this statement, indicating that price is a primary motivator in buying decisions. Ameren had the highest percentage of respondents who strongly agreed (38%).

b. *Conserving energy is a good way to save money.*
A majority of respondents strongly agreed with this statement, and the difference between the ComEd and ESPP participants was statistically significant ($p<0.01$).

c. *Conserving energy helps to protect the environment*.
A majority of respondents strongly agreed with this statement, but the difference between Ameren and ESPP samples was statistically significant at the $p< 0.001$ level.

d. *We do a very good job of conserving energy in our home.*
The majority of respondents in all three groups "somewhat agreed" with this statement, however, the differences between the responses were statistically significant ($p<0.005$). The ESPP group had the highest percentage of respondents in the "strongly agree" category, compared to ComEd and Ameren.

e. *I rarely think about my household's energy needs.*
The majority of respondents in all three groups described their opinions as "strongly disagreeing" with this statement, but differences between the responses were highly significant, with $p < 0.0001$. The ESPP group had the highest percentage of respondents in the "strongly disagree" category (49%, compared to 43% of Ameren respondents and 35% of ComEd respondents).

f. "*Energy efficient products are too expensive*."
The responses of ESPP participants were significantly different than those of Ameren and ComEd respondents. Higher percentages of Ameren (32%) and ComEd respondents (36%) somewhat agreed with this statement, whereas only 28% of ESPP respondents somewhat agreed, and 28% either somewhat or strongly disagreed.

g. *Using energy efficiently is important to me.*
The majority of respondents in all three groups said they strongly agree with this statement. However, the differences between the responses were statistically significant with a p value < 0.0001. The ESPP group had the highest percentage of respondents in the "strongly agree" category (75% for ESPP compared with Ameren at 59% and ComEd at 56%).

h. *Saving energy means being uncomfortable or giving up things I enjoy.*
The majority of ComEd and ESPP respondents chose the "somewhat disagree" option for this statement, whereas Ameren respondents had the highest percentage in the "somewhat agree" category. Ameren respondents had the highest proportion who strongly agreed with this statement. The differences between Ameren and ESPP respondents were statistically significant ($p < 0.004$).

i. *It is easy to use energy efficiently at home.*
The majority of respondents in all three groups said that they somewhat agree with this statement (Ameren, 54%; ComEd, 51%; ESPP, 48%). A larger proportion of ESPP respondents strongly agreed with this statement (35%). The difference between the Ameren and ESPP participants was statistically significant ($p<0.02$).

j. *I use as much energy as I need to do the things I want.*
The largest proportion of respondents in all three groups chose the "somewhat agree" option for this statement (approximately 40% each). The differences between the groups were not statistically significant.

k. *I have no control over the amount of electricity that my household as a whole uses.*
Approximately 80 to 85% of respondents either strongly or somewhat disagreed with this statement. However, the responses of both the ComEd and Ameren groups were significantly different than those of the ESPP respondents with 55% of ESPP respondents strongly disagreeing with this statement ($p<0.01$).

l. *I try not to use air conditioning often.*

Responses to this statement varied widely, and the differences were highly significant (p<000). The Ameren group had the highest percentage of respondents who strongly disagreed with this statement (24%) and the ESPP respondents had the highest percentage of strong agreement (47%).

m. *If it did not cost so much, I would keep my house warmer in the winter and cooler in the summer.*
The highest percentages for ComEd and Ameren respondents strongly agreed with this statement, whereas most of the ESPP participants somewhat agreed with this statement. However, differences between the groups were not significant.

n. *Fuel economy is one of the most important considerations when shopping for a car.*
All three groups had a majority of respondents who "strongly agreed" with this statement. However, differences between the groups were not significant.

o. *I am usually eager to try new products with new technologies.*
The majority of respondents in all three groups "somewhat agreed" with this statement. The differences between the ComEd and ESPP groups were significant at the 95% level, while the differences between the Ameren and ESPP samples were not statistically significant.

p. *I track my monthly costs pretty carefully.*
The majority of respondents either somewhat or strongly agreed with this statement with similar results for all three groups (37% to 41%). The differences between these groups were not statistically significant.

Public policy on energy issues

This section listed five energy-related issues and asked the respondent to rate the seriousness of each issue for Illinois in the next five to 10 years. These questions were based on a series of questions that were asked in a survey of California residents after the 2001 electrical black-outs and price spikes (Lutzenhiser 2004). The differences between the three sample groups were statistically significant on three elements: continually rising energy prices, problems with nuclear storage, and global warming.

Receptiveness to using real-time pricing for electrical service

A primary area of inquiry for this project was to determine which consumers would be most likely to participate in and benefit from real-time pricing programs. A full page of the survey (see page 5 in Appendix 3) was devoted to an explanation of how real time pricing works. This included a comparison to electricity pricing under a fixed rate plan and a discussion of the benefits of each type of plan. A graph comparing the electricity prices under the two programs on a typical day was also provided.

Respondents were asked three questions about real-time pricing (RTP). These questions were only included on the ComEd and Ameren surveys, since ESPP participants – who were already enrolled in a real-time pricing program - would not provide an accurate, unbiased comparison group.

The questions and their analysis are discussed below.

RTP Question 1: *"When rate options are available, do you think you would be interested in a variable rate plan or a fixed rate plan, like the rate you have now?"* Table 3 displays the basic frequencies of the responses to the first question.

Table 2: Interest in a fixed or variable rate plan

	Fixed Rate				**Variable Rate**					
	definitely fixed		Probably fixed		possibly fixed		possibly variable		probably variable		definitely variable	
Ameren	58	14.5%	120	30.1%	28	7.0%	47	11.8%	72	18.1%	24	6.0%
ComEd	35	14.6%	61	25.5%	17	7.1%	28	11.7%	50	20.9%	16	6.7%

NOTE: Approximately 11% of both ComEd and Ameren respondents misinterpreted the questions and chose two answers (one for their fixed rate preference and one for their variable rate preference). These respondents and the respondents who had not answered the questions were removed from the analysis.

The data were analyzed to see whether the distribution of interest in the fixed or variable rates was randomly distributed. A Chi-square analysis revealed it was not. There was no statistical difference between ComEd and Ameren samples and their distribution for interest in being on fixed or variable rates. In comparing the responses for all three choices (definitely, probably and possibly) for fixed and variable rates, more people preferred the fixed rate (57.5%) than the variable rate (42.5%). A T-test analysis showed there was no statistical difference between the ComEd and Ameren sample means, and both groups slightly preferred fixed rates. The results of the statistical analysis are recorded in Appendix 8.

RTP Question 2: *"Why did you select the variable rate or fixed rate?"*
This survey question was open-ended, designed to solicit reasons that respondents made their choices. The responses were categorized and summarized in the next section.

RTP Question 3: *"If the projected savings for the variable rate plan were 20% (with some changes in your energy use) how likely would you be to choose the variable rate option?"*
This question was designed to test whether a 20% projected savings would cause respondents to change their receptiveness to the variable rate plan. In this case, larger proportions of respondents picked somewhat or very likely to choose variable rates (78.9% Ameren, 72.5% ComEd).

Having determined that a portion of consumers are interested in real-time pricing, the next step in our analysis was to try and identify the characteristics of those consumers who were most likely to participate in and benefit from a real time pricing program. The analysis is described below.

Crosstab tests for statistical significance were completed comparing the likelihood of choosing a fixed or variable rate on the series of demographic elements: single or multi-family residences, owner/renter status, families with children under the age of 18, age of respondents, household

income, level of education, and ethnicity. Only one data element – ethnicity, or race - was significant in all four respondent combinations.

Other elements were identified as significant in the testing of "fixed" versus "variable" preferences. For the Ameren respondents, the element Household Income was significant at the 95% level, as well as the element "highest level of education." These elements were not significant for the ComEd group, however, homeowners (as opposed to renters) were significantly more likely to prefer the variable rate.

A regression analysis using these elements was completed in an attempt to model which elements were associated with the rate choice. Education level and owning a home were associated with the variable rate, and highly significant. People who have larger households (in terms of number of residents), own their own homes, and have a higher educational level were more likely to choose the variable rate. Households that recycled were also more likely to choose the variable rate, although this element was not as important as the previous elements.

Another test, a discriminate analysis, was used to try to build a predictive model for choosing the fixed or variable rates, using the demographic elements. The group that chose the variable rate was more lively to have a higher level of education, more likely to have larger households, and slightly more likely to own their own homes. However, although these results are significant at the $p<0.05$ level, the differences between the means of independent variable is not substantial. More could be done to collapse the predictor variables into more discrete groups.

Next, crosstab tests for statistical significance were completed comparing the likelihood of choosing a fixed or variable rate on the series of energy-related perception elements.
For ComEd respondents, only one element, the statement "It is easy to use energy efficiently at home," was statistically significant (p value < 0.026).

For Ameren respondents, two elements were statistically significant. One was the statement *"I am eager to try new products with new technologies"* (with a p value of <0.05). The other was the statement *"I try not to use air conditioning often,"* (with a p value of < 0.0183).

A regression analysis was also used to identify the perceptions that were associated with choosing the variable rate. Three elements emerged: *"Conserving energy helps protect the environment," "I track my monthly electric costs pretty carefully,"* and again, "It is easy to use energy efficiently at home."

A univariate analysis of variance was used to further evaluate perceptions. In the test of between-subject effects, these elements: adjusting the thermostat in summer, and the energy opinion elements "I always shop for lower prices" and "Conserving energy is a good way to save money" were significant.

Telephone Interviews

The telephone interviews were initiated four months following the fielding of the written survey. Three random samples of respondents who had indicated they would be willing to be contacted for other research studies were selected from each group of respondents (Ameren, ComEd, and

ESPP). A total of 77 telephone surveys were completed (Ameren = 16, ComEd = 27, ESPP = 34). A copy of the interview form is included in Appendix 4, and a complete report of the results is in Appendix 7.

No statistical analysis was completed on the telephone surveys due to the small sample sizes and the primarily qualitative nature of the data collected. However, these interview results are useful for providing insights into several areas of energy attitudes not investigated by the survey.

The first portion of the survey addressed energy efficiency knowledge, perceived and actual. The questions are listed and discussed below.

1. On a scale of one to five, with one meaning you have very little knowledge and five meaning you have a lot of knowledge, how would you rate your knowledge of ways to save energy at home?
The largest proportion of Ameren and ESPP respondents chose four (56% and 50%), more ComEd respondents chose three (41%).

2. Do you think your household uses more, less, or about the same amount of electricity as a similar household?
Most ESPP respondents (79%) said they used less electricity than other households. The largest proportion of the Ameren respondents (50%) said their households used less energy. Most ComEd respondents (48%) said they used about the same amount.

3. Are you familiar with the term R-value?
The largest proportions of ComEd and ESPP respondents answered "yes" (52% and 68%). The largest proportion of Ameren respondents (50%) responded "no" and 44% answered "yes". If survey respondent answered "yes" or to Question 3 or were uncertain, they were asked, "Can you tell me what it means?" Most respondents who answered "yes" were able to give an accurate explanation of the term R-Value, including the general idea that the higher the R-value, the better the insulating capacity. However, four out of the five total respondents who had answered that they were uncertain gave incorrect explanations of the meaning of the term R-value.

4. Are you familiar with the term "SEER" (pronounce sear)? That's S-E-E-R. In print, it's written in all capital letters.
Few respondents were familiar with the term SEER. The majority of respondents in each group answered "no" (Ameren, 88%; ComEd, 78%; and ESPP, 71%). If survey respondent answered "yes" or were uncertain, they were asked, "Can you tell me what it means?" Many respondents who answered "yes" then accurately noted that the term SEER was an efficiency rating scale for central air-conditioners. Some gave exact numbers for a high SEER rating and some only knew generally that the term was connected with air conditioning. However, out of the 6 total respondents who said they were uncertain about the term, no one gave a correct explanation about the meaning of the term SEER.

Two questions focused on appliances.

5. When you think about your year-round energy use, which appliance in your home would you be most interested in replacing with a more efficient model if the cost of replacement was not an issue?
The responses to this question varied widely. The most common answer was refrigerator (15 responses, 19%), followed by central air conditioner (14 responses, 18%).

6. Have you ever replaced an appliance solely to get a more efficient one?
ESPP participants had the highest percentage of "yes" responses (47%), Ameren and ComEd respondents were 31% and 33% respectively.

Respondents were queried about how much attention they paid to their electricity bills. When asked what they looked at when they received their bill, the overwhelming majority (77% for all three samples combined) responded that they only checked the dollar amount due. If respondents gave only one response, they were prompted "do you check anything else on your bill?" Then, we asked if the interviewees knew how much electricity their household used monthly. Thirty-one percent of Ameren respondents claimed they did, compared to 7% of ComEd respondents and 18% of ESPP respondents. Interviewees who replied "yes" were asked to report the kWh amount.

Next, respondents were asked about *"actions you take to limit your energy use or costs."*

ESPP participants were not asked this question because similar questions have been posed to them in previous surveys. Following this, we asked the open-ended question:

7. What are the biggest factors that might prevent you from saving energy or using energy more efficiently?

The response with the largest percentage for all three groups was "cost" (25% total). Second-largest was "other members of the household" (17%). However, there was wide variability in responses. Specific responses that could not be categorized totaled 44%.

8. What is one thing you do that you think uses a lot of energy, but you would not want to give up?

Responses to the question had great variation. Air conditioners topped the list, but the percentage was only 22% (average of all three samples). Computers were second, with an overall average of 16%.

The situation of peak energy demand was presented to respondents as follows:

9. On hot summer days, many people use air conditioners and this puts strain on the electrical system. Would you be able or willing to voluntarily use less electricity on hot summer days if it would reduce the chance of a blackout in your neighborhood?

Overall, 83% of respondents replied "yes", with 100% of the Ameren interviewees responding affirmatively.

The Cooperative used this opportunity to confirm the data on whether respondents worked from home, a situation that can interfere with energy conservation.

The interview concluded with a series of questions addressing how, and how much, respondents learned and talked about energy. When asked the question: "How often do you talk to others about energy-related subjects other than gasoline?", the majority of respondents (59% overall) reported answers were categorized as "not often". For those who did discuss energy –related topics with others, the follow-up questions "Who do you talk with about energy? and "What sorts of things would normally discuss?" were posed.

The final survey question asked "When you look for information about energy, which sources do you trust the most?" Across all groups, the largest proportion of responses were in the "news and media" category (30% overall). Correspondingly, "news and media" had the highest proportion of responses for Ameren and ComEd (27% and 38% respectively), but the highest proportion category for ESPP participants was "consumer advocacy groups" (32%). Twenty-one percent of ESPP participants referenced "news and media."

Telephone Interview Findings

The telephone interviews provided several useful insights into the Ameren, ComEd, and ESPP populations. Because of the relatively small sample size, the validity of the responses cannot be determined, but a number of areas that may be of interest for future analysis are discussed below.

The electrical bill is a monthly communication opportunity, but most consumers only check the amount of money they owe. A prerequisite to changing energy behavior is awareness, and most consumers do not even know how many kWhs they use monthly. Improvements in bill design could address this issue.

The range of responses to the open-ended question: "What are the biggest factors that might prevent you from saving energy or using energy more efficiently?" were instructive. The response with the largest percentage for all three groups was "cost" (25% total). Second-largest was "other members of the household" (17%). However, there was wide variability in responses, and specific responses that could not be categorized totaled 44%.

A very strong majority of consumers claimed they would voluntarily reduce their electricity use. This implies that there is an untapped potential for demand response that could be utilized, if consumers were aware of what they should do. Such a strategy would require a large scale public education campaign.

The Successful Real-Time Pricing Participant

One of the goals of establishing a real-time pricing rate is to reduce peak electricity use. A precondition to this occurring is to offer a real-time rate to customers, and for customers to be willing to use it. Then in order to realize the potential benefits of real-time pricing, customers must reduce their electrical use in response to peak demand, which is signaled by high electricity prices. This response is quantified as an elasticity percentage. Elasticity is the percentage change in consumption in response to price. The higher the price elasticity, the more pronounced the response.

The Cooperative analyzed the current participants in the ESPP pilot to determine whether the participants with high elasticity had characteristics that were different from the participants with lower elasticities. A K-means cluster method was used to identify relatively homogenous groups of cases, based on demographic characteristics. The cluster results showed that the more successful ESPP participants had these characteristics:

- They are more likely to have a smaller average summer kWh consumption (547 as compared to 1357 kWh)
- They have a smaller number of people in the household (2.2 as compared to 3.2)
- They have lower incomes ($25,000 to -$50,000 as compared with $50,000 to 75,000).

The analysis output is recorded in Appendix 8.

Several other hypotheses were discussed and tested as part of this research. One test addressed the relationship of average price paid to elasticity. Each ESPP participant has an elasticity rating calculated by Summit Blue Consulting, but obtaining this figure requires complex statistical analyses. A linear regression was used to test whether average price was correlated with elasticity. A correlation does exist, but average price explains very little of the variation in total elasticity. Therefore, average price cannot be used as a proxy for elasticity.

A second hypothesis concerned the relationship between summer electricity use and load shape. A significant positive association was found between average price and average consumption. But because only 13% of the variation in average price is explained by summer consumption, summer electricity use may not be a good proxy for a successful load shape.

The statistical output for both of these analyses is included in Appendix 8.

1.3 Survey Analysis and Conclusions

Along with the rest of the U.S., Illinois is suffering from the effects of high energy costs and rapidly declining oil resources. And like the rest of the world, Illinois is vulnerable to the climatic and environmental disruptions caused by current energy use practices. Significant changes are necessary to reverse this trend. While new technologies such as biofuels and other alternative energy resources have a place in addressing these energy problems, they can provide only part of the answer.

Energy efficiency and conservation practices are an untapped resource for new energy supply. But to utilize these resources, the programs to capture this energy efficiency programs must be effective. Section 2 will discuss specific examples of programs that demonstrate best practices and can be used as models. An important factor in any successful program is that the program appeals to its target audience and appropriately responds to audience needs. To accomplish this, program administrators need a clear understanding of the consumers they are trying to reach.

One goal of this survey was to gather information about ComEd and Ameren customers. The survey included questions about consumer behaviors and attitudes. The relationship between

these attitudes and behavior is complex and difficult to understand, much less to influence toward a desired response. However, understanding the social and psychological aspects of energy use is increasingly recognized as essential for developing effective energy efficiency programs.

The acknowledgment of the importance of social science research is a relatively recent trend in the energy world. Some energy-related behavioral research was completed in the 1970s, but in the 1980s and 1990s the engineering perspective held sway, with a focus on technology and market transformation. The expectation was that a rational economic model would motivate the consumer. Energy-efficient products would save the consumer money because they cost less to run, so these products would be preferred purchases. Another widely accepted belief was that attitudes such as concern for the environment would result in conservation behavior. Both these tenets were related to the same unfounded yet prevalent assumption - that information would be sufficient for motivating action.

Critical evaluation of the energy efficiency programs revealed that financial considerations were important, but they were complicated by a variety of other social, psychological, and contextual factors. The technological components of a particular piece of equipment or appliance might be flawless, but the effectiveness of a product is depends on other factors that are difficult to control or anticipate. For example, will consumers even be willing to try the product? How well does the product fit into the lifestyle of the household that will be using it? Will the way the product is used influence how well it works? Jaap Jelsma (2004) describes how integrating the gap between technology and the behavioral sciences is essential, and notes the cross-shaping occurring via the relationship between technology and human behavior A classic study that validated the importance of behavior in energy use is Princeton University's five-year analysis of a townhouse project (Harrji, Socolow and Sonderegger 1977). Buildings of similar construction, size, design, and appliances, subject to identical climate conditions, and housing families of similar socio-demographic characteristics, were found to have as much as a two-to-one variation in the energy they used.

To begin to explore these issues, Ameren and ComEd sample respondents were evaluated based on a variety of behavioral elements. The results take into account information on the prevalence and usage of appliances, heating and cooling systems, and the ever-growing variety of other electronic equipment in homes, providing valuable insight into electricity use and demand. These analyses will provide useful information for developing energy efficiency programs that will be valuable to the target audience. The findings will also be helpful in understanding how best to market programs such as real-time pricing to new audiences.

The ESPP participants analyzed as part of this research have been studied extensively by the Cooperative and a third-party evaluator, Summit Blue Consulting. The analyses have included both statistical analyses of the hourly energy use of participants (which demonstrated that there is a positive link between increasing price and decreasing consumption) and multiple qualitative metrics (Summit Blue 2005, Summit Blue 2006, Star et al. 2005, Isaacson el al. 2005). These data were used in our analysis and comparisons are made to the general ComEd and Ameren populations.

Technology and energy efficiency

The amount of energy a particular object uses is related to that object's energy requirements, to how that object is used, or to a combination of technology and behavior. Many energy efficiency programs address the technological factors, which are easier to evaluate and to affect. The psychological component of energy use is equally important, but is considerably more difficult to quantify and interpret. The data in this study informs both aspects of energy use.

Kitchen appliances are the single largest component of electricity consumption in the home. A tested and effective method for reducing this energy demand is to replace inefficient appliances with energy-efficiency models, and, most importantly, simultaneously remove the old model from circulation. Refrigerators, with their 24-hour on-cycles, account for the majority of the home's electrical load. Although refrigerators that meet the EnergyStar® standard use the least electricity, the efficiency of other late-model refrigerators is also quite high. For maximum effectiveness, refrigerators that are more than ten years old should be targeted for replacement, through mandatory trade-in and recycling programs. An average of almost 30% of all three sample groups had refrigerators that are more than ten years old. This finding supports the continuation of refrigerator trade-in programs.

The Illinois Residential Market Analysis identified dishwashers and clothes washers as candidates for appliance trade-in programs (MEEA 2003). Our survey identified separate, freestanding freezers as another appliance with potential for energy savings. The percentage of homes with freezers was especially high in the Ameren service territories. Separate freezers are more common in the ENC Division than in other parts of the U.S. The relatively high percentage of freestanding freezers in Illinois may represent an opportunity for reducing household electrical use. Upright models are preferred for convenience, but are less energy efficient. However, both upright and chest freezer models are available in EnergyStar rated versions.

A relatively high percentage of respondents in the Ameren service territory had electric stoves (48%), which are more costly to operate than gas models. The recent increases in electrical rates alone could influence consumers to replace their stoves, although lack of access to natural gas could limit the ability to switch fuel sources.

More than 90% of the homes in this survey had air conditioning, and central air conditioning is becoming increasingly widespread. The 2003 MEEA study found that 80% of the central air conditioning units they surveyed were oversized, and retrofitting would result in significant energy savings.

However, it must be noted that the free-rider factor, which can be as high as 89%, can have a significant effect on the real impact of appliance replacement programs. Careful targeting of customers is one way to counteract this issue. Targeting lower income consumers has the biggest potential to create savings (Shipworth 2000). These groups are least likely to replace appliances on a discretionary basis, and are less likely to have the extra cash to pay for a more efficient model at the time of an emergency purchase.

This survey documented the growing numbers and increasing popularity of a wide range of electric goods in the household. The EIA characterizes lighting and home electronics as "significant" contributors to end energy use and the proliferation of new technologies accelerates this trend. Each appliance draws a different amount of energy, and demand is related to the amount of time the appliance is used. These energy demands could be reduced by behavioral means, but market transformation processes provide more effective products. Effective education can encourage consumers to consider energy efficiency in their purchases.

Apart from the electricity actually used when appliances are on and in use, many appliances are responsible for so-called "phantom" or "standby" loads, referring to the appliance's continual drawing of electricity even when the appliance has been shut off (Perez 1993). Televisions and other appliances that maintain "automatic on" feature are examples of appliances that generate phantom loads, as are appliances with clock-timers. Other examples include battery-operated tools and appliances that use electricity to recharge their batteries. These devices are recharged by plug-in cords with power supplies in plastic boxes, or "wall cubes." Sheryl Carter of the National Resource Defense Council states that cell phone chargers account for one to six percent of electricity use (Olson 2006). This survey collected data on rechargeable tools, along with information on whether the recharging base unit was constantly plugged in.

Phantom loads are a classic energy efficiency opportunity. Long term, phantom loads should be addressed through encouraging or requiring manufacturers to minimize the phantom load problem. While waiting for market transformation, two techniques that can reduce phantom loads are unplugging appliances or using a power strip with an on/off switch, which will block the phantom load. However, establishing these techniques require informing consumers of the problem, and convincing them to act – two significant communication challenges.

Appliance purchasing decisions

If consumers could be convinced to routinely purchase products with the highest energy-efficiency standards, the effect on energy consumption would be significant. This survey asked respondents about factors that influenced their appliance-purchasing decisions. The energy efficiency of the product received the highest ratings of "very important" in the series, exceeding even the ratings for price. However, these encouraging responses cannot be taken at face value. Numerous studies have documented that actual behavior and purchases do not correspond to reported actions. Identifying the reasons is a complex process. They may reflect a socially desirable response bias, or an honest misunderstanding of the product's energy efficiency rating (MEEA 2003). Finally, research has shown that inter-personal contacts are highly influential sources of information (Shipworth, 2000). Carefully crafted strategies are needed in order to address all of these influences.

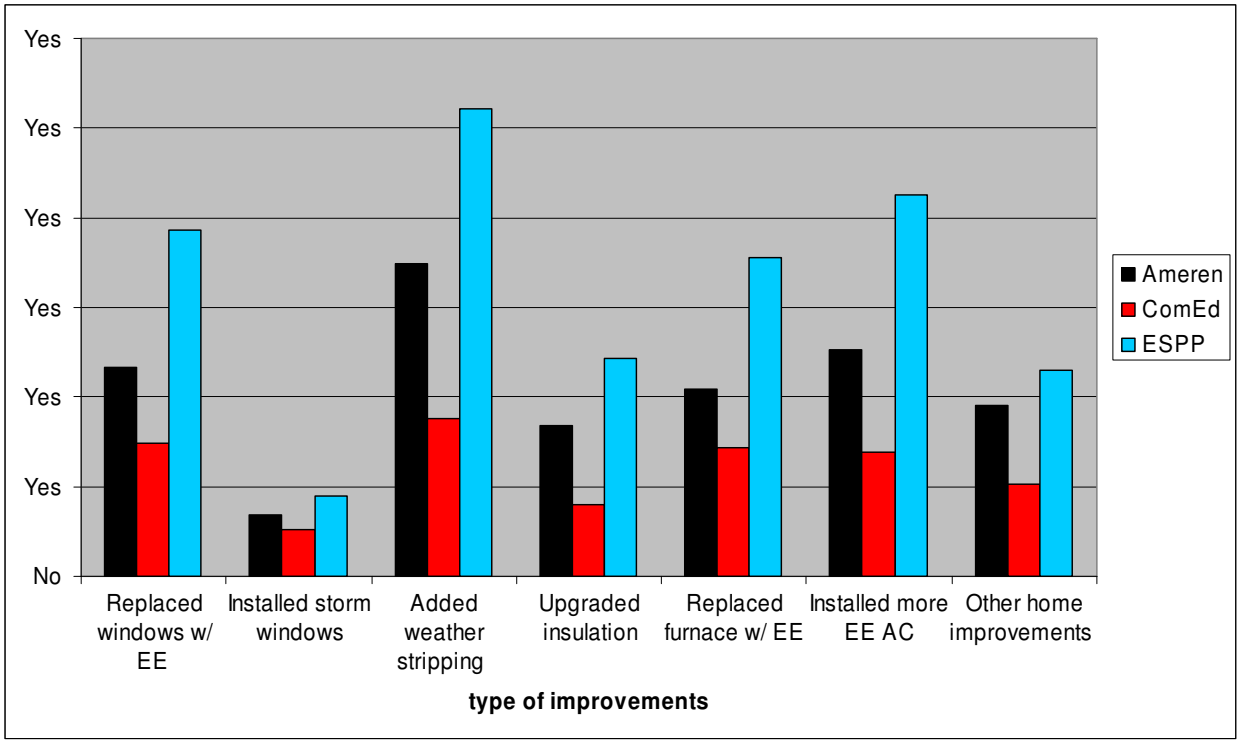
Behavior and energy conservation

An individual's relationship to energy is complex. Knowledge and context shape opinions and attitudes, and the behaviors that result depend on factors that the individual may or may not be able to control. Some of the determinants are situational. For example, homeowners have many more opportunities than apartment dwellers to make consumer decisions related to energy. Homeowners have the option of investing in heating and air conditioning systems, purchasing a variety of appliances, or making improvements to the building shell, whereas apartment

dwellers' opportunities are likely to be much more limited. Individual behavior can save energy, but actions depend on whether one is aware of the effective behaviors or is motivated to practice them. Economic issues, environmental attitudes, and personal comfort preferences also influence actions. This study explored energy attitude and behaviors in several ways, which are discussed below.

Home improvements for improving energy efficiency
Respondents were asked about improvements they had made in the past five years to increase the energy efficiency of their homes. The chart below illustrates the responses.

Figure 1: Improvements respondents have made to homes in the past five years



In total, only one improvement in the ESPP sample, adding weather-stripping, surpassed the 50% level. A recent study by Deloitte & Touche (2006) found that only 20% of the consumers they surveyed had conducted any actual energy improvements, a result which is consistent with the non-ESPP participants' responses.

The energy and economic impacts of all the actions on this chart have been well documented (MEEA 2003), and shown to offer significant potential for improving home energy efficiency. ESPP participants reported higher rates in all categories. Although self-reported actions are subject to a positive response bias, even assuming an inflation of positive responses, it is notable that ESPP respondents were consistently and proportionately more likely to report having made energy efficiency improvements.

ComEd respondents reported the lowest proportions of energy efficiency improvements. This could be related to the higher proportion of renters in this population, particularly considering the

fact that renters may not pay their individual heat bills. This also points to the split incentive factor, which complicates investments in energy efficiency. Apartment building owners may not see the value of adding weather-stripping, a highly effective and relatively inexpensive improvement. However, the payback in reduced energy bills and, not incidentally, the increased comfort and satisfaction of the effected tenants, should make this simple maintenance task a wise investment.

The type of improvements that respondents chose to make is also of interest. Only a small proportion reported upgrading their insulation. Most homes are under-insulated, and adding insulation is relatively low cost, and is simple enough for a homeowner to successfully undertake. However, adding insulation is an invisible improvement – it is hidden from view, and provides none of the positive feedback of an improvement such as new windows. Window replacement is generally a more popular improvement, although this is a more expensive project and provides less energy savings.

This typical response illustrates a significant problem in promoting energy efficiency and conservation. The biggest energy resource for the near future is the ability to utilize the energy that is wasted by implementing simple energy efficiency and conservation actions. Yet these conservation methods are also considered "dull, old, and unloved" (Olson 2006). More exciting technologies, such as alternative energy sources, capture the public's imagination. It is possible to change this attitude, but doing so requires a well-designed and consistent education and marketing campaign.

Relatively simple weatherization measures can provide significant savings to consumers. The 2003 MEEA study found that two-thirds of all audited homes lacked basic energy conservation measures. Successful programs that could be modeled include the Michigan Energy Fitness Program and the Wisconsin's Focus on Energy, both were highly effective, relatively low cost, and well received by consumers. In 2006, the city of Chicago distributed weatherization kits citywide. The contents included expanding spray foam for holes, removable window caulk, and plastic interior storm window kits. However, this program included little training and no in-house instruction, both essential features of the Michigan and Wisconsin programs.

The fuel source disconnect and its impact on energy efficiency programs

Heating equipment is a necessity in Illinois, and the majority of most households' energy expenses are related to heating costs. The fuel source for the majority of this heating (more than 90%) is natural gas (EIA 2001). In general, heating with natural gas is more economical than using electricity, but gas costs, particularly with the increases seen in recent years, are significant.

One obvious way to address high natural gas costs is to install high-efficiency heating equipment. Less than one-quarter of survey respondents reported that they had done so (Ameren, 20.8%; ComEd, 23.8%; ESPP, 26.2%).

Apart from this home improvement information, this survey did not collect data on primary space heating equipment. In the recent past, the limited energy efficiency programs that have been available to the public have been provided by electrical utilities. Consequently, natural gas fueled appliances have not been addressed.

This separation of programs by fuel sources comes from the traditional model of energy efficiency programs that are financed and administered by utilities. The result is that energy improvements are addressed in a piecemeal manner, instead of through a comprehensive strategy designed to address the improvements that are most needed and will have the highest impact. This disconnect between fuel sources and programming seriously limits energy-efficiency programs.

Energy conservation behaviors

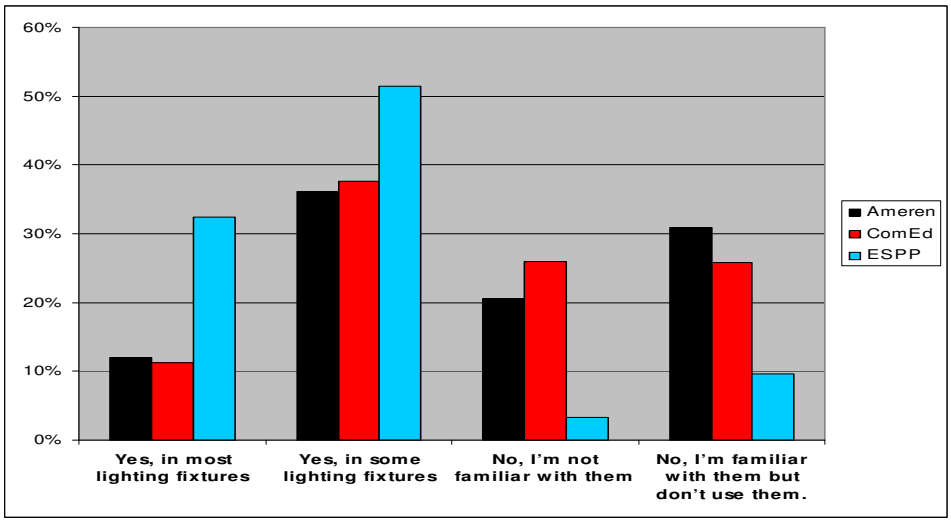
In order to gauge the respondents' attitudes toward a simple energy-saving situation, the survey asked how often respondents turned off lights that are not in use. Turning off lights is a familiar practice that doesn't require adopting new technology and requires no financial outlay. Response rates in each of the categories were very similar across sample groups, with a majority of respondents (more than 60%, and 66% in the Ameren sample) reporting they "almost always" turned off the lights when not in use. Even without assuming this response is probably subject to a positive response bias, a significant proportion of respondents are still leaving unused lights on.

Addressing this phenomenon requires examining the reasons for this behavior and effective education to alter the response, both difficult and time-intensive endeavors. A more effective intervention is a market-transformation model designed to increase the use of lower-energy consuming compact fluorescent light bulbs, which would automatically and substantially lower the demand.

Using compact fluorescent light bulbs (CFLs) instead of standard incandescent bulbs is one of the most well publicized strategies for saving. There have been large-scale programs to publicize the benefits of using CFLs, such as EnergyStar's "Change a Light, Change the World" campaign. Compact fluorescent bulbs are also widely available, at price points that are considerably lower than those common even several years ago. Free CFLs are also available through various distribution systems, including programs currently funded by ComEd.

In this survey, we found ESPP participants are much more likely to use CFLs in most and some of their lighting fixtures, and very few are unfamiliar with CFLs. This is undoubtedly related to their association with the Community Energy Cooperative. Upon enrolling in ESPP, participants received an energy-efficiency kit containing three CFLs. The benefits of CFLs were also discussed regularly in publications such as the Cooperative's newsletter. See Figure 3 for this distribution.

Figure 2: Responses to survey question "Do you use CFLs in your lighting fixtures?"



Approximately 50% of ComEd and Ameren respondents reported using CFLs in most or some of their fixtures. Assuming no positive response biases, this is a substantial improvement over the 23% CFL presence found in the audited homes in the 2003 MEEA survey (95% of the homes had less than a 10% presence). However, the potential for improvement is still very large.

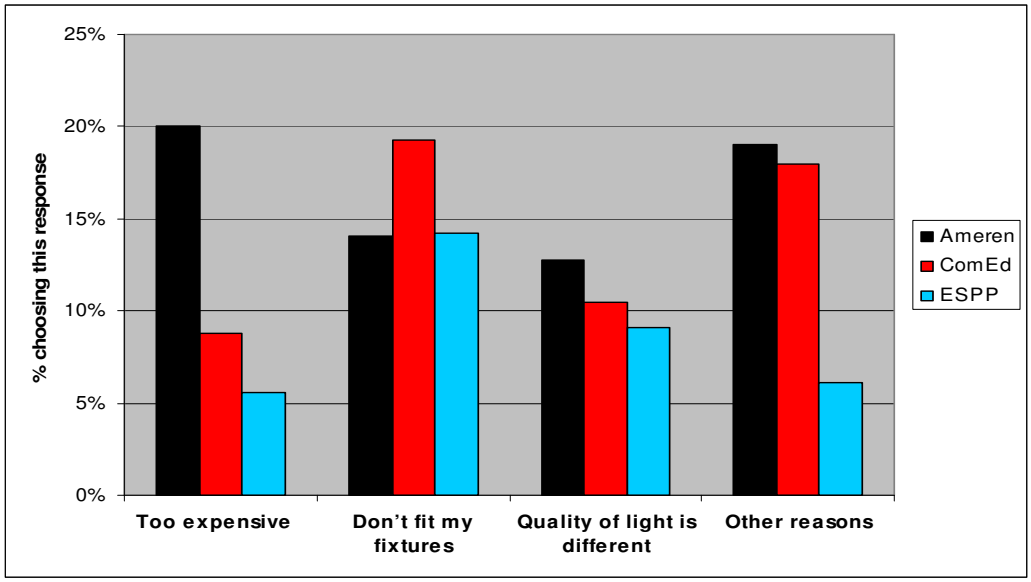
The Cooperative's survey also found a significant difference between CFL use by homeowners compared with renters. Renters were less likely to use CFLs and the percentage of renters who were not familiar with them was double that of the homeowners.

Table 3: Use of CFLs by renters versus home owners

	Rent		Own	
Yes, in most lighting fixtures	29	18.4%	219	21.7%
Yes, in some lighting fixtures	50	31.6%	463	45.9%
	79	50.0%	682	67.6%
No, I'm not familiar with them	38	24.1%	128	12.7%
No, I'm familiar with them, but don't use them	41	25.9%	199	19.7%
	79	50.0%	327	32.4%

Respondents were also asked why they did not use CFLs. Ameren respondents were more likely to choose "too expensive" as the reason they do not use CFLs, but similar proportions of all groups reported that "the lights don't fit my fixtures" and "the quality of light is different."

Figure 3: Reasons why respondents do not use CFLs



The impractical shapes and harsh light tones were deficiencies in earlier generations of CFLs, but advances in technology have addressed these problems successfully. Since it is likely that the consumers who hold these opinions have purchased CFLs before and found them unsatisfactory, an even higher barrier must be crossed to reach these consumers than to reach consumers who have not tried CFLs. Therefore, while programs that distribute CFLs have value, programs have not yet made use of strategies designing programs to address the negative associations related to CFLs.

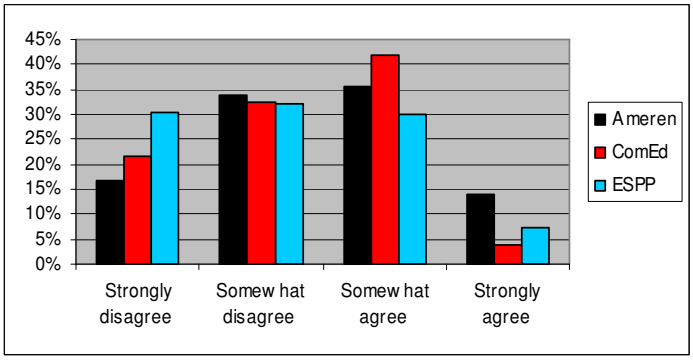
Another way to evaluate how respondents actually use energy in their homes is to explore the actions that people take to keep their homes cool during the summer. Utilizing cooling strategies other than air conditioning is particularly important for reducing summer peak loads. Survey respondents in all groups show similar patterns for actions including using fans, opening windows, and closing shades. However, ESPP participants reported significant differences in their use of air conditioning.

This response is consistent with the information provided to ESPP participants about how to utilize real-time pricing. High prices usually correspond with time when the temperature is high and most of the population is using conditioning and increasing the peak load. ESPP participants are strongly encouraged to reduce energy use by raising their thermostat setting on their central air conditioners, or turning off air conditioners in unused rooms.

The survey also contained a series of statements about energy use, reflecting perspectives that represented environmental values, comfort-oriented values, and economic values. More ESPP respondents agreed that using energy efficiently was important to them, and they were significantly more inclined to conserve energy to save money. They were also significantly more likely to believe that their home energy-saving efforts were successful, and to say that they devoted time to thinking about this goal. As noted above, ESPP participants also strongly agreed that they "tried not to use air conditioning often." This response was significantly different from those of both the Ameren and ComEd samples.

Another instance in which ESPP participants responses were significantly different from those of both Ameren and ComEd respondents was statement "Energy efficient appliances are too expensive". The responses are displayed in Figure 4.

Figure 4: Responses to statement "Energy efficient appliances are too expensive"



It is useful to view these answers in comparison with the responses to the statements about which features were important in purchasing a new appliance. In that case, 75% to 85% of respondents agreed that energy efficiency was somewhat or very important, and 67% to 70% also said that "how much costs to operate" is somewhat or very important. Here, 50% of Ameren respondents and 46% of ComEd respondents agree or strongly agree that energy efficient products are too expensive. The difference between these responses and the ESPP participants' responses are highly statistically significant. This inconsistency points to a lingering perception about slightly higher up-front purchase costs of energy efficient appliances. Some consumers may not understand that this small initial outlay will be paid back quickly through lower operating costs. Other consumers may be restricted to buying the cheapest appliance.

In the "Energy Opinions" section of the survey, respondents were asked to rate their level of agreement with a series of statements about using energy. Consistently, there were statistically significant differences between the Ameren and ComEd samples when compared with the ESPP participants. These findings are especially intriguing as some of these statements are related to the "successful" ESPP participant. A significant drawback, however, is that ESPP participants were not surveyed on these topics before they began the real-time pricing program. Therefore, it is not possible to determine whether the opinion was pre-existing or a result of the program.

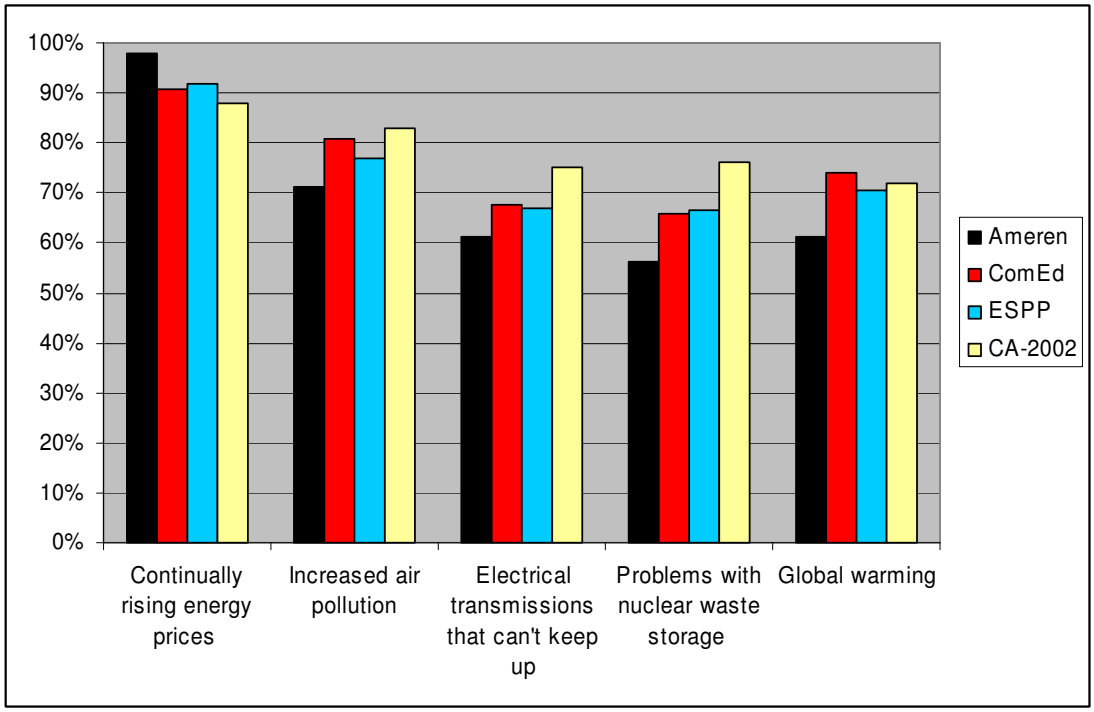
The big picture: What Illinois residents say about energy issues

A section of the survey listed a series of five "energy-related problems" and asked the respondent to rate "how serious you think each problem will be for Illinois over next five to 10 years." These items were taken from a series of questions that were used in a survey of California residents after the 2001 electrical blackouts and price spikes (Lutzenhiser 2004). Responses were limited to "serious," "not serious," and "don't know." The responses from California are compared with the three samples studied here in Figure 5, below.

The differences between the three Illinois sample groups were statistically significant on three elements: continually rising energy prices, problems with nuclear storage, and global warming.

The California sample had higher percentages of "serious" responses on four of the five issues, possibly reflecting that state's particular, recent experiences. The Illinois respondents had a higher proportion of "serious" responses on the issue of "continually rising energy prices."

Figure 5: Percentage of responses of "serious" for these energy-related problems

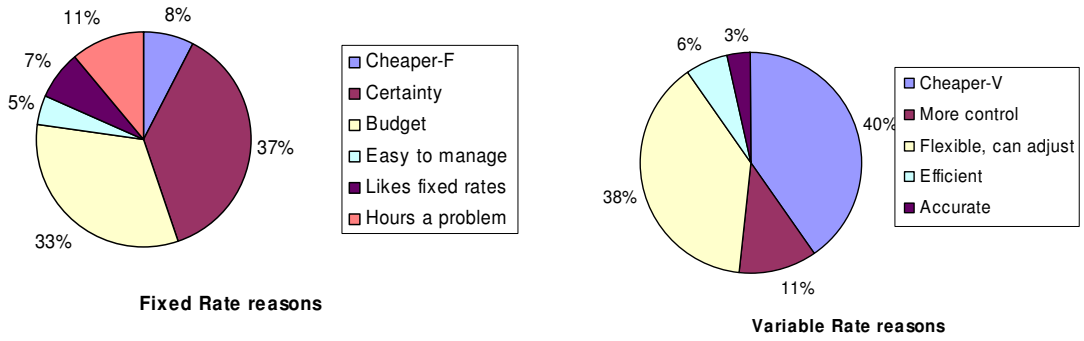


Future real-time pricing participants

One of the most important questions this research project aimed to answer was: How many consumers are interested in the new real-time pricing, hourly electricity rate? This question cannot yet be answered definitively, but this survey provides an informative estimate. Among Ameren respondents, 6% replied they would "definitely" chose the variable, and 18% replied "probably variable." For the ComEd sample, the responses were 6.7% "definitely variable" and 20.9% "probably variable."

A closer look at the reasons respondents gave for choosing a certain rate is revealed by answers to "why did you select the variable or fixed rate?" We separated the answers of respondents who had chosen the variable rate from those who had chosen the fixed rate, and categorized the answers.

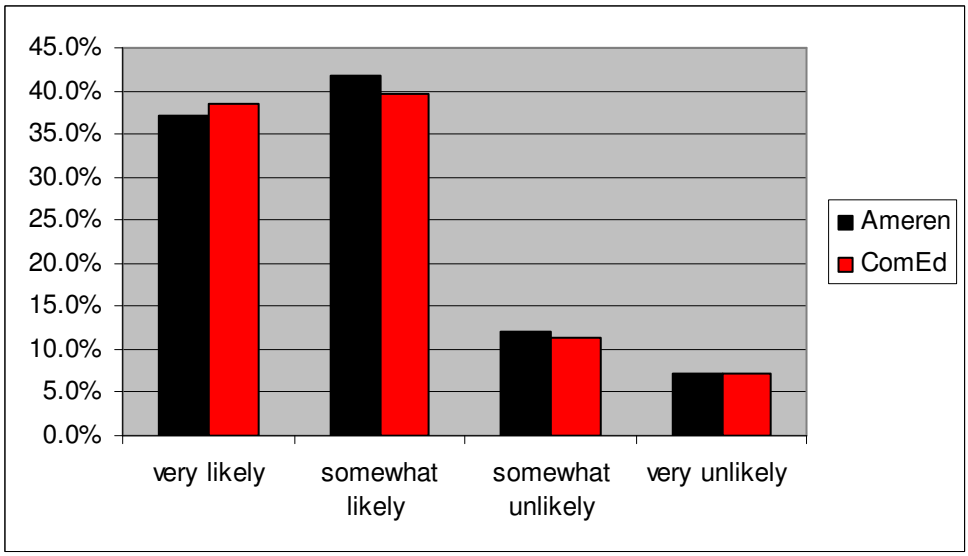
Figure 6: Reasons for choosing the fixed or variable rate



One interesting finding is that a large percentage of respondents who chose the variable rate and a small percentage of respondents that chose the fixed rate both reasoned that their choice would be cheaper. This finding should inform marketing messages for RTP, as it is clear there is a common motivation when choosing a rate. Other answers indicated the respondents understood the issues involved in their choices, for example, the standard rate respondents who indicated "budget" and "certainty" chose the rate that would provide those features.

The third RTP question asked whether respondents would be more inclined to try RTP with an estimated 20% savings, and yielded substantial increases in the percentages of respondents who would consider the rate. This finding is useful for determining the level of financial incentive that would motivate more customers to try the rate. It is also of interest to note that a number of participants in the pilot ESPP program actually experienced savings at this level.

Figure 7: Percentage of respondents interested in variable rate with projected 20% savings



The quantifiable factors that cause the most differences in home lifestyle, including the use of energy, are geographic location, socioeconomics (including race, gender, and number of household residents and their relationship to one another), and household income (EIA 2001). This study examined these factors and considered their relationship to energy efficiency behavior, including the respondent's likelihood of participating in a real-time pricing program.

The ESPP participant population represents a self-selected group (i.e., their participation in the real-time pricing program is voluntary) and has identifiable demographic characteristics that differ from the general population. However, an earlier study of ESPP participants determined that this bias does not correlate with the participants' energy-related responses to real-time pricing (Summit Blue 2004). Therefore, while knowing ESPP participant characteristics will help identify which populations will be most likely to want to participate in a real-time pricing program, it does not necessarily predict the people who can successfully participate in a real-time pricing program.

Overall, the Ameren and ComEd respondents were similar to the larger populations from which the samples were drawn. ESPP participants differ from the population at large in several ways. A larger proportion of these participants are older than the average for the population, have obtained higher levels of education, have higher incomes, own their own homes, and are white. Survey respondents who preferred the variable rate shared all of these characteristics except age, which was not a statistically significant element in choosing the variable rate. The survey respondents who preferred a variable rate were also more likely to have larger households (a greater number of residents in the household). This factor is probably related to the amount of discretionary electricity use, as well as to a larger structure. ESPP participants also disproportionately reside in single-family homes, but this variable was not associated with a preference for considering the variable rate.

However, it's important to remember that simple placing customers on a variable rate will not necessarily achieve on of the key goals of real-time pricing, reducing peak energy use. Real-time pricing is subject to the "free rider" factor, meaning participants do not change their behavior and still have lower bills. The Cooperative analyzed ESPP participants' data to determine characteristics that were associated with high elasticities, or price response, which designates "successful" participants. Their characteristics differed from the variable rate preference group. They had lower incomes ($25,000 to $50,000 as compared with $50,000 to 75, 000) and had a smaller number of people in the household (2.2 as compared with 3.2). They were also more likely to have a smaller average summer kWh consumption (547 as compared to 1357 kWh). The Cooperative is still investigating the reasons that these participants are more successful. However it is clear that in order to be successful, these participants have developed effective mechanisms for responding to higher electricity prices. These mechanisms are probably manual and behavior driven, such as turning off equipment and closing off rooms.

Ethnicity, or race, was highly significant in type of rate preferences. Non-white respondents were significantly less likely to consider using a variable rate. These findings indicate that non-white populations may require a different outreach method to elicit their interest in using variable rates. However, it should be noted that it does not mean these populations will be uninterested in, or unable to successfully utilize, real-time pricing rates, if this option is effectively

communicated to them. The ethnic distribution of ESPP respondents includes 11% African Americans, 8% Hispanic, and 7% "other." These groups enrolled in the program in response to concerted outreach efforts on the part of the Cooperative, taking place over a period of years. This illustrates the importance of utilizing appropriate marketing.

Section 2: Literature Review – What Works in Energy Efficiency?

The recent history of conservation and energy efficiency began in 1973, when the American consumer experienced energy supply disruptions in the form of gasoline shortages. Because this energy crisis was short-lived, and the efforts to address the problem focused on generally unpopular conservation recommendations, only limited changes in behavior and policy resulted. However, the public's generally-held belief that energy would always be available and plentiful had been challenged. A more fundamental shift in thinking occurred for those who realized that the old concept of expanding energy usage indicating "social progress and economic prosperity" had to change.

During the ensuing thirty years, the energy efficiency movement has increased in size and scope. There has been a series of evolving philosophies about what the best technologies and policies for promoting energy efficiency. For example:

- The engineering and market transformation models emphasized reducing energy use though improvements in technology.
- Deregulation and restructuring of the energy industries was expected to lead to competition and lower prices.
- Demand side management used prices to change energy use.
- Policy initiatives and legislation introduced and enforced standards such as better building codes.

But while each of these trends brought useful knowledge to the field, each had limitations. Products often do not deliver the expected energy savings because the laboratory-tested ratings don't transfer to real-life use. The promises of new energy markets were undermined by the Enron scandal, and the promised competition has not emerged in many deregulated states. Demand side management depends on a rational consumer who will respond to economic incentives; a model which ignores diverse and complex human behavior. Policy initiatives are limited by the political environments in which they are developed, and are complicated by conflicting local, state and federal standards. Meanwhile, the amount of energy used per capita continued to grow, and overall energy use has increased nationwide.

The newest area of energy research is the recognition of the importance of human behavior and motivations in energy use. The California energy crisis of 2001 demonstrated substantial energy savings could be obtained via voluntary conservation. The Cooperative's Energy-Smart Pricing Plan showed consumers can provide demand response and exhibit conservation behavior without complicated technological support. The potential for significant energy savings is considerable, and almost totally unrealized.

Today, energy issues are demanding renewed attention, and researchers are re-evaluating strategies to determine the most effective way to move forward. Kunkle et al (2004) describe three "Epochs" of the energy efficiency movement. Epoch 1 was technology-oriented, based on natural sciences and engineering. Epoch 2 emphasized economics, and promoted market-based

strategies. Epoch 3 is characterized by a shift in focus similar to what has occurred in the environmental movement; recognizing the interdependence of systems and people, and the importance of understanding motivations and behavior. While both Epochs 1 and 2 still have contributions to make, their work needs to be utilized within "Epoch 3 characteristics of complexity, community and partnership between energy users, energy providers, and state agencies" (Kunkle et al 2004).

The Cooperative has reviewed current literature and programs in the energy efficiency world in several different areas: education, community-based programs, the role of technology (including a preliminary report on the Cooperative's PriceLight pilot program), demand response using real-time pricing, hard-to-reach audiences, and strategies for communicating effectively to the target audience you seek to reach. This research identified the most promising directions for new program development in Illinois. Discussions of these reviews appear in the following sections.

Part of the Cooperative's research also concerned the exploration of an "energy efficiency awareness index," a concept introduced by Ameren Illinois Utilities. The role of an index in measuring the intangibles of energy use is discussed in "Evaluating Program Impacts with an Energy Efficiency Awareness Index." Such an index would be another tool for providing insight into the types of changes that are needed to produce the desired results.

This research resulted in an energy agenda titled "To Control Costs, Get Smart about Energy Use." This summary publication provides recommendations for improving energy efficiency in Illinois, in addition to providing ancillary benefits for public health and the economy.

2.1 K-12 Energy-Efficiency Education

A prerequisite to performing conservation actions is having the necessary knowledge of what should be done. Yet Americans are sorely lacking in this area. In "America's low energy IQ: A risk to our energy future," the National Environmental Education and Training Foundation (NEETF) published a report on Americans' energy knowledge. They found that most Americans overestimate their energy knowledge, and only 12% actually passed a basic quiz on the subject. "Just one in eight Americans can correctly answer such questions as how most of our electricity is generated, whether gas mileage is rising or falling, and what the fastest growing sector of the economy is with regard to energy consumption" (NEETF 2002). In that same study, NEETF found that an overwhelming majority of Americans (91%) support energy education and feel that our economic future is tied to our ability to manage energy consumption. Further, 90% of Americans believe that this education should begin in childhood, in our nation's schools.

A logical way for the public to learn about energy efficiency is to incorporate that learning into standard educational experience. Most Americans support this idea, and it is not a new concept. Many education campaigns make their way to general public via the nation's school system. Recycling is one such example that began as an educational campaign and is now an accepted norm for many Americans today (Connor et al. 2006). The same could be said of energy education. Although students are not energy purchasers or decision-makers on energy issues,

they are energy consumers. If they learn to change their behavior, there will be an impact - and perhaps an accompanying impact on other members of the household. The institutionalization of recycling is one example of how practices taught in school can influence household behavior. Longer term, children grow up, and if their energy lessons have been successfully taught and learned, these adults could bring a more informed and involved attitude toward energy issues.

Across the country, and more specifically in Illinois today, students typically learn about energy efficiency through three distinct learning vessels: organized curriculums in school, specific projects, and one-time exhibits in museums or other places. The effectiveness of these programs is as varied as the programs themselves, and uncovering meaningful results proved to be a difficult task.

Types of programs

The Cooperative's research shows that there are three kinds of educational tools most commonly used to teach students about energy efficiency. This includes organized curriculums, stand-alone projects, and one-time exhibits.

Organized curriculums

Organized curriculums engage the student for a set period congruent with the academic calendar and usually include a range of energy-related topics, not just energy efficiency. For example, the KEEP (K-12 Energy Education Program) curriculum in Wisconsin features distinct themes throughout the school year. Topics include where energy comes from, how energy is used worldwide, how energy use affects students individually, and how policy makers ensure energy resources for the future. Each theme has different lessons with age-appropriate concepts and supporting materials (Energy Center of Wisconsin 2006).

KEEP is patterned after the NEED (National Energy Education Development) Project curriculum, which features training for teachers and age-appropriate student testing for both before and after each theme is taught in order to properly gauge the level of learning. Themes are integrated with applicable subjects like science, math and technology, and in some cases, social studies, language arts and performing arts (NEED Project 2006).

In Illinois, EnergyNet infuses energy education into a curriculum format for grades K-12. Lessons are multi-disciplined, with energy concepts taught in science, math and technology. They feature hands-on learning experiences, tackling real world issues and problem solving, like the energy audit projects for home and school.

Projects

Projects are generally treated as separate from other school subjects, and are often sponsored by outside entities such as utilities or local government. For example, in Washington State, the Chelan County Public Utility District contracts with the local school district to bring ongoing opportunities for training of teachers and education programs for school-age children. Some subject topics are addressed during the school year, and others are available in a local summer science program. Teacher training and guides, supporting educational kits and hands-on activities are key elements in the Chelan PUD's Learning Center.

In Illinois, the Illinois Sustainable Energy Project (ISTEP) makes program materials available for teachers across the state. ISTEP is the only program in Illinois that is officially linked to the NEED Project. According to the ISTEP website, there are two teacher kits with videos, books and lesson plans that cover vermicomposting and recycling, but none specifically related to energy or energy efficiency. The Lights for Learning fundraiser program allows students to learn and teach others about CFLs, while earning a 50% profit on each CFL sold. Other products available for teachers include bookmarks, brochures, booklets and posters.

One-time exhibits
One-time exhibits are often established by organizations that integrate an energy messages into their mission, directly or indirectly. They are often only seen by students once or just a few times, such as a stationery museum exhibit. The Arkansas Museum of Science and History features a permanent energy exhibit that was created specifically for students. Hands-on displays, touch screens and other interactive tools help teach students about the different sources of energy, energy efficiency in the home, the production of hydrogen energy and light bulb technology.

The Power House in Zion, Illinois was one such exhibit. Geared toward students in the 7th through 12th grades, the Power House provided an interactive forum where students could learn about the sources and forms of energy and other energy-related topics. Trained professionals at the facility guided students in this experience, which included a computerized test at the culmination of each theme. Unfortunately, the site was closed in 2001 for safety reasons due to its proximity to a nuclear power station, and has not since reopened.

Good News/Bad News: Evaluating Energy Efficiency Education Today

While reviewing programs in Illinois and across the country, some key characteristics began to emerge from some of the best programs. The better equipped programs tend to include the following characteristics:

- A multi-disciplined approach to teaching energy, including science, math, technology, geography as learning opportunities.
- Age-appropriate information, providing different learning experiences and depths of knowledge for different age groups.
- Practical applications tying program concepts into the everyday lives of young students.
- Creative, attractive materials, which are increasingly important in today's world.
- Teacher training and supplementary materials.
- A clear statement of goals of what students were expected to learn.

However, even with programs that include these best practices, educational impacts are not entirely clear. Most programs have not been evaluated to document what students are learning about energy efficiency, or to make claims regarding the overall effectiveness of the program. The majority of programs both in and out of Illinois provide results in very general terms. Here are some examples of result-reporting from two different curriculum-based programs:

  - "Student energy teams made presentations to each classroom. As a result, most students and teachers are more mindful of not wasting energy."

- "Students at X High School regularly updated other students on their project by using email and posting to the project discussion area. Students created a project home page with a link to the project sponsor, X (the local utility)."

One program we reviewed was a particularly pertinent example of the importance, and difficulty, of the evaluation process. This program far surpassed other programs we had surveyed by providing a well thought out curriculum that met each of the characteristics listed above. However, the program stumbled when the time came for evaluation. Despite their careful attention to programmatic detail, the agency had not put forth measurable goals. An outside evaluator was engaged, and a report was written, but the school disagreed with the evaluator's findings, and the report was not published. All that was available for public view was a general document that referenced only minimal statistics, such as the number of teacher participants and dollars spent. More informative qualitative conclusions were lost. In fact, the process was so divisive this school asked us not to reference them by name in this research. This lack of evaluation not only impacts future operations of this promising program, but any potential for other programs to learn from their efforts.

Summary of K-12 Energy Efficiency Education in Illinois

In Illinois, there is some effort to bring energy efficiency education to K-12 students, but far more could be done. First, the quality of education must be enhanced by utilizing resources available across the nation. This includes the creation of new programs and the enhancement of those already established. Second, programs must be thoroughly evaluated (individually) to ensure their quality and validity.

Programs already in existence could begin by re-assessing their effectiveness, and establishing more measurable goals and meaningful learning objectives. These established programs should also conduct regular evaluations to measure goal attainment and effectiveness of its learning objectives, and also to assist in re-stating ongoing goals and objectives when necessary.

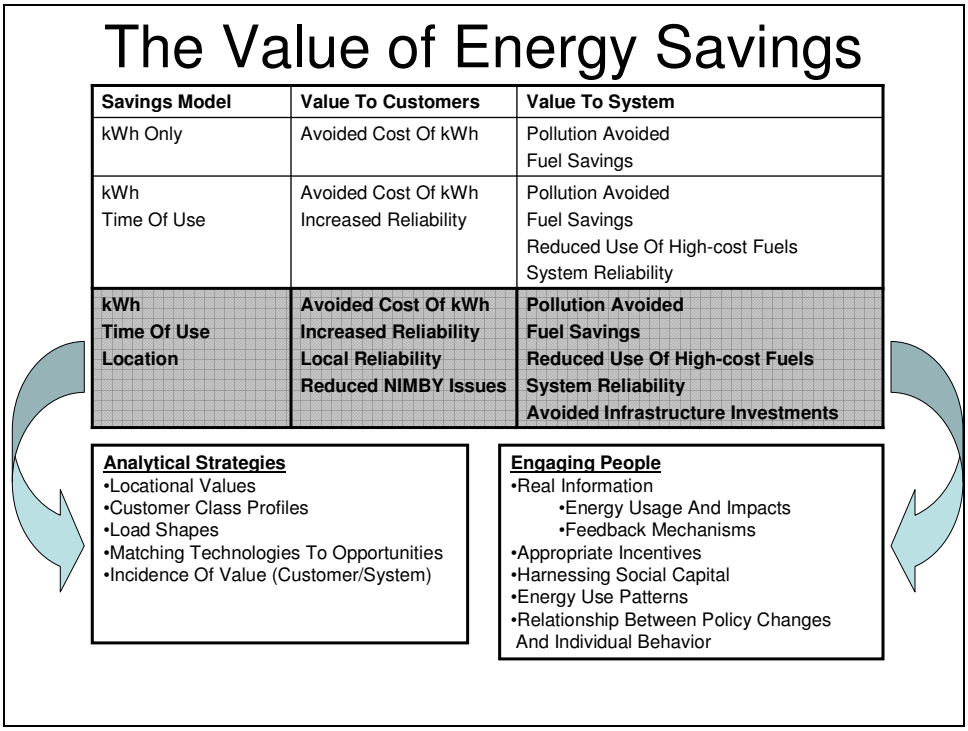
2.2 The Value of Community-Based Energy Programs

Communities can be valuable assets when creating effective energy efficiency and demand management programs. While the conventional wisdom is that it is simpler and more efficient to just target programs widely across a utility service area, a state, or even a region, the experience of the Community Energy Cooperative and a number of other programs around the nation suggests that in many cases a community-based approach has a greater value. Several positive outcomes can be achieved. First is the ability to get the right programs and offers to the right people. Second is a sense among participants of lasting ownership and responsibility. And third is the potential to address distribution system constraints in ways that can reduce the capital costs needed for building new infrastructure.

The value of rethinking energy savings

Traditional energy efficiency programs have focused on reducing kilowatt hours used. This has had a certain simple logic to it. This is how most customers are billed, and is arguably the simplest measure of energy use. However, focusing on measuring kWh only leaves out several layers of additional value. The chart below describes how thinking about *when* electricity is used and the *location* of that energy use can create additional value in managing and reducing energy consumption.

Figure 8: The Value of Energy Savings



Elsewhere in this report the concept of real-time pricing as a tool to connect energy use to its time of use is discussed. The final leg in increasing value of energy savings comes from focusing on the location of use. This is where community-based programs have some of the greatest opportunities. The combination of this system value and the societal values and benefits discussed below are essential for making these programs succeed.

The value of place

Place matters. That simple concept has been the underpinning of the work of the Community Energy Cooperative's parent organization the Center for Neighborhood Technology (CNT) since its founding in the late 1970s, and was a critical perspective taken when the Community Energy Cooperative was launched in 2000. Place is the intersection of physical geography, political geography and cultural geography. And in the case of energy efficiency there are the additional geographies of the utility system, both the physical infrastructure of the transmission and distribution system and the boundaries of various utility companies, control areas and energy markets.

When CNT looked at rising peak electrical demand in the Chicago area in the late 1990s, it found that place mattered. ComEd's infrastructure varied greatly in terms of the amount of stress on feeders and substations, as well as the rate of growth in peak demand. Capturing the value of reducing that stress on specific parts of the grid had great potential value for the communities it served. For example reliability was a problem in the Pilsen community of Chicago. In 2000, the newly established Community Energy Cooperative launched a series of programs to reduce demand. These focused on getting inefficient window air conditioners out of the homes and organizing businesses and industries into feeder-based load curtailment cooperatives. The Cooperative used a community-based marketing approach that used established community organizations as partners, used word of mouth on the streets as a means of communication, and most importantly communicated a strong message of shared values and benefits. That message boiled down to the thought that, "We are all on the same wires. If my lights go out; your lights go out." While participants in these programs largely participated because of the direct economic value it created for them (a great deal on an air conditioner, or a payment for cutting use on the hottest summer days), that shared responsibility came through loud and clear.

When the Cooperative later conducted focus groups of participants, the Pilsen participants viewed the common good value of their energy efficiency far more than participants in other communities where the Cooperative had used only traditional marketing methods. Likewise, many of the businesses emphasized the "good neighbor" aspect of their participation. What was also significant with the Pilsen experience is that Pilsen is an immigrant community, and is the port of entry for many Mexican families. It has a strong network of churches and community organizations, and is the type of community that traditional broad-based programs miss. The community-based approach was essential for reaching what would otherwise have been considered a "hard to reach" sector.

Another example of the differences between community-based programs and traditional efficiency programs can be seen in looking at recent CFL efforts in Illinois as compared with one of the classic community-based CFL programs, the Poultney Change a Light Challenge. Recent efforts to promote CFLs by both ComEd and the Northern Illinois Energy Project have focused on getting CFLs into stores at subsidized prices. In contrast, the Poultney Challenge defined a successful program through the idea of getting every household and business in the community to replace at least one incandescent bulb with a CFL over the course of a month. The effort became a source of community pride. While broad-based CFL programs are likely to achieve significant CFL sales, once they are over, it is not clear that anything else is gained in terms of long-term education and attitudinal change. The Poultney Challenge created lasting value by engaging community residents in thinking about the action of replacing a light bulb as a benefit to the entire community. In the same way that the Cooperative found that its Pilsen participants recognized the shared impacts of their demand reductions, the Poultney challenge used energy to tie a community together. A more difficult aspect of assessing the value of this program is judging its cost effectiveness, and this remains an open issue requiring more research and evaluation.

Community Programs in Illinois

Compared with many states, Illinois does not have a long track record of community based programs. However, a few examples are worth noting. The Department of Commerce and

Economic Opportunity (and its predecessor the Department of Commerce and Community Affairs) has funded community energy projects in partnership with the U.S Department of Energy's Rebuild America program. These have largely been planning efforts at the local community level. This program is not currently active due to funding constraints.

In 2001, in response to legislation passed by the Illinois General Assembly, the University of Illinois at Chicago Energy Resources Center (with ICF Consulting, Illinois Department of Natural Resources, and National Economic Research Associates) published the report, "Community Based Energy Program: A Study Of Load Aggregation And Peak Demand Reduction." This report focused on community based programs and their technical potential. It did not look at community marketing but rather the technologies used for distributed generation and energy efficiency and what their impact could be in reducing distribution system costs. The report had a broad set of findings and observations that indicated great technical potential and concluded with recommendations in four areas:

- Educate the public
- Demonstrate new concepts and technologies
- Review and experiment with changes in rates, regulations, and procedures that can change customer behavior
- Investigate financing tools that can help implement these new concepts.

(University of Illinois at Chicago Energy Resources Center, 12)

While the Community Energy Cooperative subsequently did launch a pilot real-time pricing program, the other recommendations were not adopted by policy makers.

In 2002 an earlier study by the Community Energy Cooperative that was funded by the Illinois Clean Energy Community Foundation looked at how the model of the Cooperative could potentially be expanded. That study, "Capturing and Managing Consumer Benefits In The Changing Energy Marketplace," focused on how to assess the intersections between the technical needs of the electric grid as studied by UIC and the "social capital" of communities served by that grid and describes potential expansion models for the Cooperative and a focus on the potential of real-time pricing. Recommendations in the report centered on the potential for municipal aggregation of electricity purchasing, and the potential of real-time pricing. As mentioned above, work on real-time pricing did take place, but municipal aggregation as a way to help communities with their energy costs did not catch on and legislation to enable it did not advance. In early 2007 with rising electric rates as a result of the end of the rate freeze, municipal aggregation has reappeared as an issue and several pieces of legislation have been introduced on this topic.

The Energy Trust of Oregon Study

In 2005, the Energy Trust of Oregon published the study, "Recommendations for Community-Based Energy Program Strategies." The Energy Trust is widely viewed as a national leader in energy efficiency programs, and the study was an attempt for the Trust to explore how to add a community-based focus to its work. The Trust gathered a panel of leading experts to review programs, profile some exemplary programs, and develop recommendations. While there are other studies and papers on the concept of community-based programs, this study should be

considered the best contemporary review and synthesis of ideas. Rather than detail each program that they reviewed, the following section focuses on their findings and recommendations and some observations of how those correspond with the Cooperative's experience in Illinois and the potential for future community-based programs.

The Energy Trust study found that the common characteristics of programs that they reviewed and found exemplary were:

1. At the most basic level, community-based energy programs are identified with a specific community, typically within the project name.
2. Community-based programs typically have a citizen committee of volunteers that provides guidance to the project.
3. Community-based programs typically have a strong educational component.
4. Community-based programs use community dynamics for marketing and generating interest and enthusiasm within the community.
5. They rely on community partners, whether businesses, local media, schools, or volunteer citizens, to deliver as much of the marketing and service delivery as reasonably possible.
6. Some, but certainly not all, develop on-joint ownership of project goals that continue beyond the provision of funding.

(Energy Trust of Oregon, 2-3)

These programs created a variety of benefits largely around the areas of increasing the depth of awareness and understanding. However, the Trust identified some key challenges and obstacles:

- How does a change to community strategies mesh with current programs and operations?
- What level of financial commitment to community-based programs is appropriate?
- How can the Energy Trust reduce the costs and improve the success of community-based approaches?
- How does a change to community-based approaches impact the ability to the Energy Trust to meet its goals, particularly its cost effectiveness goal?

(Energy Trust of Oregon, 9)

Many of these challenges are directly applicable to Illinois policy makers, with the key distinction that the opportunity in Illinois is to create new programs, not refine and improve existing programs. The Trust spent considerable time and effort to discuss the issue of program meshing, but because it is not relevant to the Illinois experience, that aspect of their report will not be discussed here. Ultimately the key challenge for Illinois boils down to issues of cost. Will the added value that community-based programs can add, as described above, outweigh the added costs? The Energy Trust was clearly convinced that programs can be made better with a level of community-based efforts included in them, but remained concerned about the cost effectiveness. The issue in Illinois will be no different.

Where the findings of the Energy Trust match best with some of the past experience of both the Community Energy Cooperative programs and the UIC study is in the concept of programs that can impact local transmission and distribution costs. It is in these programs that the added cost of community-based programs potentially could be quantified and an appropriate value level set.

For example, the Kane County Energy Plan that the Cooperative developed in 2005 specifically looked at the value of reducing load growth in Kane County over the next twenty-five years and found a potential of up to $990 million in avoided energy costs. If these avoided place-based costs were added into the cost benefit analysis of a traditional energy efficiency program, then the economics of having those programs target a specific geographical place rise dramatically.

As Illinois policy makers consider the shape and structure of future energy programs, community-based programs offer a highly effective tool that should be considered. They have particular additional value when targeting low-income communities. As one study found, "Social reference groups are most important for middle- and upper-income households. Low-income groups seem to be more influenced by programs run by community groups" (Shipworth 2000). Rising energy costs hit low-income households more than higher income households, making this aspect of targeting program design particularly important.

2.3 The Influence of Technology Improvements on Energy Efficiency

There are two general categories of technology improvements that can affect the energy efficiency of end use devices. The first is an evolutionary or gradual improvement of a device's energy efficiency. The second is a revolutionary or rapid improvement of either new or existing devices.

Evolutionary improvement can occur with or without direct external pressures.

Products generally go through a life cycle that may include small changes, modifications and upgrades near the end of the life cycle, in order to revitalize the products and start them on a new cycle, extending their presence in the market place. It is usually in this framework that small increases in energy efficiency are designed into that device. It may not be intentional. For example more efficient components might be the only components available or design improvements could result in less wasted energy being used.

A key element here is that an increase in the energy efficiency of the device is neither the main nor possibly any goal of the redesign. Most redesign will be with the thought of changing or improving functionality coupled with reducing manufacturing costs, and energy efficiency is usually not considered. The entire process will be driven by the cost effectiveness as it relates to the manufacturer, not the end user. The process may not be long, but the energy efficiency improvements may also not be great.

Products can also go through mandated redesign with increased energy efficiency being the specific goal. These products are usually the larger energy using devices, such as air conditioners and refrigerators, and their redesign is usually the result of a change in regulated standards being imposed on a product. A recent example of this was the change in minimum

SEER ratings, from 10 to 13, for residential central air conditioners manufactured after January 23, 2006.

The process of a redesign tends to have two stages. The first surrounds the establishment of the desired improvement, which is usually political as well as technological and can take a substantial amount of time. The central air conditioner example was a change from the 1992 standard of 10 SEER. Discussion began in 2000 but was only agreed upon in 2004, with a 2006 effective date. The second involves products that strive for a performance level above the regulated minimum in order to meet voluntary guidelines such as Energy Star. For a central air conditioner to achieve the Energy Star label, it requires a SEER of 14.

The former results in an unconscious trickle down effect, that of a user improving their energy efficiency. They become slightly more energy efficient with every device they acquire, but only to the extent that it replaces a less efficient device. A new user setting up a household also benefits from the better energy efficiency of the device, as that is the only level of efficiency available to them.

The latter also results in an uncontrolled improvement in efficiency, but there is usually more choice involved in the purchase decision and so the absolute improvement in efficiency is somewhere in between going to the new standard minimum and going to the voluntary above standard performance.

Revolutionary improvement can sometimes be seen in existing devices but more usually in new devices.

Existing products are sometimes changed by a breakthrough research design that becomes so overwhelming that it becomes public and changes the way all similar products are designed. The breakthrough design may or may not have been focused on the energy use of the device, but the resulting design does greatly reduce its energy consumption.

New products are currently being developed in an era of heightened energy awareness. This leads to a greater awareness of the energy usage of the new device. The marketing of a new product is also more likely to use a higher energy efficiency of the product as a means to have it stand out from the crowd. These factors combined make energy efficiency a much more likely goal of the new product design. Products such as these can either be direct replacements for older less efficient ones, such as LCD computer screens replacing CRT screens, or can be centered on new ways to do old things, such as microwave ovens being used to replace some processes that a range/oven was used for (such as re-heating foods or making popcorn with more efficiency), but not necessarily all processes (such as making the whole holiday meal).

Revolutionary improvement is also more often associated with what can be described as a disruptive device/technology. This is one that doesn't just slip in quietly among similar devices, but is designed to replace, augment or make obsolete the older devices and transform the marketplace. To some extent the "smart" or "wired" home is a disruptive technology. To fully implement a smart home requires a re-thinking of the way a home is used and all its energy consuming devices. For example, a smart home could feature appliances that communicate with

each other, lights that sense their need and turn themselves on and off, or could allow the consumer to have an interactive discussion with the home controller. All these are disruptive and revolutionary concepts and as such face an acceptance hurdle.

Product manufacturers concentrate on evolutionary improvement because the costs to design a small level of increased energy efficiency during a product life-cycle update are low. In fact there may just be an after effect of using the currently available raw materials and components in the updated design. This means little or no research or development costs associated with energy efficiency are needed.

This leads to a major difference with revolutionary improvement, from the manufacturer's point of view. To have a revolutionary product does take a substantial research and development effort with the associated costs. The current marketplace allows for this to occur economically when the expected outcome yields a substantial positive return on the capital invested in the research and development, taking risks into account. Most new highly energy efficient concepts don't automatically have that substantially positive return on capital, so manufacturing doesn't move forward very quickly.

It is clear that moving technology advancement forward more quickly requires external influences. These could come from positive financial or tax implications for manufacturers to increased research and development efforts directly related to the energy efficiency. These should also positively impact the pure research and development aimed at the development of the revolutionary products. Another influence should come from the consumer creating a desire and pull for these products. This can be accomplished through increased education and awareness of energy efficiency and its importance in everyday life. The need for combining the manufacturers' incentive with the consumer drive is instrumental when revolutionary improvement is desired.

2.4 Visual Technology: The "Energy PriceLight" Example

Over the past four years, the Community Energy Cooperative administered the Energy-Smart Pricing Plan^{SM} (ESPP). Through this program the Cooperative found that customers using residential real-time pricing (RTP) reduced their electricity consumption in response to price signals and made energy-efficiency investments when they were given the proper tools and education to manage their energy use. Individualized information regarding energy usage and costs was found to enhance participants' success, and this information is particularly helpful if provided in an engaging and easily understandable manner. Dynamic tools can increase energy awareness and aid behavioral changes in meaningful ways.

The tools tested through ESPP have included access to online daily updates on hourly electricity prices, phone or e-mail notification when prices rise above a certain threshold, and regularly

scheduled personal updates on energy usage and costs. While these tools have worked well, during the final year of the ESPP pilot, the Cooperative tested a new generation of technology—devices that display information in the home. Specifically, the Cooperative developed the "Energy PriceLight" using an existing hardware solution. This technology represents the cutting edge in strategies for motivating behavior change and increasing energy efficiency.

The PriceLight is a small lamp, or "orb," that plugs into a standard electrical outlet. It receives information through a pager signal and changes color to reflect the current price of electricity (the price ESPP participants paid on the real-time pricing rate). The hardware was designed by Ambient Devices, and is used to indicate real-time changes in information (in this case, the electricity market) by glowing different colors based on the price in effect that hour. It plugs easily into the wall, requires no set up, and provides "continued awareness without distracting or intruding." (Ambient Devices 2005, http://www.ambientdevices.com/)

During 2006, 50 ESPP participants were chosen at random to receive this additional tool. Participants were then able to choose to adjust their electricity usage according to the information provided to them via the PriceLight's visual display.

Through this initial test of concept, the Community Energy Cooperative gained valuable insights into the benefits of using visual display technology to aid electricity customers who are charged RTP rates. Independent evaluation of the actual energy savings of people participating in the real-time pricing program found that those in the PriceLight study, who had access to visual price signals, were better at adjusting their electricity use in response to price. In other words, as prices increased, households with the PriceLight reduced their energy use more than those households without the device.

In addition to the actual energy savings, the PriceLight technology spurred intense interest in and discussion of energy issues in the households that used the tool. Participant surveys indicated an immense satisfaction with visual technology, with 90% of participants describing the PriceLight as "very useful." For example, one respondent wrote, "The orb was so easy for us. We could see it from all over. We responded to changes immediately instead of trying to remember when the prices were going to increase." In other words, participants in the pilot demonstrated that the PriceLight tool was valuable in keeping energy issues "front-of-mind."

Despite the obvious interest from consumers and value to the electric system, visual price-signal technology has so far been tested only on a limited basis throughout the United States. Southern California Edison's Information Display Pilot, held in 2004, and Wisconsin Public Service's Thermostat Pilot Evaluation, 2005, tested visual tools for residential electric customers, however both customer groups in those pilots were charged critical peak pricing rates, not real-time pricing rates. Other in-home devices such as smart thermostats, The Energy Detective (TED), and the Kill-A-Watt, may enhance customer understanding of energy usage and costs, and have been researched (Stein 2004) but not extensively compared.

The Energy PriceLight, or similar information-display technology should be further tested by real-time pricing electric customers to determine the extent of individual and system benefits. A large-scale pilot program should test whether PriceLight users further reduce their energy use at

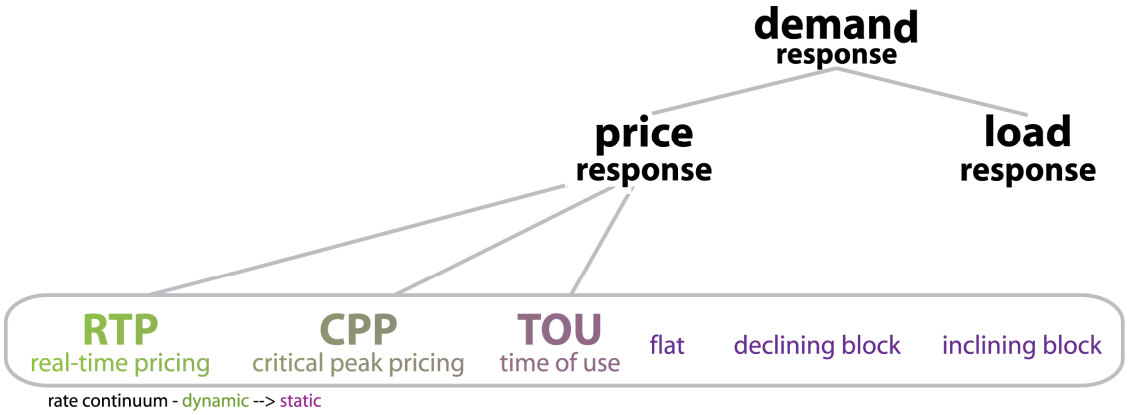
high-priced times as compared with RTP customers who receive no visual cues. A pilot program should also investigate whether consumers using such a device demonstrate increased awareness regarding energy usage and costs, and whether they demonstrate increased energy efficiency related behaviors. This additional research could provide a deeper understanding of the value to consumers for this kind of information.

2.5 Real-Time Pricing: Rate Structure and Policy Implications

As Illinois moves forward into full electricity market deregulation, policy makers will look at new rate structures to address market changes, to inform decision making, and to create policies and effective programs that will provide benefits to consumers. This section focuses on a literature review of real-time pricing (RTP), comparing RTP with other dynamic rates, and discusses barriers and challenges to residential RTP adoption and implementation. Finally, this section will discuss how RTP could fit into an integrated long-term, energy efficiency strategy in Illinois.

Demand response (DR) is typically classified in two ways: load response and price response. Although this section focuses only on price response strategies, it is worth mentioning that utilities and independent systems operators (ISOs) in deregulated markets have long recognized the benefits of demand response, both price and load (RMI 2006). Policymakers too, generally agree that DR improves resource efficiency and increases system reliability (DOE 2006). Federal and state demand response policies are not coordinated however, mainly because of the different regulatory jurisdictions of wholesale and retail electricity markets and regional resource differences. It is also worth noting that as more markets move toward deregulation, suggestions to move toward price response approaches are becoming increasingly common, both on a state and even on the federal level. The Energy Policy Act of 2005 Section 1252 requires all states (and non-regulated utilities) to consider time-based rates including time of use, critical peak and real-time pricing. Each of these time-based rates creates incentives for customers to better manage their load, and in particular, they create a focus on reducing the most expensive power, peak power. Peak load reduction reduces power costs, reduces stress on infrastructure and improves reliability, all of which provide a range of societal benefits. The chart below illustrates the continuum of dynamic price response strategies.

Figure 9: Rate Structure Continuum



Price Response Strategies

Real Time Pricing
Real-time pricing (RTP) is a dynamic rate where electricity price varies hourly to reflect the marginal supply cost to the utility to procure electricity in the wholesale market. Real-time pricing exposes customers to the true cost of electricity on the margin and shifts the burden of risk from the utility to the customer. Economists have advocated for RTP rates in restructured electricity markets, noting that RTP provides the most accurate price signals that cut peak demand, and links wholesale and retail markets (York and Kushler 2005). In most states however, RTP is a voluntary rate that is only available to commercial and industrial users. In a 2003 survey of utility experience with real-time pricing, of the 43 voluntary tariffs studied, only one program was offered to the residential class (Barbose et al 2004). The sole program was the Energy-Smart Pricing Plan, which was offered by ComEd and the Community Energy Cooperative in northern Illinois. The Energy-Smart Pricing Plan (ESPP) demonstrated that participants can cut peak demand in response to price signals and that they can become more energy efficient in general (Summit Blue 2005, 2006).

Successful results from the four year pilot led Illinois to become the only state currently offering all residential customers a real-time rate option. In 2006, the Illinois General Assembly passed legislation requiring the large investor owned utilities to offer a RTP rate option, but to do so as part of a program that provides tools to help customers manage their electricity use. In 2011, the results will be reviewed by the Illinois Commerce Commission, the state's regulatory body.

Critical Peak Pricing
Another dynamic rate commonly studied and referenced is critical peak pricing (CPP). Critical peak pricing differs from real-time pricing in that the utility designates multiple rates (typically an on-peak designation and an off-peak designation) that are charged at set times of the day and days of the week, but these rates do not reflect the true cost of electricity at each moment. Instead, the pricing schedule is set for a period of several months. Critical peak pricing also includes a component that allows utilities to periodically call for customers to curtail use when load is high, but only allows utilities to do so a limited number of times per period.

California's Statewide Pricing Pilot (SPP) of 2003-2004 is another successful dynamic rate model. California's pilot program included two and three-tiered rates that included fixed and variable critical peaks and time of use rates. After studying the pilot results, the California Energy Commission staff concluded that residential (and small to medium commercial and industrial) customers not only understand, but "overwhelmingly prefer dynamic rates" (Messenger 2006). In 2006, The California Public Utilities Commission (CPUC) ruled that: "We find that PG&E (Pacific Gas and Electric) made the most persuasive proposal for a CPP rate design and will therefore adopt it" (CPUC 2006).
PG&E is one of three investor owned utilities (IOUs) that have operated CPP pilots in California. Sacramento Municipal Utility District also ran a pilot.

Both critical peak and real-time pricing programs have shown that customers do reduce their energy use at times when prices are high. These demand reductions are measured by elasticity of demand (the amount customers reduce use as prices rise). California's critical peak pricing program had an average elasticity of -.09 (-.04 to -.13 across climate zones), compared to an elasticity of -.05 to -.12 across customer segments for the Cooperative's real-time pricing program in Illinois (US Department of Energy 2006).

Time of Use
Like critical peak, time-of-use rates (TOU) also utilize prices that vary by season or time of day, but TOU rates are set by tariffs and do not contain a callable peak. Time-of-use rates are less complex than critical peak and real-time pricing; TOU is simply a rate that includes a high on-peak price offset by a low off-peak price. Its simplicity is favored as a rate design option and thus is the most common price response strategy that utilities consider.

Both time-of-use and dynamic rates such as CPP and RTP offer incentives to customers for adjusting their electricity use. Dynamic rates, more so than TOU rates, have been shown to reduce peak load on the electrical system and are effective demand response tools. However, RTP may offer additional benefits that other dynamic residential rate options do not. For example RTP rates link the wholesale and retail markets, a link that many economists advocate (Star, et al 2006). So why hasn't there been widespread adoption of residential RTP, and what are the potential benefits and barriers to implementation?

Energy Policy

Over the last 30 years, residential energy policy and energy strategies have gone through several trends. One trend focused on improving product performance and concentrated on increasing efficiency through technological advances. Another trend centered on market transformation intended to build the market for efficient goods and services. The adoption of ENERGY STAR appliances is an example involving both trends—better performing products and an effort to build label awareness. A third trend involved efforts to influence and alter customer energy behavior. This third strategy has been less prevalent than the other two, and is more difficult to implement and assess. Recently, as more state electricity markets have been deregulated, policymakers are looking at a more comprehensive approach that integrates customer behavior and advanced technology in what Rick Kunkle, Loren Lutzenhiser and Sylvia Bender describe as a "people-**and**-devices view" (Kunkle, et al. 2004). Residential real-time pricing is an excellent example of the people-and-devices view, and there is renewed interest in RTP (Barbose et al

2004). However, there are several barriers to the widespread adoption of residential real-time pricing.

Barriers

Perhaps the largest barrier to large scale adoption of residential RTP is lack of precedent, both from the perspective of the residential customer and from the rate designers and implementers. On the residential customer side, until ESPP, no large-scale programs had been implemented and evaluated to precisely quantify and predict the impacts of RTP for the residential class. Therefore, regulators are hesitant to expose residential customers to what they feel is an unmanageable or excessive risk. This is the biggest obstacle. To a lesser extent the other lack of precedent is in writing residential RTP tariffs that address the needs of all stakeholders.

Most of the experience with dynamic pricing has been in the commercial and industrial (C&I) sector or has been limited to small-scale or short-term experimental programs for the residential class. In general, of all classes, residential customers are likely to have the fewest rate options (Winters 2001). Yet the growth rate for household energy use is higher than other sectors, so there is a large potential for savings through aggregating households for peak demand reduction. Most residential customers are used to flat rates so they do not tend to think about electricity as a commodity that has variable supply, demand and price. Furthermore, customers are not used to thinking about when and how their electricity use affects their total costs. Therefore, while RTP could be a potent and viable demand response strategy, it must include tools and education to help customers succeed. The rationale for continuing current residential rate structures declines as residential energy use increases, and as electricity markets deregulate residential customers should see more rate choices (Winters 2001).

However, even though there is renewed interest in dynamic pricing (RTP in particular), and many experts tout its potential, many policy makers are uncertain about how to implement an effective RTP program. In 2006, New Jersey's Board of Public Utilities approved tariffs for critical peak and time of use pricing, but could not resolve rate design issues related to PSE&G's (Public Service Electric and Gas Company) proposed day-ahead hourly pricing program, an RTP program (BPU 2006).

Despite other states' positive results, some regulators remain unconvinced that residential customers can understand or would voluntarily select dynamic rates, particularly real-time rates. The rate design working group of the National Action Plan for Energy Efficiency stated that, "Economists and public policy analysts can become enamored with efficient pricing schemes, but customers generally prefer simple rate forms. …Rate designs that are too complicated for customers to understand will not be effective at promoting efficient consumption decisions" (U.S. DOE and EPA 2006).

Clearly, there is disagreement among policymakers about implementing demand response and there is a disconnect between state and federal policies. To address this disconnect, the Federal Energy Regulatory Commission (FERC) began a collaborative discussion process in November 2006 to address regulatory barriers and to coordinate policies. In a report to Congress in August 2006, FERC staff identified regulatory barriers to increased customer participation in demand response programs, particularly the disconnect between retail prices regulated by states and

wholesale prices regulated by FERC (Federal Energy Regulatory Commission, 2006). Even though time of use and critical peak pricing rates are less difficult to understand and implement than real-time pricing, as mentioned earlier, RTP can address the disconnect of linking wholesale and retail markets identified in the FERC report.

The cost to implement technological solutions is also viewed by some as a barrier, but the benefits are proven. Load control devices have shown to improve demand reduction results. Combining pricing and automated control typically results in peak demand reductions that are up to twice as large as reduction from a dynamic pricing or load control program alone (King, 2004). And the technologies that can enable demand response can also be used effectively to manage energy use year-round (York and Kushler 2005b).

The general trend for technology advances is that advances start with the early adopters and trickle down to the mass market. For example, programmable thermostats are becoming more common in the marketplace, and are not difficult to use.

But devices alone cannot be depended on to realize the efficiencies needed. Economist Lynne Kiesling wrote in *Knowledge Problem*:

> The technology can't create all of these benefits on its own: rate redesign to allow dynamic pricing is imperative. What good is having technology to enable responsive demand if the meter just gets the same old, same old averaged price signal? Not much. Digital technology and dynamic pricing are symbiotic. Furthermore, the most significant benefits of digital technology and dynamic pricing are largely unseen by us in advance, which is why it's so bloody hard to get them enacted in regulation! (Kiesling 2006)

Real-Time Pricing and Energy Efficiency

Solutions for achieving greater energy efficiency cannot come from a rate alone, and cannot come solely from the adoption of new technological devices. Success will be measured by how these elements are integrated into the "people and devices view." Energy efficiency strategies that combine technological, behavior and education innovations into comprehensive energy efficiency programming will be the most successful models. As a result of the implementation of RTP rates, Illinois is an ideal place and 2007 is an ideal time to pursue new strategies and innovative energy efficiency programming that support demand reduction goals.

2.6 Programs Aimed at Hard-to-Reach Communities

When new energy efficiency programming is considered in Illinois, a concerted effort must be made to provide programs and services for hard-to-reach (HTR) residential customers. Hard-to-reach customers do not make up a single market category. Instead, this classification describes groups that have not traditionally participated in utility-sponsored energy efficiency programs. There may be some overlap between various hard-to-reach groups, but often each of the groups have distinct needs and opportunities, and should be reach through specific outreach methods and communication channels. While this presents a considerable challenge, it is extremely important to make the extra effort to reach HTR consumers. The California Energy Commission cited *changes in consumer behavior* (as opposed to hardware-based efficiency improvements) as

the biggest contributor to reductions in energy use during the state's energy crisis in 2001. Some groups of consumers may be harder to reach, but they possess the same ability to impact energy use as other consumers.

When developing programs aimed at hard to reach groups, the first step typically involves setting up criteria to determine whether a market segment is in fact hard to reach. The number of criteria can vary and should be specific to the needs of the state or region. The California Public Utilities Commission (CPUC) for example, has emphasized the importance of targeting and evaluating hard-to-reach customers in its energy efficiency programs, and it established five criteria for categorizing residential customers as hard to reach (Wirtschafter Associates, Inc. 2005). The four investor-owned utilities (IOUs) in the state all use the same criteria. CPUC criteria for hard to reach households include:

- **Language**: Primary language spoken in the home is other than English
- **Income**: Moderate income (as defined by 175%-400% of federal poverty guidelines)
- **Housing type**: Multi-family and mobile home dwellers
- **Geography**: Typically rural
- **Homeownership**: Renters

Sometimes customers fall into one or more of these categories, but certainly not always. Therefore a "one size fits all" approach will not be successful in reaching the individual segments of identified HTR customers.

Identifying and Evaluating HTR – Local, Local, Local

The utilities (IOUs) in the CPUC HTR program used 5 digit ZIP code level identifiers to predict areas where high densities of potential HTR customers live. Zip codes were used because of their availability through the utility databases. The program relied on each utility's own approach for determining which areas could have the most HTR households. Evaluators of the CPUC program found that overall, HTR communities were served by the state energy efficiency programs, but that the distribution of benefits was not equal, meaning that some areas received many benefits and others received none. They also found that ZIP codes alone could not accurately guarantee that a participant served by an energy efficiency program was indeed hard-to-reach, merely that the participant lived in an area where members of a hard-to-reach population live. ZIP code designations are simple, but often too crude a metric. For example, residents of San Francisco were excluded because the city's ZIP codes were not designated HTR. This means that San Francisco residents were not considered, even those who were non-English speaking, moderate income residents, or renters.

The CPUC evaluators stressed the importance of (1) finding good systems to identify and track which participants are HTR, and (2) studying actual participant data to evaluate how well a program met its targets. Accurate evaluation should analyze the participants' performance and their individual characteristics, not just whether they reside in a HTR ZIP code. Evaluators suggest using GIS analysis to identify participants at the census block-group level, and in the future to refine further to the census block level. Census block-groups are much more homogenous than zip code designations. Therefore, custom GIS maps can be cost-effectively produced to hone in on a particular area that a utility can use to create a specialized marketing

plan. Additionally, focusing on actual performance rather than a static geography will help utilities identify barriers to participation. In the past, policies ignored location as a factor in deciding hard to reach criteria, but CPUC is considering making areas that haven't caught on to energy efficiency programs a priority. CPUC notes that the driving force behind participation is word of mouth, but that word-of-mouth communication is likely to be contained within areas where programs are already in place. For example, with programs that use local contractors for energy efficiency home improvements contractors will tend to choose locations that they are familiar with and nearby locations. Therefore, utilities may have to offer various incentives to go into underserved areas.

Many criteria, many programs

The other key finding from the CPUC evaluation is that if the utility intends to reach many different types of customers, it must also have a diversity of programs in its portfolio targeted to the different segments of its residential customers. A multi-family program will not be successful in recruiting rural households, even if its outreach and marketing materials are stellar. Nor will a large appliance rebate program be successful in a community of renters if appliances are included with apartments. Low participation in HTR programs can be structural, and successful energy efficiency programs must be tailored to meet the needs of each HTR community.

Nevada Power and Sierra Pacific also stressed the importance of making the programs relevant to their audience, a lesson learned from their marketing of EnergyStar lighting to the Hispanic market in Nevada (2005). They found that marketing must be customized and not just translated. The messages and themes that are appropriate for one community may not resonate with another community. They also found that different groups will value different products. In support of these findings, environmental psychologist Doug McKenzie-Mohr, Ph.D. states that "behavior change rarely occurs as a result of simply providing information…but that it's achieved through initiatives delivered at the community level." McKenzie-Mohr states that such initiations should focus on removing barriers and enhancing benefits (Community Based Social Marketing website).

HTR overlap with low-income programs

There is a much longer and better funded suite of programs targeted to the low-income population than to HTR groups in general. The federal government has long supported energy efficiency and weatherization programs for the low income population through LIHEAP (Low-Income Home Energy Assistance Program) and WAP (Weatherization Assistance Program), and the value and effectiveness of these programs are well established (Kushler, York and Witte 2005) As such, the delivery mechanisms for these programs are also well tested. The low-income market is often considered separate from HTR, but there can be overlap. Therefore, when considering how to reach the HTR segments, if there is overlap, utilities should consider utilizing the strategies included in successful low-income programs.

Kushler et al. found thirteen traits common among successful low-income energy efficiency programs, and seven of them may be applicable to programs serving HTR markets as well.

- **Single or primary providers of service.** A one stop shop for services makes program participation easier for customers. If a segment is HTR to begin with, it will be crucial to make program participation easy.
- **Whole-house approaches and fuel blind programs.** These programs show maximum value. This makes programs most effective and ensures customers reduce energy costs to the greatest extent possible. The greater the value that HTR customers find in a program, the more likely they are to participate in other utility programs.
- **Customer education is integral to the program.**
- **Programs use innovative services and approaches for HTR customers**. Program marketing and materials are adapted and done in multiple languages and in different geographic areas.
- **Programs address the full spectrum of housing types**.
- **Program evaluation is integral and ongoing.**
- **Utilize community action agencies (CAAs) and other partnerships to provide customer servic**e. Often these agencies are well-connected and trusted. Identifying and partnering with local reputable organizations will help gain the trust of HTR participants.

2.7 Strategies for effective communication

Understanding Your Audience: Attitudes, Knowledge, and Energy Use

Before developing strategies to promote more energy efficient behavior, it is important to understand people's attitudes and knowledge regarding energy efficiency. This information is crucial in developing messages that the audience will find relevant, understandable, and credible. Before designing an energy efficiency program, it is also important to learn about how people use energy and about the circumstances that may encourage or discourage energy efficiency behavior. Knowledge of the target audience will allow program planners to identify incentives and barriers to energy efficiency and develop effective strategies that address the unique qualities of the targeted community.

Messages calling on people to conserve energy sometimes point out the environmental benefits of conservation or the damage caused by wasting energy. While this approach might sometimes be effective, there is not necessarily a clear link between the attitudes that people hold about the environment and the way they use energy. Nor is there a definite link between energy use and other sustainable behaviors such as recycling. A 2002 field study of Dutch households concluded that "self-reported environmental behavior and household energy use are two different constructs that are related to different motivational variables and demographics" (Gatersleben et al.). This disconnect could be due in part to a lack of understanding of the environmental impacts of energy use.

Influencing Behavior

It is tempting to assume that simply providing information about the benefits of using energy wisely will convince people to take the appropriate actions. However, energy efficiency programs that simply provide information promoting efficiency are unlikely to produce significant results. In order to influence behavior, an energy efficiency campaign must capture

attention, address audience concerns, and provide a clear, specific message. In addition, campaign planners should consider the barriers that might prevent people from taking action. For example, barriers could include inconvenience, lack of helpful information, or financial constraints. Finally, while some general communication strategies can be applied in any campaign, each energy efficiency program should be designed to address the concerns, needs, and circumstances of the target audience or community.

One common approach used in promoting energy efficiency is to inform people of the financial benefits of conserving energy. However, in "Alternative Social Influence Processes Applied to Energy Conservation," Aronson and Gonzoles note that the rational-economic model cannot always predict how people will behave in response to financial incentives or penalties. People do not always act in their own financial best interest. Furthermore, "Before consumers can take advantage of economic incentives or avoid penalties, they must first understand the provisions of conservation programs. And consumers often claim to understand conservation incentives more than they really do" (Aronson and Gonzoles 1990, 306).

In other words, to be effective, appeals based on financial benefits must be clear, understandable, and specific. In addition, research has shown that people are more likely to take action to prevent losses than to achieve financial gain. For example, a message stating how much money is being *lost* due inadequate home sealing is more likely to inspire action than a message stating how much could be *saved* by making various improvements to a home's envelope (McKenzie-Mohr 1999, 230).

The need for clear, specific information applies to any appeal for greater energy efficiency. According to Aronson and Gonzoles., "Basic learning theory principles predict that information that is clear, specific, and concrete is remembered best" (311). In order to be understood and remembered, information must also be presented in a format that will interest the audience and will not be too difficult for the average person to comprehend quickly. A 2005 report on residential energy efficiency programs in the United Kingdom concluded that information provided was often too dull and technical. The report authors concluded that programs are more effective when they reflect the self-interest, energy knowledge, and cognitive capacity of the householders targeted (Parnell and Larsen 2003).

Even when a message is communicated clearly and at a level people can understand, it may still fail to produce any changes in behavior. People might understand what they can do to save energy. They might realize that conserving energy is in their own best interest. They might even intend to take the desired action, but still not actually *do* anything to improve their energy efficiency. In order to turn education into action, it is necessary to consider the barriers that can prevent a desired behavior, and find ways to remove those barriers. In addition, tools such as incentives, prompts and social norms can be used to further encourage and reinforce energy efficient behaviors.

Community-based social marketing presents one approach for creating behavior change. According to McKenzie-Mohr's *Fostering Sustainable Behavior*, "This approach involves: Identifying barriers and benefits to a sustainable behavior, designing a strategy that utilizes behavior change tools, piloting the strategy with a small segment of the community, and finally,

evaluating the impact of the program once it has been implemented across a community" (McKenzie-Mohr 1994, 15).

Identifying barriers and benefits involves a variety of steps including: a review of existing literature, focus groups, observational research, and surveys. One behavior change tool involves asking people to make a commitment. Research has shown that when people are first asked to commit to a small action, they will be more likely to agree to take a more significant action later on. For example, people who sign a commitment saying that they will recycle are more likely to do so than those who are given information promoting recycling, but not asked to make a commitment (McKenzie-Mohr 1994, 15).

Another behavior change tool involves the use of prompts placed to grab attention at appropriate times and places. "A prompt is a visual or auditory aid which reminds us to carry out an activity that we might otherwise forget. The purpose of a prompt is not to change attitudes or increase motivation, but simply to remind us to engage in an action that we are already predisposed to do" (McKenzie-Mohr 1994, 61). To be effective, prompts should be placed so that people will notice them at the appropriate time. For example, coupons promoting CFL bulbs would be more likely to be effective if placed next to the bulbs at the store rather handed out at an event.

Social norms can also be used as tools for behavior change. When people feel that a desired behavior is the norm in their communities, they are more likely to adopt that behavior themselves. For example, when people see their neighbors recycling, they are more likely to recycle in their own households. To be effective, norms must be made visible, and must be prominent at the right place and time. Finally, social norms are best used to encourage a positive behavior rather than to discourage a negative action (McKenzie-Mohr 1994, 80).

Of course, none of these strategies will be effective if outside circumstances prevent people from adopting the recommended behavior. For example, recommending that people make significant investments to improve the efficiency of their homes will not produce results in a community where most people either rent their homes or lack the capital to make major improvements. Likewise, recommending reductions in outdoor lighting may not work if people are concerned about security. Campaign planners must determine factors that could prevent people from taking the suggested actions. The campaign should then include strategies to help people overcome barriers, or should adjust the campaign design to better suit the target audience.

In conclusion, energy efficiency programs should be planned carefully and crafted with the audience in mind. A successful campaign should addresses audience concerns, provide clear, understandable information, make use of a diverse range of behavior change strategies, and take outside obstacles into account. A community-based approach that includes personal interaction can be particularly effective in influencing behavior if it is designed to fit the target community. Several programs offer examples of the effective use of communication and education to promote greater energy efficiency.

Case Studies: Education and Communication Programs that Work

Focus on Energy

The Focus on Energy program in Wisconsin uses a multifaceted approach to energy education, and the program has produced impressive results. The program's mission is to develop and operate a range of sustainable energy efficiency and renewable energy programs. The Wisconsin Public Benefits Fund supports the both the Focus on Energy and Home Energy Assistance programs. Funds come from electric and natural gas utility rate payers.

Focus on Energy offers energy information and services to residential, industrial, and agricultural customers, and capitalizes on public-private partnerships. The Wisconsin Department of Administration's Division of Energy contracts with a variety of firms to deliver services. Residential programs include efforts to encourage the adoption of energy efficient products and behaviors. Business programs promote the use of energy efficient equipment and practices. In addition, renewable energy programs provide information, advice and technical assistance in order to encourage the adoption of renewable energy technologies.

The educational components of the program use Focus on Energy staff, but also involve credible partners including librarians, teachers, extension agents, and utility personnel. According to the 2003-2004 program report, "Our goal is for consumers to hear about Focus on Energy programs regardless of where they start looking for information about energy efficiency." Educational initiatives include the following:

- A residential information center provides information about energy efficiency and renewable energy.
- A public library initiative gives grants to libraries so that they can enhance their energy collections.
- The Wisconsin K-12 Energy Education Program (KEEP) enhances energy education and encourages teachers to include discussion of sound building practices in technical courses.
- A partnership with UW-Extension and County Extension agents helps provide information and referrals.
- Collaboration with utilities promotes utility referrals to the program.

In addition, Focus on Energy programs use strategic partnerships to get information and energy-saving tools to target audiences. The Residential Programs build partnerships with builders, contractors, and retailers to promote ENERGY STAR qualified lighting, appliances, and heating and cooling systems, and to increase construction and sales of ENERGY STAR qualified homes. Program partners learn about energy efficiency and then pass their knowledge on to their customers and clients.

The Focus on Energy Commercial Program works to establish relationships with businesses and business associations. The programs include education and training offerings for the commercial sector in areas such as energy management, efficient swimming pools, and refrigeration. Outreach for the Production Agriculture Program has been accomplished through partnerships with state agencies, utilities, extension agents, and agricultural associations.

For rural communities, the program has partnered with UW-Extension. According to the 2004 program report, "Since the UW-Extension is seen as the 'go to' organization that rural areas use

when investigating business expansions or other economic development opportunities, it was the logical organization to distribute energy efficiency information from the Focus program." (p. 25)

In another educational initiative, Focus on Energy worked with the Wisconsin Technical College System to offer a building science certificate at Nicolet Technical College in Rhinelander. Remodeling contractors, electrical apprentices, HVAC apprentices, teachers and carpentry apprentices participated. There was strong interest in the program, and as a result, six other technical colleges decided to explore the possibility of offering the courses.

Overall, these efforts have been extremely successful in engaging businesses and residents in Focus on Energy programs. Evaluation for FY04 showed that the program produced total savings of $214.5 million for the year, for a program benefit to cost ration of 5.4 to 1. Electric demand was reduced by 35.5 megawatts, and savings from natural gas efficiency efforts totaled 14.4 million therms. In addition, Wisconsin businesses saved nearly $14.6 million and residents saved nearly $20 million.

During the 2005 fiscal year, Focus on Energy Programs had more than 220,000 participants. Energy savings totaled 221 million kilowatt-hours and ten million therms, a savings of $26 million.

The education and information components of Focus on Energy have been successful for several reasons. The programs make energy information available through a wide range of sources, including sources that people already rely on and trust (i.e. libraries and UW-Extension). These partnerships increase the impact of the programs and improve the perceived credibility of the information provided. Second, information and education are woven throughout the programs so that even programs that focus promoting energy efficient technologies also help to build awareness of energy efficiency in general. Finally, all of the programs are possible because of the funding that comes from the Wisconsin Public Benefits Fund.

Flex Your Power

California policymakers launched Flex Your Power in response to the energy crisis of 2001. The program appealed directly to consumers, asking them to take action to conserve energy. Campaign components included a mass media campaign, teacher and school programs, direct outreach to businesses, and government orders to state agencies. The results exceeded expectations. By October 2001, the conservation and efficiency programs had reduced peak electricity demand by 6,369 megawatts.

Bender et al. discussed the success of Flex Your Power, in a paper presented at the ACEEE conferences in 2002. The authors concluded that Flex Your Power was successful because the campaign: targeted the right audience; delivered a credible, understandable message; presented persuasive messages; and created a social context that would lead to the desired behavior. Circumstances may also have contributed to the campaign's success since the crisis made energy conservation particularly salient to California consumers. Nevertheless, Flex Your Power demonstrated that appeals to consumers for voluntary energy conservation can produce results, particularly in times of crisis.

People are more likely to pay attention to messages that seem relevant to their interests and concerns, so the Flex Your Power media campaign delivered messages designed to appeal to the values and interests of specific segments of the population (based on age group, ethnicity, etc.). Messages were delivered in several languages and presented through television, radio, print, and outdoor advertising.

In order to be effective, a message must also be perceived as credible. According to Bender et al., "pre-campaign polls and subsequent research indicated that Californians assigned blame for the energy crisis to politicians or electric utilities for deregulation and to the new electric generators for overcharging" (Bender et al 2002, 8.19). Flex Your Power was a state-sponsored effort, so in order to increase credibility, messages were presented as associated with a consumer watchdog group, and they avoided discussing who was to blame for the crisis.

The Flex Your Power campaign employed another basic theory of effective communication by using vivid images and simple, specific messages that were played repeatedly. The ads were also repeated on television in order reinforce the message for a wide audience and increase the likelihood that the audience would take the recommended action. Finally, the messages promoted a feeling of "self-efficacy" by demonstrating easy energy-saving strategies that did not require money, contractors, or special knowledge.

Based on the impressive consumer energy savings during the crisis, Bender et al. concluded that, "Flex Your Power has demonstrated that mass media campaigns can be effective short-term policy tools given the right context." The authors go on to state that, "To be successful as long term policy strategies, public information campaigns must put the consumer's point of view about the policy outcome being addressed at the center of the campaign" (8.26).

The Flex Your Power campaign clearly demonstrated that in a time of crisis, energy consumers will take action to reduce their energy consumption. What is even more notable is that many of the energy-saving behaviors persisted one year later, after the crisis had subsided and the campaign had ended. Lutzenhiser et al. surveyed consumers in California during the energy crisis (September and October 2001) and then again one year later. In the 2001 survey, most consumers reported taking more than one action to save energy. One year later, many people continued to conserve, but to a somewhat lesser degree.

The authors note that, "Voluntary conservation did continue to produce energy savings, with about one half of the 2001 crisis savings persisting in 2002, controlling for differences in weather between the two years" (Lutzenhiser et al 2004, 7.235). The authors concluded that "widespread energy conservation is possible through voluntary change in household energy behavior when consumers are convinced that there is a relevant problem/crisis that they can help solve." (7.238) They also noted that some households saved more energy than others, and more research is needed to understand how households differ in their energy use and in how they respond to various efforts to promote energy conservation.

2.8 Evaluating Program Impacts with an "Energy Efficiency Awareness Index"

Successful energy efficiency programs require careful planning, funding, and implementation, but these are only some of the pieces of the puzzle. There also must be ways to measure and evaluate the success of a program, whether it is in terms of customers reached, energy saved, dollars spent or attitudes changed.

In the discussions facilitated by the Illinois Commerce Commission on the Sustainable Energy Plan, Ameren Utilities introduced the concept of a "customer energy efficiency awareness index." Indexes are used as benchmarks of activity or performance, and can assign values (on a scale of measurement) derived from a series of observed facts. Qualitatively, an index can reveal current conditions and give insight into the types of changes that are needed to produce the desired results. Ameren proposed that an index could be a useful metric in evaluating energy efficiency programs that cannot be directly measured by kilowatts or kilowatt-hours saved. For example, indexes could be appropriate in evaluating educational programs since the direct results of educational programs are likely to include changes in attitude or awareness, which can be difficult to measure.

Daniel Esty of the Yale Center for Environmental Law and Policy highlights the importance of concrete measures in analyzing environmental programs. In Esty's paper*, Toward Data-Driven Environmentalism: The Environmental Sustainability Index,* Esty explains, "Too often environmental debates turn on rhetoric and emotion rather than carefully considered data and analysis. Firmer factual foundations and a higher degree of analytic rigor would help to narrow the range of dispute over which environmental battles rage and to move us beyond the current polarization over how best to achieve environmental goals" (Esty 2001).

At the core of any shift toward more systematic environmental decision-making lies a need for reliable environmental "indicators" or "metrics" and other data that clarify the issues and the trends. To facilitate such a shift in environmental policymaking toward firmer underpinnings, the World Economic Forum's Global Leaders for Tomorrow Environment Task Force launched an initiative in 1999 to develop an Environmental Sustainability Index (ESI).

The Environmental Sustainability Index contributes significant knowledge to the field of environmental program management. However, the index operates on a global scale, comparing nations as a whole, and their ability to protect the environment over the next several decades. The ESI incorporates 76 data sets "tracking natural resource endowments, past and present pollution levels, environmental management efforts, and the capacity of a society to improve its environmental sustainability—into 21 indicators of environmental sustainability" (Yale Center for Environmental Law and Policy and the Center for International Earth Science Information Network 2005).

The ESI is a good model for the arrangement of an index and exemplifies a selection of indicators based on environmental subjects. However, in order to create an energy-efficiency awareness index, indicators must be based on a much more personal scale—aiming to measure the ways people think about energy and how their attitudes, in turn, dictate behavior. The

California Board for Energy Efficiency's (CBEE) Baseline Study on Awareness and Attitudes of Energy Efficiency is one example of a study that aims to measure the success of a particular small-scale energy efficiency program in order to understand personal attitudes and awareness.

The CBEE study was performed in 1999 and surveyed environmental behaviors and attitudes on an individual level. The study involved a statewide telephone survey of residential customers designed to analyze and track awareness and attitudes toward energy efficiency products and services that had been promoted through California programs. The results of this study were intended to be used as the foundation for tracking changes over time in key measures of customer energy efficiency awareness, attitudes, perceptions, and actions (largely in regards to energy efficient product purchases). The study was additionally intended to provide input into future program design.

One aspect of the CBEE study is of particular interest to the discussion of tracking awareness or attitudes through an index. Respondents to the phone surveys were asked whether they agree or disagree with 11 different statements related to energy attitudes. The CBEE then conducted a factor analysis on the series of opinion statements that represented different customer views on energy issues in order to determine which statements were highly interrelated, and which were less closely related. Respondents were then clustered in order to find groups that were relatively homogeneous in their response patterns and as different as possible from other groups. For example, one clustered group titled, "Well Meaning, but Lack Control," was found to represent about 20% of California households. Members of this group were, "generally supportive of taking energy-efficiency actions, but stand out as believing there is little they can do to personally reduce their energy use" (Hagler Bailly 1999). With this type of grouping, CBEE was able to look at the demographic characteristics of each group, and determine a loose customer profile for different types of customers.

Within this context, the CBEE study is of particular benefit to organizations and entities with interests in promoting further development of the residential energy efficiency products and services industries. The CBEE study gives incredible insight into how an awareness index could be structured, and how survey data can be analyzed to show meaningful results. However, in this case (and in the ESI) an index is largely a rank, or an organized way of categorizing populations. Ranking populations based on their energy awareness can be useful in energy-efficiency program design and has been used in several studies (such as the Roper Center for Public Opinion Research, MORI Research, and the Natural Marketing Institute) to benchmark customer attitudes, and even to inform energy policy (Elliott 2003). However, it does not give insight into how individuals change as a function of changing conditions.

Measuring changes in behaviors and lifestyles of individuals is inherently difficult. For example, it is extremely difficult to prove that a certain program has changed participants' energy attitudes, that participants have become more open to energy-efficiency, or perhaps even that they have become more pro-environmental. One problem is that pro-environmental behavior is an extremely broad and ill-defined behavioral category. Henk Staats (2003) suggests developing a list of single acts that together can be considered to adequately represent pro-environmental behavior. Using Staats' method, energy-efficient behaviors could relate to the following categories:

■ Energy-efficiency activism (e.g., actively participating in or leading energy efficient initiatives)
■ Non-activist political behaviors (e.g., voting, signing a petition, or donating to an organization that works to promote energy efficiency)
■ Consumer behaviors (e.g., purchasing energy efficient products, recycling, reducing energy use, and alternating consumption habits)
■ Other behaviors which are specific to an individual's expertise or workplace (e.g., reducing waste in the production process, establishing mortgage criteria for energy efficient houses, suing a polluter, etc.)

Using Staats' method, an individual holds positive energy-efficiency attitudes if that individual displays behaviors from at least one of these categories. Individuals who are more committed to energy efficiency should demonstrate behaviors in each of these categories, and highly dedicated people will exhibit consistent behaviors throughout many aspects of their lives.

Opportunities for an Awareness Index in the Current Study

In Re-Energizing Illinois: Building Real Demand for Energy Efficiency, the survey team conducted an analysis similar to the CBEE study, aiming to cluster responses from the survey section titled "Energy Opinions." Although this study was unable to find statistically significant opinion statement clusters, the results did contribute to the understanding of types of indicators that may be used to determine how energy-efficient a person is. If further studies of this type find significant cluster groups, it will be valuable to form inferences based on the demographics of those grouped respondents.

One opportunity to compare energy-efficiency awareness, and to measure the degree to which populations are more or less aware of energy issues after participating in a program designed to increase energy awareness is to compare the general population with program participants. In this case, a random sample of ComEd customers was compared with ComEd customers who participated in the Energy-Smart Pricing Plan. Ideally, if one is to compare attitudes of the general ComEd population with those of ESPP participants (or other real-time pricing customers), participants in ESPP should be surveyed before and after they participate in the program in order to record baseline attitudes and to reduce selection bias. Furthermore, if survey questions are to be good indicators of energy-efficiency awareness, questions must cover a wide range of topics, as discussed above in theory by Henk Staats.

The survey team in Re-Energizing Illinois drew together three main types of indicators that may be used to form an energy efficiency awareness index. These include cognitive, affective, and behavioral (measured by direct and indirect behaviors) indicators.

Cognitive indicators relate to the consumer's direct knowledge. For example, a cognitive indicator may show that: the survey respondent is aware of the existence or availability of energy efficient products and services; the respondent knows where to find information about or where to purchase these products and services; or the consumer is aware of any price differential between standard and energy efficient products and service offerings.

*Examples of **cognitive** energy efficiency indicators:*

- Survey respondent is familiar with Energy Star label.
- Respondent is familiar with the benefits of using compact fluorescent light bulbs.
- Respondent is aware of the environmental impacts of energy production.
- Respondent is aware of the potential financial benefits of energy efficiency.
- Respondent can name one fuel source for electricity generation.
- Respondent can identify appliances that have the biggest impact on bills.
- Respondent can name one environmental impact of energy production.

Affective indicators are related to consumer attitudes or feelings. For example, these indicators identify: specific features or attributes that consumers prefer with respect to various products and services (including both energy and non-energy features); importance of energy efficiency when deciding to purchase a given product or service; and general opinions on issues concerning energy use, energy efficiency and resource conservation.

*Examples of **affective** energy efficiency indicators*:

- Survey respondent feels that energy efficiency is important.
- Respondent is concerned about the environmental impacts of energy production.
- Respondent believes it is important to purchase energy-efficient appliances (such as Energy Star brands) as opposed to standard appliances.

Behavioral indicators identify: specific energy efficiency actions taken in the past; sources through which customers have purchased these energy efficient products (e.g., utility programs, retail outlets, etc.); intentions to take action in the future; and possibly identification of the time frame for these actions or intentions. Behavioral indicators can either be direct (related specifically to energy-efficiency) or indirect (other behaviors, such as environmental actions that may affect energy-efficiency in an indirect way).

*Examples of **direct behavioral** energy efficiency indicators:*

- Survey respondent uses compact fluorescent light bulbs.
- Respondent seeks out products with the Energy Star label when selecting appliances.
- Respondent considers energy efficiency when shopping for appliances.
- Respondent owns Energy Star appliances.
- Respondent routinely turns off appliances and lights when not in use
- Respondent rides a bike, walks or takes public transportation rather than driving a car.
- Respondent adjusts or programs thermostat for energy savings.
- Respondent uses fans instead of air conditioning when possible.
- Respondent maintains electrical appliances for optimal energy savings (i.e. changing furnace or air-conditioning filters as needed).
- Respondent dries clothes on a clothesline when possible instead of using a dryer.
- Respondent washes clothes in cold water to conserve energy used for water heating.
- When possible, respondent makes use of daylight instead of artificial lighting.
- Respondent keeps water heater thermostat at the lowest recommended level
- Respondent seeks out information about energy efficiency.
- Respondent makes home improvements to increase energy efficiency, for example:

- Installing weather strip or sealed small leaks
- Replacing windows with high efficiency windows
- Upgrading insulation
- Sealing ductwork
- Installing high efficiency heating and cooling systems
- Using landscaping to provide shade or wind breaks
- Installing renewable energy technology such as solar thermal water/space heating, photovoltaic electricity, or geothermal heating.

*Examples of **indirect behavioral** energy efficiency indicators:*

- Survey respondent recycles
- Respondent brings re-usable bags to the grocery store
- Respondent buys environmentally safe products
- Respondent donates to an environmental charity/non-profit
- Respondent belongs to a civic organization
- Respondent looks for products made in the USA
- Respondent supports political candidates who promote energy efficiency or who include energy planning in their political agenda

One way to structure an index that is not solely a ranking of populations would be to assign specific values to these indicators. A survey respondent would then be given a "score" depending on their answers to questions related to these indicators. This quantitative "score" would aim to coordinate measures of behavior, attitudes, or lifestyle of an individual and reveal how that value changes as a function of changing conditions (such as price signals, more knowledge of ways to be efficient, attitudes after an educational campaign, etc.). Electric utility customers could be surveyed on their energy awareness (using cognitive, affective and behavioral indicators) before participating in a real-time pricing program, or an educational campaign. Those same customers could be surveyed afterwards, to determine how their "score" changes.

Although an analysis of this sort has many benefits, it is important to consider the drawbacks and difficulties as well. There are several questions to consider relating to the formation of an energy efficiency awareness index. For example, if indicators are to be given a score, how should the scale be structured? Does each indicator carry the same weight? Is each behavior or attitude worth the same in determining energy efficiency awareness? How many indicators does a person need to be at the top of the scale?

These questions uncover the complexity in creating an energy efficiency awareness index. It may be important to note that in order to evaluate the benefits of a certain energy efficiency program, determining changes in an entire population, on a collective scale, may be more valuable than an individual scale. This may reduce the need for a top of the scale, since all participants are being evaluated together, and focus is not placed on the score itself, but rather changes in that score after a certain population participates in an energy program.

Just as careful planning and implementation contribute to the success of energy programs, careful evaluation, verification and measurement of program outcomes are equally important.

Evaluation and measurement of program results are not radical concepts. However, measuring specific energy avoided has been the traditional benchmark used. A more qualitative evaluation, to study trends in attitude and behavior, would represent a marked departure from current evaluation standards in Illinois.

If policy makers in Illinois hope to make progress toward implementing energy efficiency programs that change consumer behavior and increase energy-efficiency awareness, an index could prove valuable in setting benchmarks and documenting progress.

Section 3: Final Recommendations and Conclusions

In 2005, when this study was proposed, 2006 was anticipated to be a critical year for Illinois utilities. The electrical utility restructuring process has been completed in 2007 and both Ameren and ComEd have increased rates for their customers, despite a show of opposition from Illinois state legislators. Customers are paying 25% to 50% more for electricity, and in comparison to the previous, artificially low rates, the shock of current electricity prices is particularly acute. The four-year experiment in consumer demand response through real-time pricing is underway.

At the state policy level, there has been little progress toward establishing policies or new standards for energy efficiency. Action on Governor Blagojevich's Sustainable Energy Plan has stalled. The flurry of activity at the Illinois Commerce Commission around establishing an Energy Efficiency Portfolio Standard, as well as the Renewable Energy Portfolio Standard, has abated.

On a national level, the long-awaited Federal Energy policy was introduced, but has been criticized for including too much reliance on traditional energy sources, or as the National Resource Defense Council states, "slower, costlier and dirtier" and fundamentally flawed (NRDC 2001). The National Action Plan for Energy Efficiency is a "call to action to utilities, state utility regulators, consumer advocates, consumers, businesses, state officials and other stakeholders to create an aggressive sustainable commitment to energy efficiency" (U.S. DOE and U.S. EPA 2006). Meanwhile, no funding for this campaign is available, and budgets for proven, successful energy efficiency programs have been cut.

Despite the inertia in public policy and legislative action, the place of energy in the public consciousness has undergone some noticeable changes during 2006. Energy becomes a priority for consumers when prices are high, but while prices for natural gas and oil continue to be volatile, they have not been as high as projected. Consequently, a strong public outcry for relief from the high costs of home heating, such as occurred in 2001, has not been a factor. The increase in electricity rates is currently provoking consumer complaints, but as of this time legislators have not seriously considered, recommendations to address these costs by reducing energy use.

However, the public perception of energy use reached a turning point in 2006 in response to the issue of global warming. Although controversy and dissent are still part of the debate, a majority of the public acknowledges the reality of the climate change issue. Part of this process has involved the message that an individual's personal energy use can have an impact on the future of the planet. There is a considerable distance between an individual acknowledging this message and that individual making actual changes in personal energy use. Nevertheless, concern – an important component of the context for change -- has definitely increased. Consumers are confused and concerned about what they can do. A survey by RBC Capital Markets found that 91% of Americans agree or strongly agree that more energy conservation

programs are need, and 53% believe the U.S.'s current energy problems won't be solved in their lifetime (RBC Financial Group 2006).

To quote a well-known aphorism, "In crisis there is opportunity." How can Illinois meet this challenge? The Cooperative's work over the previous years has revealed a plethora of answers. Our challenge is to utilize these findings by helping to facilitate effective energy efficiency programs and policies.

The goals of this research project were twofold. One was to identify directions for the continued expansion and development of real-time pricing for residential consumers. The second was to enable the development of creative and effective energy efficiency programs in Illinois. The latter is a considerably more difficult goal to achieve. The research the Cooperative completed during this year provided us with numerous examples of programs that could be effectively implemented in Illinois and could produce significant energy savings. But programs and policies are not developed in a vacuum; they are part of political, economic, and social contexts that obviously cannot be controlled. Given this reality, and based on the progress that Illinois has made so far in energy efficiency programs, it is apparent that more broad based, fundamental recommendations are necessary. A discussion of these issues follows.

.

1. Evaluation and monitoring must be a required component of any program.

Over the past thirty years, thousands of programs have been launched, and an even more extensive body of literature and reports documents those programs. Not all programs will be successful, and unsuccessful programs – if critically analyzed – can provide important insights for future program development. But only a small minority of these programs have included real evaluation components or follow-up monitoring to determine whether or to what degree the stated results persist over time. Instead, most programs are measured by metrics that provide no real information about efficacy. For example, measures may include statistics about the marketing plan, or gross number of purchases or installations of products, but no quantitative information on energy usage
savings..

Compact fluorescent light bulb give-away programs provide a simple example of this issue. In most cases, the only metric reported is how many CFLs are given away. But other data is needed to determine the true impact of the program. Examples of other factors include: How many of the distributed bulbs were actually installed? What kind of bulbs did they replace? How many of the recipients were "free-riders", i.e., consumers who would have bought CFLs had they not been given away? How many recipients who received free CFLs were convinced to change their purchasing habits? The net result may be very different from the gross number of bulbs distributed.

Effective evaluations address both the process and impact of a project. In a best-case scenario, evaluation should be performed by a third party, with 3-5% of the program budget providing funding for this evaluation. Evaluation should also reach outside internal operations to include stakeholders, whenever possible. Finally, monitoring and evaluation need to be dynamic. Even the best-running program changes over time, and opportunities to adjust and improve program specifics according to these changes must be identified and incorporated into the program design

2. Social and behavioral research is essential for designing programs that work
The strict engineering approach to energy efficiency, which holds that technological fixes can eliminate energy inefficiencies, is recognized by most as a valuable but limited perspective. Understanding people's motivations and behavior is essential for developing effective energy efficiency programs. Once again, a large body of work documents programs that had less impact in saving energy than expected. In a review of the relatively little success that has been achieved in influencing consumers to take energy savings actions, Lutzenhiser (2004) argues "the story of this general non-adoption of energy conserving technologies and practices is the one with the greatest potential to inform our future efforts."

Since that time, the public response to the energy crisis in California demonstrated that significant reductions in energy use can be achieved by behavioral responses alone. Notably, these changes were not motivated primarily by economic interest. Beliefs such as civic responsibility and environmental concern provided the motivations. Lutzenhiser et al (2004) states that, "these findings point to a receptive population and a large as-yet-untapped reservoir of energy savings in the residential sector." This type of reservoir is certainly not unique to California.

This research has identified that participants on real-time pricing programs report attitudes that are significantly different than electricity customers using the standard rate. However, because these participants were not surveyed before they began the program, no baseline metrics are available. Therefore, we cannot make the critical determination of whether these attitudes were present before the participants were exposed to the real-time pricing program. The expansion of real-time pricing to most Illinois residential electricity consumers provides a unique and important opportunity for understanding this issue. The Cooperative will be conducting some basic surveying of the Ameren real-time pricing participants, but more-in depth study is recommended.

3. Effective communication drives program success
Even the most important information will not reach its audience if it is not communicated effectively. The message needs to capture the target audience's interest and be conveyed in an understandable and convincing way, or the communication attempt will fail. One of the most insightful "best practices" identified in our research, a handbook on motivating home energy use, developed much of its content by critically examining the failure of an expensive, large-scale public education campaign.

Communication requires choosing the right strategies to advance the message. A mass-market media campaign will have a very different look and feel than communications to a specific target audience. For audiences who speak different languages, the direct translation of an English-language communication may not be appropriate. The right communication vehicle is also important; different audiences require different approaches. For example, the credibility of established community organizations is important for reaching lower-income populations, whereas social networks are more influential for others. Communication messages can also "sell" energy efficiency by linking it to other non-energy benefits that are important to consumers, such as comfort in the home, environmental impact, or other values.

4. Strengthen the relationship between energy efficiency and demand response
Demand response and energy efficiency had previously been viewed as antagonistic, but recent work, including the Cooperative's experience with the Energy-Smart Pricing Plan, has shown that the two can be complementary. Real-time pricing provides participants with a context to examine their energy use, which is an important component of action – simply paying attention to electricity can make a difference in behavior. After a participants' attention is engaged, there are opportunities to motivate additional energy efficiency behaviors. To accomplish this, customers need to receive consistent messages with clear explanations of actionable options. Then, follow up and feedback is needed to reinforce these behaviors.

The deployment of real-time pricing state-wide is an important opportunity for promoting and instilling energy efficiency in Illinois. One example of an energy efficiency campaign that could be deployed with this audience is reducing phantom electricity losses.

The Community Energy Cooperative has learned many valuable lessons by analyzing case studies across the nation and by the in-depth study of the behaviors and attitudes of real-time pricing participants in Illinois. The wealth of data that was uncovered in this report exemplifies the fact that we are only beginning to understand the complexity of creating incentives for energy efficiency and demand response and more research is needed. The best measure of the success of this report will be the extent to which the stakeholders utilize the results and find them useful for guiding their plans for energy efficiency and demand reduction strategies in 2007 and beyond.

References

Alliance to Save Energy. 2005. "Students Leading the Way 2004-2005: Energy Saving Success Stories from California." Washington, D.C., Alliance to Save Energy.

Ambient Devices. 2005. "Ambient Orb Product and Technology." http://www.ambientdevices.com/

Aronson, Elliot and Marti Hope Gonzoles. 1990. "Alternative Social Influence Processes Applied to Energy Conservation." In J. Edwards, R.S. Tindale, L. Heath & E.J. Posavac (Eds.), *Social Influence Processes and Prevention*. New York, Plenum.

Barbose, Galen, Charles Goldman, and Bernie Neenan. 2004. "A Survey of Utility Experience with Real Time Pricing." Lawrence Berkeley National Laboratory. Paper LBNL-54238. http://repositories.cdlib.org/lbnl/LBNL-54238. December.

Bender, Sylvia, Mithra Moezzi, Marcia Hill Gossard, and Loren Lutzenhiser. 2002. "Using Mass Media to Influence Energy Consumption Behavior: California's 2001 Flex Your Power Campaign as a Case Study." Paper presented at the ACEEE Summer Study on Energy Efficiency in Buildings. Pacific Grove, CA: August 18-23.

Borenstein, Severin. 2005. "The Long-Run Efficiency of Real-Time Electricity Pricing, revised." Berkeley, CA, University of California Energy Institute.

Community Energy Cooperative. 2002. "Capturing and Managing Consumer Benefits in the Changing Energy Marketplace: The Community Energy Cooperative Model." December.

Connor, Jessica, Margaret Hay, and Grahame Coleman. 2006. "Extension Through Education Programs with Kids: Who Are We Educating?" Monash University, Department of Psychology and Department of Primary Industries of Victoria, Australia.

[CPUC] California Public Utilities Commission. 2006. Decision 06-07-027, Section 10.3. *Final Opinion Authorizing Pacific Gas and Electric Company to Deploy Advanced Metering Infrastructure*. San Francisco, CA, California Public Utilities Commission. July 20.

Deloitte & Touche USA LLP. 2006. "Consumers Making Few Energy Related Lifestyle Changes: Deloitte Energy & Resources Study." Washington, D.C.: Deloitte & Touche.

[EIA] Energy Information Administration, United States Department of Energy. 2001. "Residential Energy Consumption Survey: Home Energy Uses and Costs." Washington, D.C.

Elliott, David J. 2003. "Sustainable Motivation: Status Report." Presentation at the United Nations Environment Program (UNEP): Division of Technology, Industry, and Economics in Paris, France, November 17.

Energy Center of Wisconsin. 1999. "K-12 Energy Education Program Baseline Study." Madison, WI.

Energy Trust of Oregon. 2005. "Recommendations for Community-Based Energy Program Strategies: Final Report." Energy Trust of Oregon. June.

Esty, Daniel. 2001. "Toward Data-Driven Environmentalism: The Environmental Sustainability Index." *The Environmental Law Reporter.* Vol. 31, No. 5.

[FERC] Federal Energy Regulatory Commission. 2006. "Federal, State Regulators Convene Collaborative Dialogue on Coordination of Electricity Demand Response Policies." News Release, November 2.

Gatersleben, Steg, and Vlek, 2002. "Measurements and Determinants of Environmentally Significant Consumer Behavior." *Environment and Behavior*, Vol. 34, No. 3.

Goldberg, Marshall, Martin Kushler, Steven Nadel, Skip Laitner, Neal Elliott, and Martin Thomas. 1998. "Energy Efficiency and Economic Development in Illinois." Washington, D.C.: American Council for an Energy-Efficient Economy.

Hagler Bailly. 1999. "CBEE Baseline Study on Public Awareness and Attitudes Toward Energy Efficiency." Madison, WI.

Harrji, D.T., R.H. Socolow and R.C. Sonderegger. 1977. "Residential Energy Conservation: The Twin Rivers Project." *ASHRAE Trans*. Vol. 83, January.

Hirst, Eric. 2002. "Demand Response: How to Reach the Other Side." *Electric Perspectives*. Vol. 27, Issue 5, September/October.

Illinois Department of Commerce and Economic Opportunity. "The Illinois Sustainable Education Project." http://www.commerce.state.il.us/dceo/Bureaus/Energy_Recycling/Education/ISTEP_program.htm.

Isaacson, Marjorie, Larry Kotewa, Anthony Star, and Michael Ozog. 2006. "Changing How People Think About Energy." Paper presented at the ACEEE Summer Study on Energy Efficiency in Buildings Conference, Pacific Grove, CA, August 13-18.

Jelsma, Jaap. 2004. "Engineering Approach and Social Aspects of Energy Use: Mind the Gap, But Can It Be Closed?" Paper presented at the ACEEE Summer Study on Energy Efficiency in Buildings. Pacific Grove, CA. August 22-27.

KEMA-XENERGY. 2003. "Evaluation of the 2002 Statewide Education, Training and Services Program." Oakland CA: KEMA-XENERGY.

Kiesling, Lynne. 2006. "NYT on Electricity: Metering and Asymmetric Information in Retail Markets." *Knowledge Problem: Commentary on Economics, Information and Human Action*. http://www.knowledgeproblem.com/archives/001874.html

King, Chris. 2004. "Integrating Residential Dynamic Pricing and Load Control: The Literature." *Energy Pulse*. CyberTech, Inc.

Klos, Mary. 2005. "Thermostat Pilot Evaluation Impact Report: Draft Report" Wisconsin Public Service.

Kunkle, Rick, L. Lutzenhiser, S. Sawyer and S. Bender. 2004. "New Imagery and Directions for Residential Sector Energy Policies." Paper presented at the ACEEE Summer Study on Energy Efficiency in Buildings. Pacific Grove, CA. August 22-27.

Kushler, Martin, Dan York, and Patti Witte. 2005. "Meeting Essential Needs: The Results of a National Search for Exemplory Utility-Funded Low Income EE Programs." Washington D.C.: American Council for an Energy Efficient Economy.

Lutzenhiser, Loren, Rick Kunkle, James Woods, Susan Lutzenhiser and Sylvia Bender. 2004. "Lasting Impressions: Conservation and the 2001 California Energy Crisis." Paper presented at the ACEEE Summer Study on Energy Efficiency in Buildings. Pacific Grove, CA. August 22-27.

McKenzie-Mohr, Doug. 1994. "Social Marketing for Sustainability: The Case of Residential Energy Conservation." *Futures*, March.

McKenzie-Mohr, Doug. "Fostering Sustainable Behavior Community Based Social Marketing: Quick Reference." http://www.cbsm.com.

McKenzie-Mohr, Doug and William Smith. 1999. *Fostering Sustainable Behavior.* Gabriola Island, Canada: New Society Publishers.

[MEEA] Midwest Energy Efficiency Alliance. 2003. "Illinois Residential Market Analysis: Final Report." Chicago: Midwest Energy Efficiency Alliance.

Messenger, Mike. 2005. "California Statewide Pricing Pilot (SPP): Overview and Results." Presentation by the California Energy Commission at the International Demand Response Seminar, San Francisco, CA. February 4.

Nadel, Steven, Anna Shipley, and R. Neal Elliott. 2004. "The Technological, Economic and Achievable potential for Energy Efficiency in the United States." Presented at the ACEEE Summer Study on Energy Efficiency in Buildings. Pacific Grove, CA. August 22-27.

NEED Project. 2006. "Blueprint for Success." Manassas, VA.

[NEETF] National Environmental Education and Training Foundation. 2002. "Americans' Low 'Energy IQ:' A Risk to Our Energy Future." *The 10th Annual National Report Card: Energy Knowledge, Attitudes and Behavior*. Washington, D.C.: RoperASW.

Nevada Power and Sierra Pacific. 2005. "Expanding ENERGY STAR Lighting to the Hispanic Market in Nevada." Presentation for the Energy Star Lighting Partner Meeting, April 4.

[NJ BPU] New Jersey Board of Public Utilities. 2005. BPU Docket No. EO04060395. *Decision and Order on Rates and Tariffs Associated with the Time of Use Pilot Program*. Newark, NY, Board of Public Utilities. July 29. http://www.state.nj.us/bpu/wwwroot/energy/EO04060395_20050919.pdf

[NRDC] National Resources Defense Council. 2001. "Slower, Costlier, and Dirtier: A Critique of the Bush Energy Plan." New York, National Resources Defense Council.

Olson, Dan. 2006. "Dull, Old, Unloved and Still the Best Way to Save Energy Dollars" (includes an interview with Sheryl Carter, Natural Resources Defense Council), Minnesota Public Radio. June 28.

Parnell, Rosie and Olga Popovic Larsen. 2005. **"**Informing the Development of Domestic Energy Efficiency Initiatives, an Everyday Householder-Centered Framework." *Environment and Behavior*. Vol.37, No. 6, 787-807.

Perez, Richard. 1993. "Phantom Loads." *Home Power*. Vol. 37. October/November.

RBC Financial Group. 2006. "More Than Half of Americans Feel U.S. Energy Problems Won't Be Solved In Their Lifetime, Says RBC Capital Markets Survey." New York: RBC News Release. June.

Reed, John. H, A. Oh, T. Talerico, J. Riggert and K. Johnson. 2001. "Statewide Residential Customer Needs Assessment Study."

[RMI] Rocky Mountain Institute. 2006. "Demand Response: An Introduction; Overview of Programs, Technologies and Lessons Learned." Southwest Energy Efficiency Project.

Shipworth, Michelle. 2000. "Motivating Home Energy Action: A Handbook of What Works." Department of the Environment and Water Resources. Canberra ACT, Australia.

Staats, Henk. 2003. "Understanding Pro-Environmental Attitudes and Behavior: An Analysis and Review of Research Based on the Theory of Planned Behavior." In *Psychological Theories for Environmental Issues*, ed. Bonnes, Lee, and Bonaiuto, 99-120, Burlington, VT Ashgate Publishing Company.

Star, Anthony, Larry Kotewa, Marjorie Isaacson, and Michael Ozog. 2006. "Real-Time Pricing is the Real Deal: An Analysis of the Energy Impacts of Residential Real-Time Pricing."

Paper presented at the ACEEE Summer Study on Energy Efficiency in Buildings. Pacific Grove, CA. August 13-18.

Stein, Lynn Fryer. 2004. "Final Report: California Information Display Pilot Technology Assessment." Boulder, CO: Primen, Inc.

Summit Blue Consulting, LLC. 2004. "Evaluation of the 2003 Energy-Smart Pricing Plan[SM] Final Report." Superior, CO: Summit Blue.

Summit Blue Consulting, LLC. 2005. "Evaluation of the 2004 Energy-Smart Pricing Plan[SM] Final Report." Superior, CO: Summit Blue.

Summit Blue Consulting, LLC. 2006. "Evaluation of the 2005 Energy-Smart Pricing Plan[SM] Final Report." Superior, CO: Summit Blue.

University of Illinois at Chicago Energy Resources Center, et. al. 2001. "Community Based Energy Program: A Study Of Load Aggregation And Peak Demand Reduction." Chicago, IL.

[U.S. DOE] United States Department of Energy. 2006. "Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them: A Report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005." U.S. DOE.

[U.S. DOE and U.S. EPA] United States Department of Energy and United States Environmental Protection Agency. 2006. "National Action Plan for Energy Efficiency: Rate Design Working Group." DRAFT.

Wilson, John H. 2001. "Illinois Statewide Energy Survey: Report on Findings." September, American ViewPoint, Inc.

Winters, Tobey. 2001. "Retail Electricity Markets Require Marginal Cost Real-Time Pricing." *The Electricity Journal*. November.

Wirtshafter Associates, Inc. 2005. "Statewide Hard to Reach Market Update Study."

Wisconsin Center for Environmental Education. 2005. "10 Years of Empowering Energy Education in Wisconsin." Stevens Point, WI.

Wisconsin Department of Administration, Division of Energy. 2004. "Wisconsin Public Benefits Programs Annual Report for fiscal year 2004." Madison, WI.

Wisconsin Department of Administration, Division of Energy. 2005. "Wisconsin Public Benefits Program Annual Report for fiscal year 2005." Madison, WI.

York, Daniel and Martin Kushler. 2005a. "ACEEE's 3rd National Scorecard on Utility and Public Benefits Energy Efficiency Programs: A National Review and Update of State-Level Activity." Washington, D.C.: American Council for an Energy Efficient Economy.

York, Daniel and Martin Kushler. 2005b. "Exploring the Relationship Between Demand Response and Energy Efficiency: A Review of Experience and Discussion of Key Issues." Washington D.C.: American Council for an Energy Efficient Economy.