

## **The Dynamic Pricing Mousetrap: Why Isn't the World Beating Down Our Door?**

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### **ABSTRACT**

In the smart grid debate, a key consumer oriented benefit has been the potential of dynamic rates. Properly implemented dynamic rates can reduce costs for consumers and provide them with valuable information about their energy usage in ways that enable them to reduce consumption, particularly at peak times when the electric gird is most stressed. Seven years of experience with thousands of residential real-time pricing customers in Illinois has supported this theory. Participants in the Ameren Illinois Utilities' Power Smart Pricing and ComEd's Energy-Smart Pricing Plan<sup>SM</sup> and the later Residential Real-Time Pricing programs have been successful in reducing peak demand in the 15% range and achieving bill savings that averaged in the 10 to 15% range. Recent evaluations have shown a conservation effect of reduced kWh at the level of 6% in the summer and 1.5% annually. Surveys have found that participants find it easy to manage their energy use and have high levels of satisfaction. These findings span race, income, usage and community demographics. But if it's such a great idea, why have only a small percentage of customers signed up? This paper will explore the challenges and learnings from marketing a new voluntary rate that tries to undo 100 years of public policy that separated consumer electric rates from the real costs of generation.

### **Introduction**

"Build a better mousetrap and the world will beat a path to your door." If only that were true. A common frustration in energy efficiency and demand response programs is why don't customers participate at higher levels? Why do customers not take up opportunities that can save them money? The experience of the residential real-time pricing programs in Illinois underscores this phenomenon. Ongoing evaluations of the programs clearly demonstrate that customers who do participate save money and like the programs. The electric system benefits from their reduced usage, especially at peak. Yet participation levels remain low. This paper will explore what has been learned to date about customer response to real-time pricing and will provide observations on current participation rates and the potential for them to increase.

The development of residential real-time pricing in Illinois has been discussed in several earlier ACEEE Summer Session Papers (Star et al 2008 and Star et al 2006). In a nutshell, the Center for Neighborhood Technology's Community Energy Cooperative developed a pilot program in conjunction with the Chicago area utility ComEd called the Energy-Smart Pricing Plan<sup>SM</sup> (ESSP) that ran from 2003 through 2006 and demonstrated the basic proof of concept: customers reduced peak demand, liked the program and saved money. As Illinois' ten year residential rate freeze came to an end at the close of 2006, the Illinois General Assembly used the results of that pilot program as the justification to enact legislation that authorized the roll out of

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larger residential real-time pricing plans for the two large investor owned utilities in the state, ComEd and Ameren Illinois Utilities (AIU). Those programs, the ComEd Residential Real-Time Pricing program (ComEd RRTT) administered by Comverge and AIU's Power Smart Pricing (PSP) administered by CNT Energy (the successor organization to the Community Energy Cooperative) have been in operation since 2007.

For real-time pricing to be successful, it has to operate effectively at several different levels. For consumers, it must demonstrate lower electric bills, have high customer satisfaction and low difficulty of participation. For utilities, the grid and the wholesale energy markets, real-time pricing must demonstrate reductions in peak demand, and the use of less electricity overall through conservation or energy efficiency. However, for those reductions to have any meaningful impact (outside of just the consumer), the scale of the programs must be large enough to change reliability, the generation mix, market prices and other aspects of electricity supply. The assessment of how large the programs need to be to make those impacts is a subject of ongoing debate. That question, at least in Illinois, will be taken up in 2011 as part of the legislative mandate that authorized the programs. But as an indicative sense of the scale that might be needed, the testimony of Bernie Neenan in the originating rate case modeled impacts at the 10% of households participation level (Neenan 2006). As of early 2010, the program sizes were nowhere near that level. They approached 1% of households for PSP, and 0.25% of households for ComEd RRTT (participants numbering 9,133 and 9,040, respectively).

The basic value of real-time pricing to consumers has been met, and will be demonstrated below. However, in order to assess how real-time pricing, and dynamic pricing in general, will effect electricity markets, the question of why participation levels are where they are today, and what can be done to improve them in the future, must be understood and resolved.

## **Results from Illinois Residential Real-Time Pricing, 2003 - 2009**

### **Reductions in Energy Use**

For dynamic pricing programs, a key measure of peak demand reduction has been the elasticity of demand to price (DOE 2006). The four years of operation of the Energy-Smart Pricing Plan and the second and third years of Power Smart Pricing have had third-party evaluations conducted by Summit Blue Consulting (now part of Navigant). The ComEd RRTT program has had analysis of its energy use conducted, but not a full elasticity study. It is anticipated that such a study will be conducted in 2011 as part of the four year review and evaluation of the entire program that is mandated by the enabling legislation, Public Act 94-0977.

Table 1 compares the own-price elasticities from dynamic pricing programs, including the ESPP and PSP hourly pricing programs in Illinois.

**Table 1: Comparison of Elasticities of Demand across Dynamic Pricing Programs**

| <b>Location</b> | <b>Type</b>              | <b>Year</b> | <b>Own-Price Elasticity</b> |
|-----------------|--------------------------|-------------|-----------------------------|
| San Diego       | Mix                      | 2000        | -6.8%                       |
| CA CPP-Fixed    | Residential              | 2003        | -3.5%                       |
| CA CPP-Fixed    | Residential              | 2004        | -5.4%                       |
| CA CPP-Variable | Residential w/technology | 2003-2004   | -2.7% to -4.4%              |
| Chicago ESPP    | Residential              | 2003        | -4.2%                       |
| Chicago ESPP    | Residential              | 2004        | -8.0%                       |
| Chicago ESPP    | Residential              | 2005        | -4.7%                       |
| Chicago ESPP    | Residential w/AC switch  | 2005        | -6.9%                       |
| Ameren PSP      | Residential              | 2008        | -4.3%                       |
| Ameren PSP      | Residential              | 2009        | -2.30%                      |

Sources: Direct Testimony of Dr. Kiesling in ICC Docket 06-0691, page 30, supplemented with new information from Summit Blue Consulting (2009).

The elasticity of demand for the programs mirrors the findings of other residential dynamic pricing programs elsewhere in the US and Canada (Faruqui and Sergici 2009). Most of those programs have been critical peak pricing programs, but the same concept that a price alert can trigger reductions of demand hold. Many of those programs also included smart thermostats or other direct load control devices. Not surprisingly the reductions where there is automation of large loads reductions are greater, but it is encouraging what can be achieved through information provided to participants and the manual actions they take.

While reducing peak demand is clearly an important issue in terms of improving the reliability of the electric grid and mitigating market prices, overall conservation is an important goal as well. In the evaluation of the 2008 PSP program, Summit Blue Consulting also found an annualized 1.5% reduction in kWh used (Summit Blue 2009). Conservation in 2009 was 5.1% in the summer and 0.6% in the winter, spring and fall, creating an overall annual energy savings of 1.2% per year.

During 2009, hourly prices remained low all summer long, never exceeding \$0.08/kWh. This was largely due to cool weather and reduced demand for electricity because of the economic slow-down. Prices did continue to follow the typical summer pattern, with the highest prices of the day occurring in the mid to late afternoon. A special series of survey questions were developed to assess the participants' awareness of these low prices and whether they had still adjusted usage, or in fact used more energy. Most participants (66%) recognized the prices were lower than in 2008 but still changed how they used energy (70%). Only eight participants (2%) provided verbatim responses that they had increased electricity use or "did not make heroic efforts to save" because prices were low (Navigant 2009).

## Bill Impacts

Having demonstrated that real-time pricing reduces peak demand and overall energy use, the next question was: how will real-time pricing RTP impact participants' bills? Exposure to market-based RTP prices certainly does increase the volatility of electricity pricing, but there is now long term evidence that the volatility is limited in duration and scale, and that savings over time are persistent. The following chart summarizes the savings at an annual level.

**Table 2: Average Savings from Real-Time Pricing**

| <b>Year</b>                      | <b>Average Monthly Bill</b> | <b>Average Monthly kWh</b> | <b>Savings</b> |
|----------------------------------|-----------------------------|----------------------------|----------------|
| <b>Energy Smart Pricing Plan</b> |                             |                            |                |
| 2003                             | \$51.10                     | 630                        | 20.1%          |
| 2004                             | \$56.99                     | 648                        | 11.3%          |
| 2005                             | \$77.82                     | 758                        | -6.3%          |
| 2006                             | \$56.50                     | 677                        | 15.0%          |
| <b>ComEd RRTP</b>                |                             |                            |                |
| 2007                             | *                           | **                         | 13%            |
| 2008                             | \$82.00                     | **                         | 5.3%           |
| 2009                             | \$103.40                    | **                         | 15.0%          |
| <b>Power Smart Pricing</b>       |                             |                            |                |
| 2007                             | *                           | **                         | 16.2%          |
| 2008                             | \$93.00                     | 949                        | 7.7%           |
| 2009                             | \$78.67                     | 960                        | 24.4%          |

\* The unique (uneven enrollment environment) did not provide meaningful data

\*\* This data is not reported

In 2009, the aggregate savings for Power Smart Pricing participants was \$1,388,996.09 which represents a 23.6% total savings compared to what the same bills would have been under the standard rate. Average annualized savings were \$304.98 or 24.4%.

### **Participant Satisfaction**

CNT Energy has conducted ongoing participant satisfaction surveys, first for the Energy-Smart Pricing Plan and more recently for the Power Smart Pricing program. Table 3 summarizes the responses to a benchmarking survey question: Do you think participating in (the program) has been (a) quick and easy, (b) time consuming and difficult, (c) somewhere between quick & easy & time consuming and difficult or (d) don't know? The results have been remarkably consistent over the years.

**Table 3: Participation Effort**

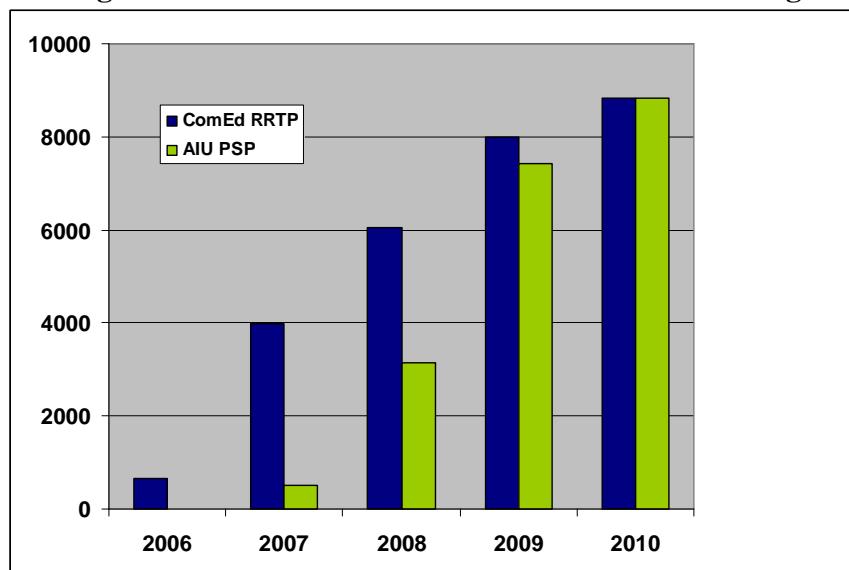
|                                      | <b>ESPP<br/>2003</b> | <b>ESPP<br/>2004</b> | <b>ESPP<br/>2005</b> | <b>PSP<br/>2007</b> | <b>PSP<br/>2008</b> | <b>PSP<br/>2009</b> |
|--------------------------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| Quick and easy                       | 81%                  | 82%                  | 75%                  | 58%                 | 71%                 | 80%                 |
| Time consuming and difficult         | 1%                   | 1%                   | 3%                   | 7%                  | 1%                  | 0%                  |
| Somewhere between quick & easy & ... | 15%                  | 12%                  | 17%                  | 20%                 | 20%                 | 14%                 |
| Don't know                           | 3%                   | 4%                   | 5%                   | 15%                 | 7%                  | 5%                  |

## Participation Results

The original Energy-Smart Pricing Plan that ran from 2003 to 2006 was a pilot where enrollment was limited by the funding available for new meters (participants did not pay for them), and participation was limited to 1,500 households. Once the mandated programs Power Smart Pricing and ComEd RRTP began in 2007, the option to participate was extended to all Illinois residential customers, giving the programs an opportunity to grow in accordance with demand. In these later programs, the cost of the meter was partially subsidized (by all residential customers) and partially paid by the participant. ComEd and AIU both estimated the incremental metering cost for real-time pricing to be \$5/month. This reflected the use of various adaptations of their existing metering infrastructure where all other residential customers are only being measured in total monthly kWh, not by any sort of smart metering option. Participants paid a \$2.25/month fee to participate and the rest of the metering costs plus the program implementation costs are spread out across the rest of the residential rate base (currently \$0.06/month per residential customer for AIU and \$0.14/month per residential customer for ComEd).

Starting in 2007, approximately half of the participants in the Energy-Smart Pricing Plan chose to continue using the real-time pricing structure, and were enrolled in the new ComEd RRTP program. Previously, participants had to “opt out” if they wanted to leave the program, and attrition rates were very low. The “opt in” requirement for transferring to the new ComEd RRTP program, combined with uncertainty about how the program would work with a new administrator and new rates (real-time versus day-ahead), contributed to the lower renewal rates. AIU customers had no prior experience with real-time pricing, so enrollment in the Power Smart Pricing program had to start from scratch. Over the first three years of operation, participation has grown as follows:

**Figure 1: Growth in Enrollment in Real-Time Pricing**



However ComEd has a much large customer base, 3.2 million residential customers versus 1 million for AIU, so the growth of the AIU program as a percentage of eligible customers has been more rapid.

Neither program has seen significant attrition. Participants are lost as people move, have their account terminated for payment issues, etc. but the number of participants who choose to leave both programs after their initial required twelve month stay have been extremely low (< 1% in PSP).

## What Are Reasonable Enrollment Rates?

Another perspective on participation rates can be gleaned from looking at the cost of enrolling a new participant. This cost has varied greatly between the two real-time pricing programs in Illinois. In 2009, Power Smart Pricing had a customer acquisition cost of approximately \$30 per participant, while the ComEd RRTT program was significantly higher, \$262 per participant (ComEd 2009). A key driver in the variation in these costs was the direct mail response rates, which were 2% for PSP and 0.27% for ComEd RRTT.

There are multiple reasons for this wide range in costs. The materials used by PSP and ComEd RRTT are similar, as are the key messages, but PSP used stronger language. For example, the headlines on each program's websites indicate the difference in tone:

*It's time to save on electricity!*

*Find out how Power Smart Pricing could help you save on your household energy bills!*  
(Power Smart Pricing, 2010)

*It's time to get real with ComEd Residential Real-Time Pricing*

*Get more control over your monthly electricity bills, and help the environment, with  
ComEd Residential Real-Time Pricing program.*  
(ComEd RRTT, 2010)

The connection to savings rather than control more clearly linked the PSP program to potential bill savings. In a similar manner, CNT Energy updates the estimate of potential savings for PSP on a regular basis, while Comverge only changed the estimate on an annual basis. In a year like 2009 where energy prices were falling (and therefore savings increasing), the difference in this timing was significant. By continuing to use full year 2008 savings estimates for all of 2009, ComEd RRTT appeared to have a lower savings rate, despite the fact that by the end of the year the average savings on each program were not that different.

## The Medium versus the Message

Although participation rates in both of the Illinois real-time pricing programs is currently lower than projected, the Power Smart Pricing program has a much higher proportion of customers enrolled than the ComEd RRTT program does (1% versus 0.25%, respectively). One reason for this disparity could be the very different strategies pursued by the program administrators. Both used direct mail as the initial communication vehicle, but the PSP program supplemented those mailings with additional strategies to increase awareness. Direct mail drops were coordinated with outreach to local media, which resulted in both print and electronic media stories featuring residents who were satisfied participants in the program. These "real people" testimonies were a persuasive supplement to the official communication materials, as evidenced

in the “how heard” data collected. The PSP program has also seen a steady increase in the number of customers who cite “word of mouth” as the mechanism for learning about the program.

By contrast, the ComEd RRTT program used big-ticket giveaways to attempt to elicit participation. The first was a drawing for a Toyota Prius in 2007, an idea conceived via the reasoning that persons interested in real-time pricing were likely to be environmentalists and thus attracted to this offering. However, research has shown that although helping the environment can be a secondary motivator for switching to real-time pricing, the primary motivation is financial. (Summit Blue Consulting 2005). Comverge explored using a monetary inducement for an enrollment campaign in 2009, offering \$100 for signing up for the program to a test sample of customers. This campaign yielded only 65 participants, a 1.08% response rate, which while higher than their other direct mail campaigns, was below expectations. Two stated hypotheses for this result were that the \$100 incentive was overshadowed by the uncertainty of perhaps losing money, and that customers were wary of the 12-month commitment. There were also anecdotal reports that the \$100 incentive was too high, inciting suspicions that the offer was too good to be true and should be avoided by prudent consumers.

### **Comparing Illinois Real-Time Pricing Acquisition Costs to other Programs**

There is a surprising paucity of information on the cost of acquiring new participants for new rate options. This is likely because this cost is a key competitive number that most alternative suppliers would never be willing to share. So to provide context for the cost of acquiring real-time pricing participants in Illinois, some indirect observations have to be made. In California, PG&E’s smart meters launch was combined with the introduction of an optional residential critical peak pricing rate called Smart Rate. The marketing of this rate in 2008 was conducted by direct mail to customers in the Bakersfield area. This was the first area where smart meters were deployed and a very hot locale where maximum temperatures exceed 100°F on many summer days. The offer included a first year bill savings or no loss guarantee and a \$50 Visa gift card for signing up. PG&E has reported that the response rate to the direct mail was nearly 7%, significantly higher than the rates seen in Illinois for real-time pricing. (George and Bode 2008)

One factor for the high response rate is likely to be that critical peak pricing with a bill guarantee is less risky than real-time pricing (in fact, the guarantee assured no risk in the first year). Both ComEd’s RRTT and the PSP programs do not guarantee savings, and require a one year commitment, and both of these factors are cited as deterrents by prospective participants. But the up front financial incentive of the Visa gift card is also significant, both as an incentive and as an acquisition cost. The report on the Smart Rate program did not include data on the cost of offering the bill guarantee or their direct mail costs, but rough estimates are \$0.50 per direct mail piece. The cost per enrollment (not including processing costs) would be \$7. Add on the \$50 Visa gift card, and the direct cost per enrollment is \$57. In contrast, the lower direct mail response rates seen by PSP, using a 2% response rate, represent a direct cost per enrollment (without an incentive like a gift card) of \$30. In sum, it is clear that by spending more on the direct mail by adding in incentives increases response rates. But the assessment of whether the cost is realistic or too high will depend on the marketing budget.

## The Dilemma of Low Participation Rates

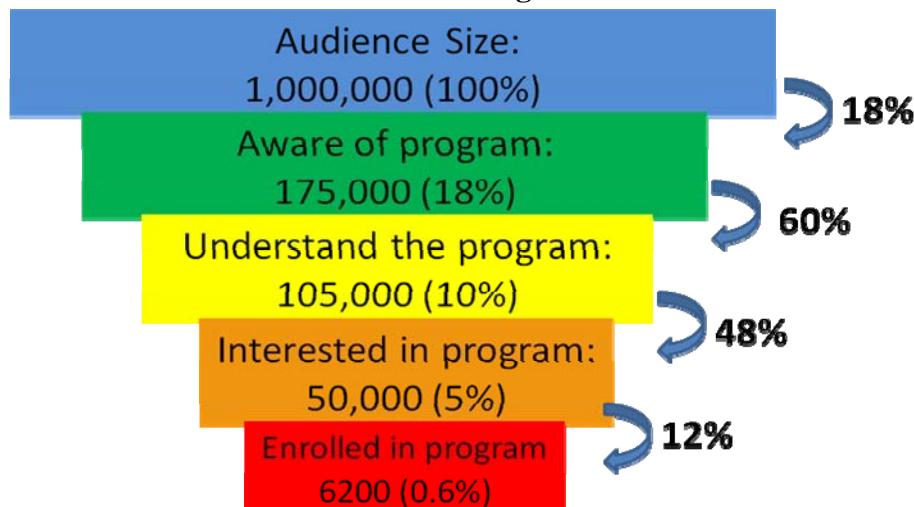
The contradiction between the success of residential real-time pricing in terms of its bill and energy savings and its lack of success in terms of enrollment levels has been vexing. In an effort to explore the cause of this disconnect, CNT Energy conducted a phone survey in the summer of 2009. A random sample of 240 AIU Illinois Utilities customers were interviewed to determine the awareness, understanding and interest in AIU's Power Smart Pricing program. In addition to these measures, the goal of the survey was to understand which marketing methods were most effective, what the barriers to adoption were and what potential alternative messaging strategies might work.

A customer's process of responding to information can be conceptualized in a conversion pyramid model. The diagram below illustrates the process of how the subject moves from the top to the bottom, with the population becoming smaller as they pass/fail to meet the criteria of awareness, understanding and interest. The conversion levels were defined as follows:

- Population size: The approximately 1,000,000 households with AIU's service territory
- Awareness: "Have you heard of the Power Smart Pricing program?"
- Understanding: Customers who were aware of Power Smart Pricing that could accurately describe it in their own words.
- Interest: Respondents who indicated that they are "very" or "somewhat interested" in PSP
- Enrolled: The population size of those currently enrolled.

The population figure and percentage within the box represents the total number of households that meet that cumulative set of criteria, the figure to the right of the boxes shows the percentage of people from only the subset above it that met the criteria.

**Figure 1: Analysis of Awareness, Understanding, Interest and Enrollment in Power Smart Pricing**



CNT Energy's analysis of these results was that among customers who were aware of the program, a significant percentage (60%) understood the concept of dynamic pricing. Of those who understood the program 48% had high interest. But the overall awareness of customers was low and enrolling those who were interested was also a challenge.

**Awareness.** The low level of awareness (18%) can largely be attributed to a limited marketing budget (approximately \$135,000 per year for a one million customer utility), relying mostly on a single communication channel (direct mail and bill insert marketing) and consumers who are not accustomed to interacting with their electric utility, because their relationship has been historically confined to paying their bills. Customer segments over the age of 40 were three to four times more likely to be aware, than those under the age of 40. The likely reason for this finding is because direct mail and bill inserts are primary read by older audiences and disregarded as junk mail by younger ones.

In order to increase awareness, the spending levels for marketing would need to be increased and strategies that move beyond bill inserts and mailings and instead use tactical outdoor and digital advertising in key markets could engage younger customer segments (ages 30-40 and 40-50 years).

**Understanding.** The high level of understanding (48%) showed that the marketing materials were working well to educate customers. There was some confusion with another well-known program called Budget Billing, which is merely a leveled payment program that spreads bill amounts out over the year but does not change the overall amount spent on energy. The quality of understanding among customers who had only received a bill insert was less comprehensive – these customers recognized the name, but stumbled on an explanation of the program.

CNT Energy worked with AIU to continually refine messaging, removing technical jargon and using consumer language with descriptive graphics. At its essence, dynamic pricing is simple: use less electricity when demand and cost is high. But many utilities, fearful of litigation, are reluctant to simplify the messaging and prefer to use technically accurate terms, multiple disclaimers and exhaustive instructions that may be incomprehensible to the average customer. This can easily undermine a well-intentioned marketing effort.

Increasing understanding would require continuing to simplify messaging when possible and using communication channels with greater likelihood of in-depth engagement such as letters to the editor, news coverage, physical presence at appropriate events, and friend referral programs.

**Interest.** Overall, the AIU customers recognized the benefits of dynamic pricing. Nearly all were motivated by savings, some just wanted to “use less”, but environmental reasons alone were not motivating. The highest interest was among the 30-40 and 40-50 age groups and the lowest among those over 70 years of age.

Among those not interested, responses were classified as fear of change, disinterest (don't want to complicate their lives, happy how things are) or a need to learn more.

In order to increase interest, it would be necessary to address consumer barriers of fear, disinterest and lack of knowledge. To tackle fear, a strategy could include generating more third party recommendations (friend and media coverage). To tackle disinterest, the focus of

messaging should remain on the ease and savings of program, educational materials and parallels to known products (cell phone plans). To address the need to learn more requires simply focused and frequent messaging.

**Enrollment.** It would seem that enrollment percentages would increase as a byproduct of increasing awareness, understanding and interest. But herein is the main challenge of behavior change: moving people from general agreement to action. Just as in any situation, the goal is to increase benefits and reduce barriers.

First, consumers may understand the program and be genuinely interested, but getting them to commit to 12 months of uncertain electricity costs is challenging unless the program can show a motivating level of benefit. This could be achieved through many of the measures previously discussed: using simple language to emphasize the most relevant benefits (money savings) and enabling trusted sources to communicate the message (local news, friends).

Second, even a program that inspires confidence will fall short of its participation potential if the process of signing up is unduly difficult. People are busy and impatient and most will never gather the relevant materials, then set aside an hour in order to figure out if dynamic electricity pricing is right for them, and then complete the enrollment process. Furthermore, different groups of people have varying thresholds for benefits and barriers. A 65-year old retiree on a fixed income can dedicate the time to read direct mail and will enroll via a mail-in form, if the message is appropriately reassuring. In contrast, a busy mother is more likely to discard direct mail, unopened, into the recycling bin, or (at best) put into a never-ending to-do pile. At the same time, this mother may not need the same reassurance of savings that the senior on fixed income would require.

In response to the awareness/understanding/interest survey analysis CNT and AIU worked to recognize opportunities for incremental improvements to both ends of the barriers/benefits spectrum. Benefits were enhanced by clearly stating the most motivating elements without multiple disclaimers on all materials, and by using trusted secondary sources to communicate program information. Barriers were removed by continually simplifying the enrollment materials and having knowledgeable and patient staff available to answer questions.

## **Dynamic Rates, Smart Meters, and the Smart Grid**

Illinois' real-time pricing programs are playing out against a background of public discourse and utilities' campaigns to update their infrastructure. ComEd has recently installed 131,000 smart meters in their service territory. A subset of that group were randomly selected and put on different dynamic pricing rates, including variations of RTP, critical peak pricing, and peak time rebates. (However for research purposes these experimental rates are revenue neutral unlike the ComEd RRTP program previously described.) While a small number of customers declined to participate in this study, the true test of the customer's willingness to accept dynamic pricing won't be evident until the higher prices and bills or summer begin appearing. However, education and outreach to the majority of customers has focused solely on the benefits of more reliability and the customers' access to information. ComEd's decision not to couple the smart meter roll-out with a dynamic rate for all customers receiving the new meter has so far has meant that they have avoided some of the criticism that utilities which are considering, or use the advent of smart meters, to making dynamic pricing the default rate, have experienced.

Meanwhile, participants in Illinois' real-time pricing programs assume they already have smart meters (and are surprised, if not resentful, to learn that their meter is "smarter" than the old analog model, but not "really smart"). These participants, who have successfully made the transition from flat to dynamic rates, provide an instructive model for implementation of alternative rates and smart grid investments. If properly implemented, the potential negative impacts to customers are likely to be limited, but if done wrong (e.g., launched during a hot season, or in conjunction with a rate increase), the push back could be significant.

## Conclusion

Dynamic pricing remains a new idea for residential customers. The real-time pricing programs in Illinois have been in operation in various forms since 2003. Other than perhaps Gulf Power's critical peak pricing program, this appears to be the longest running set of programs in the United States. Most other dynamic pricing experiments have been of limited time and scope. Compared to over one hundred years of flat rates, the test of consumer acceptance of dynamic pricing remains very limited. It's going to take more than just a bill insert, or one direct mail piece to get customers to change their electric rate voluntarily.

The goal of getting customers to voluntarily embrace dynamic pricing because it engages them to manage their energy use in exchange for lower bills will take an ongoing, long term series of engagements, reminders, pokes and prods.

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