

Demand Response Customer Experiences: Lessons Learned from ComEd Cycling Events

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Abstract

Central air conditioning demand response programs are driven by events that are called on hot days when electrical use is high in order to reduce demand by cycling central air conditioners for a period of time. From a utility perspective, these types of programs hope to reduce the discomfort level of participants as much as possible. On August 19, 2010 the ComEd Residential Central Air Conditioning Cycling program called one residential curtailment event with participants in two different types of demand response A/C cycling strategies. One cycling strategy cycles the air conditioner off for a maximum of 15 minutes every half hour over a period of no more than six hours, while the other cycling strategy cycles the air conditioner off for a maximum of one continuous three hour period.

The objective of this paper is to present research findings from the PY2 program evaluation (June 1, 2009 and May 31, 2010) on the customer effects and demand reduction of the two different types of demand response A/C cycling strategies offered by the ComEd program. The intent is for utilities with existing programs or those thinking about developing a similar demand response program to use the information as an input to potential cycling strategies and program design.

An Established Program

Central Air Conditioning Cycling is an on-going program that Commonwealth Edison began in 1996. Central Air Conditioning Cycling is a residential direct load control program that allows ComEd to cycle off and on a participant's central air conditioning compressor so it uses less electricity on the hottest days of the year. The air conditioner's fan remains powered to circulate air to help the participant's home stay comfortable. Customers can select either a 50% cycling option (curtailed a maximum of 15 minutes every half hour over no more than a six-hour period) or a 100% load shed option (curtailed a maximum of one continuous three-hour period). They receive an annual incentive of \$20 (\$5 per month bill credit from June thru September) for cycling or \$40 (\$10 per month bill credit from June thru September) for load shed.

ComEd filed a three-year Energy Efficiency and Demand Response (EEDR) plan to the Illinois Commerce Commission on November 15, 2007. In that plan ComEd proposed a portfolio of energy efficiency and demand response programs to be implemented with Program Year 1 (PY1) beginning June 1, 2008 thru May 31, 2009, Program Year 2 (PY2) running from June 1, 2009 thru May 31, 2010 and Program Year 3 (PY3) running from June 1, 2010 thru May 31, 2011. As part of that plan ComEd would recruit 22,682 new customers to its already existing Central Air Conditioning Cycling Program over the three-year period of the plan.

A total of seventeen control events have been called between 1996 and 2010. However, new guidelines from PJM now require that an annual system test be run at least once each year.

Impact evaluation of this program is regularly performed by GoodCents Solutions, the installation contractor, based on a sample of approximately 250 customers that have whole house interval meters installed. Estimated program impacts are reported annually to PJM ISO as demand response resources. At the end of summer 2010, there were approximately 70,000 participants in the program. Approximately 60% of participants are on the 100% load shed option.

As with any other mechanical asset used in the electric industry, load management programs must be maintained. For a variety of reasons, the number of switches operating in the field will degrade over time without maintenance. Some of the most common reasons for switches not operating are HVAC service tampering, switch not reconnected after a service call, customer tampering, wiring damage, and water damage. The current maintenance program at ComEd includes the conversion of some existing 900 MHz paging switches to a 152 MHz paging frequency.

Estimated Demand Response and Growth

The estimated potential demand response for a 50% cycling customer is 0.909 kW per customer and the estimated potential demand response for a 100% load shed customer is 1.818 kW per customer.¹ The total estimated potential demand response as of the summer of 2010 (prior to the August curtailment event) was 102 MW for the 70,075 customers on the program. Figure 1 illustrates the number of program participants at the end of the summer for the years 2005 thru 2010.

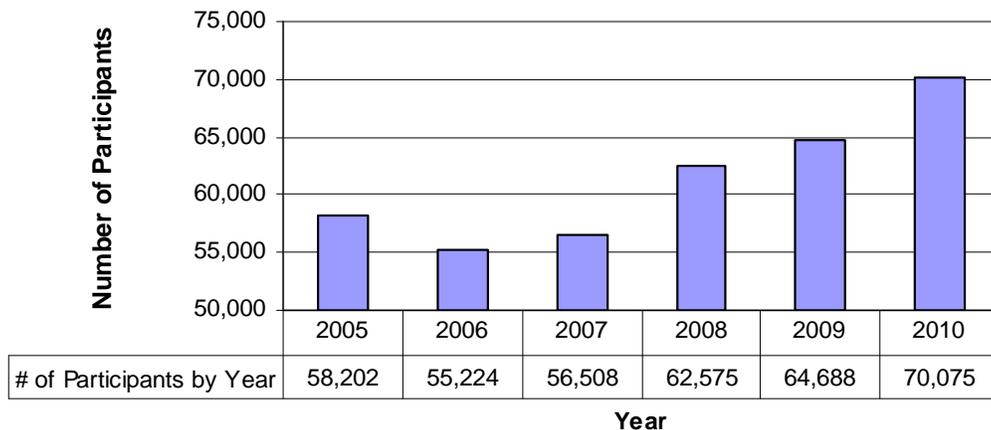


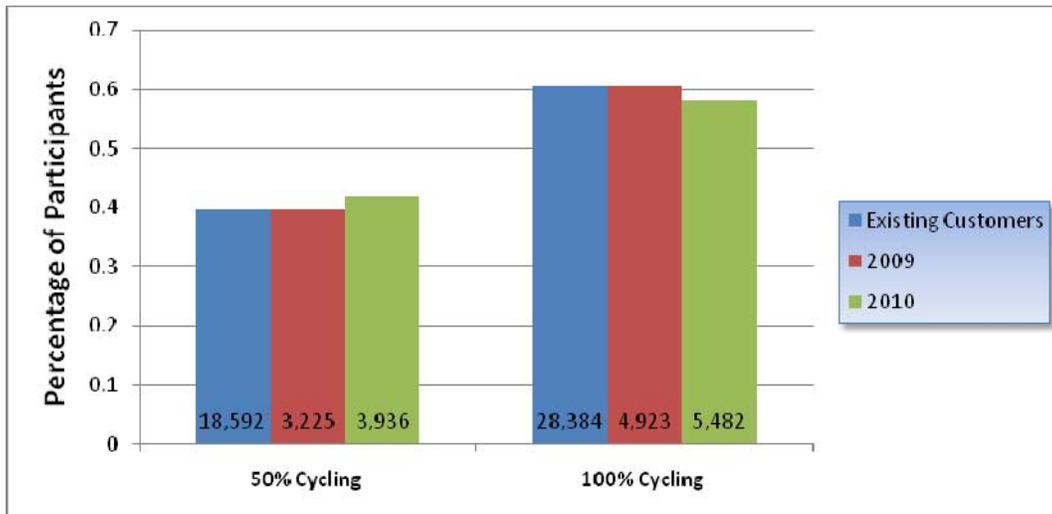
Figure 1. Program Participant Counts (2005-2010)

¹ “ComEd’s Nature First A/C Load Control Measurement and Verification, 2006 Revision and Revised PJM Control Matrices”, GoodCents Solutions, March 2007

Impact of Cycling Choice and Geography on Demand Reduction

The most significant factor affecting the impact from direct load control is the cycling level chosen by the participant. This program allows the participant to select either a 50% cycling option or a 100% load shed option.

For the ComEd program, the data shows a consistent selection of cycling options for each participant group since 1996, including existing customers who signed to the program prior to 2009. As shown in Figure 2, the share of participants selecting the 100% option has been a consistent trend of 60% since 1996 - as verified from the program tracking database in August 2010.



The numbers at the base of the bars represent the number of participants accounted for in the bar.

Figure 2. Percentage of Old and New Participants who Selected 50% or 100% Cycling Option

The evaluation team also examined differences between new and existing participants to determine whether the three different groups had different geographic distribution. This is important to analyze, because if groups have a different geographic makeup then it would be more likely that the two groups have a different socio-economic mix. A different socio-economic mix would be an indicator that impacts might be different for the respective groups. For example, higher income areas are more likely to have larger homes requiring more air conditioning. What was found is that all three participant groups have similar distributions across zip codes, as shown in the table below.

Overall, the evaluation found that 600 and 601 zip code areas are where the majority of the participants are located (Figure 3). It is important to note that if any shift away from these zip code areas would occur than an adjustment to the per customer impact estimates could be necessary due to differing AC use based on location. The similarity of geographic location patterns between participant groups in the program suggests that the program impacts of the participants would be similar and based on location, and therefore, there is no need to be concerned about significant differences.

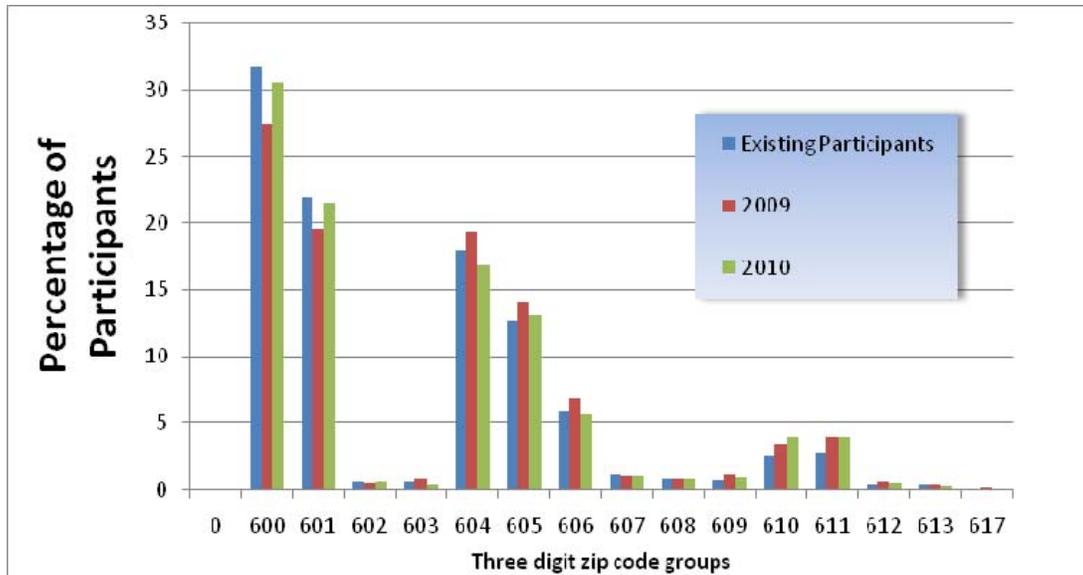
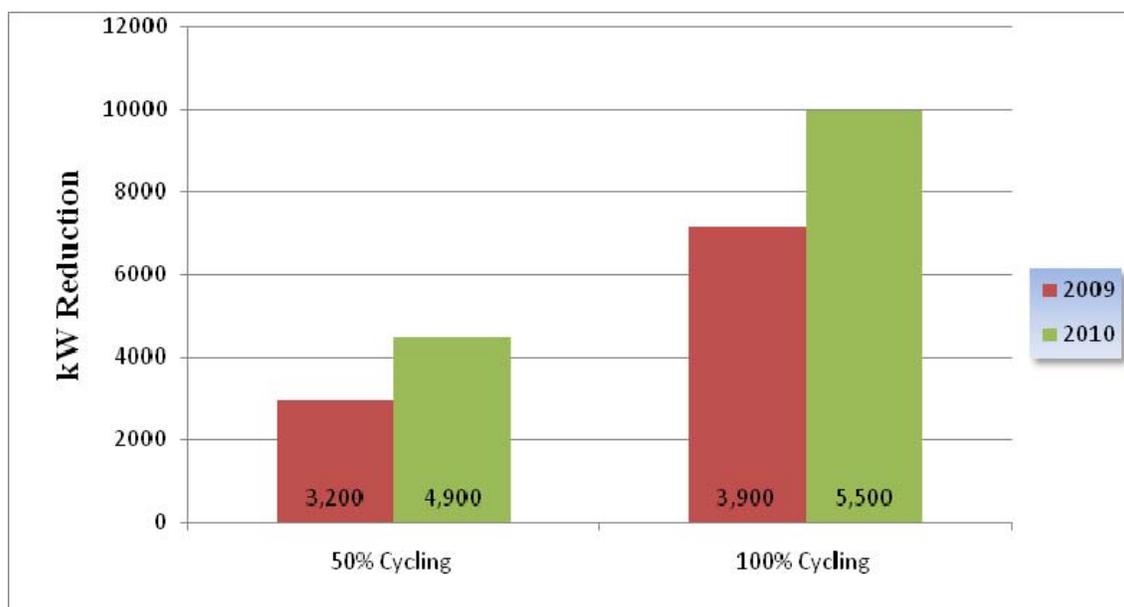


Figure 3. Percentage of Existing and New Participants Distribution by Zip Code

Historical data has found that participants who choose a 100% cycling (load shed) option will contribute twice as much demand reduction to the program as participants who choose a 50% cycling option. Specifically, participants who select the 50% option are estimated to make a 0.909 kW reduction impact, while participants who select the 100% cycling option are estimated to make a 1.818 kW reduction impact.²

Figure 4 reinforces this point by showing the kW reduction contribution of the 50% and 100% cycling participants for 2009 and 2010. While many studies have been conducted to calculate the energy reduction impacts of 50% cycling, studies providing energy reduction estimates from 100% load shed estimates are rare.

² “ComEd’s Nature First A/C Load Control Measurement and Verification, 2006 Revision and Revised PJM Control Matrices”, GoodCents Solutions, March 2007



The numbers at the base of the bars represent the number of participants accounted for in the bar.

Figure 4. Kilowatt Reduction by Cycling Option During Load Control Event

Intelligence from Program Participants

The evaluation team designed, programmed, and administered a 15-minute Computer Assisted Telephone Interviews (CATI) survey with participants who had signed up for the program since June 1, 2008. The survey focused among other things on how participants learned of the program, and their experience and satisfaction with the program and residential curtailment event called on Thursday, August 19, 2010. In order to produce results representative of the overall population of participants who had enrolled since June 1, 2008, the data were weighted to match the population distribution. Because the total number of completes overrepresented participants in the 50% option and underrepresented participants in the 100% option, we weighted these participant groups to the population distribution shown below in the table.

Table 1. Participant Survey Distribution and Weights by Strata

Strata (Rider)	Population Distribution* (N=18,450)	Completed Surveys (n=141)	Weights
50% Cycling Option	40.5%	49.6%	0.82
100% Cycling Option	59.5%	50.4%	1.18

*Population includes participants with effective dates between June 1, 2008 and August, 2010 with duplicate phone numbers removed.

Drivers of Program Participation and Satisfaction

The telephone survey with program participants found that participants are highly satisfied with ComEd's Central Air Conditioning program. Overall, 78% of respondents are satisfied with their participation in the program, and more than half (56%) are very satisfied³. Customers are also generally satisfied with ComEd overall, with 77% being satisfied and 45% very satisfied. The program induced a more favorable perception of ComEd among half of participants (50%), while the other half remained impartial (47%).

Table 2. Participant Satisfaction with Program

Satisfaction	Total N=141	Customer Option	
		100% N=71 A	50% N=70 B
Satisfied (7-10)	78%	79%	77%
Neutral (4-6)	14%	14%	13%
Dissatisfied (0-3)	3%	3%	4%
Don't know	5%	4%	6%
Total	100%	100%	100%
Mean	8.3	8.4	8.1

Source: ComEd ACLC Participant Survey (PY2), August, 2010

When asked what they specifically like about the program, nearly two-thirds (64%) indicated the monthly bill credit, while another quarter (23%) like the environmental benefits of the program. These same factors are also leading drivers of participation; almost 70% of participants said that they participated to either receive the monthly bill credit or to reduce their monthly electric bill itself, while another quarter of participants (24%) joined the program for the environmental benefits of conserving energy.

Table 3. Main Reason for Participating in Program

³ In the data analysis of responses using the 0 to 10 satisfaction scale, responses of 6-10 are classified as satisfied, and responses of 9-10 are classified as very satisfied.

Reasons	Total N=141	Customer Option	
		100% N=71 A	50% N=70 B
Receive monthly credit on my summer electric bill	36%	44% ^B	26%
Reduce my monthly electric bill	33%	28%	40%
Conserve energy	24%	23%	26%
Mutually beneficial	1%	1%	1%
Other	1%	0%	3%
Don't know	3%	3%	4%
Refused	1%	1%	-
Total	99%	100%	100%

Source: ComEd ACLC Participant Survey (PY2), August, 2010

*Percentages may not add up to 100% due to rounding

**Upper case letters indicate significance at the 95% level.

The research revealed that participants with the 100% option are significantly more likely to be driven by the monthly bill credit compared to participants with the 50% option (44% vs. 26%). The monthly bill credit is an increasingly effective motivator for this program, as significantly more participants in PY2 cited this as the main reason why they signed up compared to participants who signed up in PY1 (42% vs. 25%). In short, program managers with similar demand response programs should note the importance that incentives play as a key factor of participation, satisfaction and retention.

Customer Experience and Reactions to Residential Curtailment Event

On August 19, 2010, ComEd called a control event to test the system. All 50% cycling customers were cycled from 13:00 to 16:00 Central Time. All 100% cycling participants were interrupted from 13:00 to 15:00 Central Time. In order to provide the results in its proper context, it is important to note the temperature and humidity during the called residential curtailment event. The high temperature in Chicago on August 19, 2010 was 88 degrees at about 2pm, which is up 8 degrees from the normal temperature.⁴ The relative humidity was 46 percent at 2pm, with a daily average of 65 percent that day. During a typical summer day, participants report keeping their air conditioning system on for an average of 13 hours. Customers in the 50% options operate their air conditioning for significantly longer hours than 100% option customers (15 hours vs. 12 hours).

The telephone survey with program participants (effective as of June 1, 2008) was fielded

⁴ Weather.gov

on August 19, 2010 in the evening immediately following the residential curtailment event. The responses from participants found that the residential curtailment event was implemented in an effective manner with few customer complaints. An important aspect to the program is ensuring that participants are not inconvenienced by the event, either through temperature change in their home or technical problem with their air conditioner. In regards to comfort level, the majority of participants (74%) did not notice a change in the temperature in their home during the event which is good news for ComEd. Furthermore, three-quarters of participants (76%) indicated that their central air conditioner continued to operate normally after the event, while another 21% were unsure. Only 3% of participants indicated that their air conditioner system did not operate after the event. What is important to note is that the program did not experience a large percentage of participants with technical problems on their air conditioning system.

The August 19 curtailment event was the first time in the program's sixteen year existence that ComEd gave participants prior notification of an event. The decision to send participants an automated message notification of the event was an effective strategy as the majority of participants (85%) who recalled receiving the notification message found the message helpful. This proactive communication strategy is an effective way at maintaining and increasing positive customer service levels with participants.

Influence of Cycling Strategies on Program Effectiveness

The program's incentive levels for both cycling strategies appear to be a key factor at driving an 87% retention rate among respondents. Of note, participants with the 100% cycling option are less likely to participate in the DR program without the incentive compared to participants with the 50% cycling option. This is not surprising, given that 100% participants receive a larger incentive amount and is drawn to the incentive more so than 50% option customers. Not surprisingly, the most frequent recommendation among those who actually offered suggestions for program improvement is to increase the incentive amount. Twenty-nine percent of these participants would like to see an increase in the bill credit, representing about 10% of the total population.

One of the more surprising findings from the survey was the percentage of respondents who claimed they did not receive their monthly bill credit. More than half (51%) of all program participants since June 1, 2008 were able to confirm they received a monthly credit on their summer electric bill. Another 29% could not recall receiving the credit, while 20% indicated they did not receive the monthly credit. Customers with the 100% option are significantly more likely to have indicated receiving a monthly credit compared to 50% option customers (61% vs. 37%). Given the importance of the monthly bill credit, it is paramount that customers do not only receive their credit, but that they all know they received it. Even though customers may simply not recall seeing the credit applied to the bill, their perception can lead to dissatisfaction and even cancellation of the program. To guard against this possibly, DR programs should consider new cost-effective ways of communicating to program participants that the monthly credit has been applied to their summer electric bill. This can be communicated via email or an automated voicemail message at the end of the program year.

Demand response programs that are able to offer similar cycling incentive levels and strategies are likely to see an increase in customer participation, satisfaction and retention.

Conclusions

Over the years, the ComEd program has gathered anecdotal evidence that calling more than one event in a year or calling an event during a peak hot day can be viewed by program participants as an inconvenience. Utilities should be cognizant of this and therefore attempt to design programs that try to minimize any perceived inconvenience with proactive customer-centric strategies. Using ComEd as a model, utilities should prepare customers of the event with a notification during the day of the event. Furthermore, utilities should have appropriate customer service staff ready to answer customer questions and concerns during the event. After the event, utilities should consider sending a follow-up thank you email and/or notice confirming that the participant has received the incentives. These suggestions are just a few ways that utilities can be proactive in deflecting any perceived discomfort or inconvenience during the event with strong attention to customer service.

In addition to these customer service strategies, developing an effective cycling strategy and incentive amount has been shown in the evaluation to be important for a demand response program. As found in the ComEd evaluation, the 100% cycling option is more popular among participants than a 50% cycling strategy, mainly driven by the larger monthly credit on their electric bill. Furthermore, a 100% cycling option contributes twice as much demand reduction to the program than the 50% option. Based on the effectiveness of the 100% cycling strategy in the ComEd program, utilities should consider a similar approach as ComEd.