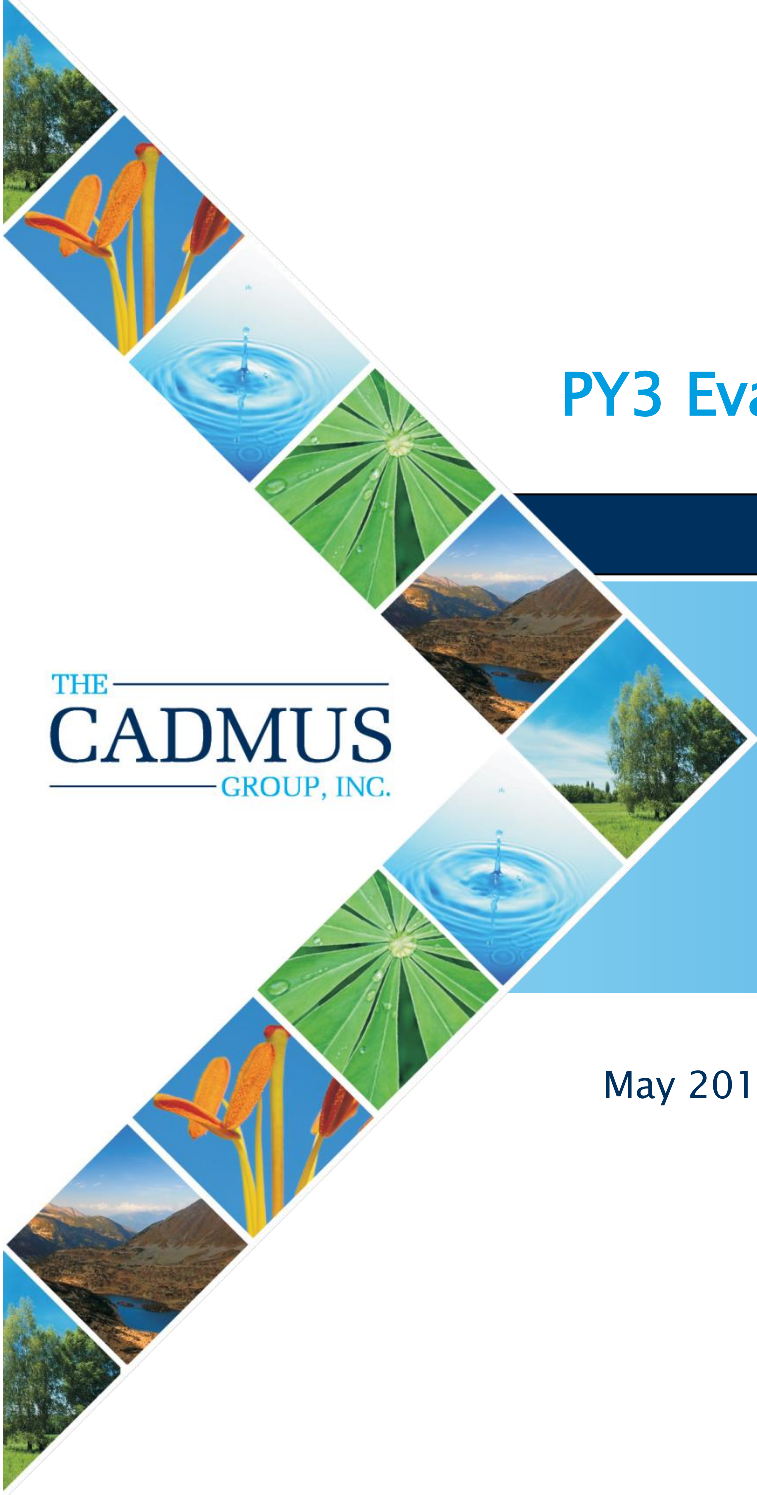

PY3 Evaluation

THE CADMUS GROUP, INC.

Demand Response Program Evaluation

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Summary

Ameren Illinois offered a direct load control program to geographically targeted residential electricity customers for part of Program Year 3 (PY3). The program launched in July 2009, when customers in five regions were offered free Comverge "SuperStat" programmable thermostats with Internet control and programming capability. This evaluation report updates the engineering analysis to estimate energy savings through the setback capabilities of the thermostat as well as controllable demand. Since Ameren Illinois is no longer pursuing this program, Cadmus did not perform any primary research to evaluate the program.

The E-Smart Programmable Thermostat program, implemented in conjunction with Conservation Services Group (CSG), offers customers free installation and programming of the thermostat. In exchange, participating customers agree to have their central air conditioner remotely cycled down for up to twelve days per cooling season during peak load events. The cycling timeframe is between 1:00 p.m. and 5:00 p.m., Monday through Friday.

Energy Saving Calculations

Cadmus calculated the energy savings by applying engineering analysis using the ENERGY STAR® calculator. Those savings were applied only to customers who previously did not have programmable thermostats and intended to use the programmable capabilities of their new thermostat.

Based on the data collected during the Pre-Event Survey in PY2, we assumed the temperature settings for the baseline usage of those who had manual thermostats as shown in Table 1. In addition, temperature settings for those who used their new programmable thermostats were assumed based on settings recommended by the EPA and are shown in the table.[1]

Table 1. Assumed Temperature Settings Use in ENERGY STAR Calculators

Status	Temperature Setting with Manual Thermostat	Temperature Settings with Programmable Thermostat
When no one was home	76.4	82.0
During the day when someone was home	75.0	75.0
During sleeping hours	75.3	79.0

These temperature settings, along with defining the climate zone as Peoria, Illinois, were input into the ENERGY STAR® programmable thermostat calculator to determine the average annual AC usage shown in Table 2. The difference in energy use is 333 kWh per year. This savings figure was then adjusted for the percentage of participants in the PY3 tracking database that had manual thermostats prior to participating in the program, 71 percent, and the proportion from the PY2 pre-event survey who said they would actually use the programmable thermostat, 62

[1] http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=TH

percent. The result of these calculations was an average expected savings of 147 kWh per program participant. Table 2 illustrates this approach.

Table 2. Derivation of Per Install Savings for Programmable Thermostats

Annual AC Energy Use with Manual Thermostat Temperature Settings (kWh)	Annual AC Energy Use with Recommended Programmable Thermostat Settings (kWh)	Savings	Percentage with Manual Thermostats	Percentage with Manual Who Will Change Their Settings	Per Install Energy Savings (kWh)
1,774	1,440	333	71%	62%	147

We multiplied the number of installations (1,619) by the per install energy savings calculated estimate (147 kWh) to obtain the gross savings of 237,993 kWh. Table 3 shows the resulting net and gross energy savings.

Table 3. Net and Gross Energy Savings

Measure	Ex Ante Gross Savings (kWh)[1]	Realized Gross Savings (kWh)	Realization Rate	PY2 NTG Ratio	Prospective Net Savings (kWh)	PY3 NTG Ratio	Retrospective Net Savings (kWh)
E-Smart Programmable Thermostat	233,653	237,993	1.02	0.77	183,255	0.77	183,255

[1] Total gross kWh savings recorded in PY2 program tracking database.

Demand Savings Calculations

Cadmus metered a sample of 23 E-Smart programmable thermostat customers to estimate demand savings during the period from 1 p.m. to 5 p.m. on August 10, 2010, during a test event where AIC remotely controlled air conditioners connected to the thermostats. Cadmus modeled the hourly air conditioning demand as a function of weather variables (temperature, humidity, temperature humidity index, and cooling degree hours), interacting with day type (weekend or weekday) and hour. We modeled separate indicator variables for each event hour. Table 4 shows the average hourly load reduction and standard error during the test event control period. The load reductions ranged from -0.23 kW to -0.83kW and increased between 1:00 p.m. and the hour ending 4:00 p.m.[2] The load impact trend reversed during the hour ending 5:00 p.m. The maximum load reduction of -0.83 kW was achieved during the test event hour ending 4:00 p.m.

Table 4. Mean and Standard Error of Estimated Load Reduction During Test Event

	Hour ending 2:00 p.m.	Hour ending 3:00 p.m.	Hour ending 4:00 p.m.	Hour ending 5:00 p.m.
Mean	-0.48 kW	-0.62 kW	-0.83 kW	-0.23 kW[3]
Standard Error	0.030323	0.029747	0.025976	0.02448

[2] Load reductions likely increased because temperatures and therefore air conditioning loads increase throughout the afternoon hours. However the decrease in late afternoon may be to residents returning home and overriding the control in the late afternoon. Further research may be warranted to understand this variation.

[3] The beta coefficient on this impact estimate is not statistically significant at the 90 percent confidence level.