ComEd
Energy Efficiency Program

UTILIZING SMART METER DATA TO IMPROVE PROGRAM COST-EFFECTIVENESS AND CUSTOMER OUTCOMES EXECUTIVE SUMMARY

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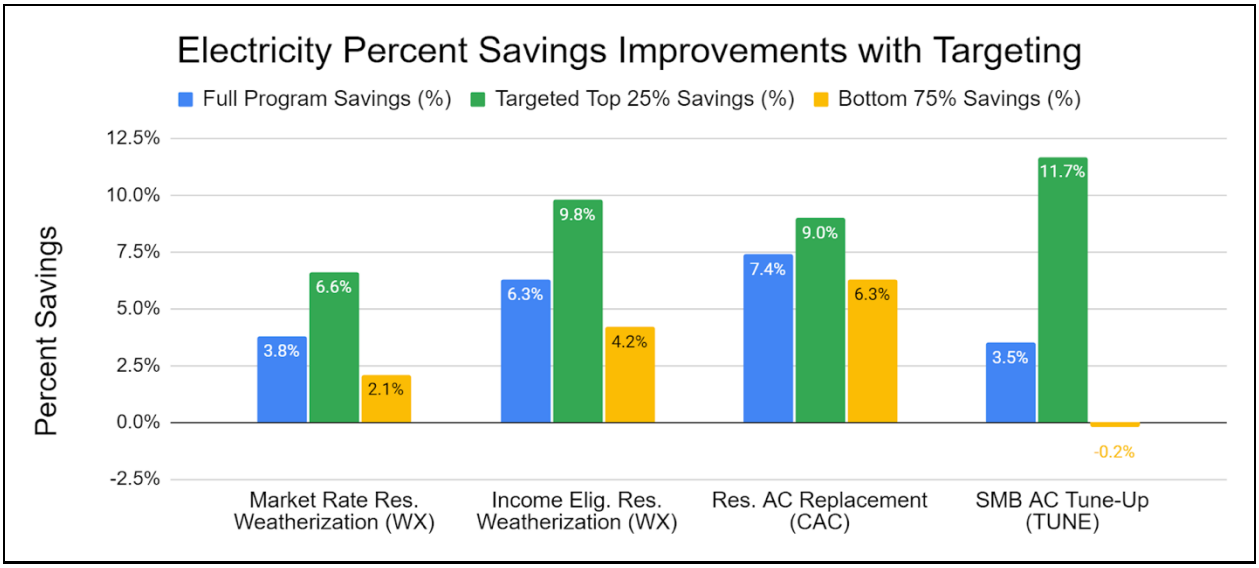

Prepared For
Commonwealth Edison Company

Prepared By
Recurve

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Acknowledgements

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1.0 EXECUTIVE SUMMARY

Recurve is pleased to submit this report in partnership with ComEd's Emerging Technologies team to test how smart meter data can be utilized to predict customer performance in demand-side programs, improve savings, and boost cost-effectiveness.

This pilot was designed to scientifically test the predictive capacity of Recurve's customer targeting methods to identify the potential for customers to achieve cost-effective outcomes from ComEd programs.

The analysis was conducted across four ComEd programs: a residential market rate weatherization program (Market Rate WX), a residential income eligible weatherization program (Income Eligible WX), a residential early air conditioning (AC) replacement program (CAC), and a commercial AC tune-up program (TUNE; see section 2.3 for program details).

The study was conducted using a rigorous experimental design that split program participants into two groups. Recurve used group A to develop targeting strategies, which were then tested on the group B participants. The targeting features are derived by analyzing pre-program customer usage patterns and the recommended strategies resulting from assessing the correlation of these features to metered savings results (see section 3.1 for details).

Results show that targeting metrics were predictive of savings outcomes for the multiple programs evaluated and could be applied to future participants to optimize programs and customer benefits.

These results suggest that if targeting was deployed to ComEd's energy efficiency portfolio, customer bill savings per dollar spent may increase along with program savings.

Key Findings

- Market Rate Weatherization Program (WX):
    - The top 25% of targeted Market Rate WX customers delivered 3x the program average MWh savings.
    - Customers in the bottom quartile drove no observable savings at the meter.
    - If the Market Rate WX program was able to double participation among the top 25% of targeted customers and did not incentivize the bottom 25% that produce low savings, projected avoided costs would

increase by $276 per enrolled customer or $1.4M for a program of 5,000 participants.

- Low-Income Weatherization Program (WX):
    - Customers in the top 25% achieved an average MWh savings 2x higher than the average program average.
    - The bottom 75% of customers achieved nearly 50% less savings per customer compared to the program average.
- The Central Air Conditioning Program (CAC) for Early Replacement:
    - Targeting has the potential to more than double average program savings.
    - The difference in energy savings between targeted and non-targeted customers was highest during summer peak hours.
- DX Tune-Up Program (TUNE):
    - Targeting the top 25% of customers has the potential to drive over 4.5x more MWh savings per customer.

Applying appropriate targeting strategies has the potential to dramatically influence program performances. These findings point to the potential for ComEd to significantly improve average savings per customer, identify customers who will have the greatest bill savings, and provide a greater return on ratepayer investment.

Recurve recommends ComEd investigate the following potential value streams based on the results from this study:

- Explore the impact on acquisition costs. The additional costs associated with customer targeting could be optimized by finding customers with the greatest savings potential and greatest customer value.
- Explore pathways to utilize Illinois's significant investment in smart meters. This could include using targeting in existing deemed programs to claim higher values for projects that include targeting, and also exploring options to measure program impacts in real-time.
- Explore targeting as a method to fulfill desired programmatic outcomes supplemental to energy savings. Targeting does not only have to focus on

maximizing savings, customers could be targeted to maximize peak savings or specific customer subsectors, or could be targeted for contractor-specific outreach efforts.

- Explore pay-for-performance approaches that encourage market innovation and ensure ratepayers only pay for measurable outcomes.

Table 1[1] shows the impact of targeting on savings, and grid value from each of the four programs studied. For example, Recurve found that targeting the top 25% of WX Market Rate participants could increase average annual electricity savings from 0.33 MWh to 0.92 MWh. Similar improvements are observed in the WX Income Eligible, CAC, and Tune programs.[2]

Table 1: Impact of Targeting on Savings, and Grid Value

	Avg. Annual MWh Savings			Increased Avoided Cost Value per Customer Improvement	
Program	Full Program	Targeted Top 25%	Not Targeted Bottom 75%	Value $	Percent Increase
WX Market Rate	0.33	**0.92**	0.15	**$276**	**179%**
WX Income Eligible	0.53	**1.27**	0.29	**$349**	**142%**
CAC	0.80	**1.75**	0.51	**$449**	**120%**
TUNE SMB	5.70	**26.07**	-0.28	**$9,575**	**357%**
TUNE Large C&I	399.80	-	-	-	-

Moving from MWh to Avoided Costs

The average pre-program daily load shapes and the corresponding program savings (a resource curve shows the savings on an hourly basis) of the targeted and non-targeted WX Market Rate participants are shown in Figure 1 below. Targeted

[1] All meters in this analysis pass a series of eligibility requirements including data sufficiency, model fit and outlier criteria. Further details are provided in Section 4.2. The dollar values in the last column are the increase from the full group to the 25% targeted subset, determined assuming a 10-year effective useful life of the measures and a grid value of $0.047/kWh.

[2] Very large TUNE customers (> 5% of total usage in each sample) risked skewing the population-level results of this analysis and were therefore removed. Results for these customers are given as "Tune Large C&I."

customers deliver higher savings throughout the day, in particular during midday and early evening hours.

Figure 1: Program Load Shapes

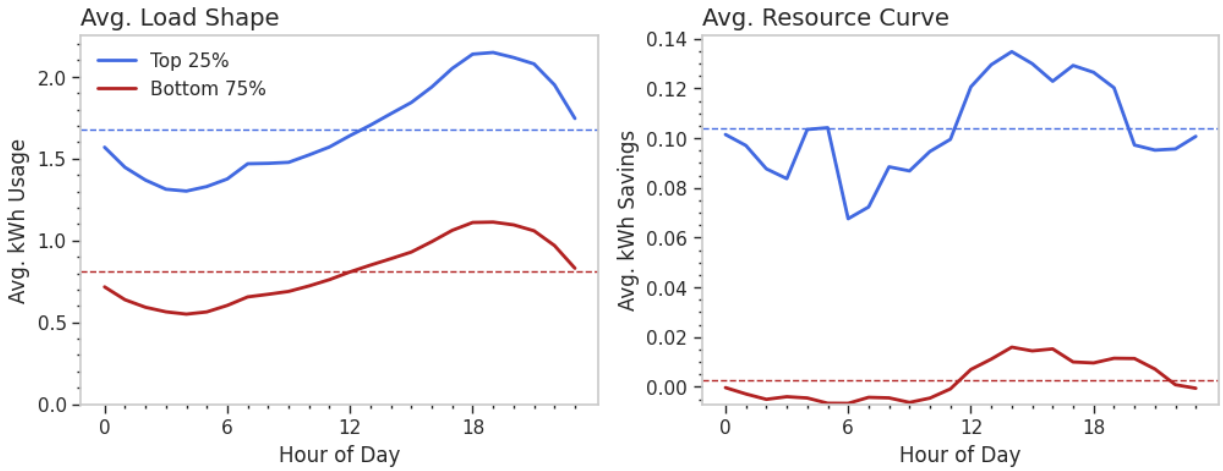

Figure 1: The average daily pre-program (left) load shape and resource curve (estimated savings, right) of the average targeted (blue) and non-targeted (red) participant in the Market Rate WX program. The dashed lines represent daily averages.

The targeting schemes, detailed in Table 2, were each derived using approximately half of the ComEd sample for each program (group A). Recurve then applied the targeting scheme to the remainder of the sample (group B), at which point ComEd provided the post-program meter-level data needed to test the predictive capacity of each scheme.

Table 2: Optimal Targeting Schemes

Program	Targeting Feature 1	Targeting Feature 1 Threshold	Targeting Feature 2	Targeting Feature 2 Threshold
WX Market Rate	Annual MWh	9.80 MWh	% Baseload	62.9%
WX Income Eligible	Baseload MWh	8.21 MWh	-	-
CAC	Summer MWh	5.22 MWh	Winter MWh	3.01 MWh
TUNE SMB	Discretionary MWh	17.83 MWh	% Cooling	5.50%

The group A (predict) and group B (test) results are broken out for each program in Table 3. In each case the sample A schemes of Table 2 successfully differentiated the sample B results into high and low performing populations.

Table 3: Targeting Results Group A and Group B

Program	Group	Meters	Annual MWh Savings Top 25%	Annual MWh Savings Bottom 75%
WX Market Rate	A - Predict	707	0.90	0.02
	B - Test	623	0.94	0.29
WX Income Eligible	A - Predict	912	1.42	0.27
	B - Test	847	1.08	0.31
CAC	A - Predict	260	2.02	0.59
	B - Test	208	1.36	0.41
TUNE SMB	A - Predict	63	36.84	0.38
	B - Test	56	14.48	-1.02

These results show that customer targeting based on advanced metering infrastructure (AMI) data analytics is a powerful tool to find customers who would most benefit from an energy efficiency program – which may improve program cost-effectiveness and customer satisfaction. With new or adjusted program designs that reward savings measured at the meter, targeting also presents opportunities to increase implementer compensation and customer incentives.

Recurve recommends the following next steps to further explore how targeting and other meter-based solutions could benefit ComEd and overall Illinois energy efficiency efforts:

1. Share the results and recommendations from this report internally and with other energy efficiency stakeholders in Illinois.
2. Consider using targeting and real-time project savings tracking as part of program implementation to improve program performance and the efficiency of ratepayer dollars deployed.
3. Look for ways to use this approach to enhance existing program offerings, and/or explore different pay-for-performance options for program implementation with a focus on reducing risk to ComEd and ratepayers as dollars deployed are based on measured savings delivered.
4. Explore innovative program implementation strategies in line with the 2021 Illinois energy law and Illinois Commerce Commission innovation goals in the FLEXmarket deployment model.