ComEd Residential Optimized Charging Pilot M&V Executive Summary

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Executive Summary

Pilot Overview

The ComEd Residential Optimized Charging Pilot ("ROC Pilot" or "the Pilot") ran from February to September 2025, testing optimization of customer electric vehicle (EV) charging based on grid signals. The implementer, Optiwatt, optimized participants' EV charging to ComEd's hourly pricing signal, which is based on wholesale energy prices sourced from PJM. The Pilot aimed to shift EV charging load to lower-cost periods within a given day, reducing wholesale energy costs, lowering energy bills for participants on ComEd's Hourly Pricing rate ("the hourly rate"), and reducing strain on the grid, while ensuring that the customer's EV experience was not diminished.

To participate, customers needed to be a ComEd customer who charges a battery electric vehicle (BEV) or plug-in hybrid electric vehicle (PHEV) at home using a level 2 (L2) charger. Participants could be on any ComEd rate, and all participants were optimized to the hourly pricing signal regardless of their rate. In total, 1,137 ComEd customers enrolled 1,292 vehicles into the ROC Pilot. The seven-month optimization ran from February 18, 2025, through September 30, 2025. Participants received a $50 incentive at pilot enrollment and an additional $50 incentive after pilot completion.

Evaluation Methodology

Opinion Dynamics ("the M&V team") served as the M&V partner for the ROC Pilot. The M&V team conducted both process and impact evaluation activities, leveraging the following methods:

- Surveys: The M&V team designed and fielded baseline and end-of-pilot surveys to assess participants' driving and charging behaviors, changes in knowledge and understanding of managed charging topics, satisfaction and experience with the Pilot, and recommendations for improvements. Seventy-four percent of participants completed the baseline survey, and 63% completed the end-of-pilot survey.
- Charging Pattern Analysis: We utilized device telemetry data to explore patterns in participant charging behaviors, how these changed before and during the ROC Pilot, and differences between key customer segments.
- Load Impact Analysis: The M&V team constructed device-level charging baselines based on actual customer charging behaviors before optimization ("customer-calibrated baselines") and compared these to hourly vehicle charging load during optimization to assess load impacts from managed charging. Load impacts are reported by hour of the day and by period based on the relative price in a given hour compared to the other 23 hours in the day.
- Quantification of Costs and Benefits: Using the load impacts as a starting point, we calculated customer bill impacts, wholesale energy cost impacts, and emissions

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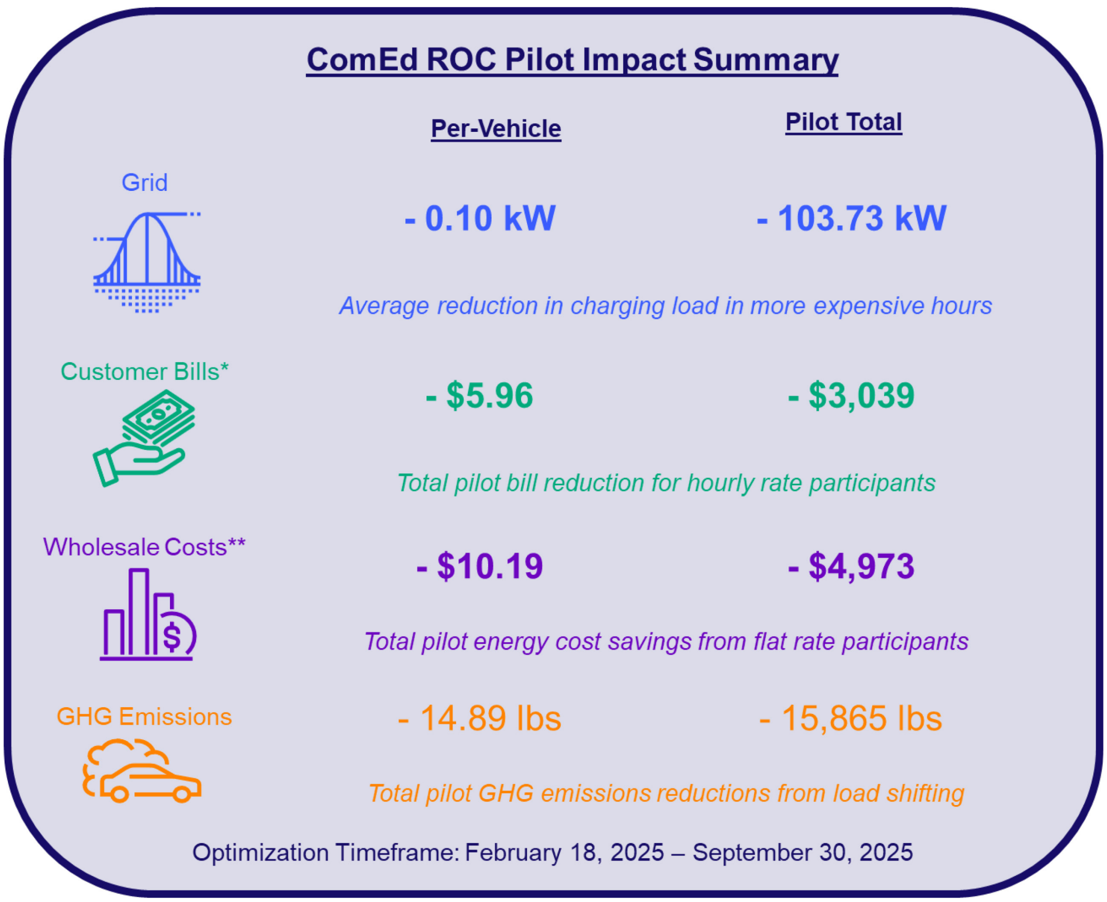
reductions. These impacts were all converted to monetary terms and compared to the implementation costs of the Pilot.

Results

The ROC Pilot reduced EV charging load in the most expensive hours, reduced energy costs for participants and ComEd, and led to reductions in GHG emissions. Figure 1 summarizes the Pilot impacts.

Figure 1. Summary of ROC Pilot Impacts



*Bill savings achieved by hourly rate participants only
**Wholesale cost savings achieved by flat rate participants only and distributed among all flat rate customers via monthly reconciliation process

The ROC Pilot successfully shifted charging load from higher-priced to lower-priced periods. On average per vehicle and day, the Pilot reduced charging during the most expensive hours (unfavorable period) by 0.10 kW (45% of the baseline), reduced charging in moderately expensive hours (non-preferred period) by 0.09 kW (35% of the baseline), and increased charging in the least expensive hours (optimal period) by 0.07 kW (16% of the baseline).

Across all participants, this equates to a 104 kW daily demand reduction during the unfavorable charging period, a 92 kW daily reduction during the non-preferred period, and a 70 kW increase during the optimal period (Table 1).

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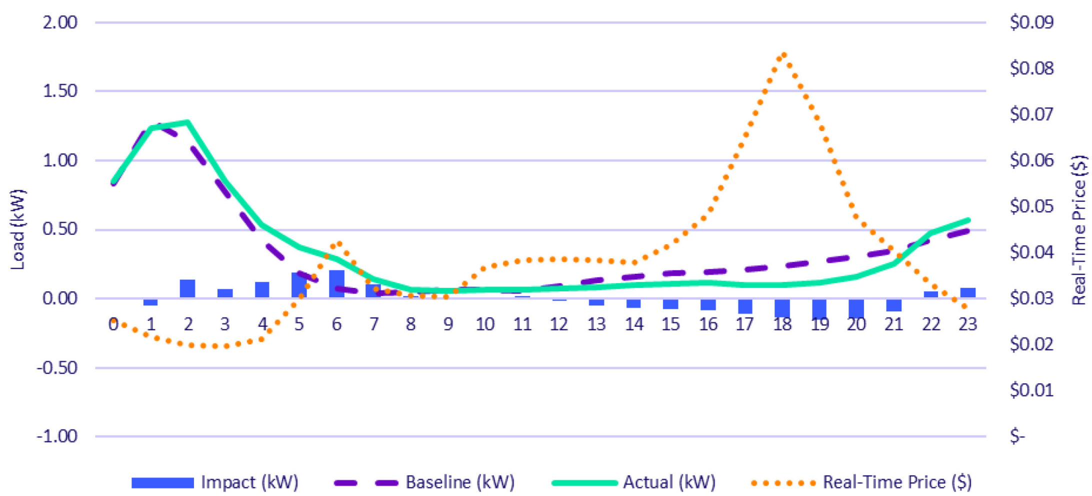
Table 1. Average Per-Participant and Total Load Impacts by Charging Period

Charging Period Type	Per-Participant			Total Load Impacts (kW)	Average Hourly Price/kW
	Baseline (kW)	Impact (kW)	% Impact		
Unfavorable ($$$)	0.22	-0.10	-45%	-103.73	$0.08
Non-Preferred ($$)	0.24	-0.09	-35%	-91.74	$0.04
Optimal ($)	0.41	0.07	16%	70.40	$ 0.02

Note: Percent impacts do not sum to 100% because they represent changes in average demand, not in total consumption. Charging periods were comprised of different hour durations, typically 4 hours for unfavorable, 6 hours for non-preferred, and up to 14 hours for optimal.

Figure 2 depicts how the ROC Pilot shifted charging load over the course of a typical day. On average across the ROC Pilot, the optimization resulted in a reduction in charging in the early to mid-evening hours and an increase in charging in the late evening and early morning hours. The largest increase in charging demand occurred between 4:00 a.m. and 6:00 a.m., while the largest reduction was between 5:00 p.m. and 8:00 p.m. The ROC Pilot was generally not successful in managing the timer peak, which is observed between the 1:00 a.m. and 2:00 a.m. hours in both the baseline and actual charging (Figure 2). A two-week timer peak experiment resulted in shifting, but not smoothing, the timer peak.

Figure 2. Average Daily Per-Vehicle Baseline and Actual Charging Load



The ROC Pilot led to modest energy cost reductions for ComEd's customers and Pilot participants. The ROC Pilot included customers on both an hourly and a flat rate. Any cost reduction achieved by flat rate participants resulted in wholesale energy savings, while any cost reductions achieved by hourly rate participants were passed onto those customers as bill savings.[1]

[1] Wholesale energy cost impacts among flat rate participants were subsequently distributed among all flat rate customers via a monthly reconciliation process.

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Cost impacts were limited by modest pricing variability – on average, the most expensive hour in the day was $0.06 more costly than the least expensive hour in the day – as well as the fact that most participants – in particular those on the hourly rate, but also many flat rate participants - already avoided charging in the most expensive part of the day prior to the ROC Pilot.

Flat rate participants produced an average cost reduction of $10 per vehicle. Seventy-three percent of flat rate participants generated a cost reduction during the optimization period. Hourly rate participants saw bill savings of about $6 total on average, with 65% of hourly participants realizing bill savings. These impacts are for approximately seven months of optimization during the Pilot (Table 2).

Table 2. Average Per-Vehicle Optimization Cost Impacts

Segment	Impact Type	Average Cost Impact ($)	Percent of Pilot Participants that Achieved Savings
Flat	Wholesale Energy	-$10.19	73%
Hourly	Participant Bill	-$5.96	65%

Although most participants saw limited financial benefits from the ROC Pilot, satisfaction with the Pilot was high, with 68% of participants that remained enrolled until the end of the Pilot very satisfied and only 2% not satisfied. The most common benefits reported were help in finding the lowest charging rate (33%), automatic charging of their car (20%), and saving money (20%). Over half (53%) of participants reported no issues or concerns, while the most common difficulties were overriding app settings (14%) and the car not charging to the correct level (12%). Participants were engaged with the Pilot and their EV charging, with 78% agreeing that they gained awareness of optimized charging benefits through the Pilot. Overall satisfaction and engagement were higher among hourly rate participants compared to flat rate participants. The Pilot experienced some attrition (23% of vehicles), mostly in the first couple of months, suggesting some participants did not find optimized charging to be a good fit for their household.

The optimization signal for the ROC Pilot was ComEd's hourly pricing signal. While it produced reductions in GHG emissions, the overall decrease was small due to limited variability in GHG emissions throughout the day**.** The overall GHG emissions impact depends on emissions intensity and load impact (e.g., change in EV charging load) in a given hour.

As shown in Figure 3, the average vehicle achieved a reduction in marginal emissions of 0.0662 lbs. per day, with decreases in the afternoon and evening hours partially offset by increased emissions in the overnight and early morning hours due to higher charging demand.[2]

[2] The methodology for calculating avoided GHG emissions was developed by Opinion Dynamics and the assumptions may differ from those used by ComEd in other GHG emission calculations.

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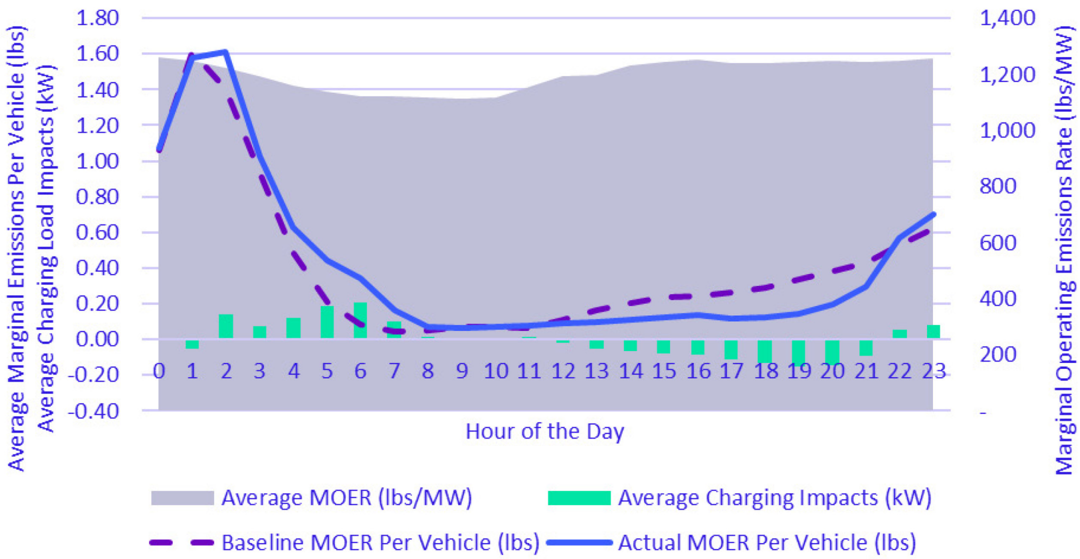
Throughout the ROC Pilot and across all treated vehicles, there was a total reduction of 15,865



lbs. of marginal emissions, equivalent to offsetting 18,326 miles driven by an average gasoline passenger vehicle, or the CO2 emissions from the electricity use of 1.5 homes over a year.

Figure 3. GHG Emissions Reduction from ROC Pilot

Overall, the per-participant cost of the ROC Pilot was $798, totaling $860,225. On average, the Pilot achieved financial savings of $9 per participant. The M&V team found that the ROC Pilot implementation costs exceeded the fiscally quantifiable benefits by $789 per participant. Therefore, the benefits of the Pilot only made up about 1% of the costs (Table 3).[3]

Table 3. ROC Pilot Costs and Benefits

Category	Amount	
	Per Vehicle*	Pilot Total
Implementation	$418	$450,225
Incentives	$111	$120,000
M&V	$269	$290,000
Total Costs	**$798**	**$860,225**
Avoided GHG Emissions**	$1	$1,367
Wholesale Energy Costs	$10	$4,973
Participant Energy Bills	$6	$3,039
Other Energy Costs***	$3	$252
Total Benefits**	**$9**	**$9,631**
Net Benefit	-$789	-$850,594

[3] Flat rate participants recouped a slightly greater share of costs than hourly rate participants because they had more potential for load shifting, due to their baseline charging behaviors, and achieved greater load impacts. The average benefits were $10 per flat rate vehicle compared to $6 per hourly rate vehicle. The pilot benefits made up about 1.5% of costs for flat rate participants and 0.9% of costs for hourly rate participants.

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*Based on average treated vehicles
**The methodology for calculating avoided GHG emissions was developed by Opinion Dynamics and the assumptions may differ from those used by ComEd in other GHG emission calculations
***Produced by participants with unknown rate codes, so attribution is unclear
****Per-vehicle wholesale energy cost and participant energy bill impacts are not cumulative, as each participant can only produce one of these benefit types

Conclusions & Recommendations

The M&V and implementation teams offer the following conclusions and recommendations.

Pilot Design and Implementation

- The ROC Pilot had a unique design. ComEd tested an innovative concept that is gaining traction among other utilities, but their existing hourly rate and its adoption among EV owners make ComEd a leader well-positioned to test EV charging optimization to wholesale energy prices.
- Co-branded outreach between ComEd and Optiwatt produced strong and rapid enrollment. ComEd's hourly pricing customers were highly engaged, and targeted lists, bill inserts, and LMI outreach efforts generated substantial interest—even exceeding the initial pilot cap. This confirms that collaborative outreach increases awareness, reduces acquisition costs, and ensures the recruitment of high-quality participants.
    - Recommendation #1: Maintain a coordinated outreach strategy using clearly defined roles and shared communication plans. A larger-scale program would benefit from earlier alignment on segmentation criteria, marketing plans, and message cadence. Creating a repeatable outreach model will support predictable enrollment and sustained customer engagement across a multi-year initiative.
- From an implementation perspective, the optimization engine worked as expected by consistently shifting charging to lower-cost hours while ensuring participants routinely achieved their desired state of charge, with relatively few overrides.

  However, some participants were unclear about why charging occurred at certain times, particularly during seasonal price shifts or periods of higher price volatility. This misunderstanding contributed to some unenrollments.
    - Recommendation #2: Make it easier for customers to understand their savings and program impacts. Introduce new touchpoints and channels with gamification and personalized metrics on savings and impact, potentially instead of incentives. Improve clarity in rate visualizations and charging schedules within cost categories. Providing straightforward customer education will increase customer trust, reduce confusion, and minimize unnecessary support interactions in a scaled deployment.
- Developing customer-calibrated baselines created transparent and accurate comparisons for evaluating managed charging impacts. This methodology aligned well with evaluator expectations and improved confidence in the results. However, some participants found the baseline period confusing, particularly when scheduling behaviors did not immediately activate managed charging.
    - Recommendation #3: Continue using calibrated baselines but strengthen customer-facing guidance. Early communication about what the baseline is, why it

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occurs, and what customers can expect before optimization begins will reduce confusion.

- Reporting became more complex as the Pilot progressed, particularly with multiple data sources, evaluator requirements, and shifts in reporting formats. The lack of early unified data structures led to manual reconciliation, increased effort, and delays. There were a couple of key issues that led to reporting complexity and delays, including unclear scope (i.e., limited documentation on what would be included in interim reporting and the methodology for calculating the desired data points) and ad hoc data requests (i.e., unplanned requests that led to additional data extracts, analysis, discussions, and alignment).
  - Recommendation #4: Define a standardized reporting structure before program launch. Establishing consistent data schemas, unique identifiers, and shared expectations across ComEd, the evaluator, and implementation teams will streamline reporting processes. Clear roles, responsibilities, and SLAs for data delivery will ensure accuracy and reduce administrative burden during a scaled program.

Participant Experience and Feedback

- Satisfaction with the ROC Pilot and interest in future managed charging were high among the 79% of participants who remained enrolled until the end of the Pilot. They retained strong satisfaction with ComEd and had high acceptance of managed charging. Participants generally stated they became more aware of the benefits of managed charging through the Pilot.
- Compared to flat rate participants, in general, hourly rate participants had higher satisfaction with the Pilot, greater acceptance of managed charging, and were more engaged with the Pilot. Hourly rate participants were more likely to be motivated by, and report as beneficial, support in charging their car at the lowest-priced times.

  They also directly experienced the financial benefits of any cost savings achieved and may have been more engaged with their energy use to begin with, given they signed up for the hourly rate. However, given the "set it and forget it" Pilot design, participants can succeed with very low engagement after enrollment if that is their preference.
- Participants were motivated by saving money on their bills and/or incentives, but most participants did not report bill savings. Further testing is necessary to determine whether satisfaction can be maintained, and attrition can be minimized absent bill savings, and the level of incentive required to support this.

EV Charging Patterns

- Based on device telemetry data, and as expected based on Pilot communications, participants made minimal changes to their driving and charging behaviors over the course of the Pilot, except those changes that are seasonal or weather-driven and not due to the Pilot.
- Participants were more likely to be plugged in and available for optimization during optimal (least expensive) charging periods compared to unfavorable (most expensive)

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or non-preferred (moderately expensive) periods, as these lower-priced periods tended to occur overnight.

- We observed variation in how often vehicles were plugged in and how much they charged overall based on customer segment (i.e., flat vs. hourly rate, LMI vs. non-LMI, and Tesla vs. non-Tesla vehicles). This was at least partially driven by differences in the frequency of level 1 (L1) charging, which, while not the target of optimization and excluded from the impact analysis, was ultimately included in optimization. Non-Tesla and flat rate participants have significantly higher rates of L1 charging than other participants, and L1 charging offers less load flexibility and fewer opportunities for optimization.
    - Recommendation #5: Consider conducting targeted outreach with participants in future managed charging programs who display regular L1 charging behaviors to ensure they are aware of L2 charger incentives offered by ComEd. Additionally, to ensure program equity for ComEd customers, maintain accessibility and customer choice with numerous original equipment manufacturer (OEM) options and DER types (i.e., both EVs and EVSEs).
- Based on survey data, most drivers have more charging flexibility than they programmed into the Optiwatt app, suggesting greater load flexibility was possible among drivers than could be achieved given the implementation team's knowledge of the state of charge (SOC) and ready-by requirements.
    - Recommendation #6: Consider experimenting with behavioral techniques to encourage drivers to indicate and update their true level of charging flexibility.

Optimization Signal

- Charging was typically cheapest in the overnight and early morning hours and most expensive in the late afternoon and early evening hours during the optimization period.
- The day-ahead and real-time prices generally aligned, but the day-ahead price was not a reliable predictor of relative hourly pricing within a day.

  Specifically, the day-ahead price often failed to accurately forecast which hours would be the most or moderately expensive, though it did better at predicting the lowest-priced hours. There could be incremental gains in optimization outcomes with improved day-ahead price forecasts, especially for customers who charge during typically higher-priced periods (like during the day or early evening), and to avoid any price spikes that occur overnight.
  - Recommendation #7: ComEd should consider developing their own algorithm that improves on the accuracy of PJM's day-ahead price forecast if this forecast will be used for EV optimization in the future. Improvements should focus on the ability to forecast the relatively most expensive hours in each 24-hour period.
- The emissions intensity in ComEd's service territory did not vary much throughout the day during the optimization period, constraining the opportunity for emissions reductions from load shifting, as emissions are not much higher or lower in one hour compared to another. Additionally, the variability that existed in the emissions signal was not always aligned with the pricing signal. While the most expensive energy hours

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tended to be the highest-emission hours as well, the lowest-emission hours were not necessarily the least expensive energy hours and did not necessarily correspond well with typical charging times.

Pilot Impacts

- Charging was successfully shifted from times of higher cost to times of lower cost within a given day. This was generally achieved by shifting charging out of the evening hours and into the early morning hours. Load shifting impacts were achieved across all customer segments, although the effects varied. Load shifted out of higher-priced periods was greater among flat rate participants than hourly rate participants and among Tesla vehicles than non-Teslas. LMI and non-LMI participants had similar load shifting impacts.
- Most hourly rate participants and a high share of flat rate participants charged overnight before the ROC Pilot. Our analysis shows that ComEd's advice to hourly rate customers given outside the ROC Pilot - to charge between 1:00 a.m. and 5:00 a.m. - is sound, at least given the variation in day-to-day pricing observed during the ROC Pilot. Optimization resulted in incremental gains in charging during ideal hours based on the unique pricing signal for a particular day.
- Cost impacts were modest across all participants. Most participants experienced a reduction in EV charging costs (if on the hourly rate) or produced wholesale energy cost savings (if on the flat rate), but the savings were small. Flat rate participants produced slightly greater energy cost savings than hourly rate participants experienced due to differences in their baseline charging behavior.
- Optimizing all participants to the same signal exacerbated the pre-existing timer peak. Efforts to smooth the timer peak ultimately only caused it to be shifted to a later hour.
    - Recommendation #8: If implementing active managed charging at scale, consider layering in distribution system optimization. Monitor the impact of more aggressive load smoothing on customer bills and consider quantifying the benefits of this smoothing to appropriately account for costs and benefits, and to allow for enhanced incentives if appropriate.
- Optimization to the hourly pricing signal led to small reductions in marginal GHG emissions among participants. It may be possible to achieve greater reductions in GHG emissions if this were the primary optimization signal; however, prioritizing GHG emissions may conflict with the objective to minimize energy costs.
    - Recommendation #9: If ComEd wishes to prioritize emissions reductions in the future, target customers for GHG emissions vs. price-based optimization based on their charging schedules and flexibility, while monitoring any tradeoffs or unintended consequences (i.e., by potentially shifting charging to higher-priced hours). Recognize that emissions savings may be limited unless the generation mix changes.
- Use of managed charging to curtail charging during forecasted annual coincident peak hours for hourly rate participants had a modest incremental additional impact, which was not statistically significant. Participants were generally not plugged in during the

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predicted coincident peak hours on event or non-event days, and the optimization already avoided charging during these hours due to their consistently elevated prices.

- Recommendation #10: Given the weight that the optimization algorithm already applies to avoiding charging in high-cost hours, customers' behavioral avoidance of charging during these hours, and how the optimization algorithm handled the events, it's understandable that low average incremental impacts were realized. The algorithm did not override all customer charging during these event periods if the vehicle conditions and customer preferences created conditions in which a charge was necessary, such as plugging in with low SOC and requiring a charge to reach the minimum SOC threshold. Better communication about the impact the events can have on a customer's bill may help encourage behavioral changes. Updates to the optimization algorithm are possible to reduce the few instances of charging that did occur during the demand response events.

- The costs of implementing the ROC Pilot far outweighed the emissions and energy cost benefits observed during the evaluation period for both flat and hourly rate participants. Hourly rate participants, in particular, provided limited additional benefits compared to those achieved through passive load management. Passive management does create timer peaks, which could be a problem at the local distribution level as EV adoption grows. If optimization were able to smooth those peaks, there could be more value in managed optimization, but the Pilot was unable to smooth those peaks and demonstrate that value.
  - Recommendation #11: Given the incremental benefits of optimization, ComEd should consider allowing hourly rate customers to continue managing EV charging to the hourly rate themselves unless the optimization can provide other benefits, such as alleviating timer peaks.
  - Recommendation #12: ComEd could also encourage flat rate customers to switch to the hourly rate, as passive management of the rate performs nearly as well as active management, especially when considering costs versus benefits. This recommendation assumes that current flat rate customers can manage their own charging as well as those customers who have already adopted the hourly rate, an assumption that would require testing and monitoring.

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