Guidehouse

Valuing Xcel Energy Charging Perks

Memo

Prepared for:

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Summary

The following memo summarizes potential value streams from a managed charging program like Xcel Energy's Charging Perks pilot. A full evaluation of the pilot program is provided in Guidehouse's evaluation report; readers are advised to refer to the evaluation report for more complete and formal analyses of program impacts. Per the evaluation report (draft, as of early April 2023), data collected during the pilot supports estimates of marginal cost savings for Xcel of $8.72 per vehicle per year due to load shifting and peak demand reductions on the order of 0.08 kW per vehicle across the entire population – resulting in an avoided cost for Xcel of $8.62 per vehicle per year, for a total value of $17.34 per vehicle per year. Reduced curtailment of renewables by shifting 0.55 kWh on average to early morning hours results in an estimated additional value of $6.42 per vehicle per year, resulting in a total value for Xcel of $23.76 per vehicle per year.

Introduction

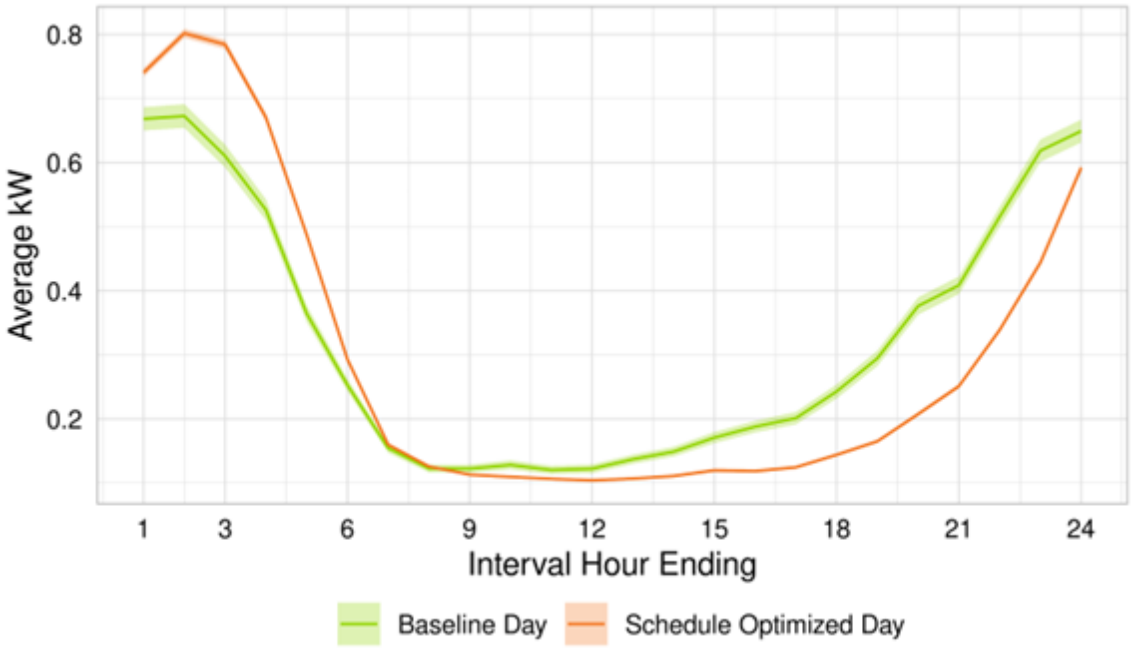
The Charging Perks pilot study was designed with an in-program population for comparison, so any comparisons are drawn between baseline and optimized days within the pilot period for all program participants. The pilot was neither an energy efficiency (EE) program, nor a demand response (DR) program; rather, it is a load-shifting program, and estimating net benefits of load shifting could include consideration of additional benefits, namely reduced renewable curtailment.

Results

The reader is advised to review the evaluation report for details on the analyses conducted, as well as a thorough appendix comparing impacts across many variables of interest. For estimation of avoided costs, charging data is averaged across all sessions into a representative loadshape for all baseline days and all schedule optimized days. Impacts are derived from the difference between the baseline and optimized average loadshapes. The following section summarizes the grid impacts discussed in the evaluation report and an additional value stream from reduced renewable curtailment.

Figure 1 below presents the average loadshapes for baseline and optimized days and reflects all vehicles on all days during the pilot; the space between the two loadshapes indicates that load is shifted away from afternoon and evening hours and into early morning hours during optimized days.

Figure 1. Average Loadshapes for Baseline and Optimized Days



Avoided (Peak Demand) Costs

Table 1 below provides an estimate of avoided costs, based on impact during peak hours (3 pm – 7 pm) and avoided cost values of $7.98/kW-month for generation and $1/kW-month for distribution, totaling roughly $9 of avoided cost per kW-month or roughly $108 per kW on an annual basis. The pilot program evaluation shows that average power during peak hours is 0.13 kW on optimized days and 0.21 kW on baseline days, equating to a reduction of 0.08 kW on optimized days and an avoided cost of $8.62 per year.

In the future, with the addition of increased solar to Xcel's Colorado generation mix, we can expect peak hours to shift to later in the evening. Applying the same analysis as above to the hours ending 5 pm – 9 pm, the average power during peak hours is 0.19 kW on optimized days, and 0.38 kW on baseline days, resulting in a reduction of 0.19 kW – double the reduction seen during hours ending 3 pm – 7 pm

Marginal Energy Cost Savings

Per the evaluation report, the monetary value of shifting load was calculated by multiplying the hourly avoided capacity by the hourly marginal cost of energy, resulting in a value of $0.0239 per vehicle per day. Scaling this value up to reflect annual avoided cost results in $8.72 per vehicle per year.

Table 1. Summary of Impacts on Annual Avoided Cost

Impact Metric	Value	Annual Avoided Cost ($)	Notes
Avoided Peak Power	.08 kW	$8.62	Uses pilot baseline and optimized days for comparison. Includes an average across all sessions during all months, limited to peak hours (3 pm – 7 pm), and reflects the difference between the average on optimized days and the average on baseline days.
Total Shifted Energy	$0.0239 Per day	$8.72	Daily cost savings were calculated as $0.0239 per vehicle, with maximum savings occurring around 7 pm – 8 pm MST (see section 4.4.3 of the evaluation report).
Reduced Renewable Curtailment	0.55 kWh	$6.42	This uses the difference in energy consumed during hours of high renewable curtailment (1 am – 5 am) on baseline days and schedule optimized days, and assumes all energy shifted to hours of high renewable curtailment (1 am – 5 am) could be eligible for estimating value.
Total		$ 23.76	

Methods

Calculating average avoided costs: We multiply a reduction in demand (average monthly kW per vehicle) by a known avoided cost rate ($/kW-month) to get to a dollar value per vehicle per month. The evaluation report computes two average loadshapes (one for optimized days, another for baseline days) across all customers and days, then takes the difference (baseline – optimized) in average loads during peak hours. This is the best estimate of observed program impact on average across the entire pilot.

Calculating marginal costs: Refer to the evaluation report section titled “Grid Metrics – Marginal Energy Cost Savings.”

Avoided Renewable Curtailment: Times with the highest renewable curtailment generally fell between hours ending 1 am – 5 am, and the difference in energy consumed during these hours between baseline and optimized days is 0.55 kWh per day per vehicle on average. Assuming a value for avoiding renewable curtailment of $32/MWh and multiplying by 365 days in the year, this avoided curtailment is worth $6.42 per vehicle per year.