Charging Toward the Future of Flexible Load Management: Xcel Energy's Renewable Battery Connect Evaluation

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ABSTRACT

As utilities modernize the grid and integrate distributed energy resources (DERs), residential battery storage offers a promising solution for year-round demand response. This paper presents an evaluation of Renewable Battery Connect (RBC), a pilot program by Xcel Energy in Colorado, designed to assess the performance and value of direct battery dispatch. Unlike thermostat-based demand response, battery storage enables frequent, flexible load reductions without compromising occupant comfort.

This evaluation focuses on RBC's 2024 summer season, which tested three dispatch strategies: peak period reduction, 24-hour load shifting, and evening ramp mitigation. The study assessed load impacts, estimated bill effects, and surveyed participants on their experience. Incremental impacts were measured using a randomized control trial and difference-in-differences methodology. Results show statistically significant battery discharge across all strategies. Peak period events (4–7 PM) produced an average incremental discharge of 0.42 kW per battery and reduced grid demand by 0.35 kW. Evening ramp events (6–9 PM) achieved 0.94 kW in battery response and 0.89 kW in grid demand reduction. By contrast, 24-hour load-shifting events had limited impact, resulting in a net grid usage increase of 0.08 kW. Under 2024 rates, average participant bills rose $0.27–$0.61 per event day, largely due to discharge restrictions from required battery reserves. Surveyed participants reported high satisfaction – 75% would recommend the program.

In summary, RBC demonstrates strong technical feasibility and customer engagement, particularly for targeted peak and ramp strategies. These findings offer guidance for scaling DER integration through improved battery dispatch program design.

Introduction

The Xcel Energy Renewable Battery Connect Program, also known as RBC, was launched in 2023. Participants in the program allowed Xcel Energy to force charge or discharge their battery storage systems. In return, customers received an incentive for their participation in the program. Renewable Battery Connect is marketed to residential customers by solar battery installers, and participants are enrolled in the program upon installation of their battery or batteries. Therefore, all RBC participants are new battery storage customers as well, in contrast to the previous Battery Connect pilot, which was marketed to customers who already had battery storage systems.

The incentive structure for RBC in 2024 was as follows: Non-income-qualified participants received $500 per kW of energy storage installed up to 50% of their equipment-only cost, and income-qualified participants received $800 per kW of energy storage installed up to 75% of their equipment-only cost. All participants will also receive an annual participation and retention incentive of $100 for up to 5 years of participation.

Figure 1 displays the interaction between Xcel Energy and participants, the battery vendors, and Resource Innovations (RI). Xcel Energy was able to dispatch battery charging, discharging, and holding events via each battery vendor's web portal. The events could be scheduled ahead of time or could be called in real time. As part of participation in the program, customers allowed Xcel Energy to discharge their battery until it had a minimum of 40% charge remaining. To dispatch events, Xcel Energy would enter the desired total kW from the batteries across each event duration, while accounting for the 40% reserve level. Additionally, during the dispatch periods, participants were not given the ability to opt out of events.

The RBC program could have discharge events lasting up to three hours. However, the program did not have a limitation on the battery charge or hold events if they occurred the same day as the discharge. In the RBC program, batteries are charged with solar availability each event day before the discharge occurs. Accordingly, the batteries are allowed to export stored solar energy back to the grid. On event days, batteries are not allowed to charge from the grid and then export the stored energy back to the grid.

At the end of each quarter, Xcel Energy was able to download quarterly participant 15-minute telemetry data for Tesla participants via Tesla's web portal. This quarterly telemetry data, which included grid, battery, solar, and site power readings, formed the basis for the impact analysis. Due to the small number of enrolled SolarEdge participants relative to Tesla participants and the telemetry data being provided only from Tesla, the impact analysis looks exclusively at Tesla Powerwall enrollees.

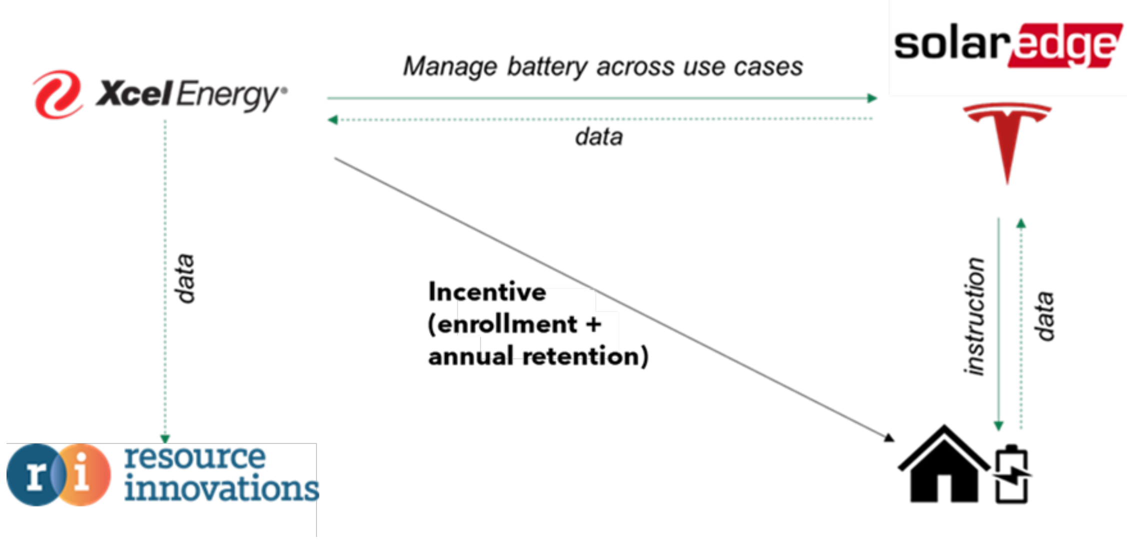

Figure 1. Overview of 2024 RBC Program Operations

Participants in RBC were split into two different rate groups: those on the Residential Time-of-Use rate (RE-TOU) and those on one of the standard flat rates, Residential General Service (R), or Residential General Service Opt-Out (R-OO)[1]. Hereafter in this paper, these groups are referred to as TOU and non-TOU, respectively. Figure 2 displays the peak periods for TOU customers, whose rate is the most expensive during peak demand periods in the afternoon. As discussed throughout the remainder of this paper, during non-event days, TOU and non-TOU participants generally have their batteries programmed to behave differently throughout the day. These differences in behavior lead to differences in power and bill impacts, which will be discussed in the Results section.

[1] The R-OO rate is distinguished from R as it is offered to customers who were previously on the RE-TOU rate but later chose to opt out, but in practice, the per-kWh costs of electricity are identical across the two rates.

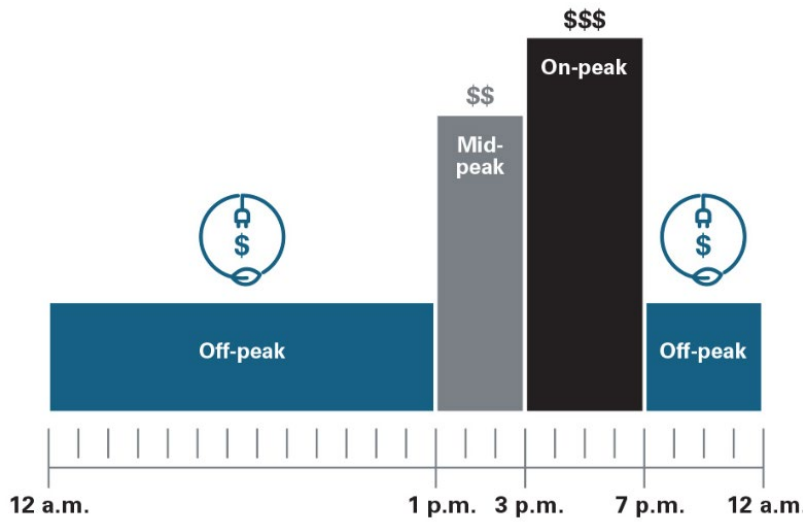

Figure 2. Xcel Energy 2024 TOU Peak Periods

For the purpose of calling events with consistent customer segments, the participants were split into four groups. There were two groups of all TOU participants and two groups of non-TOU participants in the analysis. For each event, one TOU group and one non-TOU group were selected as participants, and the other two groups were selected as controls. These control participants ultimately allowed RI to estimate the incremental impacts of the program.

Based on the user-selected operating mode, the batteries of TOU and non-TOU customers generally behave differently on non-event days. TOU customers have the option to select the "Time-Based Control" operating mode, which instructs their battery to discharge during the TOU peak periods. With this mode, TOU customers can ensure their battery is discharged when the price of electricity is at its highest. Similarly, non-TOU customers generally select "Self-Powered" mode, which tells their batteries to help support the site after the sun sets.

Methodology

Event Use Cases

Xcel Energy implemented three different use case strategies when calling events to test discharging and charging at different periods. Each use case was called on multiple event days, with Xcel Energy varying the participant and control groups across events within the same use case. By doing this, Xcel Energy sought to get a sense of how batteries respond to each use case on average, independent of which customers are participating.

The primary distinction between each use case is the time when the batteries were signaled and the dispatch command implemented. There were three primary dispatch commands that Xcel Energy utilized for the events in 2024: charging, discharging, and holding the batteries. During the hold command, the batteries were instructed to neither charge nor discharge. Each use case varied the length of the hold, charge, and discharge periods. There is no operational difference in the hold, charge, and discharge dispatch signals sent to the batteries from one event to another, other than the length and timing.

Table 1 presents a description of the use cases called throughout the summer 2024 event season. The three summer use cases are labeled SU-1 through SU-3 for ease of reference.

Table 1. Summer Use Cases

Use Case	Details	Hold	Charge	Discharge	Notes
SU-1	Peak Period Grid Usage	12 AM - 12 PM, 7 PM -12 AM	12 PM - 4 PM	4 PM - 7 PM	Reducing peak period usage by aligning the battery dispatch when demand for electricity is at its highest level.
SU-2	24-Hour Grid Usage	12 AM - 12 PM, 4 PM - 8 PM	12 PM - 4 PM	8 PM - 11 PM	Maximizing reductions in grid usage over the entire event day to allow solar to provide as much as possible to the site before using the battery dispatches.
SU-3	Reducing Grid Ramp Up	12 AM - 3 PM, 9 PM -12 AM	3 PM - 6 PM	6 PM - 9 PM	Focuses the charging and discharging periods in the afternoon and evening to help ease demand on the grid until later in the night after the sun goes down.

Peak Period Grid Usage

Reducing peak period usage requires the batteries to be dispatched when demand for electricity is at its highest level. Xcel Energy can align the battery dispatch with the peak period, which usually occurs in the afternoon. The battery should hold from (~12 AM to 12 PM) until it can be charged when solar is peaking (~12 PM to 4 PM). Usually during the period of peak solar production, there is enough energy to charge the battery and power the site. The battery can then be discharged during the peaking period (~4 PM to 7 PM). In essence, this will guarantee each site switches from using solar to battery, with the excess solar being sent back to the grid. This strategy emphasizes exporting energy back to the grid during the peaking period.

The main drawback of this use case is that many batteries are already being dispatched during the peak period without program intervention. For example, if TOU customers have their battery operating mode set to align with the pricing peak periods, then the battery dispatches from 3 PM to 7 PM.

Additionally, a hold period after the event ends is recommended to ensure no batteries charge from the grid when electricity demand is still high.

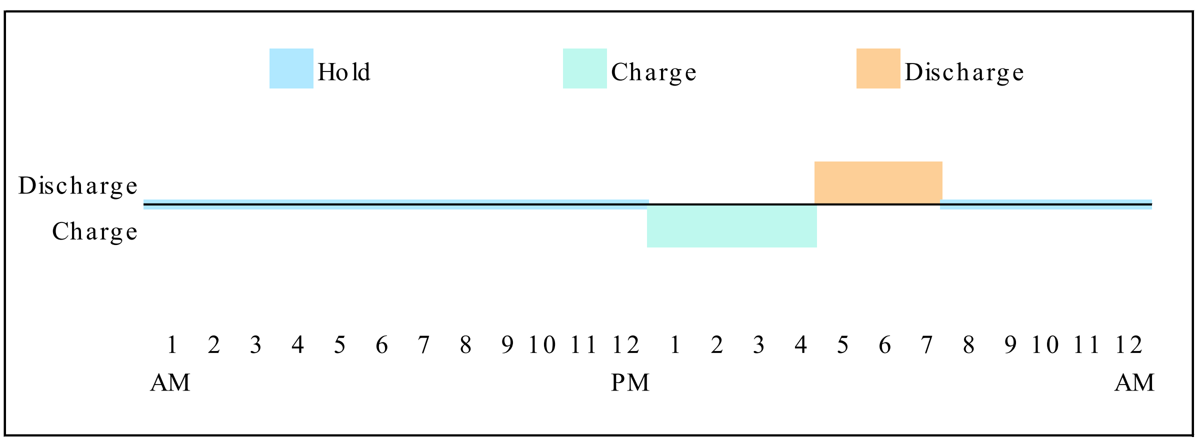

Figure 3. Use Case SU-1 - Peak Period Grid Usage Dispatch Strategy

24-Hour Grid Usage

The goal of this use case to minimize the energy drawn from the grid over the entire day. Maximizing reductions in grid usage requires the batteries to be utilized when solar energy is not available. To accomplish this, the batteries should charge when solar is peaking (~12 PM to 4 PM). Typically, during this period, there is enough solar energy being produced to charge the battery and provide energy to the site at the same time. Accordingly, no energy from the grid should be consumed.

Next, the batteries will hold (~4 PM to ~8 PM) until solar is providing minimal energy to the site, which depends on when the sun is setting. During the battery hold period, solar can still supplement the site's usage, so minimal energy is being drawn from the grid. Finally, the battery can be dispatched at dusk when it otherwise would not normally be utilized. The idea is to allow solar to provide as much as possible to the site before using the battery dispatches. Meaning, there is only a slight overlap between solar and battery energy powering the site.

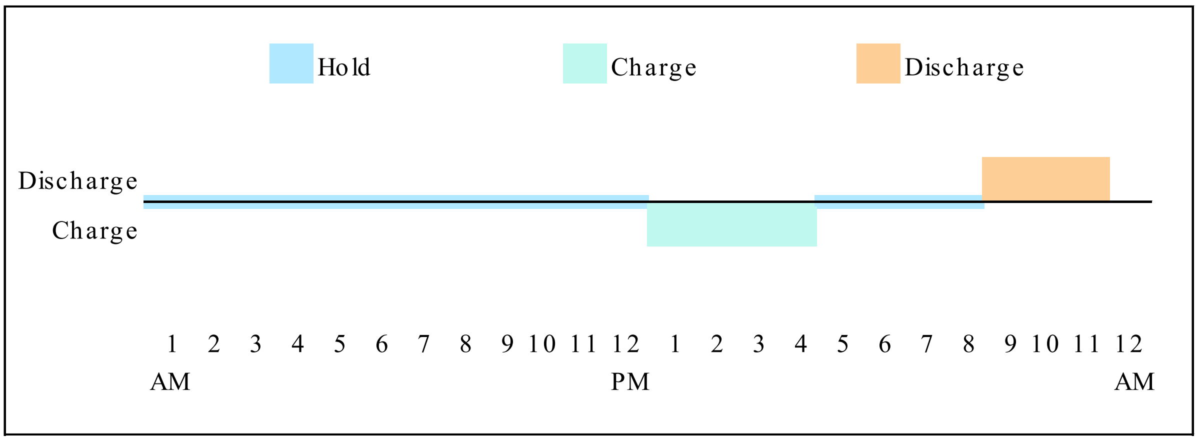

Figure 4. Use Case SU-2 – 24-Hour Grid Usage Dispatch Strategy

Reducing Grid Ramp-Up

A potential concern for Xcel Energy may arise when households with solar power switch to grid usage in the evening. Since each home with solar relies on sunlight to power their home until dusk, all these homes simultaneously need to draw from the grid when the sun sets. As a result, the demand on the grid increases rapidly as daylight fades.

This issue can potentially be alleviated by reducing the ramp-up period when sites with solar switch over to the grid. Using the batteries to absorb some of the excess solar and power the home at dusk can reduce strain on the grid.

This use case focuses the charging and discharging periods in the afternoon and evening. The batteries should hold (~12 AM to 3 PM) until they can charge (~3 PM to 6 PM) when there is excess solar before dusk begins. This means less energy is being sent back to the grid, which can lessen concerns over ramp up in demand. The batteries should discharge (6 PM to 9 PM) during the period when the sun sets and the home normally switches from solar to the grid. The battery can power the home during this time, which helps ease demand on the grid until later in the night.

This use case has a slightly different objective compared to the previous two. The goal here is to use the batteries to address a potential issue caused by all solar customers. It leverages the batteries as a tool to help mitigate a grid-wide challenge resulting from large-scale solar production. In contrast, the previous two use cases focus on reducing grid usage during peak periods and throughout the day.

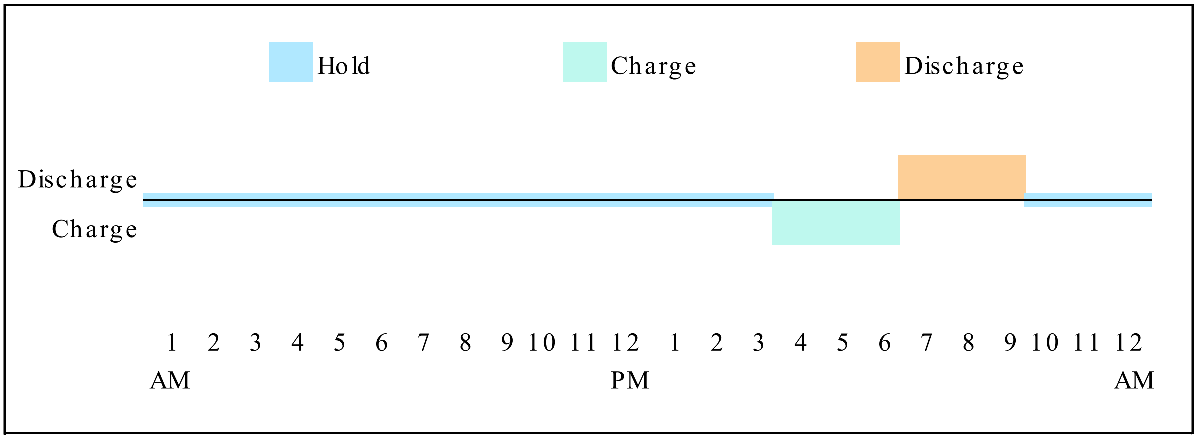

Figure 5. Use Case SU-3 – Reducing Grid Ramp-Up Dispatch Strategy

Throughout summer 2024, a total of 22 events across the three distinct use cases were called, with ten events being called for Use Case SU-1 (Peak Period Grid Usage), and six events being called for Use Cases SU-2 and SU-3 (24-Hour Grid Usage and Reducing Grid Ramp-Up), respectively. For each use case, half of the events were called with Groups 1 & 2 as the participants, and half were called with Groups 3 & 4 as the participants.

Incremental Impacts Methodology

To estimate incremental impacts, *counterfactual* grid and battery usage must first be estimated. The counterfactuals represent what the participants' battery and grid usage would have been in the absence of the event occurring. This section discusses the methodology for estimating these counterfactuals for the RBC program events. Once these counterfactuals are estimated, the incremental grid and battery impacts, respectively, are mathematically equivalent to the difference between the actual participant and counterfactual usage for each metric.

Randomized Controlled Trial Assignment Methodology

A randomized controlled trial (RCT) is a research approach in which customers are randomly assigned to treatment and control conditions so that the only difference between the two groups, other than random chance, is the existence of the treatment condition. For RBC, TOU customers were randomly assigned to groups 1 and 4 with a 50 percent chance of going to either group, and non-TOU customers were assigned to groups 2 and 3 with a 50 percent chance of going to either group. For each event, either groups 1 and 2 or groups 3 and 4 were assigned as the treatment groups and the other two groups (3 and 4 or 1 and 2, respectively) were assigned as the control groups. Which groups were the treatment groups and which groups were the control groups alternated for each event within a given use case to ensure that for each use case, half of the events had groups and 1 and 2 as the treatment groups, and half had groups 3 and 4 as the treatment groups.

Difference in Differences Estimation Methodology

When using an RCT methodology alone to estimate incremental impacts, the counterfactual usage during a given event day is the average control usage during said event day, and the incremental impact of the program is simply the average treatment usage minus the average control usage. However, due to random chance, participants in the treatment group may differ in average battery and grid usage from participants in the control group due to inherent differences not related to the impact of the event. In this case, a more robust estimation of incremental impacts can be yielded by utilizing a difference-in-difference (DiD) methodology. This methodology assumes that the program impact is equal to the difference in usage between the treatment and the control groups during the event day, minus any pre-existing difference that may exist between the two groups on non-event days. When using a DiD methodology, the randomly assigned control group does *not* need to perfectly match the treatment group on non-event days. Subtracting any difference between treatment and control customers on non-event days adjusts for any difference between the two groups that might occur due to random chance. Therefore, any further change between the groups in the post-treatment period can be measured as the impact of treatment, which in the context of RBC is the incremental impact of the program.

DiD regressions were performed for the entire participant population, as well as separately for the TOU and non-TOU participant populations, to estimate incremental impacts individually for each segment. These regressions were also run at the hourly level, to create DiD estimates for each hour of each event day.

The final results of the DiD regression created a counterfactual measure of battery and grid usage for each event day, hour, and rate group. This counterfactual represented the battery and grid power that participants would have used in the absence of the event occurring. The incremental impacts for a given period were therefore the difference between the actual participant and estimated counterfactual usage during this period. This counterfactual usage allowed for visually presenting incremental impacts as seen in the Battery and Grid Impacts section below.

Incremental Bill Impacts Methodology

Similar to incremental load impacts, incremental bill impacts are relative to a counterfactual – what the participants' bills would have looked like in the absence of the events. The methodology for estimating incremental bill impacts is similar to the process for estimating incremental load impacts as discussed above. The same difference-in-difference estimates calculated in determining incremental grid impacts were used as the starting point for incremental bill impacts. These grid impacts were estimated at the hourly level, producing results for each hour of each event day, and calculated separately for TOU rate participants and non-TOU rate participants.

Next, these hourly grid impact estimates were then multiplied by the hourly electricity rates for each rate group. Note that these impact estimates were estimated in kilowatt (kW) terms, and hourly electricity rates are per kilowatt-hour (kWh). However, as the total kWh in a given time period is equivalent to the average kW across the period multiplied by the number of hours in that time period, for a single hour, the total kWh consumed is equal to the average kW demanded in that hour. Therefore, the hourly bill impact for a given hour can be calculated as the estimated kW impact during that hour multiplied by the hourly rate in kWh.

Once the hourly bill impacts for each hour and each event day are estimated, the impacts are summed up to the total daily level and then averaged for each use case, as with the load impacts. Next, these hourly impacts are added together to get a final 24-hour impact value for each use case. While 24-hour *load* impacts are the *average* kW impact across the day, 24-hour *bill* impacts are the total *summed* $ impact across the day. These impacts are summed rather than averaged to reflect the total cumulative change in participants' bills across the day. All 24 hours are included in this impact, because the battery is receiving signals, and therefore behaving differently, during most, if not all, of the day. For this reason, the total bill impact that a participant experiences is the combined effect of the changes in grid energy consumption during the charge, hold, and discharge periods.

Note that like power impacts above, bill impacts were estimated on a per-battery, not per-household basis. For this reason, the bill impacts reported below represent the incremental effect on participant bills of each participating battery a household owns.

Post-Season Survey

The 2024 post-summer survey was designed to gauge the customer experience of the program in its first year. The survey was distributed to all participants who enrolled in the program and aimed to assess multiple aspects of their engagement. It explored participants' awareness of the marketing channels used for recruitment, their motivations for enrolling, and their experiences with the enrollment process. Additionally, the survey examined how participants utilized their battery backup systems and measured their overall satisfaction with the program and Xcel Energy. Demographic insights and other relevant feedback were also collected to inform future program enhancements. The survey was structured into the following sections:

- **Recruitment Awareness and Preferences** – participants' familiarity with marketing efforts and preferred outreach methods
- **Enrollment Process** – the enrollment experience with installers and Xcel Energy
- **Enrollment Decision** – factors influencing participants' decision to join the program
- **Battery Usage and Purpose** – how participants used their battery backup systems and their intended purpose
- **Program Experience** – feedback on overall program engagement
- **Satisfaction with the Program and Xcel Energy** – participants' overall satisfaction levels
- **Customer Demographics** – demographic information to understand participant characteristics and inform future outreach strategies
- **Battery and Grid Impacts**

Table 2 presents a summary of the participant survey. The survey was administered via the web and was sent to 305 participants. In total, 120 responses were received, bringing the response rate to about 39%. Respondents were asked a maximum of 42 questions for which they were provided an incentive of $20 in the form of an Amazon gift card, with an option for donation to the American Red Cross.

Table 2. Post-Summer Participant Survey Summary

Survey Open	Survey Close	Days in Field	Responses		# Survey Questions	Incentive
			Count	Percent		
11/14/2024	12/5/2024	22	120	39%	42	11/14/2024

Results

Key findings from the 2024 RBC evaluation are summarized at a high level below. Due to the large number of events during the summer, and because the timing of battery dispatch is consistent across event days within use cases, the impacts presented are reported as averages by use case, rather than reported individually for each RBC event. This condenses the amount of information presented and ensures the results give a sense of how each use case affects power and customer bills on an average basis.

Battery and Grid Impacts

Table 3 presents the average total and incremental battery and grid power impacts (in kW) at the per-battery level during the discharge period and across all 24 hours of the event day for each of the three summer use cases. In this table, asterisks indicate impacts that are statistically significant at the 90% confidence level.

Total battery impacts refer to the total amount of battery power charged or discharged, whereas *incremental* battery impacts refer to the marginal change in battery power as a result of the event. *Total* grid impacts refer to the total amount of power demanded from or exported to the grid, whereas *incremental* grid impacts refer to the marginal change in grid power as a result of the event.

Table 3. Battery and Grid Power Impacts (All Participants)

Use Case	Impact Period	Impact Metric			
		Total Battery Power (average kW charged to (-) or discharged from (+) battery)	**Incremental Battery Impact (kW change in battery power due to event)**	**Total Grid Power (average kW exported to (-) or demanded from (+) the grid)**	**Incremental Grid Impact (kW change in grid power due to event)**
Summer Use Case SU-1 (Peak Period Grid Usage)	Discharge Period (4-7 PM)	1.28*	0.42*	-0.61*	-0.35*
	24 Hours	-0.07	-0.07*	0.17*	0.08*
Summer Use Case SU-2 (24-Hour Grid Usage)	Discharge Period (8-11 PM)	1.16*	1.00*	0.34	-1.08*
	24 Hours	-0.10	-0.09*	0.23*	0.08*
Summer Use Case SU-3 (Reducing Grid Ramp-Up)	Discharge Period (6-9 PM)	1.24*	0.94*	0.35	-0.89*
	24 Hours	-0.02	0.00	0.12	0.01

* Result is statistically significant at the 90% confidence level

Table 4 presents key findings and recommendations from the impact evaluation. These findings and recommendations cover both the total and incremental power sections.

Table 4. Program Design and Impact Evaluation Findings and Recommendations

Finding	Recommendation
Total battery impacts were positive and statistically significant, indicating that enrolled batteries responded as expected to event signals.	Xcel Energy can feel confident in the responsiveness of enrolled batteries to DR events. Xcel Energy should also implement a variety of discharge times and durations to better understand how these parameters affect impacts.

Participants used less grid power during events' discharge windows. The magnitude of these impacts depended on event timing, with events coincident with the TOU peak period having the smallest impacts.	Xcel Energy should carefully consider the timing of RBC events. Batteries operating to discharge during the TOU peak period already function as a daily demand response resource, therefore the incremental benefit of calling RBC events is smaller when coincident with this period.
RBC events were effective at curtailing grid demand during the ramp-up period (6 to 9 PM). Reducing impacts during this period is likely to increase in importance as more customers adopt solar PV technology.	Xcel Energy should continue to call RBC events during the grid ramp-up period. By marketing RBC to current solar PV customers who do not yet have battery storage, Xcel Energy will reduce the future magnitude of this ramp-up.
Participants' 24-hour grid energy consumption increased during RBC events. These increases are partially the result of batteries being unable to discharge more than 60% of participants' total battery energy.	Eliminating or reducing the battery reserve requirements would reduce participants' grid energy consumption across all event types, including helping reduce 24-hour grid usage.

Bill Impacts

Table 5 presents the incremental impact of each summer use case on participants' total daily electricity bills for TOU and non-TOU participants. These bill impacts are incremental and therefore they represent the *net* effect of the events on participants' bills for each battery they have enrolled. Once again, asterisks indicate statistically significant impacts.

Note that these bill impacts, like the load impacts above, are on a per-event-day basis. For example, the impacts for Use Case SU-1 represent the 24-hour per-battery bill impact for the *average* Use Case SU-1 event day, as estimated using the average grid impacts estimated from all ten Use Case SU-1 event days. In this case, participants saw an average bill increase of $0.27 per enrolled battery under the current rate. These bill impacts were calculated under two scenarios – the current electric rates that participants faced during the 2024 season, and a new TOU rate structure that will be implemented in 2025.

Table 5. Summer Event Use Case and Season Incremental Bill Impacts

Use Case	Rate Structure	24-Hour Incremental Bill Impact		
		TOU Participants	Non-TOU Participants	All
Summer Use Case SU-1 (Peak Period Grid Usage)	Current TOU Rate	$0.35*	$0.31*	$0.27*
	2025 TOU Rate	-$0.02		$0.08*
Summer Use Case SU-2 (24-Hour Grid Usage)	Current TOU Rate	$0.87*	$0.24*	$0.61*
	2025 TOU Rate	$0.22*		$0.24*
	Current TOU Rate	$0.87*	$0.05	$0.57*

Summer Use Case SU-3 (Reducing Grid Ramp-Up)	2025 TOU Rate	$0.06		$0.09*

Key findings and recommendations relating to bill impacts are as follows in Table 6. These include findings from 2024 impacts as well as projections based on the upcoming 2025 TOU rate.

Table 6. Bill Impact Findings and Recommendations

Finding	**Recommendation**
Because participants consumed more grid energy during event days, their bills increased slightly due to events. This increase was higher for TOU participants as it prevented them from utilizing their TOU-optimized battery programming.	Eliminating or reducing the battery reserve requirements, in addition to reducing grid consumption, would reduce participants' bills during event days, as they would consume less grid energy.
TOU participants' event day bills would be lower under the 2025 TOU rate schedule, relative to the current TOU rate structure (holding load impacts constant).	The 2025 TOU rates would likely benefit participants on event days, as the longer peak period with a lower volumetric cost per kWh means that customer bills are less sensitive to changes to participants' battery programming.

Customer Satisfaction

A post-summer event season survey was designed to gauge the customer program experience. The survey was distributed to all participants who enrolled in the program and aimed to assess multiple aspects of their engagement, including awareness of the marketing channels used for recruitment, motivations for enrolling, and experiences with the enrollment process. Additionally, the survey examined how participants utilized their battery systems and measured their overall satisfaction with the program and Xcel Energy.

presents key findings and recommendations from the customer survey.

Table 7. Process Evaluation Findings and Recommendations

Finding	**Recommendation**
Participants who responded to the survey were very satisfied with the program. Most respondents (75%) would recommend the program to their colleagues, friends, or family.	Xcel Energy should continue to support and grow the RBC program. The survey results suggest that the current enrollment process provides clear information on the program and incentives associated with it.
A large portion (39%) of survey respondents had concerns before enrolling. The most reported (35% of concerns) was a worry that the batteries will not have enough energy reserve remaining following an RBC event.	Xcel Energy should emphasize that a participant's battery system will not be discharged lower than the predetermined program battery reserve level. This should be highlighted in recruitment materials to assuage potential enrollees' concerns.

Participants were generally aware of their energy usage, with most respondents checking their battery app or website at least weekly (84%). Many respondents would like more notifications about events.	Although participants are actively engaged in the program and would like pre-event notifications, Resource Innovations only recommends notifications if the program switches to a pay-for-performance model instead of an upfront incentive.
Most participants (82%) who responded to the enrollment survey reported that financial incentives motivated them to enroll, but other motivations such as helping the environment and improving grid reliability were also noted.	Xcel Energy should clearly highlight the financial incentives for participating in the program while also mentioning the environmental and social benefits of the program.

Next Steps

The results of the 2024 Renewable Battery Connect evaluation reinforce the technical viability and customer appeal of battery-based demand response. As Xcel Energy plans for the next phase of program evolution, several critical developments are already underway. The utility's Renewable Energy Plan includes a goal of 10 MW of residential battery storage by the end of 2025, necessitating careful program scaling and sustained customer engagement.

Solar-plus-storage installations grew 44% in 2024, which coincided with a sharp rise in Tesla Powerwall 3 installations in Xcel Energy's customer population (Wood Mackenzie 2024). With discharge capabilities of 11.5 kW, which is more than double that of earlier models, Powerwall 3 systems led to a 130% increase in upfront incentives. The surge in applications during Q3 2024 pushed the program near budget limits, prompting swift programmatic responses from Xcel Energy, including a temporary pause in new enrollments and filing a motion to rebalance the program budget by capping incentives at $5,000 per customer. These shifts illustrate the dynamic nature of distributed energy resource (DER) adoption and underscore the importance of responsive program design and budget flexibility.

Looking ahead, Xcel Energy is transitioning toward a Virtual Power Plant (VPP) tariff structure and a pay-for-performance model, both of which are expected to enhance program sustainability and scalability. The VPP tariff, filed in early 2025, will enable aggregation of diverse DERs that deliver measurable grid value. Future event strategies will increasingly focus on supporting constrained feeders through locational dispatch. Additionally, the deployment of a new grid-edge DERMS platform in partnership with Itron will provide the operational foundation for real-time coordination. Renewable Battery Connect will be the first program integrated into this platform, laying the groundwork for a broader, more adaptive DER portfolio.

Together, these advancements signal a shift toward a more adaptive, performance-based demand flexibility framework, supporting grid reliability, enhancing customer value, and accelerating the integration of DERs at scale.

References

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