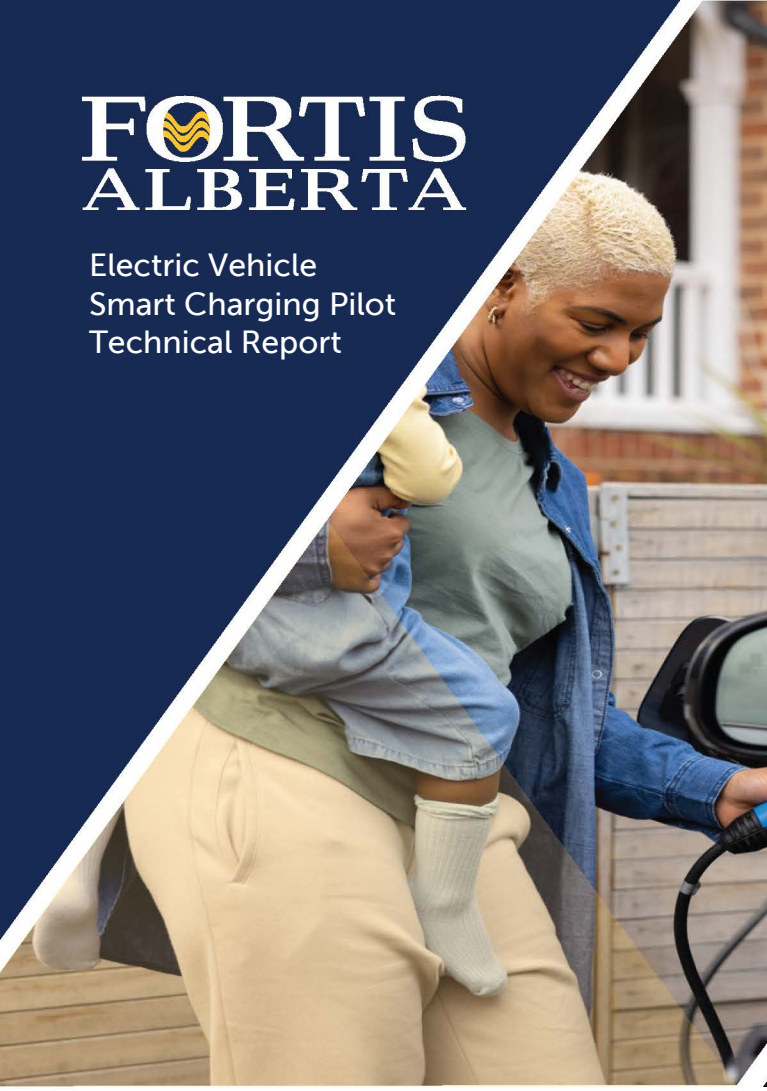
FORTIS ALBERTA

# Electric Vehicle Smart Charging Pilot Technical Report



First published online, June 2025.

## Electric Vehicle Smart Charging Pilot

In January 2023, FortisAlberta Inc. (FortisAlberta or the Company) launched an Electric Vehicle (EV) Smart Charging Pilot (the Pilot), which was approved by the Alberta Utilities Commission as part of FortisAlberta's 2023 Cost of Service application. The Pilot ended in June 2024. 319 electric vehicles were enroled, across 57 of the 240 communities in the FortisAlberta service area. This document describes, at a high level, the questions posed in the Pilot as well as the insights gained throughout.

It takes a combination of customer participation and technology to make this work and FortisAlberta thanks the participation of customers that helped make this pilot successful.

## Pilot and Timelines

The Pilot focused on investigating these main questions.

1. How are FortisAlberta customers charging their EVs today and how could EV charging impact the grid both now and in the future?
2. How could demand side management (DSM) impact the use of the grid due to EV charging and how does managed charging compare to time-of-use (TOU) rates?

DSM provides customers with incentives to lower or shift their electricity use. This can help reduce demands on the electricity system, leading to system optimization, and can contribute to the avoidance or deferral of building traditional upgrades to the power grid (i.e. wires and/or generation). DSM can cause customers to shift when they charge their EVs, and during peaks, this can reduce stress on the electric grid.

The Pilot design included a comparison of managed charging and TOU incentives. Managed charging uses an algorithm to automatically adjust charging so multiple EVs don't all charge at the same time. To create managed charging, participants received incentives for letting the algorithm manage their charging this way. To create the TOU incentives, participants received incentives for charging at specific times of the day outside of peak electricity use, for example, from 10 p.m. to 6 a.m.

### Team

The Pilot project team included members from FortisAlberta's Emerging Customer Solutions and Engineering teams, a research team that included faculty members from the University of Calgary and the University of Alberta (NZERI), and Optiwatt, the EV charging solution provider.

## Timelines

The EV Smart Charging Pilot involved three phases, with each phase lasting approximately six months. Each phase, illustrated in Figure 1 below, concluded with a survey to track satisfaction and gain insights from participants.

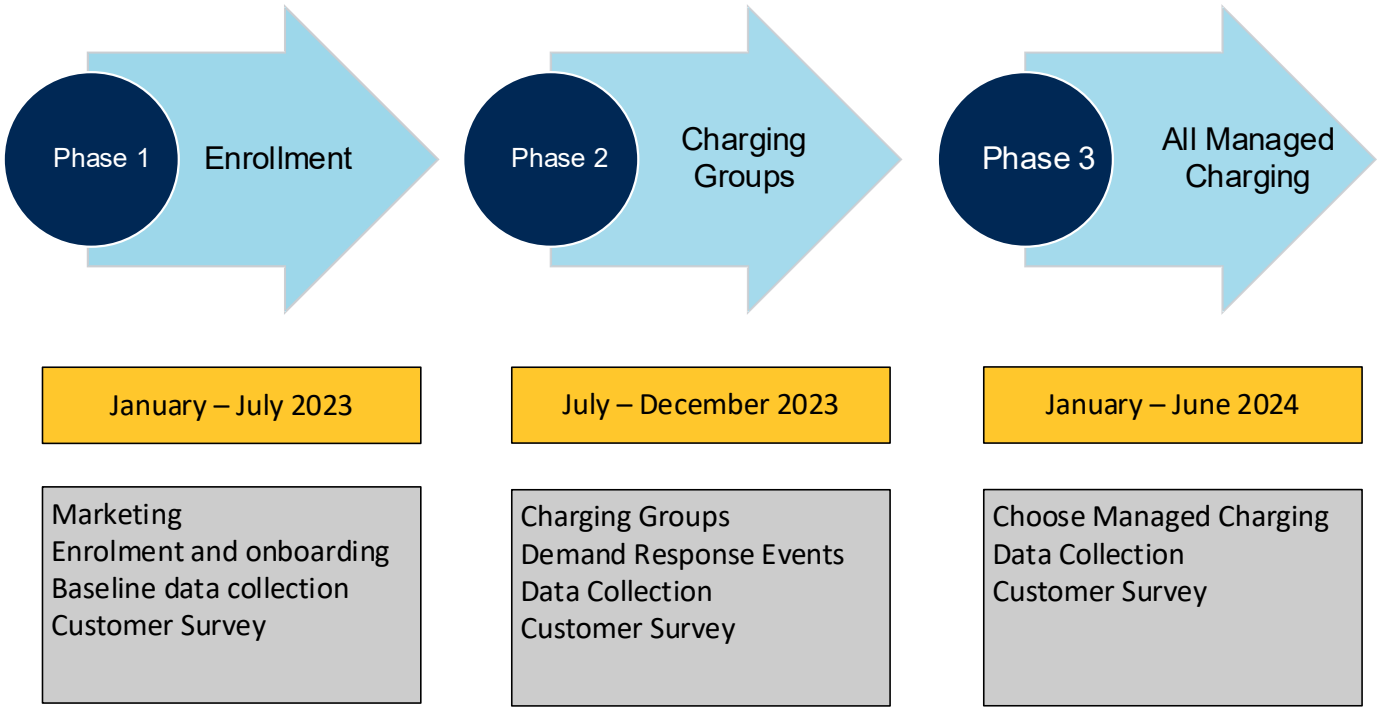



*Figure 1 Project Timelines*

## Phase 1 – Enrolment and Baseline Data Collection – January to July 2023

Phase 1 of the Pilot included the marketing campaign to potential participants, enroling and onboarding participants, and collecting baseline data. Participants enroled as Optiwatt users through the Optiwatt app and then were able to enrol in the Pilot from within the app. Baseline data was necessary to show how participants were charging their EVs before charging incentives were put in place. Participants were recruited through social media advertising, digital displays, press releases through news outlets, and affiliate advertising through businesses. The baseline data collected in Phase 1 was used in Phase 2 and Phase 3 of the Pilot to measure changes in participant charging behaviour.

## Phase 2 – Charging Groups – July to December 2023

In Phase 2, participants were assigned to three different charging groups at random.

> **Group 1:** Control group, where no additional instructions or incentives were provided to participants.

**Group 2:** Simulated TOU group where participants received a $/kWh incentive for charging at home during two incentive windows, from 10:00 a.m. to 2:00 p.m. and from 10:00 p.m. to 6:00 a.m.

**Group 3:** Managed Charging group where participants received the same $/kWh incentive to have their home charging managed by Optiwatt's charging algorithm. These participants used the Optiwatt app to set the battery percentage they required and the time they needed to leave each day (i.e. battery target of 80% and charged by 6 a.m.) Participants could opt-out of a managed charging session if they needed to have their vehicle charged as quickly as possible and did not receive a charging incentive for charging sessions where they opted-out.

## Virtual Transformer Groups

FortisAlberta has a large service area and currently EVs are fairly spread out. There are not many transformers with more than one EV connected to them and where it does occur, it is usually due to a household with more than one EV. To investigate the impact of transformers where every household has an EV, participants were randomly assigned to virtual transformer groups made up of 10 vehicles per transformer shown in Figure 2. The randomization included assigning the virtual transformer groups to one of the three charging groups, shown in Figure 3.

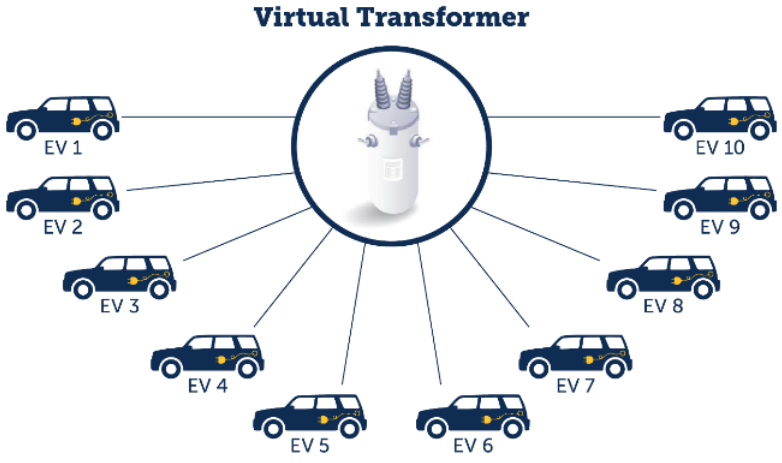



*Figure 2 Virtual Transformer*

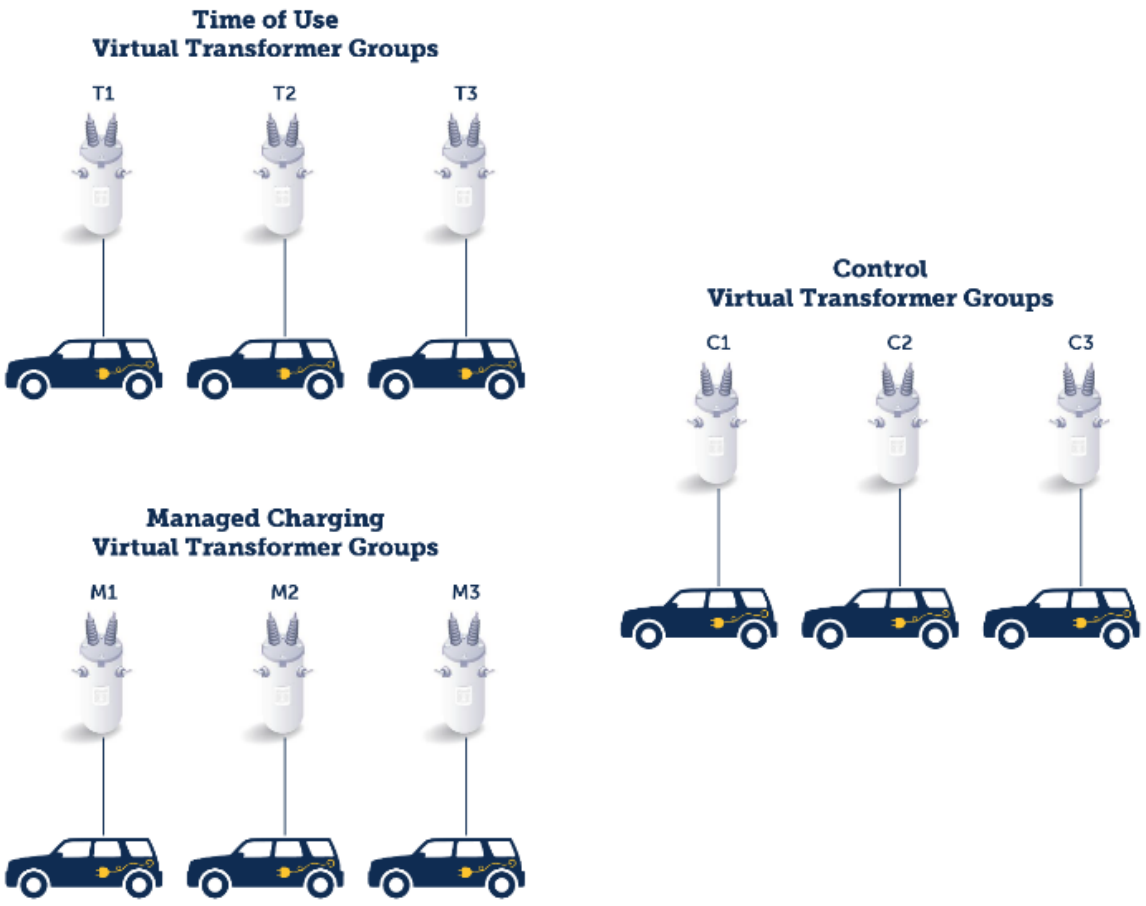



*Figure 3 Virtual Transformer Groups*

Figure 4, below, shows a graph of a typical daily electricity use from midnight to midnight.

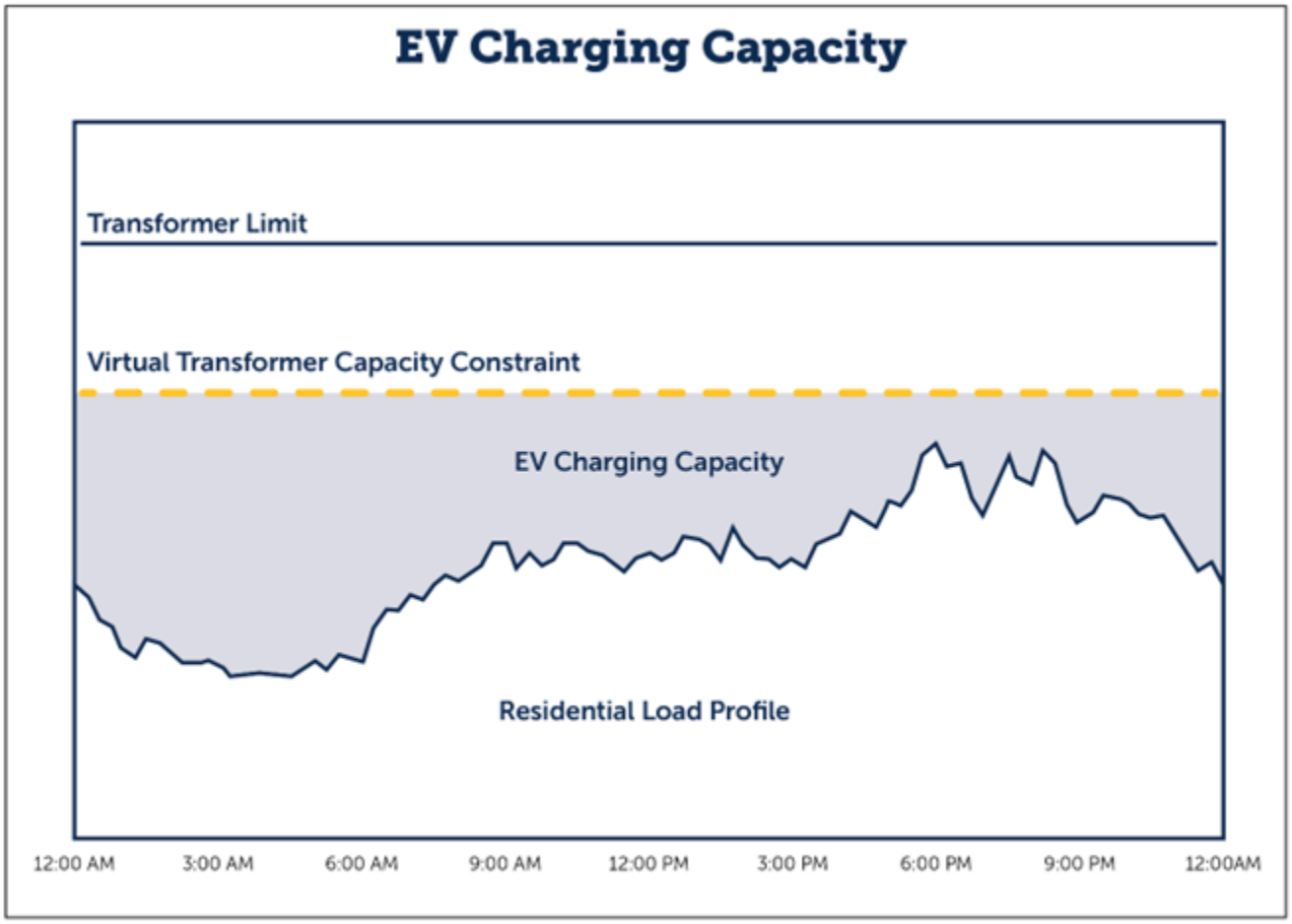



*Figure 4 Virtual Transformer Limit*

The white area in the graph labeled Residential Load Profile is the electricity use for 10 houses on one transformer and it changes throughout the day with a peak around 6:00 p.m. This area does not include EV charging. Above the Residential Load Profile is the grey area labeled EV Charging Capacity. This is EV charging electricity use. The dashed yellow line at the top of the EV Charging Capacity is the Virtual Transformer Limit. The electricity from adding the white section and the grey section must stay below the yellow dashed line. The managed charging algorithm adjusted charging automatically to make sure this happened. The blue transformer limit at the top of the graph shows what the real transformer limit would look like. The virtual transformer constraint was lower than this to create the conditions for EV charging to cross the yellow line, overloading the virtual transformer, thus testing that the managed charging algorithm would adjust EV charging to bring it back below the yellow line. The Pilot compared how many times the different charging groups crossed the yellow line.

Phase 2 also included six demand response events. Participants in the Managed Charging group and the TOU group were asked to stop their charging during a simulated time of high electricity demand and were given an incentive for participating. To test the difference in customer participation between opt-in demand response events and opt-out demand response events, TOU participants were given the option to opt-in by clicking a button and Managed Charging participants were automatically enroled and given the option to opt-out of the demand response events by clicking a button. The participation rates were assessed and compared between the groups.

### Phase 3 – All Managed Charging – January to June 2024

In Phase 3, participants had the option to choose managed charging. In Phase 2, participants were assigned to the control, TOU, and Managed Charging groups while in Phase 3, participants received a choice. They could continue participating in managed charging, switch to the managed charging group, or stop participating in the Pilot altogether and they were offered a randomly assigned one-time incentive as part of this. The same $/kWh charging incentive was used for managed charging in Phase 2 and Phase 3 and participants were randomly assigned to new transformer groupings under managed charging. Phase 3 followed all participants who chose managed charging, managing their EV charging based on the settings they had entered into the app. Phase 3 was to gain further insights into what factors influenced customers to choose managed charging.

## Results

### EV Charging Results

The Pilot results indicate that participants in both the TOU and managed charging groups were willing to adjust their EV charging behaviour, resulting in lowered EV charging during daily peak hours and, by extension, reduced stress on the grid. However, the TOU group results showed that EV charging started at the beginning of the incentive window and caused a new peak demand. In contrast, participants in the managed charging group had their charging managed so that collectively, their charging stayed under the virtual transformer limit while still ensuring EVs were charged as needed. This resulted in reduced charging peaks across every hour of the day. The differences in these charging patterns are highlighted in Figure 5 which shows the number of times charging went above the virtual transformer limit. Managed charging is shown in green, the TOU group is shown in blue, and the control group is shown in yellow.

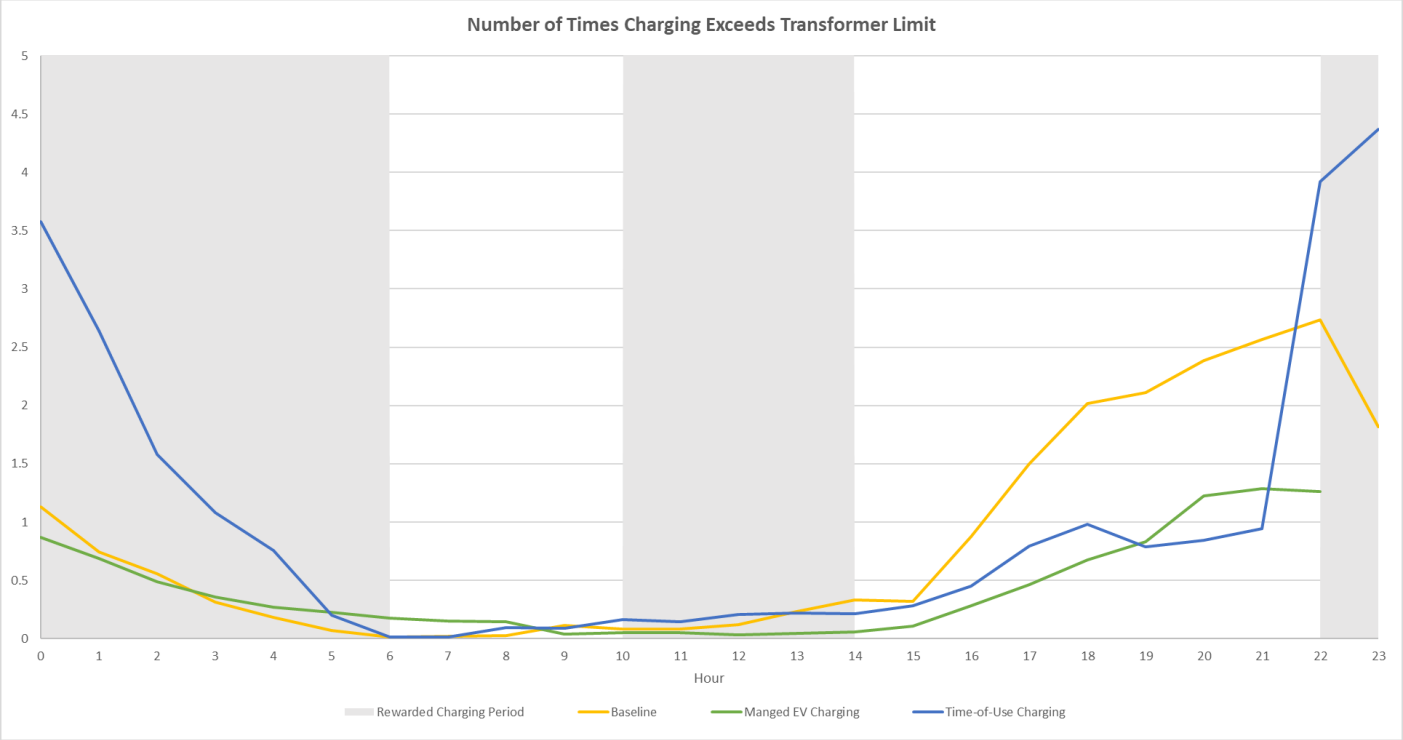



*Figure 5 Charging Results*

## Demand Response Results

Six demand response events were simulated in Phase 2. These events were communicated to participants using notifications in the Optiwatt app. Participants in the Managed Charging group had the opportunity to opt-out of an event by clicking a button (i.e. they were automatically enroled) and participants in the TOU group had the opportunity to opt-in to an event (they had to click a button to stop charging their vehicle). Participation in the demand response events for the opt-in group was consistently around 7% while participation for the opt-out group was consistently around 93%, shown in Figure 6 below. These participation rates suggest that making participation in demand response automatic will have higher participation rates than one that asks participants to take action to participate (i.e. click a button).

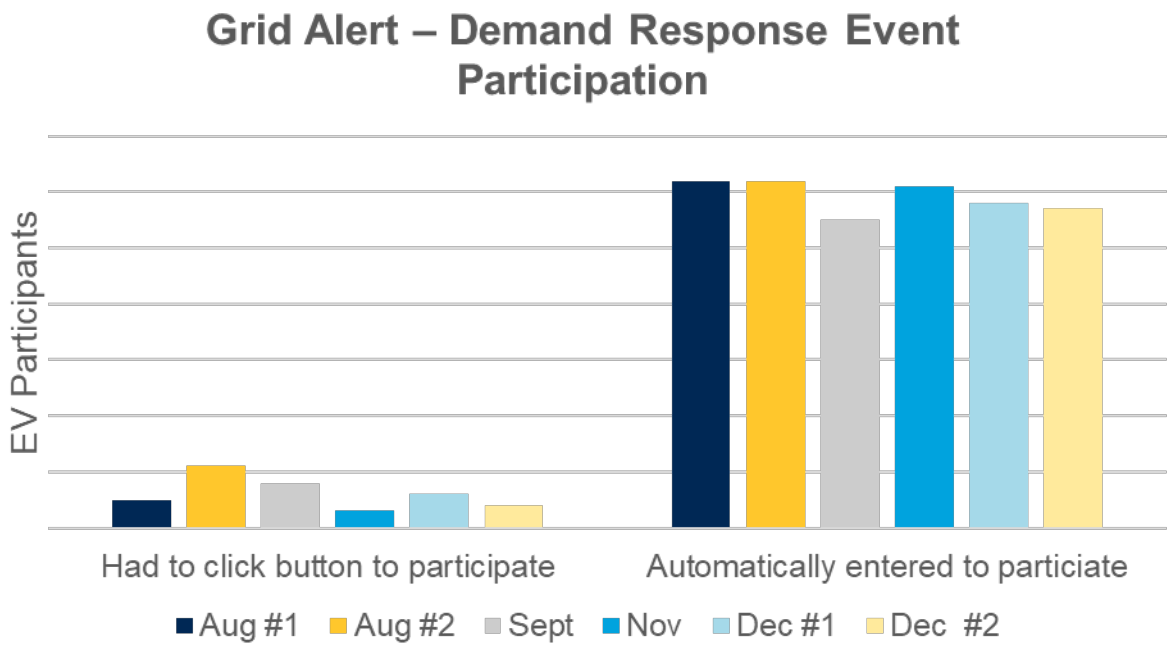



*Figure 6 2024 Demand Response Event Participation*

### Participant Satisfaction Results

Participant surveys were sent at the end of each phase and included a question on overall satisfaction with the pilot. Over the three surveys, participants reported an overall satisfaction of 4/5 stars.

Additionally, as mentioned earlier, participants in the Managed Charging group were able to opt-out of individual managed charging sessions if they wanted their vehicles to start charging immediately when they were plugged-in their EV. Participants chose to opt-out of managed charging sessions only 0.16% of the time. This supports the conclusion that participants were willing to rely on Optiwatt's algorithm to achieve the desired level of charging for their EVs by the time they needed their vehicle.

## Findings

The Pilot results indicate that TOU rates were effective at shifting EV charging outside of traditional peak times, but that, in so doing, have the potential to create a new EV charging-driven peak at the outset of the incentive time block. This outcome has the potential to drive system upgrades the TOU are intended to avoid or defer. On that basis, TOU rates should be paired with other DSM programs to reduce the new demand peak that can be created at the start of the

incentive window. FortisAlberta found that managed charging was an effective way to automatically reduce EV charging peaks while meeting participant's EV charging requirements. The use of managed charging has the potential to help reduce the need for infrastructure capacity upgrades and costs through optimization of the existing grid through charging management. The results of the Pilot also indicate that customers were willing to participate in demand response events and were more willing to participate when they were automatically enroled.

## Next Steps

FortisAlberta is using the findings from the Pilot to inform policy makers about DSM program opportunities in Alberta. Currently, Alberta is one of the only jurisdictions across North America without DSM programs enabled through the utility system or offered by a government entity. One of the DSM programs that FortisAlberta is evaluating is a long-term managed charging program. This evaluation looks at leading indicators including Alberta's EV registration rates and EV adoption projections to determine when a managed charging program will be more cost effective than traditional options to increase grid capacity.