



Startup

[ev.energy](https://www.ev.energy)



Host

[Ameren](https://www.ameren.com)

Technology Solution

According to the International Energy Agency, electric vehicle (EV) sales have been growing at a rate of 50% per year since 2013, and the Edison Electric Institute forecasts 20 million EVs on U.S. roads by 2030. EVs represent a significant opportunity for utilities to sell more electrons but could have grid impacts at high penetration. Unmanaged EV charging at peak can strain distribution networks, create resource inefficiencies, and increase costs for customers. Managed EV charging shifts EV loads to off-peak times or curtails them entirely during high-intensity events, providing utilities with a non-wires alternative for meeting charging needs. In addition, managed charging can schedule load to align with renewable generation and help customers to benefit from cheaper off-peak rates.

This pilot focused on testing ev.energy software as a telematics-based solution for helping utilities and their customers manage residential EV charging. The software platform connects wirelessly to compatible vehicles and L2 chargers to control charging via an algorithm that calculates the optimal charging schedule given inputs including current charge level, desired ready-by time, charge rate, forecast generation mix, wholesale price, network intensity, local feeder load, and/or the customer's rate schedule. Utilities can monitor EV loads and schedules on the back end, while a smartphone app allows the customer to connect their vehicle and/or charger, set a ready-by time, earn rewards for adhering to managed charging, override managed charging if needed, and track energy consumption, costs, and savings.

Challenge: E-Mobility



The ev.energy app was customized for this pilot

Project Overview

Through this collaborative pilot, Ameren sought to deploy ev.energy's managed charging software with its employees and interested customers within its service territories in Missouri and Illinois, consistent with both long- and near-term commitments. Notably, Ameren committed to net-zero carbon emissions by 2050 through \$8 billion of investment in wind and solar generation, and EVs provide a flexible source of demand for optimizing utilization of variable-output renewables. Also, Ameren's 5-year capital investment plan for grid modernization includes provisions for smart grid software and EV charging infrastructure.

Given the ongoing COVID-19 pandemic and related shelter-in-place restrictions, the pilot deployment was entirely remote. The ev.energy app was customized for Ameren, and EV drivers were given a link to download the app on their phone. Participants on-boarded over the course of a few weeks in June 2020,

enabling them to connect their Tesla vehicle to ev.energy’s platform, confirm their rate plan, and begin managed charging. Between July and September 2020, 40 Tesla vehicles had their charging managed for a period of 8 weeks. Two weeks were used for establishing a baseline, and the other 6 weeks were used to manage charging.

The 40 participating Teslas were divided into four 10-vehicle groups, each with charging optimized according to a different variable:

1. **Static time-of-use pricing:** shift EV charging to off-peak times under Ameren Missouri’s time-of-day rate plan
2. **Dynamic hourly pricing:** schedule EV charging for the lowest-priced hours in Ameren Illinois’ Power Smart Pricing program
3. **Low-carbon generation:** align charging with periods served by the least carbon-intensive supply mix on the MISO grid, drawing on generation forecasts
4. **Network intensity:** aggregate 10 Teslas into a virtual neighborhood drawing from the same 12kV feeder line and shift/curtail charging according to virtual load signals provided by Ameren’s Distributed Technologies team

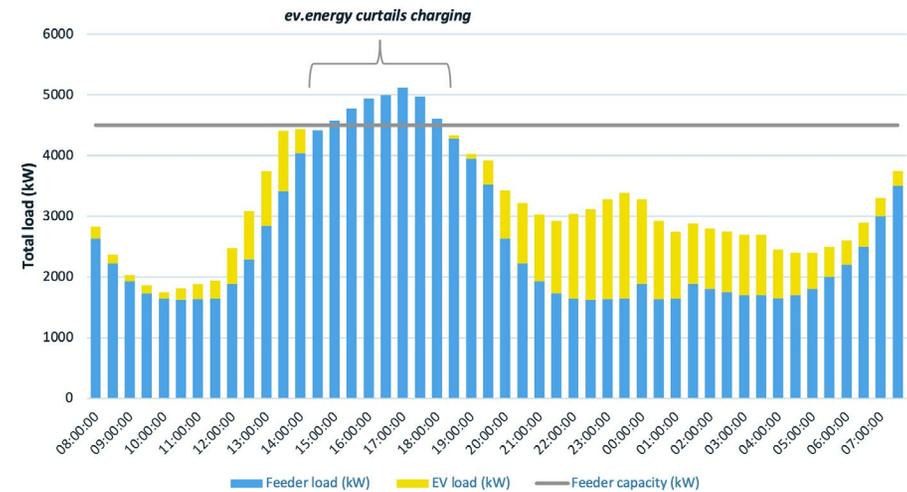
Participants in the first two groups were given the option of donating their accumulated savings to a charity of their choice. Those in the other two groups earned points for each managed charging session greater than 10 kWh, which they could also redeem in exchange for a donation to a chosen charity.

Results & Learnings

Comparing the 2 weeks of baselining data with the 6 weeks of managed charging data, ev.energy’s solution demonstrated the following benefits to Ameren and its customers:

- **Energy bill savings:** Missouri customers on time-of-day rates saved an average of \$11 per month on their EV charging, compared to the baselining period. This is largely due to the large price difference between the peak (30.5¢/kWh) and off-peak (7.2¢/kWh) prices; ev.energy shifted 80% of unmanaged EV load to off-peak times. Illinois EV drivers enrolled in the Power Smart Pricing program saved an average of \$3 per month. Though ev.energy was able to schedule 90% of EV loads to the lowest-priced hours, the smaller differential between the higher-priced (~4¢/kWh) and lower-priced hours (~2¢/kWh) did not result in significant savings.
- **Reduced carbon emissions:** By drawing on a live application programming interface displaying MISO’s regional generation forecast, ev.energy was able to align EV charging schedules to periods of lower-carbon generation, which tend to be overnight due to lower demand and sizable installed wind capacity. The carbon intensity of the electricity delivered to customer EVs, measured in lbs CO₂/kWh, was reduced by 20%. This cut the average EV driver’s total emissions from EV charging by 112 lbs CO₂ per month. Even greater emission reductions are possible for EVs charged by grids with larger daily variations in carbon intensity, such as CAISO.
- **Reduced feeder loading:** Using virtual loading data from a 12kV feeder line, ev.energy’s algorithm overlaid real EV charging demand and shifted and

Simulated thermal constraint event: Aug 26, 4pm-8pm



Modeling demonstrated curtailment of EV charging at times of high feeder loading

curtailed EV loads to prevent the line from exceeding its upper limit. Over the course of the 6 weeks of managed charging, 40 potential thermal constraints were avoided by either delaying the start of charging sessions or curtailing sessions already in progress, as shown in the figure above. This test demonstrated the viability of the ev.energy solution as a non-wires alternative.

Implications & Next Steps

This successful pilot has three key implications. First, telematics can serve as a cost-efficient and scalable way for utilities to manage EV charging. Drawing on smart phones and the intelligence embedded in vehicles and chargers, this approach requires no additional hardware but provides utilities with a high degree of control over EV loads. It reduces costs for both the utility and the customer, and it can be deployed remotely and scaled up quickly. Second, user-friendly apps and rewards programs can be





Managed charging benefits customers and the grid

effective in helping customers reduce their energy bills, track consumption and savings, meet environmental goals, and adhere to managed EV charging through gamification and rewards.

Third, the benefits of managed charging are not mutually exclusive and can instead be stacked to deliver multiple sources of value for a utility and its customers. For example, given that bill savings and low-carbon generation align in the overnight hours in MISO and other regions, load shifting to off-peak periods can provide a cost-effective non-wires alternative while delivering a cheaper and greener charge to customers.

As a next step, Ameren continues to support grid integration of renewable generation. In parallel, ev.energy is continuing to expand its range of vehicle and charger integrations, to build new features for EV drivers and managed charging programs, and to explore additional partnerships with U.S. utilities.

TESTIMONIAL: ev.energy

We're glad that our software solution was able to be deployed remotely to customers despite the ongoing COVID-19 pandemic. The opportunity to work with Ameren to deliver managed charging to EV drivers across two states was a great way to prove the value of our solution for reducing costs for customers and utilities.

TESTIMONIAL: Ameren

Ameren is proactively preparing for increased adoption of EVs and renewables across the communities we serve and is always looking for ways to help our customers reduce their energy costs and carbon footprints. We were impressed with the bill savings and emission reductions some of our customers realized by using the ev.energy app, and we are looking forward to making the benefits of managed charging programs available to our customers as soon as is practical.

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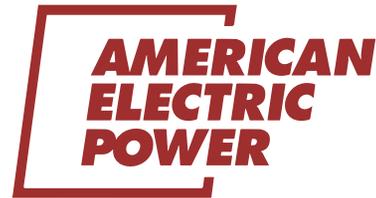
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