

Member Advisory Electric Vehicle Market Potential

Will Electric Vehicles Take Charge in Co-op Nation?

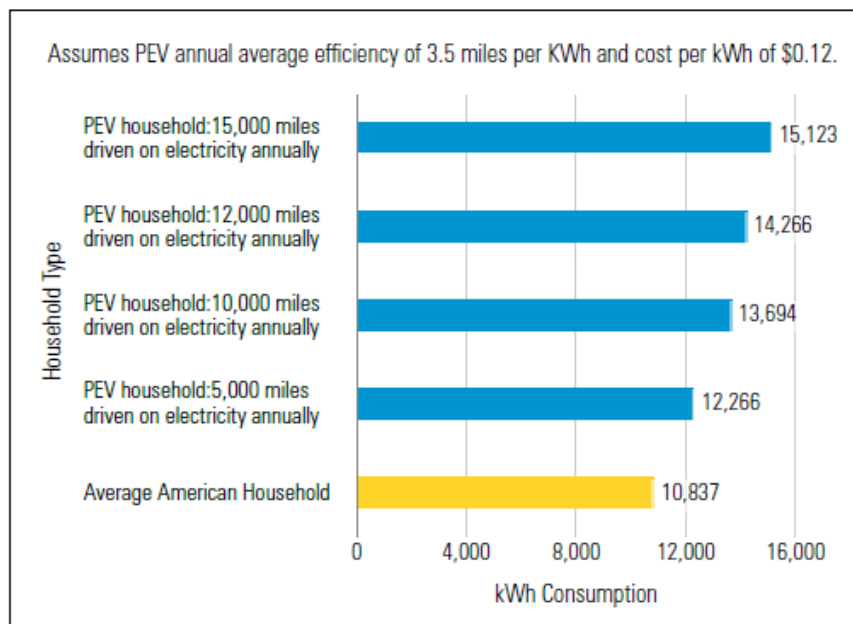
What has changed?

Electric vehicle (EV) announcements are appearing almost daily as jockeying among EV manufacturers is at an all-time fevered pitch. This coupled with actions by local and national governments around the world to restrict the use of gas and diesel powered vehicles may eventually accelerate the adoption of EVs in the United States. A trend to alternatives to gas and diesel will present potential costs and benefits to electric cooperatives. If managed properly, growth in the electric vehicle market can present a financial win for both vehicle owners and cooperatives. As America's Electric Cooperatives meet this month at NRECA's Annual Meeting and TechAdvantage® conference, and consider the new resolution on electrification¹ which included transportation conversion to electricity, we wanted to put a focus on the EV marketplace.

What is the impact on cooperatives?

According to the Energy Information Administration (EIA), the average American household consumes 10,837 kWh of electricity annually. As shown in Figure 1, co-ops can expect a 13 to 40 percent increase in electricity consumption among households that own an EV – a nice increase to offset flat, if not decreasing, electricity sales in parts of the country. Annual mileage driven is the key variable influencing overall energy consumption. A survey of 2,039 EV drivers found that, on average, survey participants drove 28.9 miles per day or 10,548 miles annually; the average annual vehicle miles travelled for all light-duty vehicles is 11,318.

Figure 1: Average Annual kWh of Grid Electricity Consumed per Household Type.



Source: EIA DETAILS

¹ The resolution is titled *Promoting the Benefits of End-Use Electrification*.

This predicted increase in household electricity consumption is consistent with what utilities are seeing in early adopter markets. For example, Seattle City Light in Washington State, which serves the third-largest EV market in the nation, advises customers that their electric consumption will increase by about 30 percent when making the switch to fueling with electricity.

What do cooperatives need to know about it?

Many electric cooperatives around the country are facing stagnant load growth and decreasing revenues due to changing consumer behavior, energy efficiency, and distributed generation. At the same time, the costs of maintaining a functioning grid remain constant, which increases the pressure on the co-op obligation to provide safe and reliable electricity at an affordable rate. EVs represent a unique opportunity for co-ops to grow load in a way that has social and environmental benefits.

Because of this load growth opportunity, some utilities around the country are beginning to promote transportation electrification. However, a common concern among electricity providers is that load growth from EVs will stress distribution systems or result in additional marginal generation costs. Many electricity providers are not actively promoting EVs because of these uncertainties along with concerns about the future of federal and state tax credits, fuel efficiency standards, competing technologies, and driver perceptions about EVs. However, in the face of those potential challenges, cooperatives are uniquely positioned to evaluate methods to mitigate any system impact through pricing, program design (water heater controls), and other technology deployment, were such to materialize.

Electric Vehicle Growth Predictions

Predicting how many electric vehicles will be sold in the United States is at best an educated guess. The experts do not agree and their estimates vary widely. Most automotive analysts seem to predict EVs as a percentage of total car sales in the United States to be somewhere between 5 percent and 20 percent of new car sales by the year 2025. The number trends higher when the discussion is about global new car sales.

Much has been made in the media of high profile proclamations from auto manufacturers and some governments that appear to predict the death of gas and diesel powered cars. The mayors of Paris, Mexico City, Madrid, and Athens have announced plans to ban all diesel-powered vehicles from entering their cities by roughly the year 2025.² The bans often face criticism from residents and may ultimately never be enforced. However, nations such as India, Netherlands, Germany, and Britain are moving to encourage the adoption of alternative fueled vehicles.³ In September 2017, the Chinese government announced that manufacturers that sell more than 30,000 vehicles in the country will need to comply with rules mandating that 10 percent of

² <https://www.autoblog.com/2016/12/05/paris-mexico-city-lead-diesel-vehicle-ban-2025/>

³ <https://www.nbcnews.com/business/autos/these-countries-want-ban-all-vehicles-run-gas-or-diesel-n781431>

vehicles sales need to be electric.⁴ Even though some of the above announcements may not be realistic in timeline and/or not fully enforceable, they nevertheless have the impact of enabling increased consideration of electric transportation by both automobile manufacturers and consumers.

Electric vehicle sales are expected to grow internationally and domestically. According to IHS Markit, EVs as a percent of global new car production will reach 33 percent by 2025. Plug-in hybrids (PHEV) accounts for the lion share of this with 29 percent. In North America, they predict 20 percent of new car production will be electric in this time frame, with PHEVs accounting for 15 percent.⁵

A similar prediction is presented by the consulting firm UBS Securities LLC. UBS predicts that 30 percent of global new car sales will be EV by 2025, though just 5 percent of new cars sales will be EV in the United States in that timeframe.⁶

Morgan Stanley looks at three possible scenarios. It predicts that 2025 could be a turning point for EVs. In its base case, it predicts that EVs will constitute 10 percent of new car sales in 2025, grow to 30 percent in 2035, and reach 70 percent in 2049. It also prepared a more aggressive scenario putting EVs at 90 percent of new car sales by 2045. However, it also presented a bearish model that saw EVs at or below 10 percent of new car sales for the foreseeable future.⁷

The reason for the drastic differences in models is somewhat simple. The cost to manufacture an electric vehicle today is substantially higher than the production cost of conventional vehicles. The disparity in the models reflects the differing views among analysts with regard to how quickly production costs will fall. Electric vehicles are a disruptive technology, and as such, it is difficult to gauge how successfully they will be and how quickly.

Some analysts believe that investments being made by companies such as Tesla and Volkswagen will lead to a significant reduction in cost of the battery. According to UBS, the battery makes up 76 percent of the cost of the powertrain. An 80 percent reduction in battery costs would bring the cost of the EV powertrain to rough parity with the production cost of the internal combustion engine.⁸

If costs do not fall and government mandates are not enacted then it is possible that electric drive vehicles will remain a niche product, more prevalent among high end cars, performance vehicles, and fleets.

⁴ <http://www.dw.com/en/china-sets-new-deadline-for-electric-car-quota/a-40719095>

⁵ <http://www.cargroup.org/wp-content/uploads/2017/08/Robinet.pdf>

⁶ <http://www.cargroup.org/wp-content/uploads/2017/08/Langan.pdf>

⁷ <https://electrek.co/2017/05/05/electric-vehicle-sales-vs-gas-2040/#jp-carousel-43397>

⁸ <http://www.cargroup.org/wp-content/uploads/2017/08/Langan.pdf>

What Does the Car Buyer Want?

A majority of U.S. car buyers say they are poorly informed about electric vehicles and they perceive significant shortcomings. According to a 2016 survey conducted by Altman Vilandrie & Company:

- 83 percent believe EVs cost too much
- 85 percent believe EV charging infrastructure is inadequate
- 74 percent believe charging takes too long⁹

In 2017, NRECA's Business & Technology Strategies Department – as part of its Regional Centers program - partnered with Poudre Valley Rural Electric Cooperative, the utility consulting firm ESource, and 23 other utilities in a new, multi-year initiative to learn about how design thinking can help utilities better serve their communities. The project covers a variety of topics of interest to staff at Poudre Valley. *Design thinking* is an approach that combines observations of customers' activities and engaging discussions to develop products, services, and experiences that address consumers' emotional needs. This allows companies of all types to create better products, better user experience, and better customer satisfaction.

This design thinking project includes in-depth interviews with Poudre Valley members and consumers of the other participating utilities. In this project, it turned out that one of the topics that consumers want to talk about is electric vehicles and the role of the utility.

Three themes related to electric vehicles emerged from this project. These themes are based on research from across the country and can be considered representative of a national audience and not that of a particular co-op. The themes are:

1. Purchasing EVs is a smart decision, both short- and long-term
2. Existing owners embrace their role as EV advocates
3. There is an opportunity for co-ops to lead

A smart decision, both short- and long-term

Currently, a federal tax credit of \$7,500 is available to EV buyers. The tax credit has had a positive effect on EV sales, but is set to expire when an auto maker reaches 200,000 vehicles sold. Companies such as Tesla, Nissan, and Chevy are approaching that mark. Some analysts believe that once the credit expires, there will be a decline in the number of middle class consumers purchasing the vehicles. When the state of Georgia eliminated a state EV tax credit in July of 2015, a sharp decline in EV sales

⁹ <http://www.businesswire.com/news/home/20161208005809/en/High-Costs-Lack-Awareness-Threaten-Short-Electric>

followed. Higher end Tesla sales have since rebounded, but cars like the Nissan Leaf, targeted for middle class consumers, did not.

Long-term financial savings can be realized by EV owners. According to the ESource surveys, owners are pleasantly surprised by the low cost of operating their electric vehicle. Depending upon the type of EV and owner habits, stops at the gas station can be greatly reduced or eliminated. While costs vary, in general it is cheaper to “fuel” a vehicle on electricity than gasoline. EV owners also save on maintenance costs compared to traditional gas vehicles. According to Langan, cars such as the Chevy Bolt have 60 percent lower maintenance costs than comparable gas powered cars.¹⁰ Lower maintenance costs could have a negative impact on local repair shops and car dealers. While anecdotal evidence exists that some dealers guide people away from EVs and toward traditional cars, this could be because the gas powered car is truly right for that prospective buyer’s lifestyle and not because of potential loss of business due to reduced maintenance costs of EVs. At any rate, the co-op is in a good position to explain the benefits of electricity powered transportation, and offer ways to maximize savings through off peak charging of EVs.

However, the nationwide focus groups in the ESource project identified value beyond the wallet to participating cooperative’s member-consumers. Electric vehicle owners are not solely motivated by economics. They are reported to love the fact that they are actively reducing their carbon footprint and using a technology that is better for the environment. For them, owning an electric vehicle is a “win-win” proposition. Many electric vehicle owners also own (or are seeking to purchase) solar panels or use public solar power charging stations. This suggests that co-ops with community solar projects have an opportunity to promote those programs to EV owners or prospective owners, and vice versa.

Existing owners embrace their role as EV advocates

Results from the utility focus groups suggest that electric vehicle owners feel they are on the early end of a broader movement, and love to discuss their vehicles with other owners and non-owners. Discussions happen online, with friends and family at get-togethers, and also while charging the vehicle at public charging stations. Often, electric vehicle owners see their role as a “guide” in helping others mitigate typical EV anxieties. Most frequently, this means mitigating *range anxiety* (the fear of being stuck without a charge) and *power anxiety* (the fear of the car having weak performance relative to gas vehicles).

Co-ops can work with these early adopters to demonstrate the real-world potential of EVs. This is an opportunity for proactive member engagement and leadership.

Several electric vehicle owners shared similar power concerns heading into their purchase... “Is this going to drive like a golf cart?”... “Will this have enough power?”

¹⁰ <http://www.cargroup.org/wp-content/uploads/2017/08/Langan.pdf>

However, these owners reported that such concerns were allayed once they drove an EV, won over by the torque, speed, and nimble handling of the vehicle.

Opportunity for co-ops to lead

The focus groups revealed another opportunity for the utility – help in acquiring a home-based charging station. Expert information, rebates, discounts, financing, and installation were cited as ways a utility can provide value to EV owners.

Focus group participants suggested that utilities have a business opportunity in the leasing of residential chargers. Such a program could be modeled after co-op dusk-to-dawn lighting programs. Co-ops could charge a small monthly fee plus the energy consumed to the consumer each month. The program could also enroll the member in the co-op's demand response program and ensure that the vehicle is charged off-peak.

In general, utilities have an opportunity to be leaders in expanding the charging network – at home, work or public - and aiding adoption of EVs to the benefit of cooperative, the community and the individual member-consumers.

Potential Impacts to the Co-op

Ultimately, the impact to a co-op will depend on how many electric vehicles are charging within the service territory, where they charge, and when they charge. A recent survey of more than 1,000 American EV drivers found that 81 percent of charging takes place at home.

In all likelihood, urban and suburban areas will see the greatest penetrations of electric vehicles. This will be driven mostly by commuting patterns and income. Rural and lower income areas will see electric vehicle adoption levels low for the foreseeable future. CoBank, in a recent paper on electric vehicles and rural areas, reaches similar conclusions from analyzing EV costs and adoption trends.

The NRECA Business and Technology Strategies report [Managing the Financial and Grid Impacts of Plug-In Electric Vehicles](#) goes into detail on what could be expected from a technical perspective. From a detailed analysis, this report concludes that co-ops need to manage the timing of EV charging and track geographical EV penetration to avoid negative financial and grid impacts. Further, as EV penetration increases, "EV clusters" can form which could have the potential to overload transformers and can result in accelerated transformer aging. This is another reason to manage EV charging both temporally and spatially.

Figure 2 shows the distribution of vehicle locations throughout the week, based on data from the 2001 National Household Travel Survey. This infographic further enforces the preference for residential charging and the likelihood that distribution grid impacts will be seen in residential areas due to increased electricity needs at the household level.

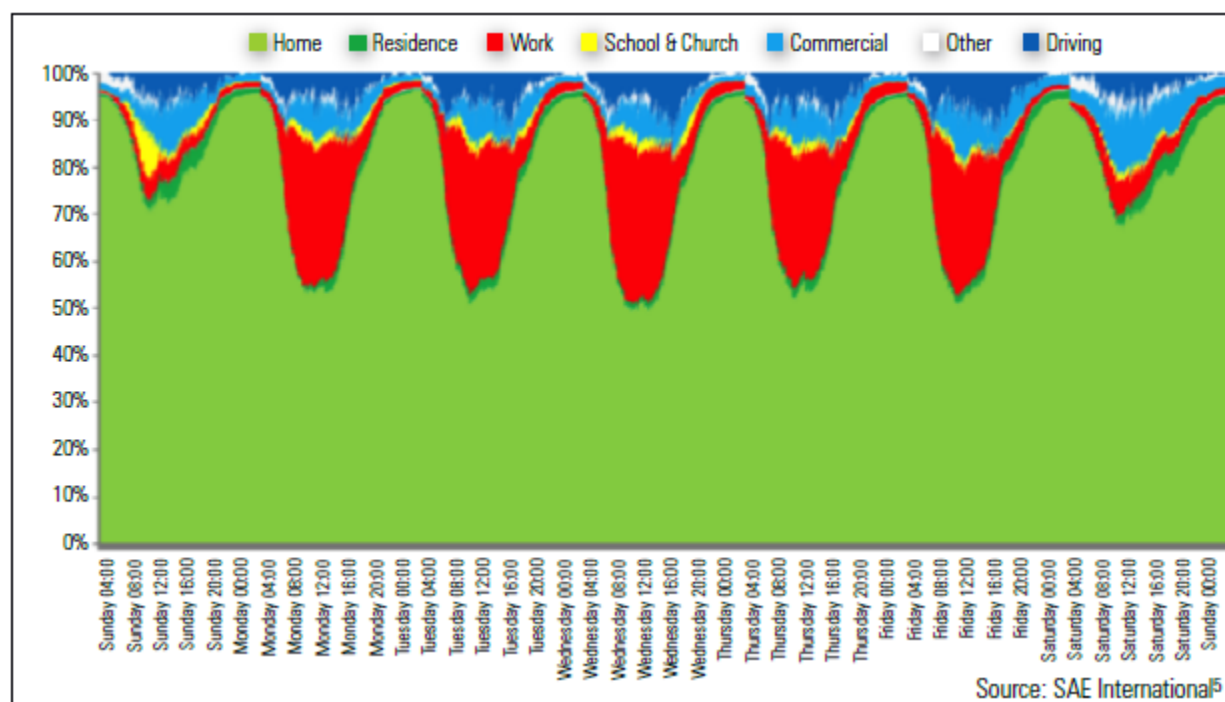


Figure 2: Car Location Over a Typical Week

This graphic also helps explain why EV load is often referred to as “malleable” or “moveable.” Unlike air conditioners or lights, consumers typically do not care when energy is flowing into their EV battery, as long as the battery is full when they next want to drive. If an EV driver returns home at 6:00 p.m. and leaves the next day for work at 7:00 a.m., that provides a 13-hour window for charging a battery that will likely only take three to eight hours to charge. The graphic also demonstrates that emphasis should be placed on home and workplace charging.

Many non-EV owners have range anxiety. This is a concern that an EV does not have the ability to perform normal trips and return home on a single charge. The 2009 National Household Travel Survey created by the U.S. Department of Transportation shows that the average urban driver travels 23 miles per day. The average rural driver travels an average of 34.1 miles per day.¹¹ It is interesting to note that the averages have not varied significantly since 1995.

Financial benefits to co-ops from an increase in the EV load may include the following:

- **Increased Revenue:** At the median residential rate of 12 cents per kilowatt-hour, co-ops could expect to collect between \$340 and \$515 as additional revenue per year from all-electric EV owners. Revenue increases vary depending on electricity prices, the model of EV end-users purchase, and the annual mileage of the EV.

¹¹ <http://nhts.ornl.gov/2009/pub/stt.pdf>

- **Highly Malleable Load:** Co-ops can influence when and where EV load affects their systems, reaping the benefits of additional revenue while minimizing or avoiding the need to pay for additional generation capacity or distribution infrastructure upgrades.
- **Load Can Offset Financial Losses from Solar:** Members who own both an EV and a solar electric system use the same amount of grid electricity as the average member without either of them.
- **Politically and Environmentally Accepted Form of New Load:** Electrification of the transportation sector results in a reduction in greenhouse gas emissions, and will be viewed favorably by a significant portion of the public.
- **Opportunity for Member Engagement:** Working with members to ensure off-peak charging can help members save additional money. EVs also represent an opportunity for the co-op to work with employers in the service territory to establish workplace charging programs.
- **Long-Term Load Growth Opportunity:** Although EVs do not present a quick fix to the financial challenges many electricity providers face today, a growing number of utilities are putting time and resources into accelerating EV adoption now in the hopes that EVs will provide a boost to finances down the line.

At the localized level, distribution infrastructure is typically sized to meet current peak electricity needs. EVs, if charged during peak periods, could strain the local distribution systems and accelerate infrastructure investment. The electric vehicle service equipment (EVSE) level used for charging is a critical factor. Charging capacity is determined by circuit voltage (volts) and the level of electric current (amps). Peak charging loads commonly range from 1.4 kW to 6.6 kW, but can be much higher if fast charging is employed.

Programs that encourage off-peak charging of EVs can reduce or eliminate negative impacts on the distribution system. This makes early engagement with EV owners vital to influence their EV charging patterns.

The Road Forward

For electric vehicles to gain acceptance and market share, consumers need more sources of balanced information on EV capabilities and relative affordability. Co-ops have several options to consider in the context of their role as trusted energy advisors. These include:

1. Monitor the development of the technology and possible impacts that EVs could have on the distribution system. Most available studies have shown that there is a clear benefit to the distribution system and a financial benefit to the vehicle owner to encourage off-peak charging.

2. Monitor the adoption patterns within and around the service territory. Early adopters are most likely those currently driving hybrids or luxury SUVs or performance sedan. The luxury SUV and performance sedan segments are likely segments for conversion to electric.
3. Educate consumers on their residential charging options in terms of equipment and rate structures.
4. Consider adopting an EV rate to encourage off-peak charging and increase potential savings to the member while limiting negative impact to distribution equipment.
5. Work with local employers on strategic charging station deployments at workplaces and key shopping and dining centers.
6. Offer financing options for consumers purchasing electric vehicle supply equipment.
7. Consider new business models that would have the cooperative own and maintain residential chargers for a nominal fee.
8. Consider offering rebates to members interested in purchasing an EV.

Surveys show that a person who drives an electric car often falls in love with the car and becomes an advocate. The cars perform well from a noise and performance perspective. Co-op sponsored ride-alongs or track days can go a long way in educating the public about the vehicles – and provide co-ops a new way to engage with members.

Additional Resources

- [Managing the Financial and Grid Impacts of Plug-In Electric Vehicles](#)
- [Keys to Developing a PEV Program For Your Electric Cooperative](#)
- [Electric Vehicle Resource Page](#)
- [US Department of Energy Alternative Fuels Data Center Incentives Database](#)

Contact for Questions

Brian Sloboda, Program and Product Line Manager-Energy Utilization/Delivery/Energy Efficiency, brian.sloboda@nreca.coop