Business & Technology Strategies

TechSurveillance

Rate Options That Support Electric Vehicle Adoption

BY **TOM TATE**
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SUBJECT MATTER EXPERT FOR QUESTIONS ON THIS TOPIC

Allison Hamilton, Senior Principal – Markets & Rates: *Allison.Hamilton@nreca.coop*

INTRODUCTION

The wise use of electricity, *Beneficial Electrification*, has sparked widespread re-thinking of policies that encourage or mandate less electricity use and promote infrastructure planning. Advancements in electric technologies continue to create new opportunities to use electricity as a substitute for on-site fossil fuels like natural gas, propane, gasoline, and fuel oil, with increased efficiency and control. It also offers local economic development and enhances the quality of the product used by the customer.

Electrifying common processes is a proven method to help local businesses stay competitive. Beneficial electrification strengthens the cooperative presence in the community and offers benefits to the electric system. Electric vehicles fall in the category of beneficial electrification and can have important impacts for cooperatives in terms of load growth and future application as distributed energy resources. The proper rate design will allow co-ops to encourage and manage EV adoption and charging impacts on the distribution system.

NRECA
America's Electric Cooperatives

ARTICLE SNAPSHOT:

Consumer perceptions regarding electric vehicles (EV) are rapidly changing as the technology evolves and many existing barriers to adoption diminish. Wider availability of sales and service outlets, increased range, lower prices, and a steady growth of charging stations are making the EV a better solution for many consumers. As a result, cooperatives in areas of significant EV adoption may want to consider creating rates that incent members to charge their EVs in ways that align with the strategy of the cooperative when it comes to managing and reducing peak demand. In service areas with flat or declining kWh growth, an influx of EVs can benefit the cooperative in terms of new revenue.

According to a recent CoBank report looking at the trends in EV market penetration, the greatest impact will remain in urban and suburban areas. Cooperatives with service areas that encompass suburban/urban areas and tourist destinations could see the most growth in EV ownership on their lines.

This report should be of interest to any cooperative whose service areas include the types of areas experiencing the largest growth in EV adoption. Cooperatives in predominantly rural areas may find the report of interest as well, as a means of keeping pace with the evolution of electric transportation alternatives and the potential benefits of EV adoption in their service areas.

What has Changed?

There is an interesting corollary between the modern incarnation of the EV and the original that dominated the automotive market until the advent of the mass produced, affordable, gasoline powered alternative. In those days, the EVs were limited to cities because rural areas lacked electricity. Today, rural electrification has delivered electricity to all corners of the country, but the EV owner is still somewhat confined to larger, more affluent population centers, in large part due to the higher vehicle price tag and lack of government incentives.

Aside from the barriers of vehicle cost, availability, and service, for some consumers one of the obstacles to adoption of the technology has been range anxiety, the fear that the vehicle simply will not have the range necessary to go places and do the things the consumer expects to do in a vehicle. Pure EVs are limited in terms of range. A comparison tool available from the DOE[1] lists 51 all-electric cars, model years 2017–2019. The combined city/highway mileage ranges run from a high of 136 miles to a low of 72 miles. A variety of factors impact range including use in mountainous versus flat terrain, and the impact of hot and cold weather when ancillary heating and cooling systems are used. The vehicle manufacturers will often post higher per charge ranges. In a U.S. News and World Report article,[2] the top 10 ranges in 2017 were from 84 to 335 miles per charge.

Hybrids resolve the range anxiety nicely, but EV "purists" who want an all-electric option are still limited in many respects. As the technology evolves and education about the technology improves consumer understanding and comfort, range anxiety should subside. Surveys show

[1] https://fueleconomy.gov/feg/PowerSearch.do?action=noform&path=1&year1=2017&year2=2019&vtype=Electric&pageno=1&sortBy=Comb&tabView=0&rowLimit=50

[2] https://cars.usnews.com/cars-trucks/electric-cars-with-the-longest-range

that a lack of awareness remains one of the highest barriers to EV adoption.[3] For more on this topic, see our related advisory: **Alleviating Misconceptions about Electric Vehicles**.

Price can also be a barrier. Typically, in a normal product life cycle, after the early adoption phase turns into wider acceptance and market maturity, prices decline and availability/service expands. Eventually, electric vehicles may become a viable option for many car buyers.

Auto manufacturers are taking note and, according to James Dunckley of EPRI, there will be 32 EV models on the market in 2019, and he predicts that there will be an EV alternative for every driving need in the near future.[4] To underscore the extent to which manufacturers are targeting every transportation need, Tesla and others are introducing a semi[5] for freight hauling — an all-electric 18-wheeler.

Further, the Edison Electric Institute (EEI) forecasts that there will be 7 million[6] EVs on the roads by 2025, up from 567,000 in 2016. As a result, an emphasis will have to be placed on installation of residential, workplace, and strategically located public charging stations to provide the 5 million charge ports needed for this surge in EVs on the road. This alone represents a significant infrastructure investment. For information on possible programs that co-ops could explore to support the availability of electric vehicle supply equipment (EVSE), see our related *TechSurveillance* article *Gearing Up for Electric Vehicles: Residential EVSE Program Design for Co-ops* on **cooperative.com**.

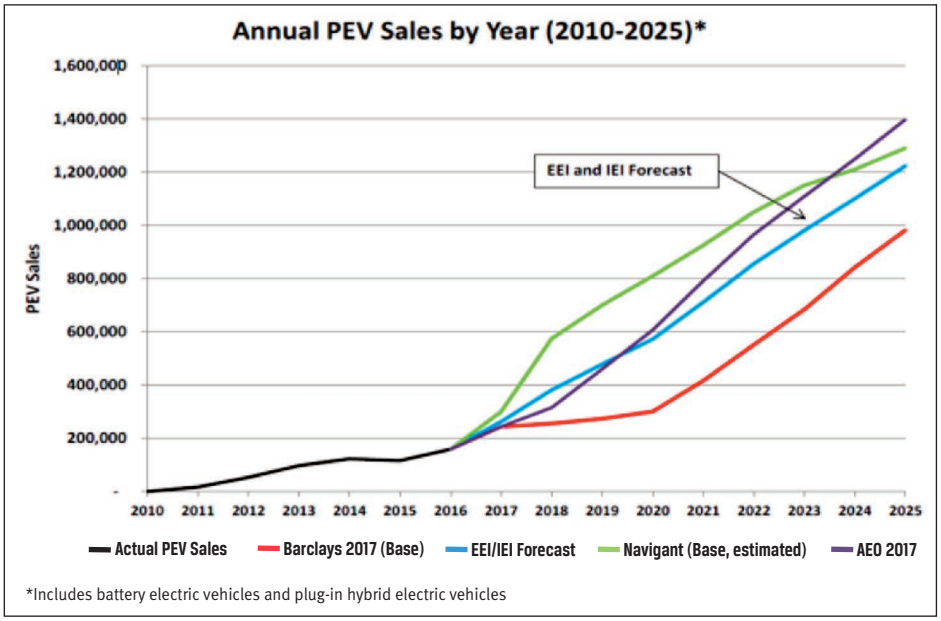

FIGURE 1: EEI/IEI Annual PEV Sales Forecast Compared to Selected Forecasts[7]

Figure 1 is from a joint EEI/IEI report and shows the rate of sales growth through 2025. Its numbers include all-electric and hybrid vehicles.

What is the impact on cooperatives?

In short, EV charging and increased load. What makes chargers an important consideration for cooperatives? Distribution system impacts, local power quality, member satisfaction, peak load issues, and potential sources of new revenue are the key reasons why co-ops need to be ready for chargers showing up on their lines.

[3] http://www.cargroup.org/wp-content/uploads/2018/02/The-Great-Divide-What-Consumers-Are-Buying-vs-The-Investments-Automake....pdf

[4] https://www.utilitydive.com/news/time-of-use-rates-can-manage-ev-charging-new-report-says/515284

[5] https://www.tesla.com/semi

[6] https://www.utilitydive.com/news/eei-7-million-electric-vehicles-could-hit-the-road-by-2025/446141

[7] http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20(2).pdf

Like any new load, a charger can have a negative impact on local distribution infrastructure. Transformers may not be sized to handle the new load and protection schemes may need to be adjusted. Excessive power draw at peak times can create power quality issues, such as dimming lights and related electrical supply quality characteristics. When members plug their vehicles into a Level 2 charger or faster during periods of peak demand, they increase the demand, negate the effects of other load management and demand response programs, and can lead to higher energy supply costs. Even operating a Level 1 charger that draws 1.4 kW can impact load management/demand response initiatives.

Member satisfaction can also be impacted. The EV owner may become dissatisfied if there are hurdles to charger installation and if local distribution facilities are not able to handle the load properly, creating issues for the charge process. Members adjacent to the EV owner may also become dissatisfied if their power quality suffers.

These are the immediate issues related to the growth of EV chargers in a co-op's service territory. In the long run, however, rates that appropriately recover costs, and the right program structures may turn EVs and their chargers from a cost and satisfaction negative to a source of new revenue as more consumers purchase EVs. The proper rate incentives can help the co-op keep the charging cycle off peak and take maximum advantage of lower cost power, while building load in a beneficial manner.

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Also related to the future possibilities of revenue from ancillary services, the co-op might want to investigate owning the charger itself. With the co-op specifying the charger used, future management of the charger for aggregation purposes and demand response programs is greatly simplified.

Lastly, the ability to install chargers at strategic locations and charge for their use (another revenue stream) is another consideration to owning the charger. In California, the PUC has put limits on utility ownership of chargers. In the PG&E program mentioned in the following section, that limit is 35 percent. The rest are owned by individuals and local businesses, so they benefit economically from charger use. PG&E will only receive the energy sales from charger use. However, there are costs associated with owning public charging infrastructure. Most utilities are unaware of the cost to maintain these systems.

What do cooperatives need to know or do about it?

For cooperatives in areas with growing EV adoption, they may consider coordinating the charger installation process and providing incentives and price signals for when the vehicles charge, so that the demand management strategies of the co-op are supported rather than negatively impacted.

For co-ops in largely rural areas, many may choose to take no action at this time, although it is recommended that even these co-ops have an idea of how they will respond to an EV connecting to their lines. It puts the processes and rate structure in place, so there are no last-minute scrambles to accommodate the EV early adopters in their service area.

The following sections highlight actions being taken by regulators, IOUs, and cooperatives in remote areas when it comes to charger infrastructure and rates.

STATES TAKING A ROLE

California's Initiatives

States like **California** are ramping up efforts to expand the number of chargers available to accelerate EV adoption. Three of the largest investor-owned utilities in the state have programs approved by the Public Utilities Commission (PUC):

- San Diego Gas & Electric (SDG&E) has a program to install 3,500 chargers in its service area.
- Southern California Edison (SCE) has one for 1,500.
- Pacific Gas & Electric (PG&E) is rolling out the largest program in the country with 7,500 chargers.

North Carolina's Initiative

As part of a settlement between the State and Volkswagen (VW) for the latter's falsification of emissions data, the State of **North Carolina** is looking at a program to install chargers[8] in areas where tourism is an important part of the economy. The feeling is that EV owners may be hesitant to visit the more distant areas in the Blue Ridge Mountains or the Outer Banks for fear of not being able to recharge because of the average range of 100 miles for their vehicles.

The first charger to go in under the program is in West Jefferson, NC, a town served by electric cooperative, Blue Ridge Energy. Capable of providing a full charge in 3 to 4 hours for two EVs at a time, this provides tourists with ample time to visit shops, sample the local cheese emporium, or take in a show at the historic local theater.

Another charger is being considered for Blowing Rock, and a DC fast charger[9] on a major thoroughfare into the Blue Ridge Mountains high peaks area is in the works. In addition, Brunswick EMC in the southeastern part of the State has installed five chargers in its service area to cater to the beach vacation crowd, a significant economic driver in that portion of North Carolina.

COOPERATIVE ACTION

Other co-ops are getting into the charger game as well. Two more examples are from Cordova Electric Cooperative in Cordova, Alaska[10] and Flathead Electric Cooperative in Kalispell, Montana.[11]

Cordova, AK

The town of Cordova has a total of 45 miles of road and a single EV with a second rumored to be on the way. Not only that, the state highway system ends 40 miles short of the town, meaning that most vehicles arrive by one of two ferries.

The town installed two chargers that can support two EVs each, and there is no charge to users to "top off" their batteries. Why did the town do this? To get ahead of the EV curve and encourage tourism.

The purpose of the chargers is to take advantage of the co-op's abundance of hydroelectric power and move Cordova towards a completely renewable energy infrastructure, including vehicles. Clay Koplin (Cordova Electric CEO and the town's mayor) notes that EVs can travel twice the number of miles as gas vehicles for about the same cost and a one-hour charge will provide a 20-mile range. "It's all about economics, the environment, and getting ahead of the EV curve," continued Mr. Koplin. He sees a future with EVs even replacing hybrids and is getting Cordova ready.

"It's all about economics, the environment, and getting ahead of the EV curve."

– Clay Koplin, CEO, Cordova Electric

[8] https://energynews.us/southeast/north-carolina-hopes-to-lure-ev-tourists-with-rural-charging-stations

[9] See Appendix A for the infrastructure required to service a DC Fast Charger.

[10] https://www.adn.com/business-economy/energy/2018/01/10/off-road-alaska-town-offers-free-electric-car-charging-first-you-have-to-get-there

[11] http://nbcmontana.com/news/local/flathead-electric-launches-program-for-electric-car-charging-stations

…the thought is that having chargers where people work will encourage greater adoption in co-op service area.

– John Gorski, Regulatory Affairs, Flathead Electric Co-op

Kalispell, MT

Flathead County has the second highest number of EVs in Montana behind Missoula. Flathead Electric Cooperative has decided to survey local businesses to see if there is an interest in installing chargers at their locations for their employees. The co-op itself has chargers at their office in Kalispell for employees with EVs and is interested in finding out what other businesses think.

One impediment to EVs is where they can be charged other than at home, notes Walter Rowntee, head of the co-op's EV committee and a Tesla owner. EVs have less range in the winter, likely due to increased heater and defroster use, says John Gorski, head of regulatory affairs at the co-op. Having a charger at work helps his hybrid run "all battery" and the thought is that having chargers where other people work will encourage greater adoption in their service area.

These and other efforts will drive the installation of chargers higher and ultimately reduce the costs. Figure 2 shows the locations of EV chargers in the United States today.

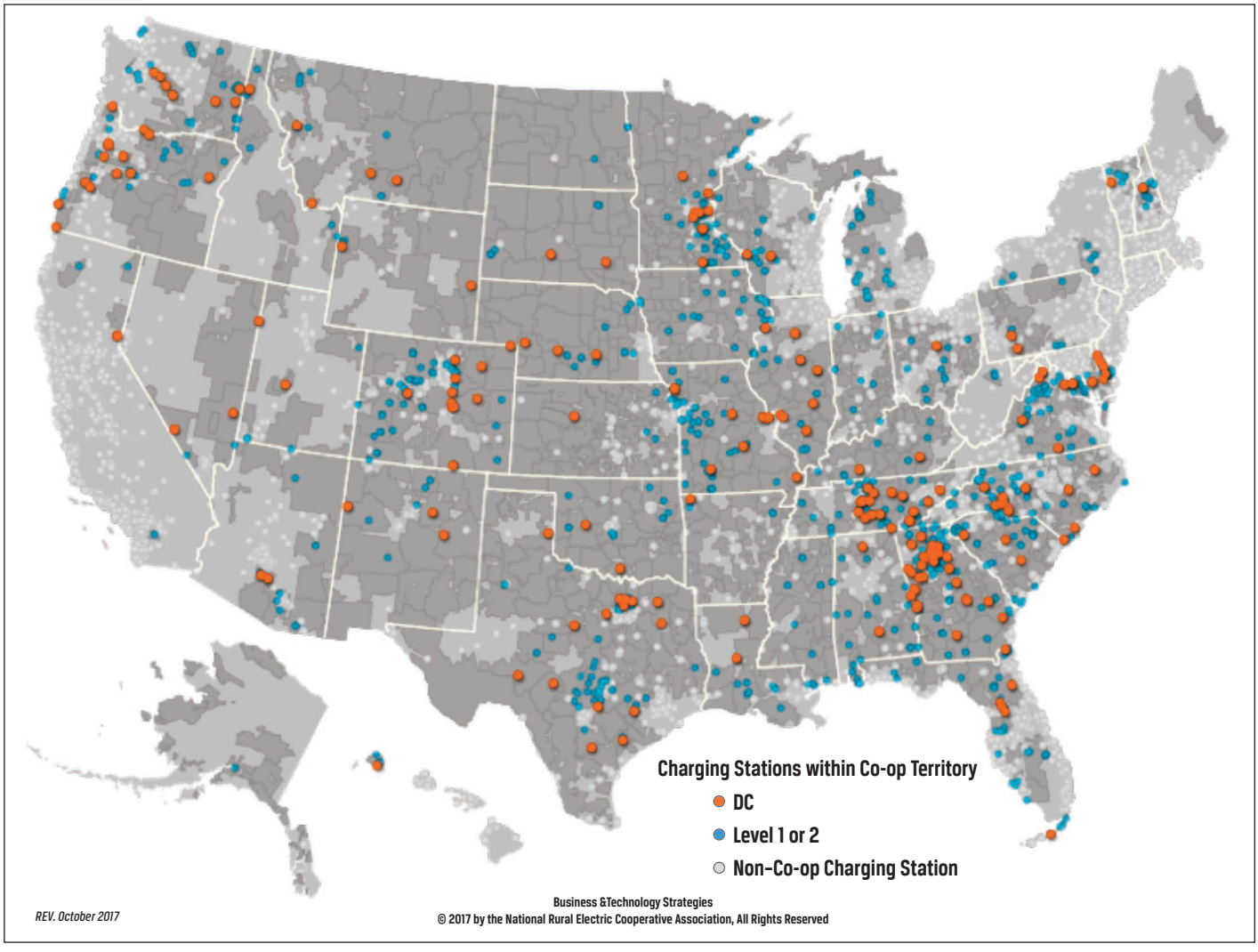

FIGURE 2: Distribution of Public Charging Stations in Co-op Service Territories

CHARGERS AND RATES

Cooperative service rates and EV chargers are inseparable, as charging at 120 volts simply takes too long for situations other than an average daily commute. Even the shorter charging times with 240 volts might take too long in certain instances. Longer charging cycles at Level 2 or above means a higher likelihood of charging hitting a peak demand period if the member is on a standard residential rate. Even Level 1 chargers can impact load management/demand response activities. Cooperatives can consider designing rates to accommodate the differing charge levels and charger capabilities, and to encourage EV owners to shift charging off peak. Figure 3 is taken from Xcel Energy's website and summarizes the three charging levels and their capabilities.

Cooperatives can consider designing rates to accommodate different charger levels and capabilities, and to encourage EV owners to shift charging off peak.

Looking at chargers in the same manner as street and area lighting seems to make some sense. Chargers will grow in numbers, and municipalities as well as members will demand them to support EVs. When a member or a town within the service territory wants area and street lighting, the co-op has a standard design and rate for that purpose. Why not add chargers to that category? Yes, they are substantially more expensive ($1,100 to $21,000 for a Level 2 charger installation according to a January 2018 DOE report[13] — see **Figure 1**), but they offer several benefits to the cooperative.

HOT OFF THE PRESSES

- **Concierge mobile** EV charging
- **Tesla 2170 cell** adds 40 to 50 percent more energy density compared to the 18650 cell
- **Six trends** driving vehicle electrification: More cars, more utility programs, using EVs as DERs and more...

There are three industry-standard levels of charging for your vehicle, providing varying degrees of electrical mileage. The level you choose will depend on the make and model of your vehicle and charging and driving needs; for most homeowners, this ends up being level 1 or 2.

Level 1: 120V outlet	Level 2: 240V, up to 40 amp circuit	Level 3: Quick charge
3-5 mi/ 1 hr charging 80-160 mi/ 8 hrs charging	80-160 mi/hours 80-160/hour	Typically not added to homes
Does not require an electrician	Level 2: 240V with the help of an electrician to add a new outlet or breaker and potentially upgrade your service panel.	Contact us prior to installing. Electrician needed.

FIGURE 3: Charge level definitions from Xcel Energy website[12]

[12] https://www.xcelenergy.com/energy_portfolio/innovation/electric_vehicles/get_started_going_electric/ev_power_at_home

[13] https://www.afdc.energy.gov/uploads/publication/EV_Charger_Selection_Guide_2018-01-112.pdf

Developing an EV rate may not be as big a task as imagined... existing rates may be enough to move EV owners' charging off peak.

LEVELS OF CO-OP INVOLVEMENT AND RATE CONSIDERATIONS

Just how involved a co-op gets in developing EV rates and becoming engaged in charger management ranges from simply making sure the members know to tell the co-op when a charger is going to be installed and upgrading local distribution equipment accordingly, to developing an active program of treating chargers and EVs as distributed energy resources that offer new sources of revenue.

Do You Already Have an EV Rate?

When thinking about developing an EV rate for your cooperative, it may not be as big a task as it sounds. Existing rates such as your Time of Use (TOU) may be enough to move EV owners onto charging periods that do not impact peak demand. Two examples of utilities using their TOU rates follow:

The Salt River Project

The Salt River Project (SRP) has approximately 4,400 EVs on their lines. This number of EVs consumes 9,121 MWh annually and contributes 1 MW to peak demand. To determine if the existing TOU rate would incent EV owners to move charging off peak, SRP conducted a survey[14] of 100 EV owners. The results of the study revealed that the TOU rate was incentive enough for EV owners to use the rate, even with the higher on peak energy charge for normal use.

An interesting discovery of the study was that EV owners today are early adopters, and as such, were quite aware of the various rates offered. What concerns SRP is that future buyers will not be that "rate savvy" and they will need an effective communication plan to educate these customers on the benefits of TOU charging.

Xcel Energy

Xcel Energy uses a slightly modified version their TOU rate for EV customers. **Figure 4**[15] is taken from their online rate page. Their EV Rate offers a lower facility charge than the regular TOU rate, further enhancing the attractiveness of the rate to EV owners — and with a significant and growing percentage of its generation portfolio coming from renewables, especially wind, Xcel can position EV ownership as "zero emission from energy source to vehicle."

THE NEW MENU OF POSSIBLE CO-OP RATES?

- Security/Area/Dusk-to-Dawn Lighting Rates
- Neighborhood/City/Town/Industrial Park Street Lighting Rates
- Off Peak/TOU Rates
- EV Charger Rates
- Distributed Energy Resources Management Rate Rider

DO YOU EVEN NEED A RATE?

A vendor, **FleetCarma**, takes the need for having a rate out of the equation. One of their programs uses a device that plugs into the vehicle's ODB-II port and tracks when it is charged. When the member charges off peak (schedules can be set by the co-op), they earn rewards. Examples include reduced kWh costs or points towards e-cards.

Other program features:

- 10 second member self-install
- No sub-metering
- Lots of useful anonymized data for program customization and adaptation.
- No billing system adjustments

Expect to see more programs emerge as the number of EVs increase.

[14] https://www.utilitydive.com/news/time-of-use-rates-can-manage-ev-charging-new-report-says/515284

[15] https://www.xcelenergy.com/energy_portfolio/innovation/electric_vehicles/electrical_vehicle_rate

What's the best rate plan for you?

- **EV Rate:** If you charge your vehicle at night and on weekends, but need to use a lot of electricity for other activities during the day, this rate might be best for you. You'll pay about half the amount of standard residential rates if you charge at night—and double the rate during the day.
- **Time of Day Plan:** If you charge your vehicle at night and on weekends, and can also limit other electric use to the off-peak hours, explore our Time of Day rate plan.
- **Standard Rate:** If you can't limit your EV charging to nights and weekends, our standard rate may be best for you.

Rate Options*	Monthly Charge	Off-Peak charge *per kWh - All year*	On-Peak Charge *per kWh - June-Sept.*	On-Peak Charge *per kWh - Oct.- May*
EV Rate[1]	$4.95	$0.04260	$0.21096	$0.16968
Time of Use Rate	$10 - $12	$0.04260	$0.21096	$0.16968
Residential Standard Rate	$8 - $10	$0.1058	$0.1058	$0.1058

- *On-peak period: 9:00 a.m. - 9:00 p.m.*
- *Off-peak period: 9:00 p.m. - 9:00 a.m.*
- *Seven major holidays are also billed at the off peak rate. They are New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas Day.*

*Rates apply to single phase - secondary voltage use only. Rates are subject to resource and/or fuel adjustments, city fees, and taxes where applicable. The rates listed above include current riders and adjustments, excepting taxes. Rates may change upon PUC approval. Rates include the Variable Fuel Cost Charge.

[1]You must remain on the EV Rate plan for a minimum of one year from the date of enrollment.

FIGURE 4: Xcel Energy EV Rate Comparison

An EPRI[16] study that focused on 21 utilities including the SRP also found that the TOU rate was the most prevalent offered and that EV rates were much more common for residential than commercial customers. **Table 1** provides a summary of the rates offered by the study utilities. A more complete table for each rate is also included in that EPRI study which is free to download.

Further findings from the study about regulatory agency reaction to various rate designs include the following:

- Commissions generally supported Time-Of-Use structures, with the rationale that these reflect cost differentiation and provide signals to shift electric consumption to lower cost periods.
- An important attribute often cited for commission approval was the demonstration of a good mechanism of cost recovery from the rate structure without spreading revenue shortfall onto other ratepayers.
- Low participation rate was sometimes cited as a reason to disallow requests for pilot rate option extensions, reasoning that the goal of incentivizing EV adoption is not facilitated when the result is low enrollment.

[16] https://www.epri.com/#/pages/product/000000003002012263/

TABLE 1: EPRI EV Rate Study Summary Table

Distribution of rate options for three customer classes			
	Customer Classes		
		Non-residential	
	Residential	Business	Public Charging
Number of Utilities	21	6	5
Number of Rate Options	29	14	8
Rate Structures*			
Time-of-Use (TOU) Energy Charges	26	7	5
Monthly Daily Fixed Charge	26	12	0
Demand Charge	2	2	0
Seasonal Differentiation	19	3	1
Separate Rate, Fee or Rider	1	2	0
Discount Bonus Offer	2	3	0

* Rate structure statistics are based on the number of rate options rather than the number of utilities, because multiple rate optionswith diverse rate structures can be offered by the same utility.

RATE DRIVERS/USE CASES — TAILORING A RATE TO THE CO-OP'S BUSINESS STRATEGY

The drivers behind the specifics of an EV rate may be determined in large part by how the cooperative views the EV and its charger in terms of how they can be integrated into cooperative operations. One consideration is the value of a typical EV to the co-op in terms of revenue. **Appendix B** addresses this and provides a link to a DOE calculator for hybrids and gives a simple formula for all-electric vehicles' contributions to revenue.

Four broad categories, or use cases, include:

1. Business as Usual

View the EV/charger simply as a new load, just as they would the addition of an air conditioner or pool pump to an existing residence.

In this case, the co-op may want to develop appropriate standards and processes for having EV owners notify the co-op of their purchase and have engineering/construction standards for proper installation of the charger and upgrading of facilities, if required. Effective methods of communicating this information to members include:

- Providing EV dealers with handouts and signage asking members to contact the co-op
- Clearly indicating EV related information on the co-op website
- Bill messages, social media posts, and articles in newsletters

Optional rate — standard residential service

2. Potential Peak Impact

View the EV/charger as a load to move onto low demand periods to mitigate the impact on peak demand and the associated charges, especially with Level 2 chargers and above.

For this use case, the co-op may need the same processes and procedures as mentioned in Case 1.

Additionally, they may need to develop, repurpose, or use an existing rate. As already mentioned, research is showing that traditional Time of Use rates are, or can be, an adequate incentive to move charging off peak.

This use case relies on members voluntarily adhering to the time periods of the rate to avoid the cost penalty, so it does not prevent on-peak charging.

Optional rate — standard residential TOU service

3. Load Management/Demand Response

View the EV/charger as a load that has a detrimental impact on peak demand and, therefore, needs to be controlled accordingly. Even Level 1 chargers might be viewed as a contributor to demand. These chargers

draw around 1.4 kW. If they operate during a peak demand period or load management event, they present an opportunity for load management basically because the operate continuously as opposed to intermittently like air conditioning, pool pumps, and water heaters.

For this use case, the co-op may need the same processes and procedures as mentioned in Case 1 and existing rates may be used/repurposed, or a new rate developed.

Load control programs and incentives may need to be modified to accommodate the new asset.

Work will most likely need to be done with the G&T to determine the acceptability of the EV/charger as a DR asset.

Regulatory approval may be a requirement.

Treat the EV as a DR/Load Management asset by turning them on and off.

Optional rate — standard load management/demand response rate

4. **Manage as a Distributed Energy Resource (DER)**

View the EV/charger as an asset to build revenues beyond simple load growth.

This capability may not be as far off as many think. FERC recently released a ruling[17] directing the Regional Transmission Operators (RTO) and Independent System Operators (ISO) to draft rules for treating energy storage on a par with generation assets. Aggregating EVs and dispatching them as storage is in its infancy, but rulings like FERC's may move this possibility along. For example, the Mid-Atlantic RTO, PJM, operates a grid-interactive water heater program in which participants offer demand response into the ancillary services market.[18] EV chargers could be aggregated in the same manner and earn revenues from ancillary services.

This use case is, admittedly, in its infancy as many pieces must come together. However, generally, the co-op will need appropriate rate structures, processes, and procedures to:

- Identify and engage members who own the EVs for aggregation.
- Work with their G&Ts and regulators to accept DER aggregation and dispatch as a service.
- Determine the ancillary services possible from the DERS which may include the following depending upon the actual DER mix:
  - scheduling and dispatch
  - reactive power and voltage control
  - loss compensation
  - load following
  - system protection
  - energy imbalance
  - load reduction
  - rapid energy provision

Optional rate — standard load management/demand response rate/ market-based rate

SURVEY RESULTS

Part of this report was a survey to find out what drove cooperatives to develop rates for their EV members. The survey itself is included as **Appendix C**, along with a link for any co-ops not surveyed to complete it on their own and submit it to the NRECA to further develop the EV rate data set.

[17] https://www.ferc.gov/industries/electric/indus-act/rto/02-15-18-E-1-presentation.pdf
https://www.greentechmedia.com/articles/read/ferc-energy-storage-wholesale-markets#gs.BkzPH8Q

[18] http://www.pjm.com/-/media/markets-ops/dsr/2018-demand-response-activity-report.ashx?la=en

According to responses received, the primary reasons for creating an EV rate today include the following:

- Stimulate adoption of EVs in the service territory. EVs represent an excellent opportunity for load growth.
- Encouraging members to self-identify that they own an EV to prevent distribution system issues, such as overloaded transformers.
- Incenting/encouraging members with EVs to move charging to off peak periods to help with load control/demand reduction programs.

Other benefits the cooperatives mentioned because of creating the rate included:

- Demonstrating to members another way in which the co-op is concerned about the environment and encouraging EV use to reduce emissions.
- Showing that the co-op is concerned about system reliability for all members by addressing potential EV charger impacts.
- Demonstrating that the co-op is focused on the future of the grid and upgrading its systems accordingly.

While no respondent yet pursued the installation of chargers or the management of EVs as distributed energy resources as potential revenue opportunities, respondents did indicate those options are under consideration.

Given the objectives of growing load off peak, the TOU structures is the most logical and easiest to modify for the co-op.

TOU IS THE LEADING RATE STRUCTURE

The most common rate structure mentioned in survey responses was the co-op's time of use (TOU) rate or some variation on it, such as three-time slots, sub-metering, and an EV discount per kWh. The CoBank report also noted the effectiveness of the TOU rate. Given the objectives of growing load off peak stated above, the TOU structure is the most logical and easiest to modify for the co-op. Reactions to the rates offered have been positive, the survey respondents are proceeding with their promotional efforts (more below), and with planning for the future potential of larger numbers of EVs on their lines.

RATE IMPLEMENTATION

The first hurdle cooperatives must overcome in the creation of an EV rate is the sentiment that EVs are simply inappropriate or are not likely to ever be accepted in the service territory. The folks at Flathead Electric Co-op see the future as their members having an EV for daily use with fossil fueled pickup trucks for hauling RVs, quads, boats, farm equipment, and so forth. Cost, availability, service, and range anxiety remain significant impediments to EV adoption in predominantly rural areas, but co-ops serving more densely populated areas have the opportunity to address some of these impediments with the right rate design and promotion.

As part of an effort to determine the number of EVs in your State, contact with your division of motor vehicles can provide that type of data. From there, it can be parsed into where the EVs are located and an assessment made of the potential number that could come onto your lines, or that may already be there! Another excellent source of EV data (for both all-electric and hybrid) can be found in the Wikipedia article ***Plug-in electric vehicles in the United States***.

The next step is to decide how your co-op wants to manage the EVs that do come on the lines, as outlined in the preceding section. It may be that an existing TOU rate can be used or modified to meet the purposes and objectives of the co-op. NRECA has excellent resources available for rate design for co-ops looking for greater detail or in starting fresh.

Internal process changes and modifications to billing software may be necessary. Training of member service personnel will be needed to familiarize them with the rate and any program details. Engineering staff may need to update their installation requirements, so that chargers installed by members meet all electrical and safety requirements related to the co-op's distribution system.

Communication becomes the next step in the process. Members need to know that a rate is available for them when they buy an EV. This can flow through the traditional channels of bill inserts, newsletters, bill messages, and so forth. It is important to also use social media channels and provide clear links online to cover all member contact options and information resources.

Knowing that the co-op supports EVs can go a long way to getting the dealership engaged in more proactive sales efforts.

If there happens to be an EV dealership in the service territory, the co-op should make it a point of working with them to ensure charger installation requirements are clearly understood. Just as trade allies are essential in other co-op programs, dealers can serve the same role in EV programs.

It is important to integrate EVs into co-op planning and to lay the rate groundwork.

Utilities are taking pains to provide charger installation details plus information about rate options to EV dealers. Aside from Tesla, EV dealers generally offer a full range of EV, gas, and diesel vehicles. Knowing that the co-op supports EVs can go a long way to getting the dealership engaged in more proactive sales efforts.

For more information on communicating a rate change see the **NRECA/CFC toolkit**.

CONCLUSION AND NEXT STEPS

Electric vehicles, both hybrid and all-electric, are making significant inroads in terms of sales and are showing up in every corner of the United States. As examples included in this report indicate, being remote is not stopping all EV adoption, though the mostly rural co-op can expect very limited penetration in their service areas for some time. Certainly, range anxiety and other issues impact adoption, but rapid advances in battery technology and a growing charging infrastructure are making EVs more appealing to larger and larger numbers of consumers.

EVs represent an excellent opportunity to grow load and to shift load to off peak periods. Whether viewed as a static device connected to the lines or as an asset in an advanced distributed energy resource management system, every cooperative should be prepared to accommodate the natural growth of EVs on their lines at the very minimum.

Given the potential for positive revenue growth, a proactive approach by co-ops already experiencing appreciable EV penetration seems prudent. Even if it is a simple promotion of existing TOU rates as the best option for EV owners, it positions the co-op to benefit from the EV revolution and simultaneously demonstrates that they are sensitive to EV member needs.

The most important next steps are to integrate EVs into strategic, business, promotional, and engineering planning efforts and lay the rate groundwork, so that the co-op can lead in their service area when it comes to encouraging members to buy EVs and supporting those who already own one. In the long run, it benefits the membership and strengthens the cooperative. ■

APPENDIX A: INFRASTRUCTURE REQUIREMENTS FOR A DC FAST CHARGER

The real solution to eliminating range anxiety is development of a changing infrastructure that provides for readily accessible charging stations at intervals close enough to allow EV owners to take trips of any length, confident they will not get stranded because they have exhausted their batteries. According to a report issued late last year by the Idaho National Laboratory, Argonne National Laboratory, and the National Renewable Energy Laboratory, drivers with such access drove an average of 25 percent more miles annually.

This raises the issue of which type of charger to install. At the very least, it would need to be a Level 2 to allow drivers to recharge in as little time as possible. On major thoroughfares, direct current (DC) fast chargers are going to be required simply to handle the growing number of EVs on the roads.

As the DOE graphic (Figure 5) indicates, DC Fast Chargers typically require three phase 208/480V AC service which, when the charger is to be installed in more rural areas, may not be readily available. Given the large kW draw[19] of these chargers, either 50 kW or 120 kW, transformers and other equipment will also need to be correspondingly larger. Finally, unlike Levels 1 and 2 that utilize a common connector, there are three styles being used by different EV manufacturers.

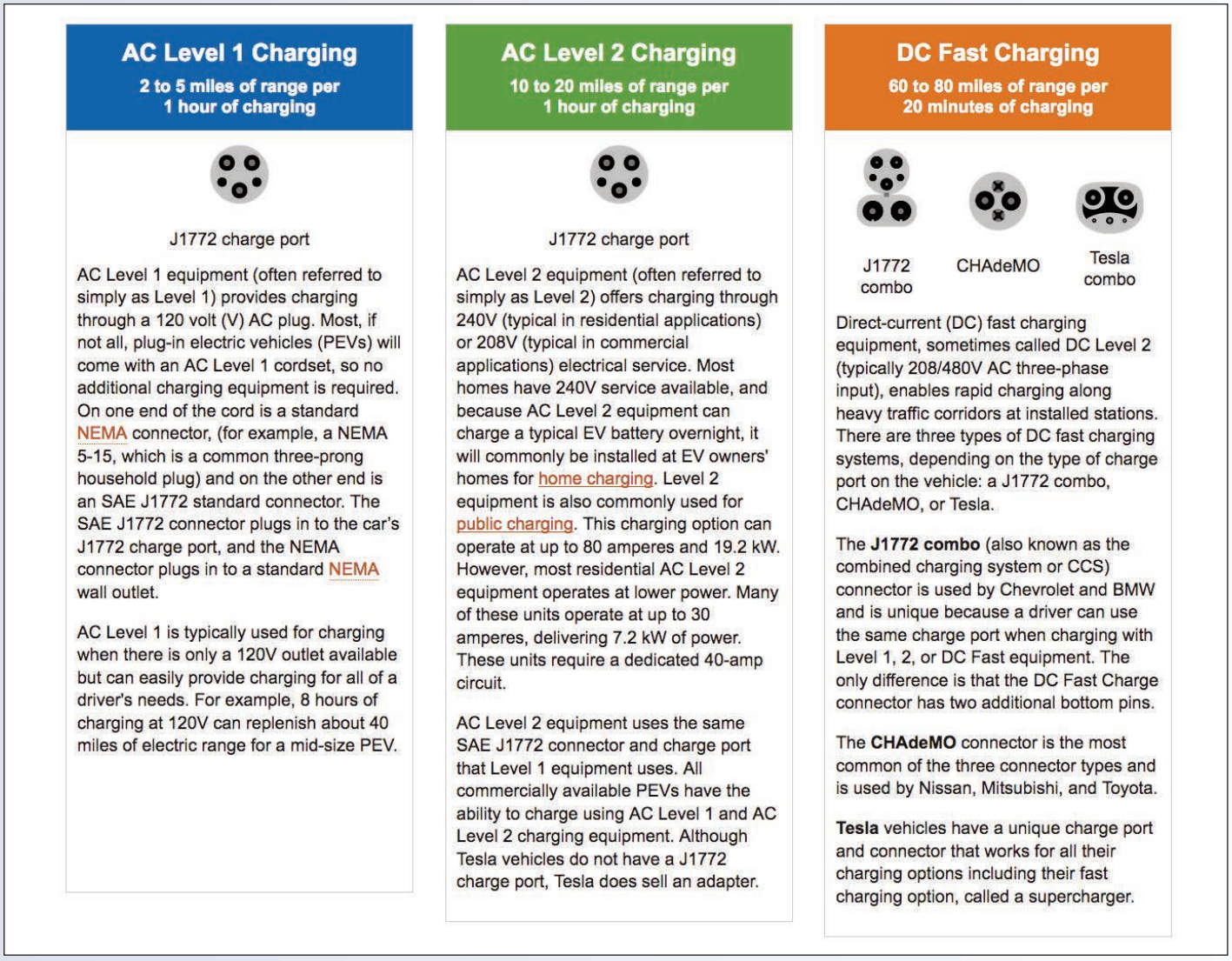

FIGURE 5: Charger Requirements Comparison[20]

Continued

[19] https://www.energy.gov/sites/prod/files/2017/10/f38/XFC%20Technology%20Gap%20Assessment%20Report_FINAL_10202017.pdf [Page 4]

[20] https://www.afdc.energy.gov/fuels/electricity_infrastructure.html

APPENDIX A: INFRASTRUCTURE REQUIREMENTS FOR A DC FAST CHARGER (CONT.)

TABLE 2: Charger Performance Comparison[21]

Power Level Types	Charger Location	Typical Use	Energy Supply Interface	Expected Power Level	Charging Time	Vehicle Tecnology
Level 1 (Opportunity) 120 Vac (US) 230 Vac (EU)	On-board 1-phase	Charging at home or office	Convenience outlet (NEMA 5-15R/20R)	1.4kW (12A) 1.9kW (20A)	4–11 hours 11–36 hours	PHEVs (5–15kWh) EVs (16–50kWh)
Level 2 (Primary) 240 Vac (US) 400 Vac (EU)	On-board 1- or 3-phase	Charging at private or public outlets	Dedicated EVSE	4kW (17A) 8kW (32A) 19.2kW (80A)	1–4 hours 2–6 hours 2–3 hours	PHEVs (5–15kWh) EVs (16–30kWh) EVs (3–50kWh)
Level 3 (Fast) (208-600 Vdc)	Off-board 3-phase	Commercial analogous to a filling station	Dedicated EVSE	50kW 100kW	0.4–1 hours 0.2–0.5 hours	EVs (20–50kWh)

[21] https://www.energystar.gov/sites/default/files/asset/document/Electric_Vehicle_Scoping_Report.pdf

APPENDIX B: ECONOMICS OF AN EV

One factor to how aggressive co-ops get with respect to supporting EV growth is how much revenue each will generate in a year. According to an article[22] on the Plug in America website, efficiencies vary between EV models the same way they do between internal combustion vehicles. According to the site,

> "Just as with gasoline cars, some electric vehicles are more efficient than others, and the average EV needs about 30 kWh of electricity to power the vehicle for 100 miles. For example, the EPA rating for the Nissan LEAF is exactly 30 kWh per 100 miles. A Tesla Model S 60D is rated at a combined 32 kWh per 100 miles and uses a little more energy since it's heavier and more powerful than a LEAF. The Chevrolet Volt is currently the most efficient electric car and has a combined consumption rating of 28 kWh per 100 miles. The consumption for all electric vehicles can be viewed at the U.S. Department of Energy's website: www.fueleconomy.gov"

The DOE provides a very nifty calculator[23] for determining the annual cost of operation for hybrid vehicles. It factors in average costs for gasoline and kWhs, allows for inputs regarding diving habits (miles per day and per year), and then provides a total cost of operation for a year. For illustrative purposes only, the following data from Minnesota was selected:

- 2018 Toyota Prius Prime
- 20 miles per day
- 12,000 miles per year
- $2.87 per gallon of gas
- $.10 per kWh

According to the calculator, this usage would require 1935 kWh or $193.50 in electricity sales.

To estimate contribution for an all-electric vehicle, the following formula can provide a good estimate:

Inputs:

- A: kWh per 100 miles
- B: Estimate of annual mileage
- C: $$$ per kWh

Annual electric revenue = (((B/100)*A)*C)

Example: (((15,000/100)*30)*.12) = ((150*30)*.12) = $540.00 annually

The addition of an EV to your lines becomes similar to the addition of other major energy consuming appliances. Calculating these numbers and comparing an EV to other improvements members make to their residences that require facilities upgrades is an excellent exercise when calculating any CIAC your co-op needs to charge. A word of caution about CIAC, if it is uncommon to charge members for service upgrades, doing so suddenly with an EV coming onto the lines can create member dissatisfaction and push back without proper advance communication.

[22] https://pluginamerica.org/how-much-does-it-cost-charge-electric-car (Updated in 2016)

[23] https://www.fueleconomy.gov/feg/Find.do?action=phev1Prompt

APPENDIX C: EV RATE DEVELOPMENT SURVEY

As noted in the body of the document, a survey was used to gather insights from cooperatives about their use of EV rates. If any readers are interested in completing the survey on their own, the data will help enrich the data set and expand the understanding of the current state of EV rates. It can be completed online (link below) or in hard copy and mailed to the NRECA. This is completely optional.

All survey responses are confidential. No data that clearly identifies an individual cooperative will be communicated in any context without that cooperative's express permission.

Link to online version of the survey: **https://www.surveymonkey.com/r/79KTDKT**

Upon completion of a hard copy of the survey, please mail it to Allison Hamilton — Senior Principal – Markets & Rates, NRECA, 4301 Wilson Blvd, Arlington, VA 22203.

For those completing the survey, thank you for sharing your insights and experiences.

See the following page for printable survey.

EV Rate Development Survey

1. What prompted you to create the EV rate?
   Circle all that apply.
   a. Influx of EVs? Please provide the number of members currently on the rate in the ***Other*** box.
   b. Stimulate adoption?
   c. Regulatory pressures?
   d. Recommendation from your power supplier?

Other

2. What is the objective of the rate?

3. Are there any specific operational issues the rate will solve? Other benefits it will provide to your cooperative?
   Circle all that apply
   a. Overloading of local facilities?
   b. Power quality issues?
   c. Phase imbalance?
   d. Move load off peak demand periods?

4. What has been the reaction from members, regulators, community leaders, and others to the rate? Please add any comments in the ***Other*** box.
   Circle all that apply

a. Positive
b. Negative
c. Neutral

Other

Continued

EV Rate Development Survey (Cont.)

5. What are the key provisions of the rate? Are there any that you plan to change?

6. What challenges did you face in creating the rate? Please add comments in the ***Other*** box. ***Circle all that apply***
   a. Internal: billing, accounting, etc.
   b. Operational: engineering, construction, etc.
   c. Regulatory

Other

7. What advice would you give other cooperatives about the need for and about creating an EV rate? What key lessons did you learn?

8. Please describe your communication/marketing plan to promote the rate, if any.

Continued

EV Rate Development Survey (Cont.)

9. Is there a demand for or, are you planning to install, charging stations within the community or at businesses? If yes, please describe how that will work in terms of costs for installing/ maintaining charging stations and paying for the electricity used.

10. Are you looking at EVs as distributed energy resources? If yes, do you plan to aggregate them for load management or other purposes now or in the future?

Upon completion of a hard copy of the survey please mail it to the following, or email an electronic version to: **Allison.Hamilton@nreca.coop**:

Allison Hamilton
Senior Principal — Markets & Rates,
NRECA
4301 Wilson Blvd.
Arlington, VA 22203.

Thank you for sharing your insights and experiences.

About the Author

Tom Tate has been in the electric utility world for 25 years, working in various capacities for both IOU and cooperative operations and is well versed in the municipal business model. With experience in every member service, marketing, and sales management role, Tom discovered a passion and talent for writing about technology in a manner that makes complex concepts easily understandable for members and customers. Today, he runs his own freelance writing company and provides content for a number of cooperative and industry operations from his adopted home of Minneapolis, MN.

Questions or Comments

- Allison Hamilton, Senior Principal — Markets & Rates, **Allison.Hamilton@nreca.coop**
- To find more resources on business and technology issues for cooperatives, visit our **website**.

BUSINESS AND TECHNOLOGY STRATEGIES
DISTRIBUTED ENERGY RESOURCES WORKGROUP

The Distributed Energy Resources (DER) Work Group, part of NRECA's Business and Technology Strategies department, is focused on identifying the opportunities and challenges presented by the continued evolution of distributed generation, energy storage, energy efficiency and demand response resources. For more information, please visit **www.cooperative.com**, and for the current work by the Business and Technology Strategies department of NRECA, please see our **Portfolio**.

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