NARUC Electric Vehicles Working Group

JANUARY MEETING

JANUARY 14, 2020

AGENDA

3:00 PM	**Welcome and Introductions (5 minutes)** • Agenda review • Roll call, by state
3:05 PM	**Presentation: Smart Electric Power Alliance (30 minutes)** • 20 minutes: Erika Myers and Richard Farinas will present on residential time-varying EV rates, and SEPA's recent report, Residential Electric Vehicle Time-Varying Rates That Work: Attributes That Increase Enrollment • 10 minutes: Q&A
3:35 PM	**Presentation: Synapse Energy Economics (30 minutes)** • 20 minutes: Melissa Whited will present on time-varying EV rates, including for commercial and industrial charging • 10 minutes: Q&A
4:05 PM	**Peer-Sharing Discussion (20 minutes)** • States will have an opportunity to share lessons learned from their own experiences with time-varying EV rates and ask questions of one another (see discussion questions below)
4:25 PM	**Next Steps and Announcements (5 minutes)**
4:30 PM	**Adjourn**

Roll Call

Working Group Members

States:

- Arizona
- California
- Colorado
- Connecticut
- Florida
- Georgia
- Hawaii
- Illinois
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Missouri
- Nevada
- New Jersey
- New York
- North Carolina
- Ohio
- Oregon
- Puerto Rico
- South Dakota
- Texas
- Vermont
- Washington
- Wisconsin

National/Federal Partners:

- NARUC
- U.S. DOE
- U.S. EPA

Smart Electric Power Alliance

Electric Vehicle Rates That Work:

Attributes that increase enrollment

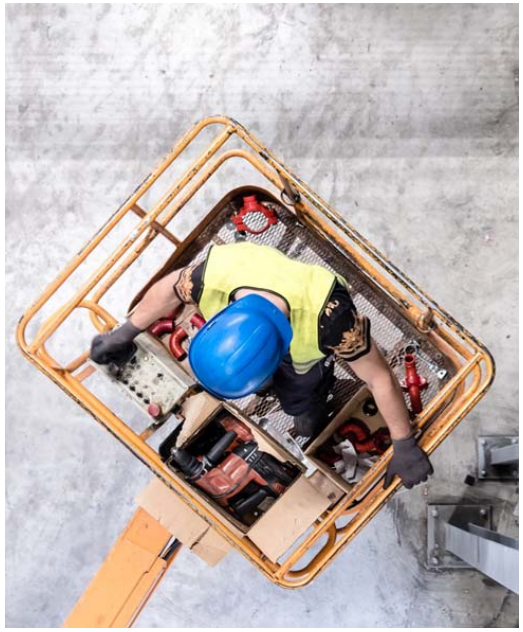
NARUC EV Working Group

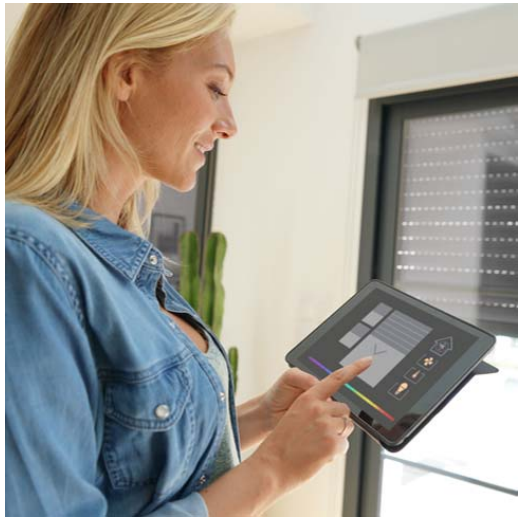
January 14, 2020

Erika H. Myers, Principal, Transportation Electrification
Richard Farinas, Manager, Research

Clean + Modern Grid

Utility Business Models | Regulatory Innovation | Grid Integration | Transportation Electrification





Who Are We?

Smart Electric Power Alliance

A carbon-free energy system by 2050

- A membership organization
- Founded in 1992
- Staff of ~50
- Research, Education, Collaboration & Standards
- Budget of ~$10M
- Unbiased
- Based in Washington, D.C.
- No Advocacy – 501c3

Pathways

Utility Business Models

Sustainable Utility business models to facilitate and support a carbon-free energy future.

Grid Integration

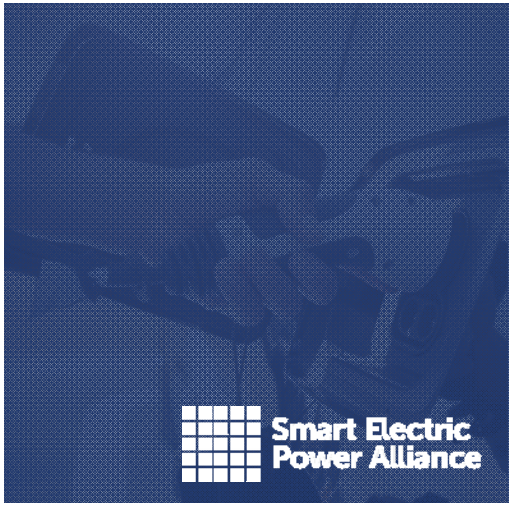
Seamless integration of clean energy yielding maintained or improved levels of affordability, safety, security, reliability, resiliency and customer satisfaction.

Regulatory Innovation

State regulatory processes to enable the timely and effective deployment of new technologies, partnerships and business models.

Transportation Electrification

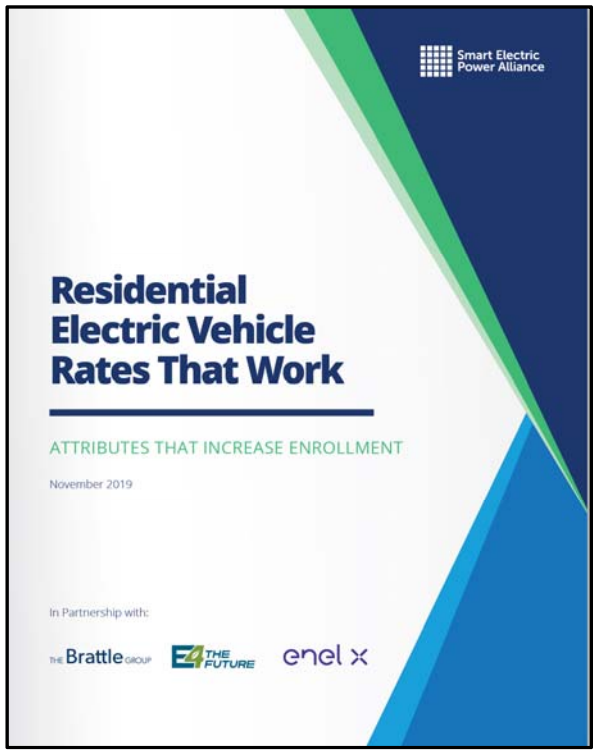
The nation's fleet of light, medium and heavy-duty vehicles powered by carbon-free electricity.



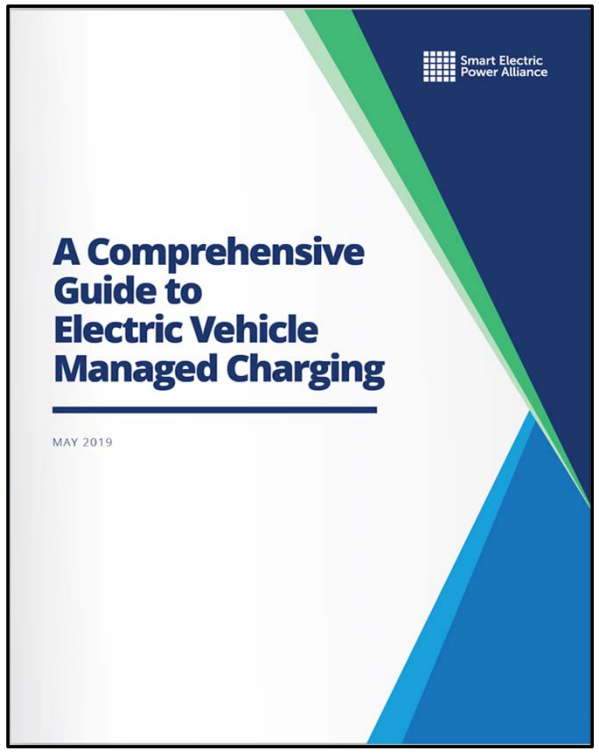
Future Proofing for Electric Vehicles

Smart Electric Power Alliance

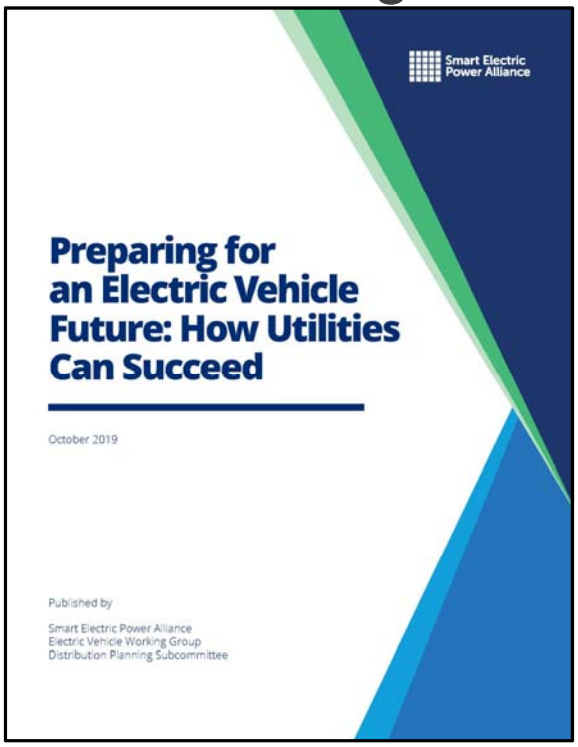
Rate Design



Managed Charging



Distribution Planning



Vehicle-Grid Integration Overview

Passive

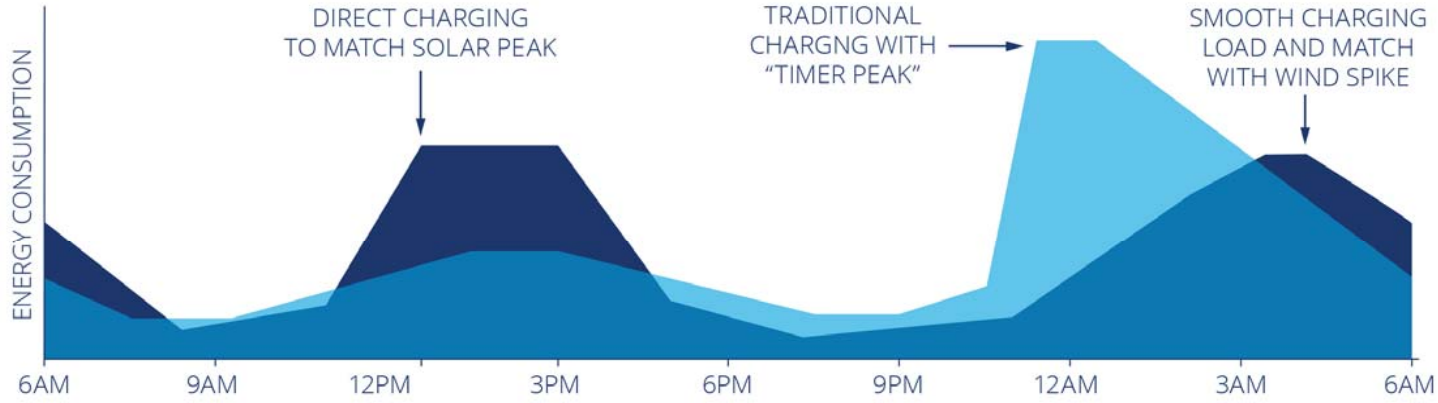
Behavioral Load Control

- Choice
- User experience
- Timing is key
- Grid Operator Considerations

Active

Direct Load Control

- User experience
- Transport Layer
- Messaging Protocol/ Standard
- Grid Operator Considerations



Source: BMW of North America, 2016 with edits by Smart Electric Power Alliance, 2017

Note: The light blue area illustrates the impacts of a hypothetical TOU residential charging rate with the lowest rate period beginning at 11 pm. The dark blue area shows how managed charging could distribute charging loads with peaks in renewable energy generation.

Load management strategies should consider local variables

Smart Electric Power Alliance

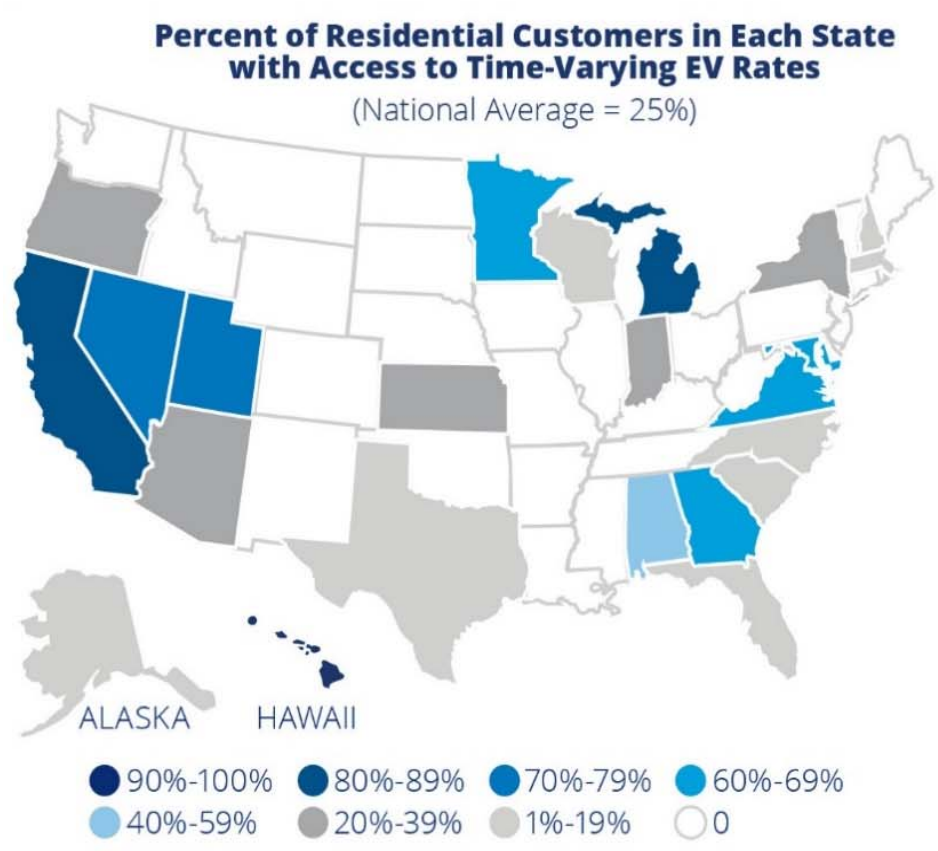
EV Load Management Option	Penetration of Light-duty Residential EVs	Available Distribution Capacity (including substations/ transformers/ feeders)	Integration of Intermittent Loads (e.g., solar, wind)	Cost of On-Peak Electricity
Passive				
Behavioral Load Control (e.g., text message during system peak)	Low	High	Low	Average
Generic Time-of-Use Rate	Low	High	Medium	Above average
Generic Dynamic Pricing Rate	Low	High	High	High
EV Time-of-Use Rate	Medium	Medium	Medium	Above average
EV Dynamic Pricing Rate	High	Medium	High	High

Load management strategies should consider local variables (cont'd)

EV Load Management Option	Penetration of Light-duty Residential EVs	Available Distribution Capacity (including substations/ transformers/ feeders)	Integration of Intermittent Loads (e.g., solar, wind)	Cost of On-Peak Electricity
Active				
Managed Charging (designed to minimize distribution impacts)	High	Low	High	Above average
Managed Charging (designed to minimize on-peak electricity costs)	High	Medium	High	High
Vehicle-to-Grid	High	Low	High	High

Source: Smart Electric Power Alliance, 2019.

EV Rates Landscape



Source: Smart Electric Power Alliance & The Brattle Group, 2019.

28 investor-owned utilities, **12** municipal utilities, and **10** electric cooperatives	**18** pilot programs, **46** fully implemented residential rates

Of the 64 EV rates, **58** were TOU rates, **1** was a subscription rate with an on-peak adder, and **5** were off-peak credit programs.

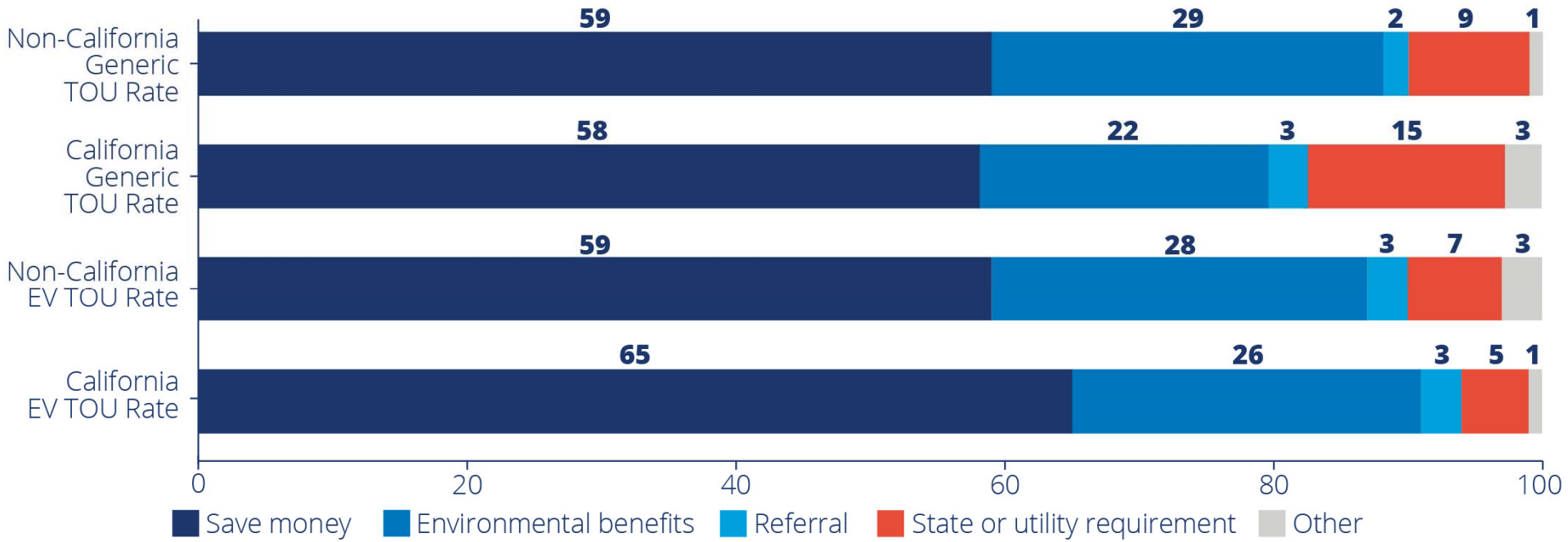
How the rate applies to the home load:

- **35** rates apply to the **total household energy consumption**, including the EV charging load.
- **21** rates **apply strictly to EV charging**. These rates typically require the installation of a second meter or submeter, and two rates are metered from a submeter in the EV charger itself.
- **8** rates allowed customers to **choose between whole home or EV-only options**.

Why do utilities develop EV rates?

Source: Smart Electric Power Alliance & The Brattle Group, 2019. N=29. Respondents selected all that applied.

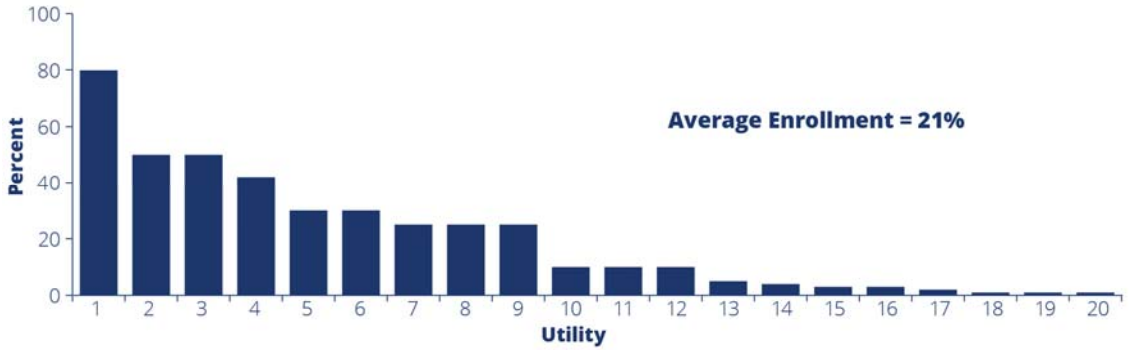
Why do customers enroll in EV rates?



Source: Smart Electric Power Alliance & Enel X, 2019. Respondents selected all that apply. N=1,192. (1,704 options selected)

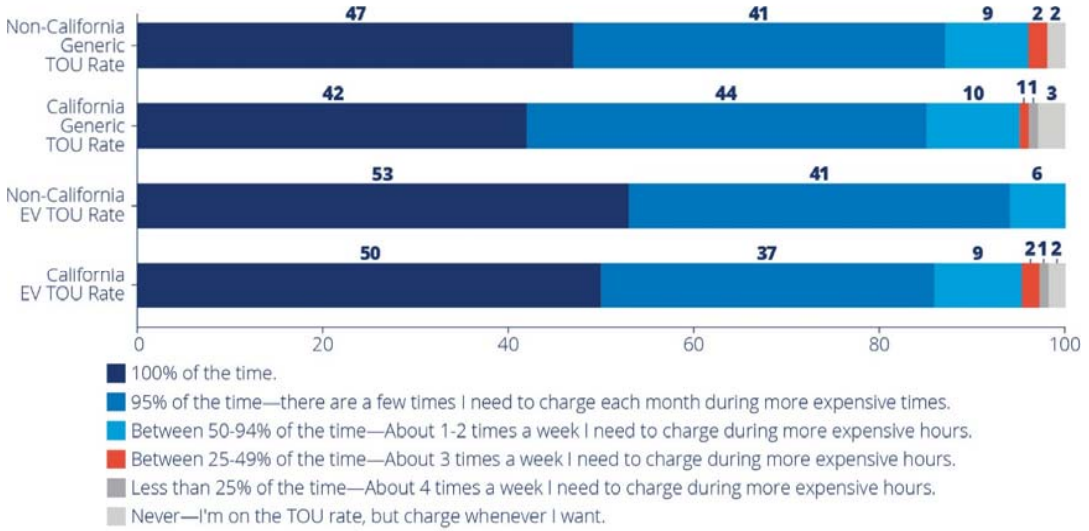
EV rates work when….

EV drivers are enrolled



Source: Smart Electric Power Alliance & The Brattle Group, 2019. N=20.

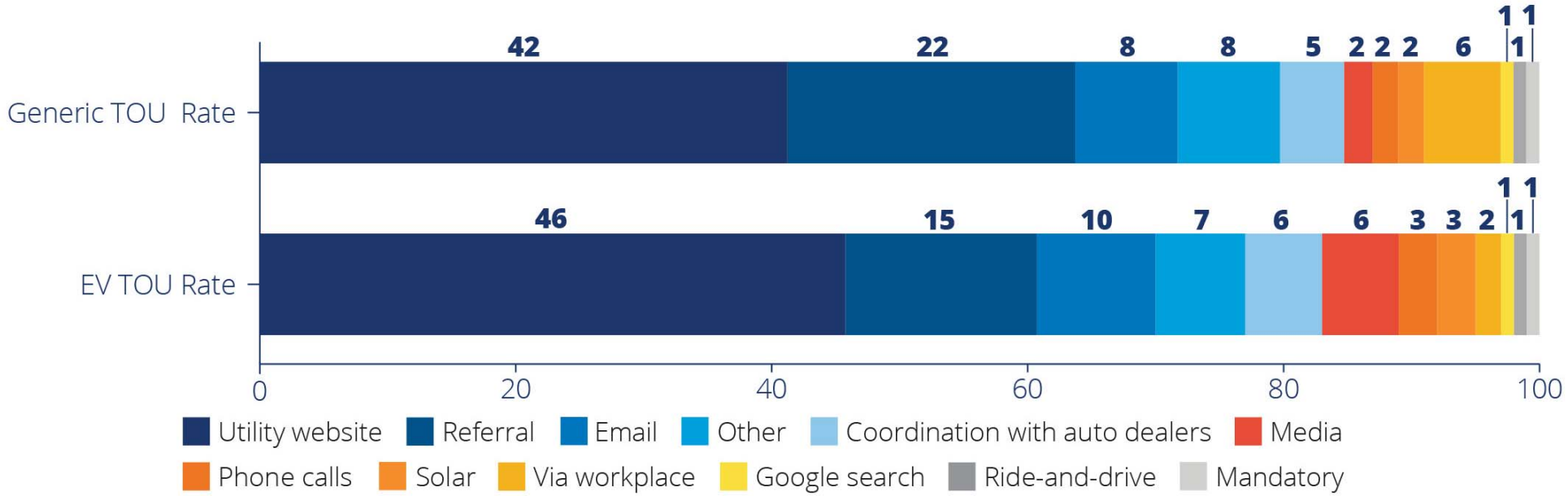
And customers are charging off-peak



Source: Smart Electric Power Alliance & Enel X, 2019. N=1,167.

Marketing can be inexpensive

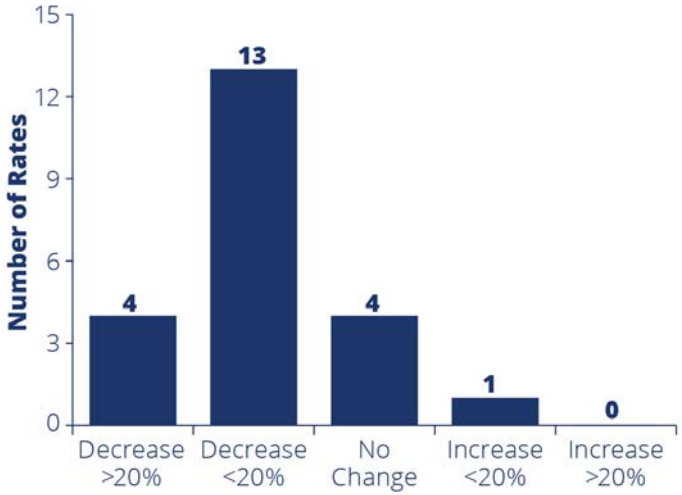
Engaging customers at the time they make their EV purchase leads to better enrollment.



Source: Smart Electric Power Alliance & Enel X, 2019. Respondents selected all that apply. N=1,173. (1,611 options selected)

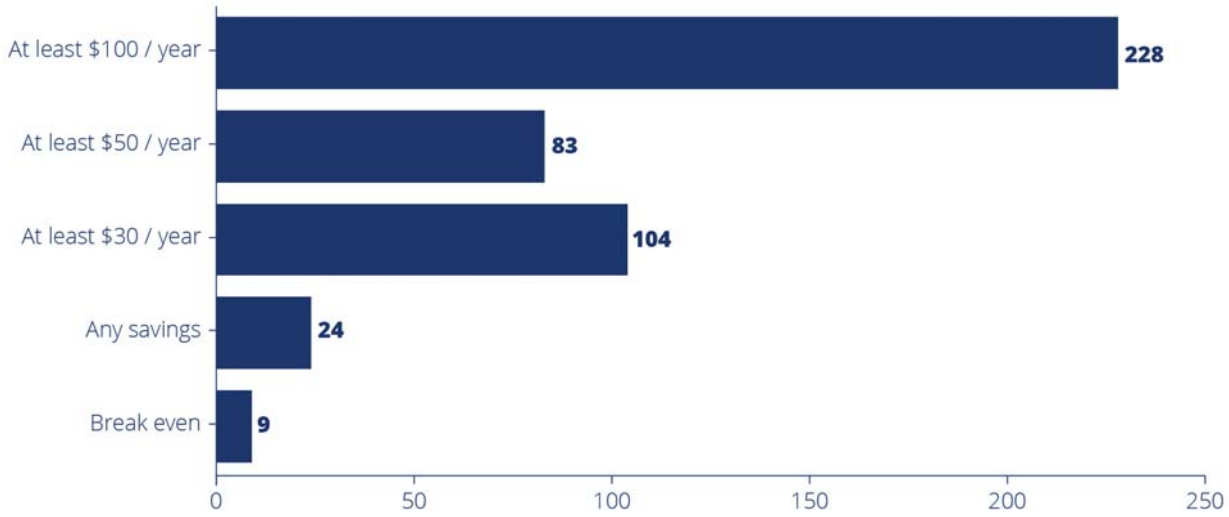
How much money do customers need to save?

Majority of utilities target between 0-20% monthly bill savings for EV customers



Source: Smart Electric Power Alliance & The Brattle Group, 2019. N=30
Note: Six respondents indicated that the bill change was 'unknown'.

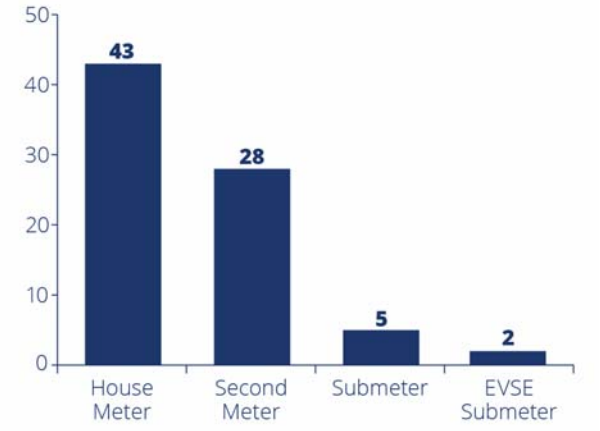
Customers need to save at least $100 per year to enroll



Source: Smart Electric Power Alliance & Enel X, 2019. N=448.

Keep metering costs low

While using the house meter may be the cheapest option,…



Source: Smart Electric Power Alliance, 2019. N=64
Note: The authors did not identify AMI vs. non-AMI meters.

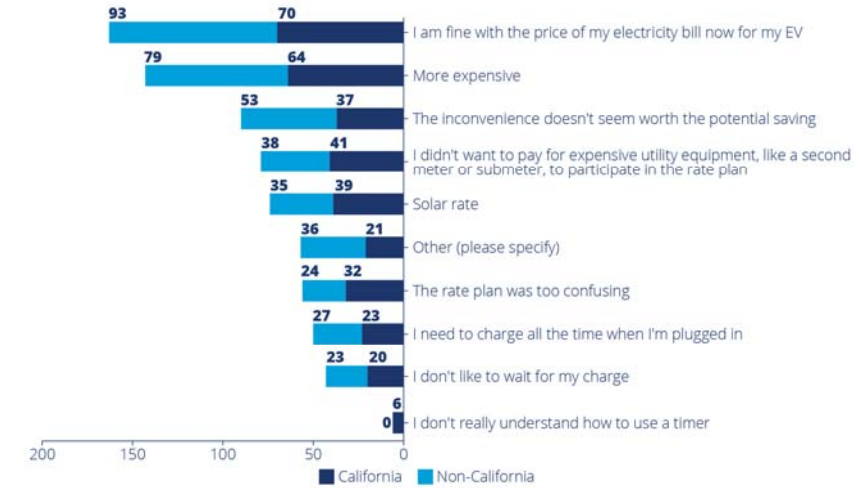
… there are a number of pros/ cons from a user perspective. Consider alternative options that are still inexpensive.

	Existing Meter	Secondary Meter	Submeter	EVSE Telemetry	AMI Load Disaggregation
Ability to Meter EV Charging Separately	No—Does not separate the EVSE from rest of load	Yes	Yes	Yes—Accuracy for billing purposes depends on EVSE manufacturer	Yes—Accuracy depends on ability to identify unique kW signature of EVSE
Utility Bill Integration	Easiest to integrate	Easiest to integrate	Easier to integrate	Difficult to standardize among multiple vendors and retroactively integrate into billing system; data via AMI backhaul more accurate	Depending on the format of the disaggregated data, may not integrate
Consumer Participation Cost	No additional cost	Depending on tariff, no up-front cost to consumer, or consumer pays for the full cost	Depending on tariff, no up-front cost to consumer, or consumer pays for the full cost	No additional cost if consumer already purchased the equipment; potential additional cost for compatible EVSE	Depending on tariff, some cost for administration, third-party costs, or equipment
Volume of Eligible Customers with AMI	Highest—independent of EVSE type	Highest—independent of EVSE type	Highest—independent of EVSE type	Limited to eligible EVSE vendors	Highest—independent of EVSE type

Source: Smart Electric Power Alliance, 2019.

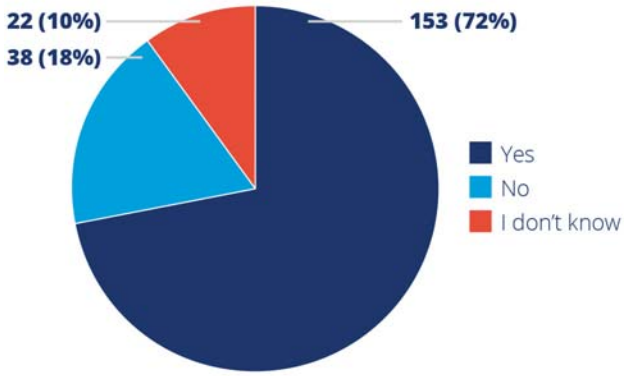
Why don’t customers enroll?

Your EV rates may not be perfect today…



Source: Smart Electric Power Alliance & Enel X, 2019. N=526. (761 options selected)
Respondents selected all that apply.

… but it isn’t too late! Nearly ¾ of survey respondents said they would be willing to charge off-peak.



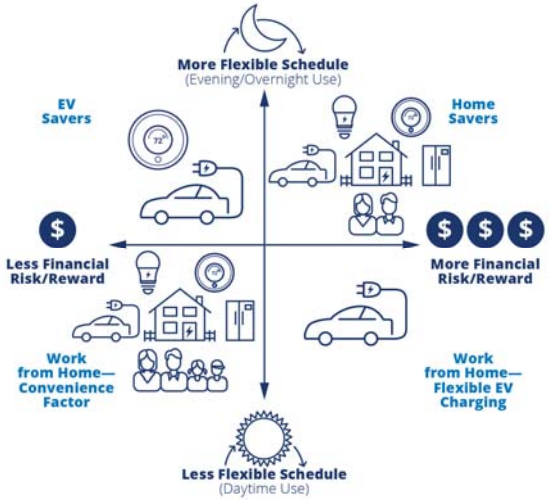
Source: Smart Electric Power Alliance & Enel X, 2019. N=213.

Respond to Customer Preferences

Provide **meaningful choices** that meet needs of:

a) Most EV customers
b) System constraints
c) Cost-benefit assessment
d) The future

Source: The Brattle Group, 2012.[42]



Attributes that lead to highest levels of enrollment

Examples of innovate EV rates

Xcel Energy Minnesota Residential EV Service Pilot

- Use the EVSE telemetry for billing
  - ChargePoint and Enel X Level 2 chargers
  - Billing integration with EVSE data was challenging
  - 96% of charging off-peak

Austin Energy, EV 360 Subscription-based Rate

- Use a dedicated second meter
  - Less than 10kW demand unlimited charging for $30/month during off-peak (7pm-2pm weekdays, anytime weekends)
  - More than 10kW is $50/month during off-peak
  - On-peak is $0.14/kWh during winter and $.40/kWh in summer

Braintree Electric Light Department, Bring Your Own Charger

- Use AMI load disaggregation
  - 80% EV enrollment (due to Sagewell EVFinder algorithm), 95% of charging off-peak
  - Retroactive bill credit; less expensive administration and enrollment fees

Webinar: Utility Experiences with Residential EV Rates (Public)

February 4, 2020, 11am PST/ 2pm EST, 60 minutes

Learning objectives:

- The current landscape of residential EV time-varying rates
- Utility approaches to EV metering
- Consumer insights
- Features of effective time-varying rates

Speakers:

- Richard Farinas, Research Manager, SEPA (moderator)
- Ryan Hledik, Principal, The Brattle Group
- Jeffrey Lehman, Electric Transportation Program Manager, AEP
- Lindsey McDougall, EV Program Manager, Austin Energy
- Bill Bottiggi, General Manager, Braintree Electric Light Dept.

Sign-up at www.sepapower.org under Events

Recommendations

1. **Minimize up-front costs** for customer enrollment
2. Make **price differential** between ‘on-peak’ and ‘off-peak significantly large to incentivize participation, but not too large to deter enrollment
3. Incorporate an **‘opt out’** rather than ‘opt in’ for an EV rate, especially for rebate or incentives for charger or vehicle purchases
4. Provide **meaningful customer choices** and tools to help customers make rate selection easier
5. Consider **innovative approaches to rates**, such as dynamic rates, off-peak credits, subscription rates, etc.
6. **Adequately fund marketing** budget and use multiple channels
7. Develop a **long-term strategy** to transition from passive to active managed charging
8. **Work with EVSE providers** to lower cost of integrating networked EV charger telemetry

Collaborative teams of member SMEs addressing important industry issues

EV Subcommittees:

1) Utility Rates, Tariffs, and Incentives
2) Managed Charging/ V2G
3) Distribution Planning for EVs
4) Fleet Electrification

Smart Electric Power Alliance

Working Groups

- Community Solar
- Customer Grid Edge
- Cybersecurity
- **Electric Vehicles**
- Energy Storage
- Energy IoT
- Grid Architecture
- Microgrids
- Solar Asset Management
- Testing and Certification
- Transactive Energy Coordination

Renovate INITIATIVE
Regulatory • Process • Innovation

Smart Electric Power Alliance

The Renovate mission is to **spur the evolution** of state **regulatory processes** and **practices** to **enable innovation**, with a focus on scalable deployment of new technologies and operating models, to meet customer needs and increasing expectations while continuing to provide all with clean, affordable, safe, and reliable electric service.

4 Problem Statements:

1. People & Knowledge
2. Managing Risk & Uncertainty
3. Managing Increased Rate of Change
4. Complexity of Objectives / Cross-Coordination

Learn more: https://sepapower.org/renovate/

Partnering Organizations:

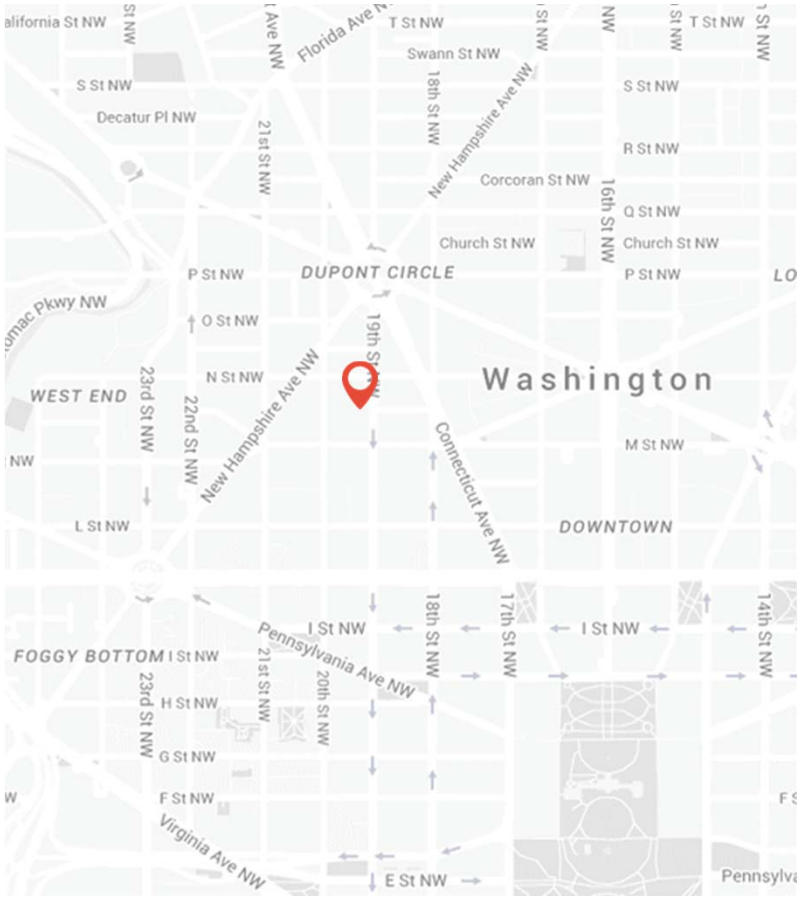
Smart Electric Power Alliance

Erika H. Myers
Principal, Transportation Electrification
emyers@sepapower.org
202.379.1615

Richard Farinas
Manager, Research
rfarinas@sepapower.org
202.595.1147

HEADQUARTERS

Smart Electric Power Alliance
1220 19th Street, NW, Suite 800
Washington, DC 20036-2405
202.857.0898



Questions?

EV Rate Design

Considerations for C&I Customers

NARUC EV Working Group Meeting

January 14, 2020

Melissa Whited

Synapse Energy Economics

Why EV Rates?

EV rates can help to:

- **Avoid grid upgrades** by encouraging customers to charge off-peak
- **Encourage EV adoption** through low-cost charging options, making EVs more affordable

In turn, this can:

- **Reduce rates** for all customers by spreading the fixed costs over more kWh, while adding no additional infrastructure costs
- **Reduce emissions, achieve policy goals**

Who are C&I EV Customers?

Examples:

- Public DCFC
- Transit vehicles
- School buses
- Municipal fleets
- Commercial fleets (delivery vehicles, forklifts, etc.)

Image credit: Lord Alpha, Wikipedia

Image credit: City of Houston

Rate Design Involves Balancing Multiple Objectives

- Provide appropriate price signals to maximize benefits for the wider grid
  - E.g., encourage off-peak charging
- Encourage EV adoption by ensuring that the economics of transportation electrification are not artificially undermined
  - Cost is the #1 deterrent to EV adoption (NREL)
- Provide rate options that work for multiple types of customers, recognizing that the ability to shift charging load varies across use cases
  - One size may not fit all

Three Key Issues for Today

1. Demand charges can hinder adoption of EVs
   - Should demand charge discounts be considered?
   - Can time-varying energy rates be used instead?
2. Should different rates be available to different customers?
3. Recovery of marginal costs vs. Embedded costs
   - Should EV rates reflect full embedded costs?

Demand Charges

Demand Charges

- For DC fast chargers (DCFC), demand can be high but energy consumption low. At low numbers of EVs, the economics do not pencil out.
- Fast charging stations may have low usage initially, but a fast charger with two 50-kW ports could still be assessed a demand charge on 100 kW monthly.

Tariff example:

Customer Charge	$/Month	$ 166.00
Demand Charge	**$/kW**	**$ 20.00**
Energy Charge	$/kWh	$ 0.08

- Annual bill assuming 16 charges per month: $26,760 = **$139/charge**
- Annual bill assuming 60 charges per month: $28,872 = **$40/charge**

Highly uneconomic to operate a fast charger at low EV penetrations. Chicken-and-egg problem.

Temporary Demand Charge Conversions

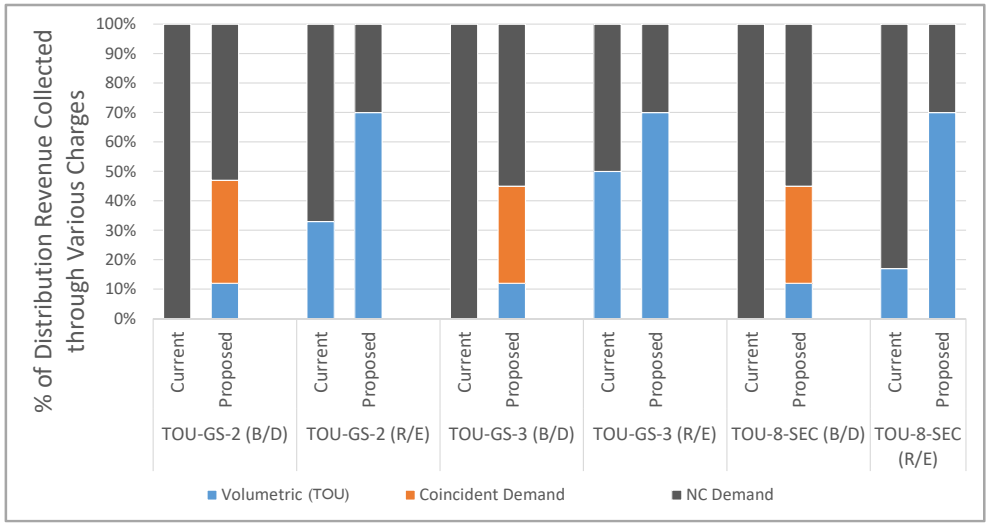
Some utilities have reduced or eliminated demand charges for public charging infrastructure, opting instead to price electricity using TOU energy rates only.

- Pacific Power (OR) shifted a portion of demand charges to on-peak energy rates, reducing DCFC bills by up to 59 percent. The demand charge would gradually be phased back in, by year 9.[1]
- Con Edison's (NY) Business Incentive Rate is available to DCFC customers for seven years, until April 30, 2025. This incentive reduces customer demand charges by between 34 percent and 39 percent.[2]
- Southern California Edison will offer a rate to general service customers serving EV loads that does not include a demand charge for five years, and then is phased back in during years 6 through 11.[3]
- National Grid (RI) pilot provides a 100 percent distribution demand charge discount for dedicated DCFC stations for three years with the opportunity to extend the credit for an additional three years.[4]
- Baltimore Gas and Electric has proposed to provide a fixed demand charge credit to non-residential customers with EV chargers based upon the nameplate capacity of the installed charging infrastructure.[5]
- Connecticut Light and Power's demand charge discounts at two pilot public charging stations have reduced monthly bills by between 65 percent and 88 percent.[6]
- The Hawaiian Electric Companies' EV-F rate and EV-U rate substitute higher TOU rates for demand charges.[7]
- Pepco DC has proposed to provide a fixed demand charge credit based upon the nameplate capacity.[8]

Less emphasis on non-coincident demand charges

- "…non-coincident demand charges do not reflect cost causation for primary distribution, transmission, or generation capacity costs"
- "…non-coincident demand charges also promote inefficient use of energy" and do not promote socially beneficial energy usage

- CPUC D.18-08-013



No “One-Size Fits All”

Different use cases; different rates

- **Public DCFC:**
  - Demand charges very difficult to translate into prices charged to EV drivers
  - Very difficult to throttle customers' charging
  - May not have space or economics to install storage to manage demand charges
  - Critical Peak Pricing may be more economic than demand charges, while providing price signals that can be more easily communicated to drivers

- **Fleets:**
  - May be able to easily shift charging to overnight hours to avoid certain demand charges (e.g., coincident peak demand charges)
  - May be good candidates for demand response programs (direct load control, V2G)

Marginal vs. Embedded Costs

Recovery of Marginal vs Embedded Costs

- Embedded costs reflect historical expenditures, while marginal costs are those incremental costs associated with serving new load.
- To support transportation electrification policy goals, EV rates can be designed to primarily **recover marginal costs, rather than embedded costs** in the near term, similar to an economic development rate.

Benefits

- Lower cost of charging will enhance adoption of EVs and help to advance policy goals.
- As long as EV customers pay at least marginal costs, other customers will experience no increase in rates.

Drawbacks

- Rates will not decrease due to greater sales from EVs as long as rates only collect marginal costs

Recovery of Marginal vs Embedded Costs

- "Due" vs. "Undue discrimination":

  "… discrimination is often socially desirable. If it allows a company to expand its sales and utilize its facilities more fully, average costs are reduced as fixed costs are spread over more units of output and the firm's profits are increased. Fuller utilization, in turn, may result in lower prices for *all* customers and in wider use of the utility's services."

  - Philips' The Regulation of Public Utilities (1993), p. 438

- Conditions:

  (1) "there are high fixed costs and chronic unused capacity, so that costs per unit are reduced as the fixed costs are spread over a larger volume of output;

  (2) the lower rates are needed to attract new business;

  (3) all rates cover at least the variable costs and make some contribution to fixed (overhead) costs; and

  (4) regulation is undertaken to keep total earnings reasonable and to keep discrimination within bounds.

  If these conditions exist, discrimination is desirable since it leads either to an increased use of the facilities or to a lower rate for the customers discriminated against." (Philips (1993) pp. 440-441)

- Rates should gradually move toward embedded costs

Contact

Melissa Whited
Synapse Energy Economics

617-661-3248
mwhited@synapse-energy.com
www.synapse-energy.com

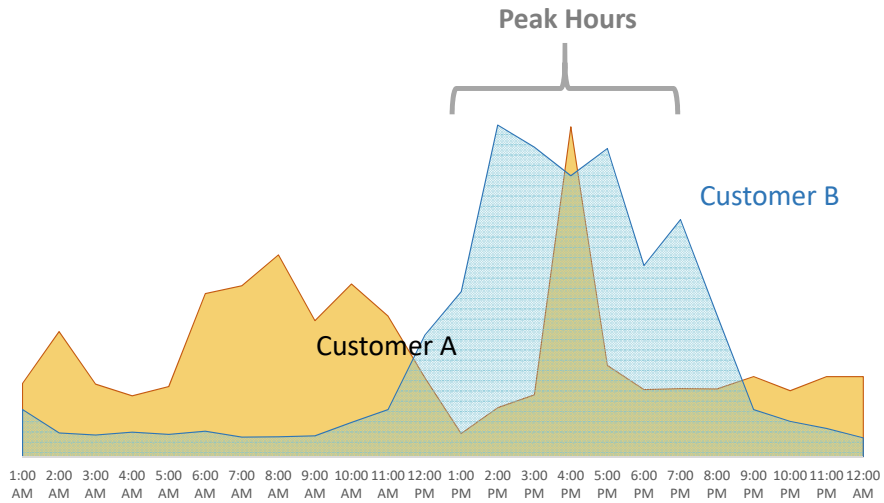
About Synapse Energy Economics

- Synapse Energy Economics is a research and consulting firm specializing in energy, economic, and environmental topics. Since its inception in 1996, Synapse has grown to become a leader in providing rigorous analysis of the electric power sector for public interest and governmental clients.
- Staff of 30+ experts
- Located in Cambridge, Massachusetts

Additional Slides

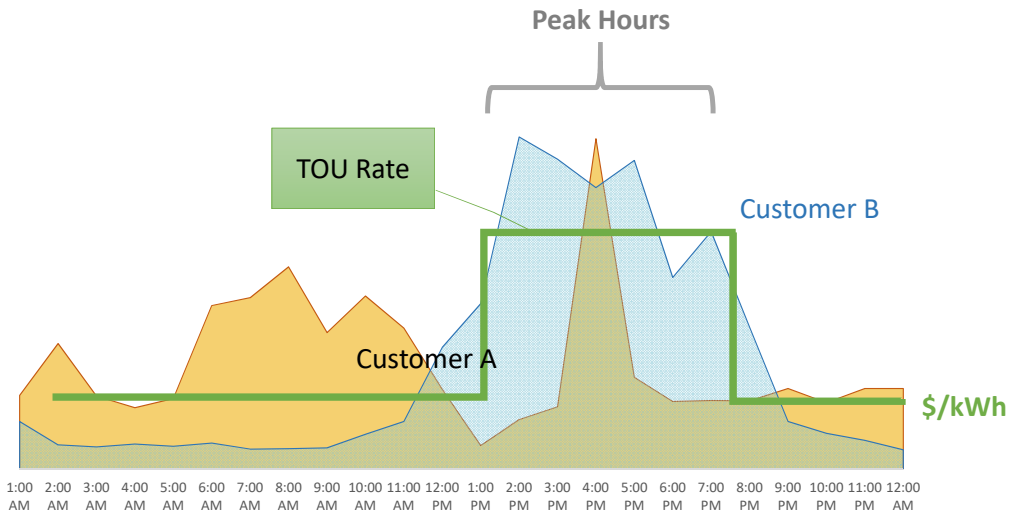
Demand Charges

- Customer A and Customer B pay the same bill under a demand charge
- Even with demand charges that apply only during peak hours, the signal is only concentrated in one hour.



Modifications to demand charges

- TOU rates can provide a more accurate reflection of cost- causation



Subscription Charges

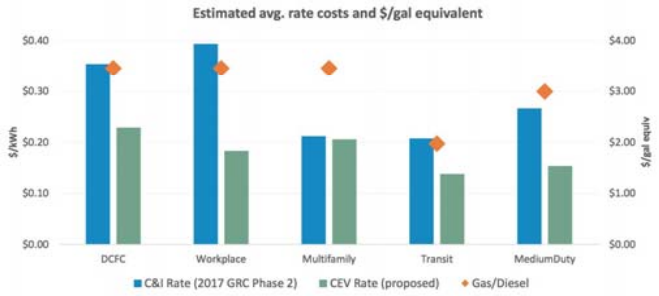
Many utilities offer C&I EV TOU rates, which enable workplaces to avoid crippling demand charges

PG&E's proposed subscription alternative

Estimated bill savings for sample site types

For modeled customer sites, new EV rates can enable significant savings compared to existing commercial rate plans

Actual bill impacts will vary for each customer depending on charging usage patterns



tate and billing estimates are preliminary and only reflect the sample site modeled. Actual costs will ary based on approved rate values, as well as individual site energy usage.

References re: Demand Charge Discounts

- [1] Max St. Brown, “Staff Report Re: Schedule 45- Public DC Fast Charger Delivery Service Optional Transitional Rate,” Docket No. ADV 485/Advice No. 16-020, May 8, 2017.
- [2] Consolidated Edison Company of New York, Inc., Tariff Book, Revision 5, Leaf 201, Rider J, issued February 1, 2017.
- [3] California Public Utilities Commission, Decision on Transportation Electrification Standard Review Projects, Decision 18-05-040, May 31, 2018, p. 111.
- [4] The Narragansett Electric Company, Settlement Agreement, Docket Nos. 4770 and 4780, June 16, 2018.
- [5] Baltimore Gas and Electric, et al., “Proposal to Implement Statewide Electric Vehicle Portfolio,” Docket
- No. PC44, January 19, 2018.
- [6] Jeffrey R. Gaudiosi, Esq., “EV Pilot Filing Letter, Attachment 1,” Docket No. 13-12-11, June 24, 2016.
- [7] Hawaiian Electric Companies, “Electric Vehicle Pilot Rates Report,” Docket No. 2016-0168, March 29, 2018.
- [8] Potomac Electric Power Company, et al., “Proposal to Implement Statewide Electric Vehicle Portfolio,” Docket No. PC44, January 19, 2018.

Synapse
Energy Economics, Inc.

Questions?

Peer Discussion – Commissioner Commission Staff Only

Facilitators

- Working Group Chair Maria Bocanegra and Illinois Commerce Commission Staff
- Working Group Vice-chair Jason Stanek and Maryland Public Service Commission Staff

Preparatory Questions

To Consider in Advance:

- What time-varying rates or pilots are available to EV-owners in your state? If none, are you considering any?
- Who first proposed the rate? The commission, a utility, or another party?
- Are residential rates EV-only or whole-home? If EV-only, how is the rate metered?
- How is the rate structured (e.g. TOU, hourly, subscription, etc.)?
- What time-varying rates are available for public, workplace, and fleet charging, if any?

Discussion Questions

Consider time-varying rates for EV charging in your own state:

- What are the most successful parts of your program? What challenges did you encounter?

Discussion Questions

Consider time-varying rates for EV charging in your own state:

- How effective is the rate at shifting charging load off-peak? How high is participation?

Discussion Questions

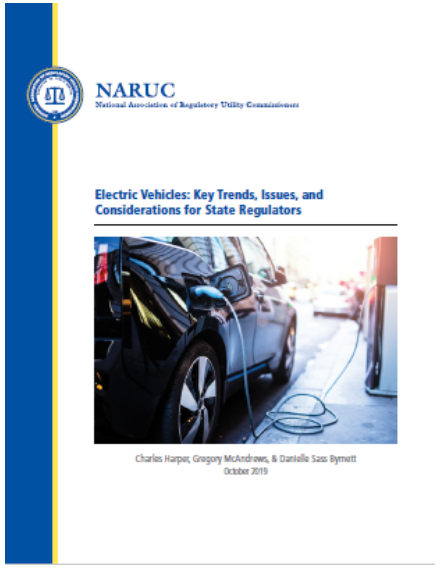
Consider time-varying rates for EV charging in your own state:

- What would you do differently if your state was approaching this topic for the first time?

Announcements

New NARUC Report on EVs

- "Electric Vehicles: Key Trends, Issues, and Considerations for State Regulators" was released in December
- Feel free to share with colleagues: http://bit.ly/EVkeytrends



Next Steps

February Meeting

- **Sunday, February 9, 2020** from 10:30-11:45 AM EST
- To be held in-person at NARUC's Winter Policy Summit in DC with the Staff Subcommittee on Energy Resources and the Environment (a dial-in option will be available)
- Topic: State Approaches to Electric Vehicle Proceedings
- We will hear from three states on their experience with EV proceedings and lessons learned