Smart Electric Power Alliance

Future Proofing EVs to be a Grid Asset

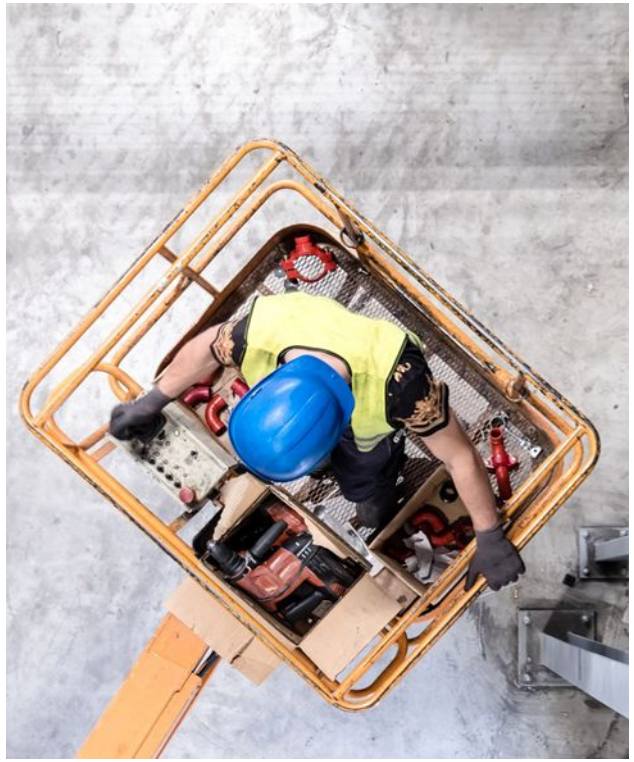
Electrifying the Transportation and Building Sectors in the PJM Footprint

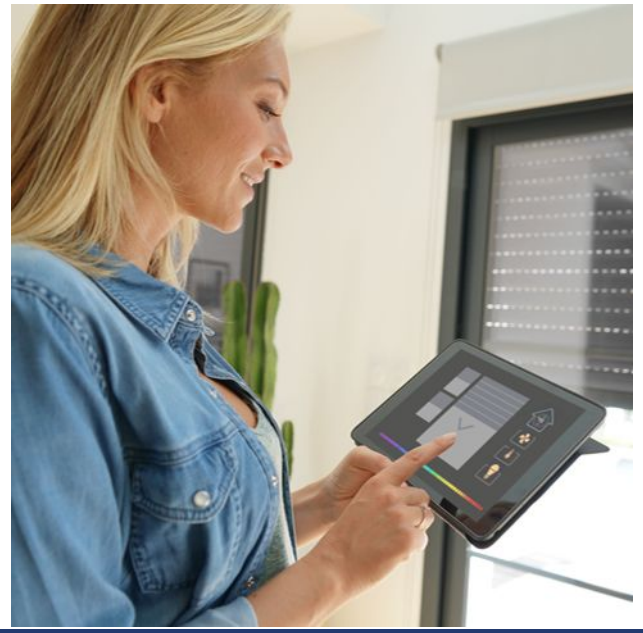
December 18, 2019

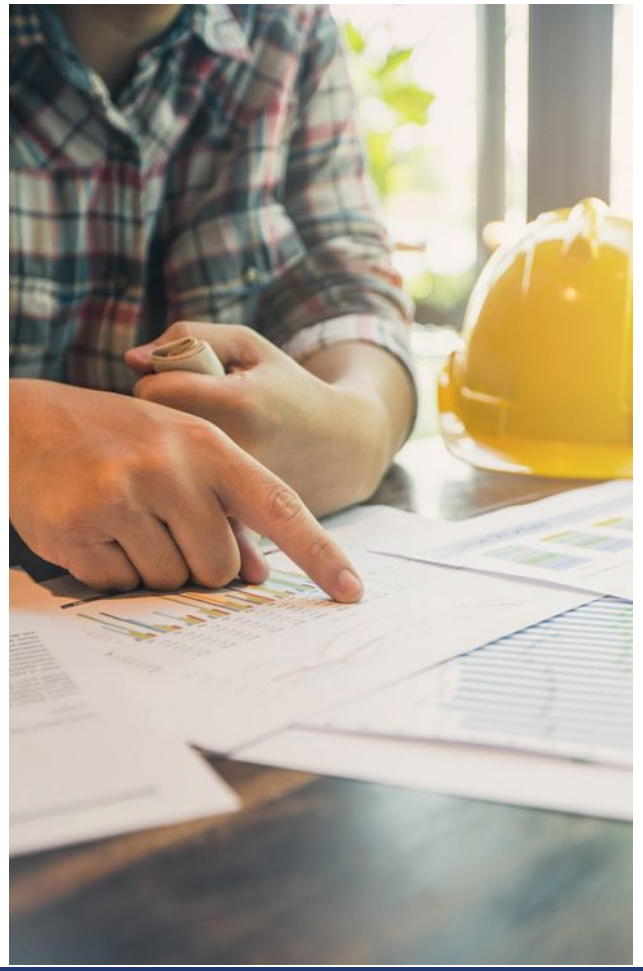
Erika H. Myers
Principal, Transportation Electrification

Clean + Modern Grid

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







Who Are We?

Smart Electric Power Alliance

Smart Electric Power Alliance

A membership organization

Founded in 1992

Staff of ~50
Budget of ~$10M

Research, Education, Collaboration & Standards

Based in Washington, D.C.

Unbiased

No Advocacy – 501c3

Technology Agnostic

Pathways

Smart Electric Power Alliance

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.

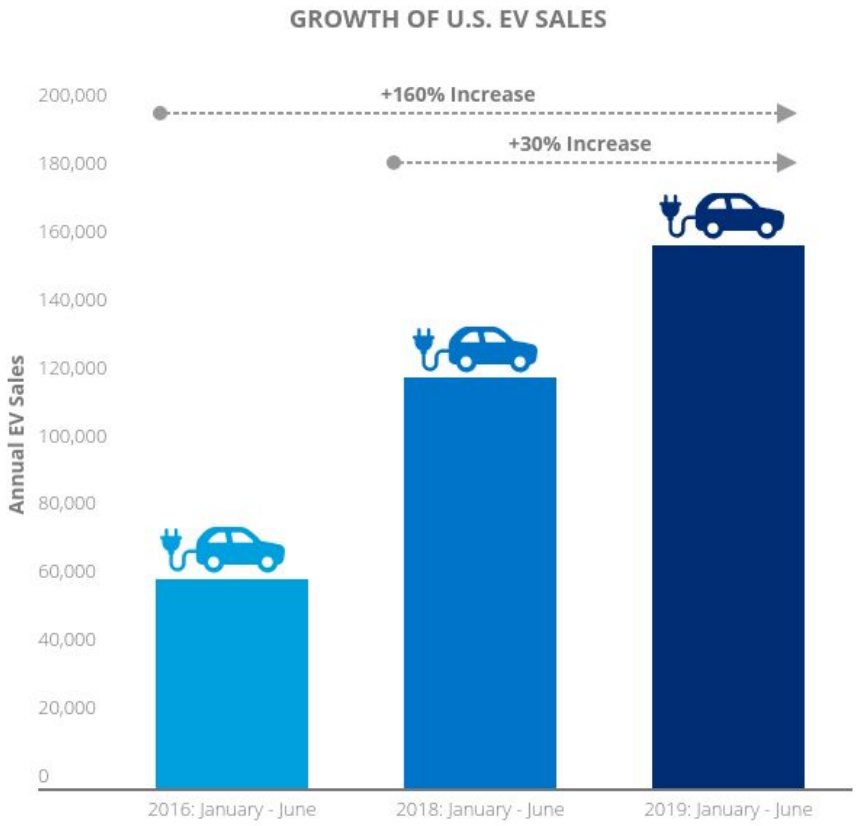
Transportation Electrification

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

Electric Vehicle Trends

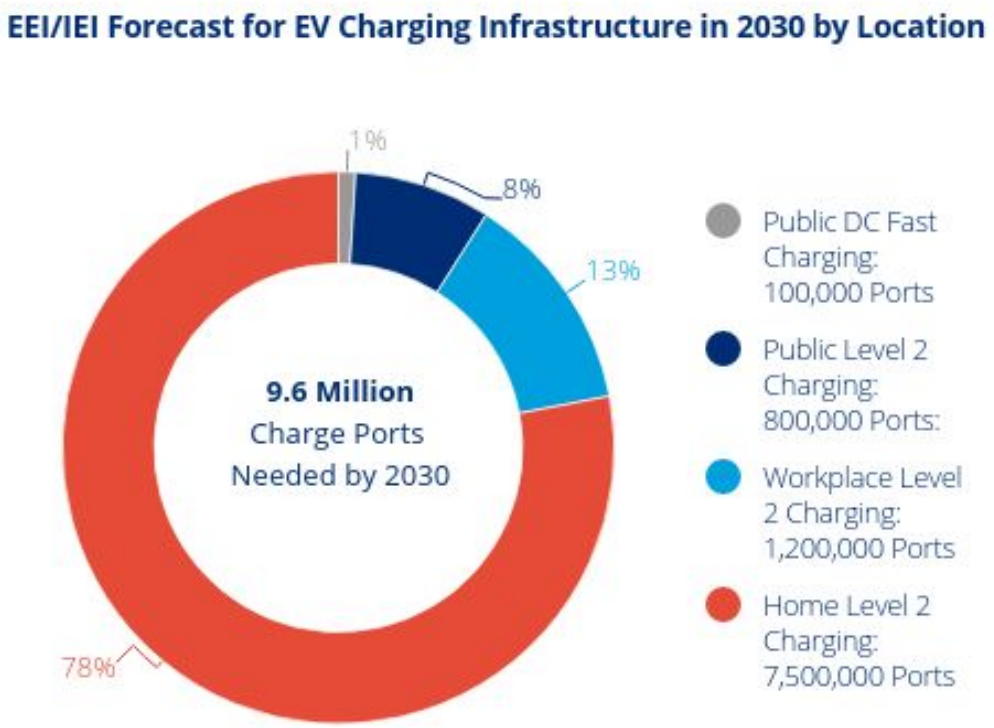
Smart Electric Power Alliance

Steady EV growth…



Source: Auto Alliance's Advanced Technology Vehicle Sales Dashboard

… will translate to major EV infrastructure needs

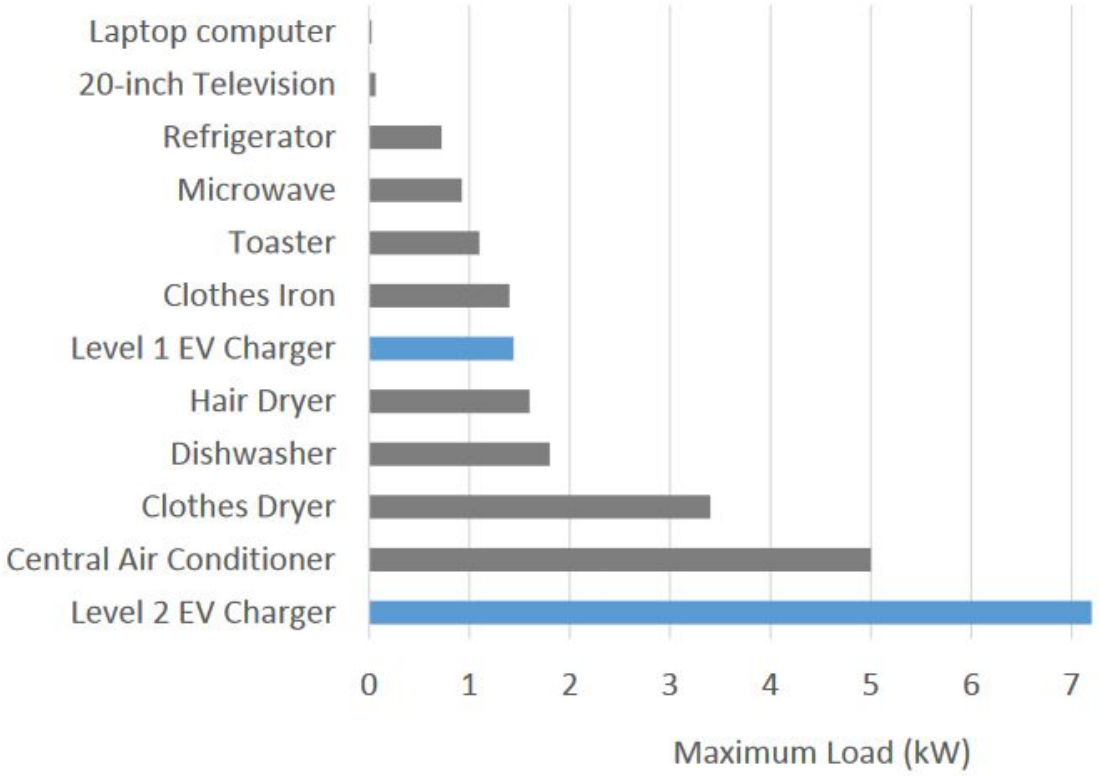


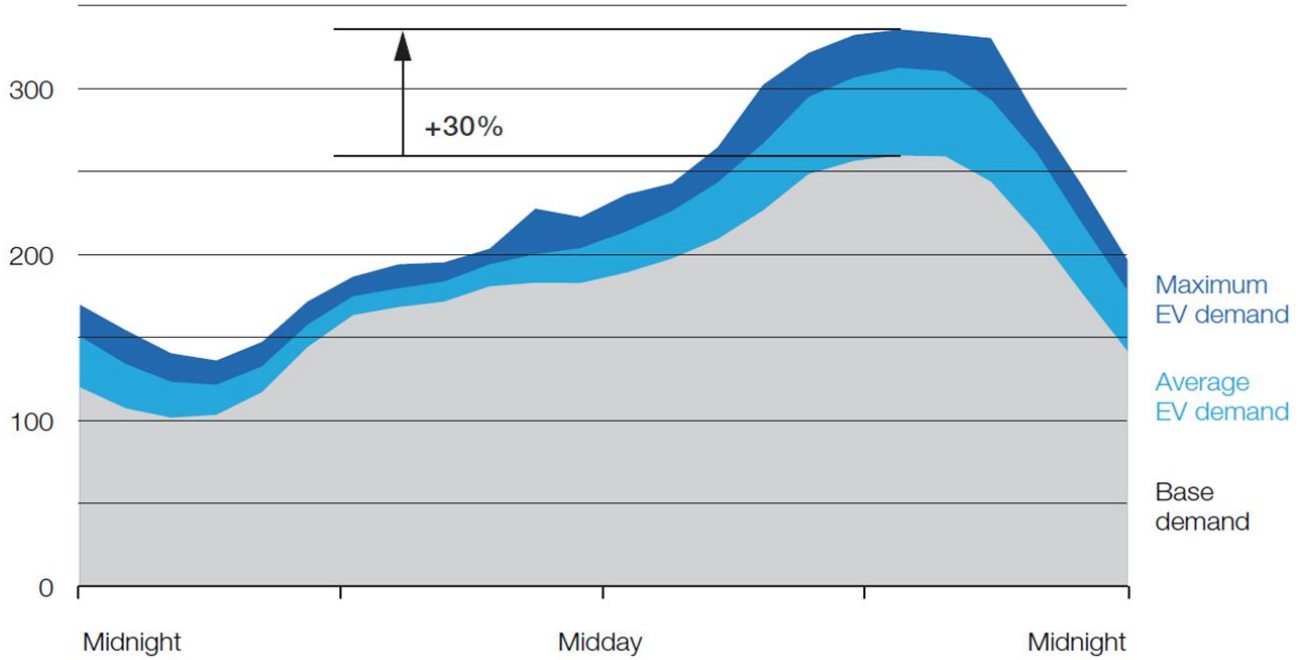
Source: EEI/IEL, November 2018, *EV Sales Forecast and the Charging Infrastructure Required through 2030.*

Impact of residential EV charging

Smart Electric Power Alliance

The next generation of EV charging could have significant impacts on peak demand.





Source: Synapse Energy, 2019.

Future Proofing for Electric Vehicles

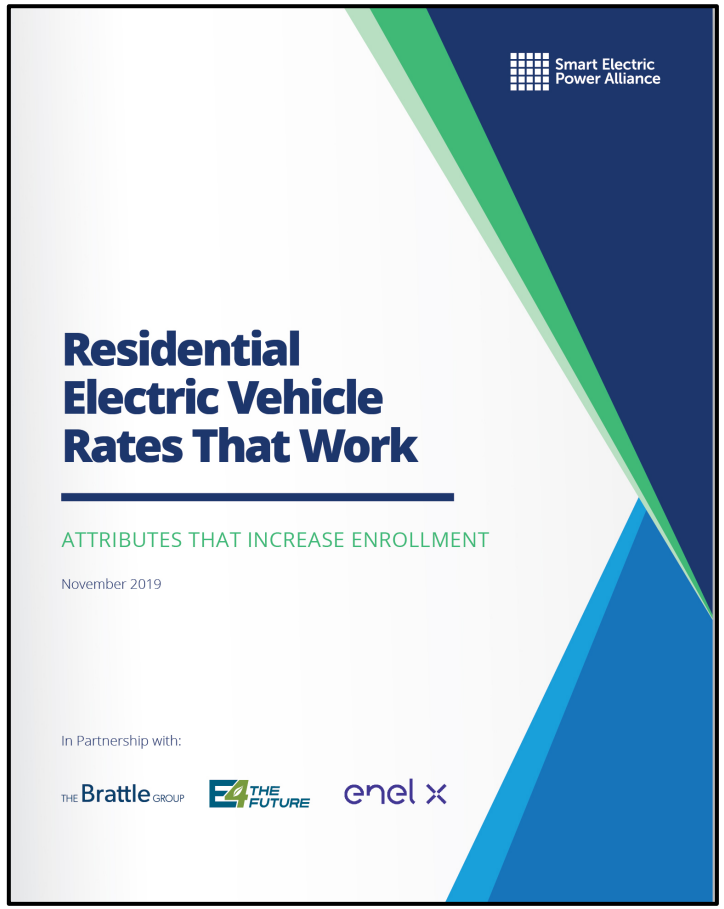
Smart Electric Power Alliance

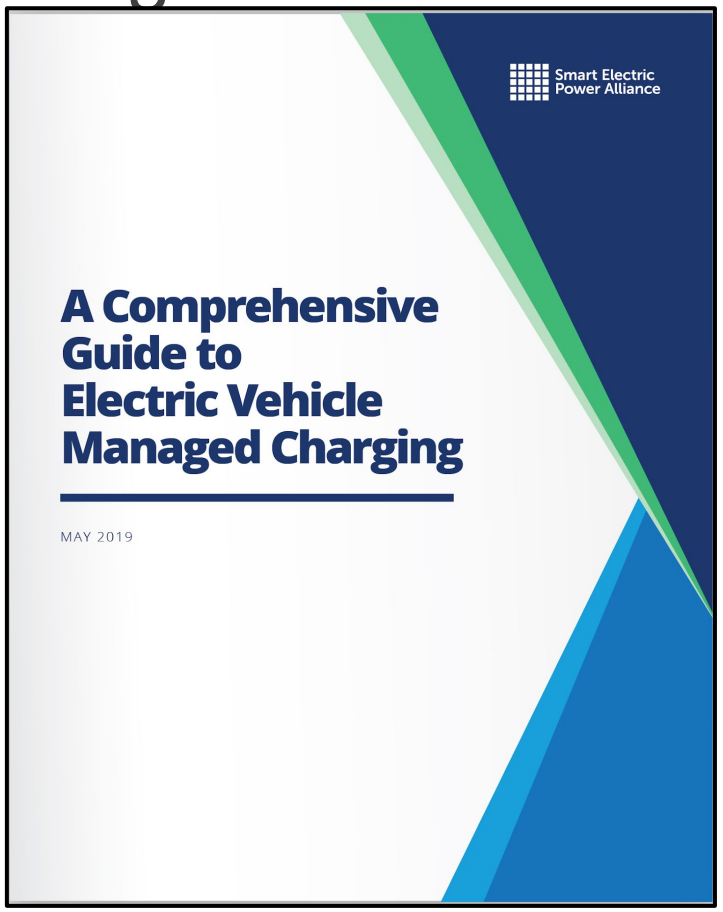
Rate Design

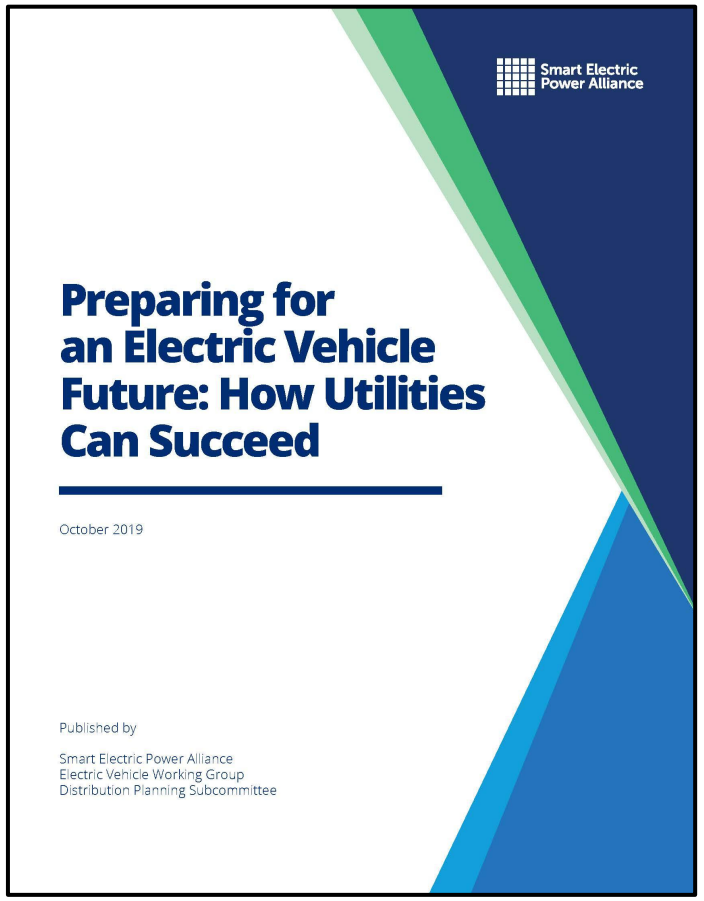
Managed Charging

Planning

Distribution







Vehicle-Grid Integration Overview

Smart Electric Power Alliance

Passive

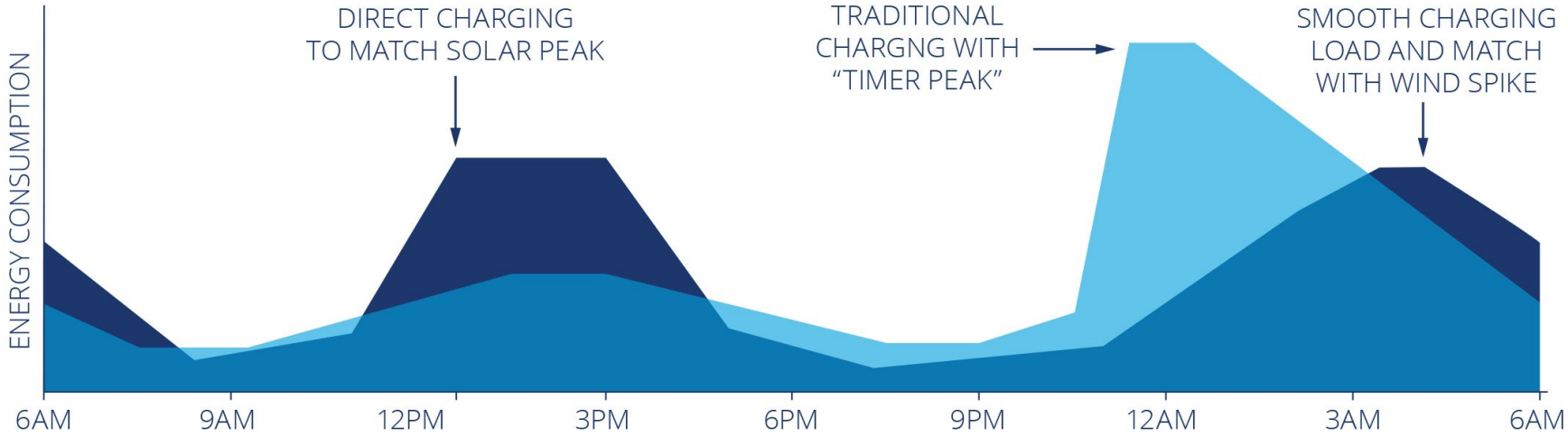
Behavioral Load Control

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

Active

Direct Load Control

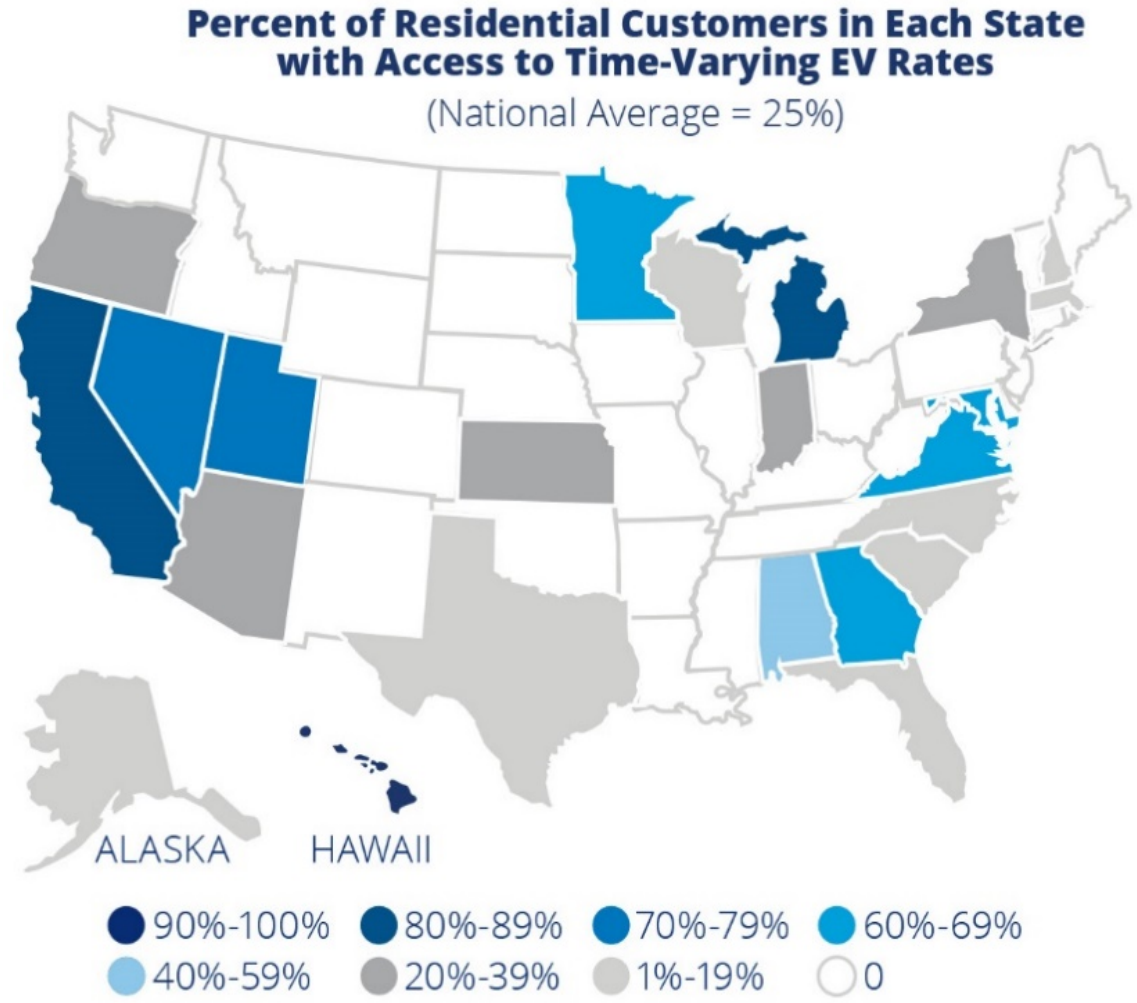
- User experience
- Transport Layer
- Messaging Protocol/ Standard
- Grid Operator Considerations



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.

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

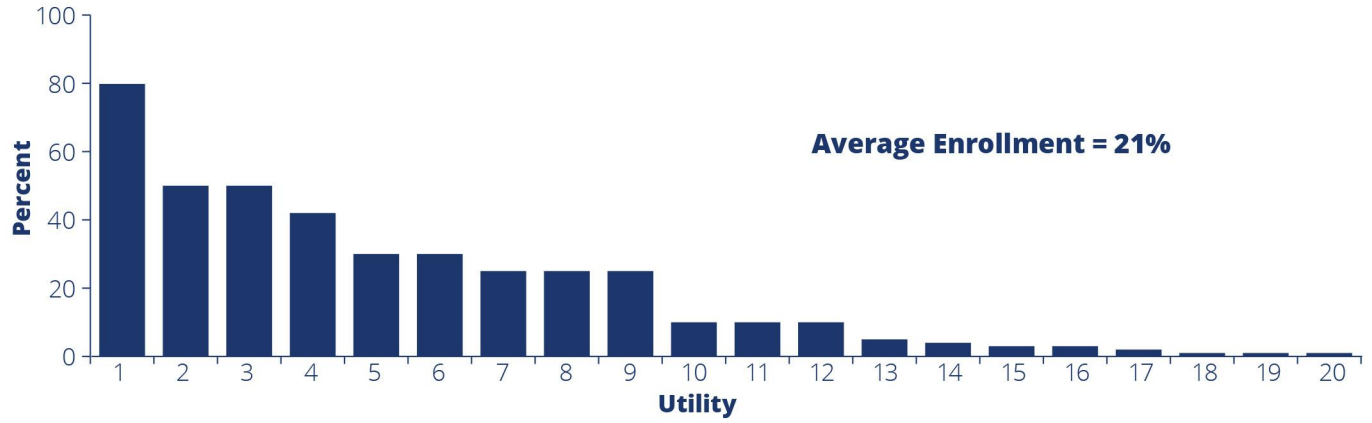
Of the 64 EV rates, **58** were TOU rates, **1** was a subscription rate with an on-peak adder, and **5** were off-peak credit programs.

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**.

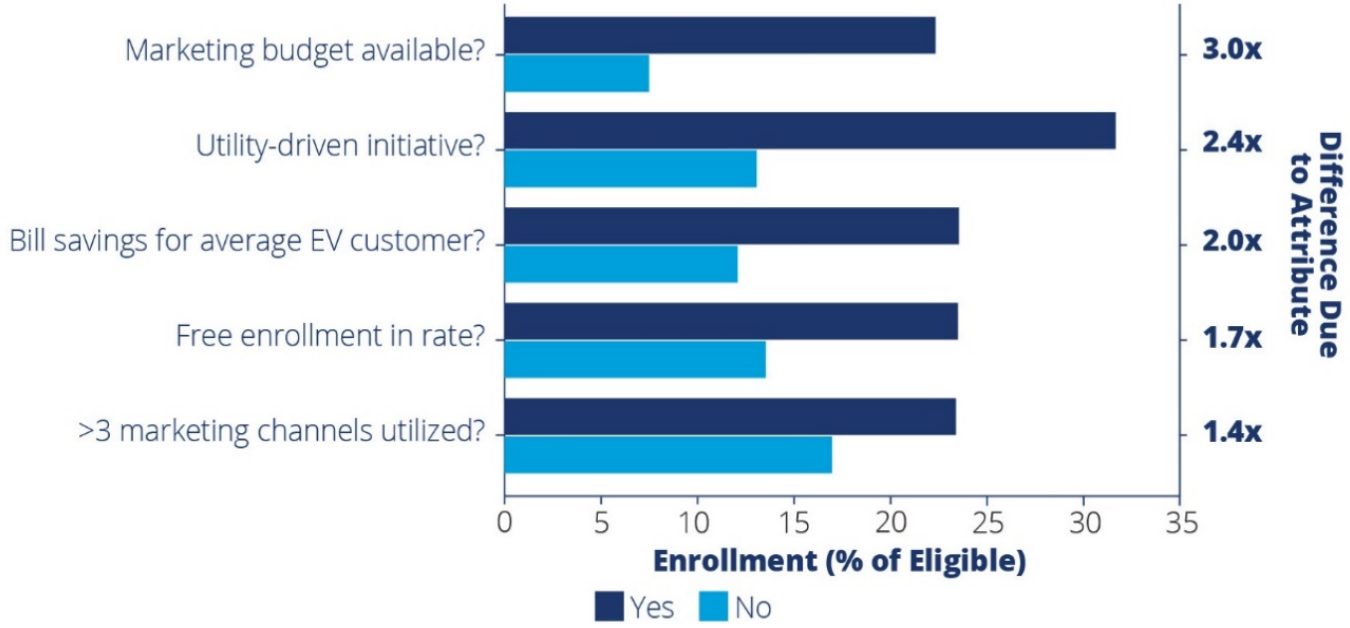
EV rates work when….

EV drivers are enrolled



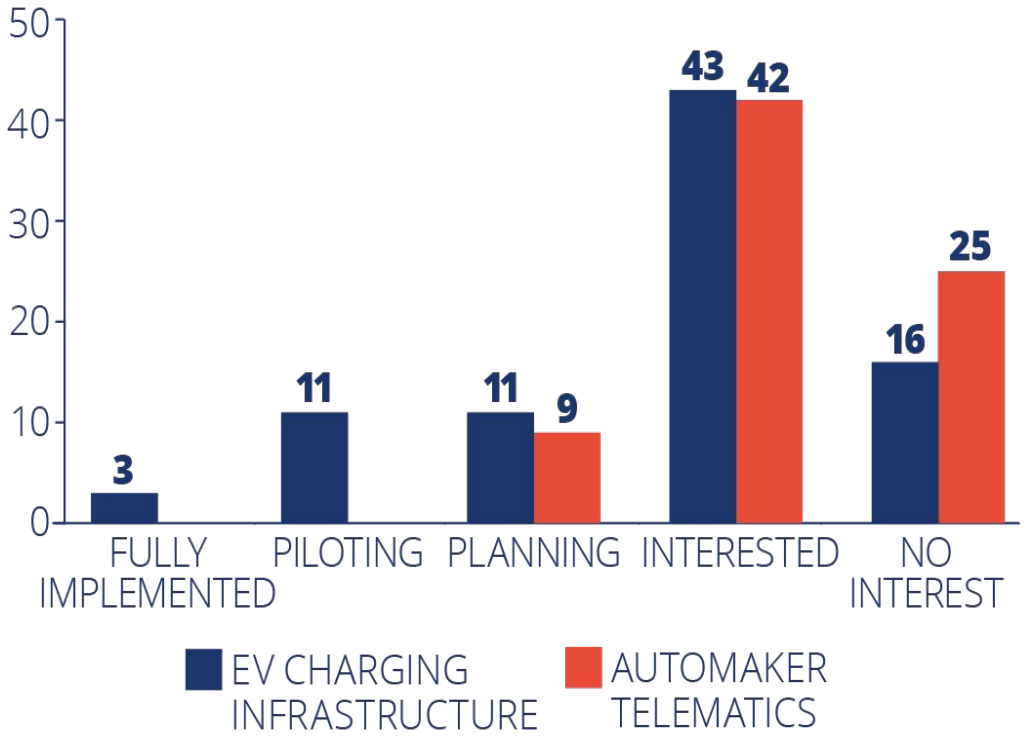
Source: Smart Electric Power Alliance & The Brattle Group, 2019. N=20.

Rates align with customer need

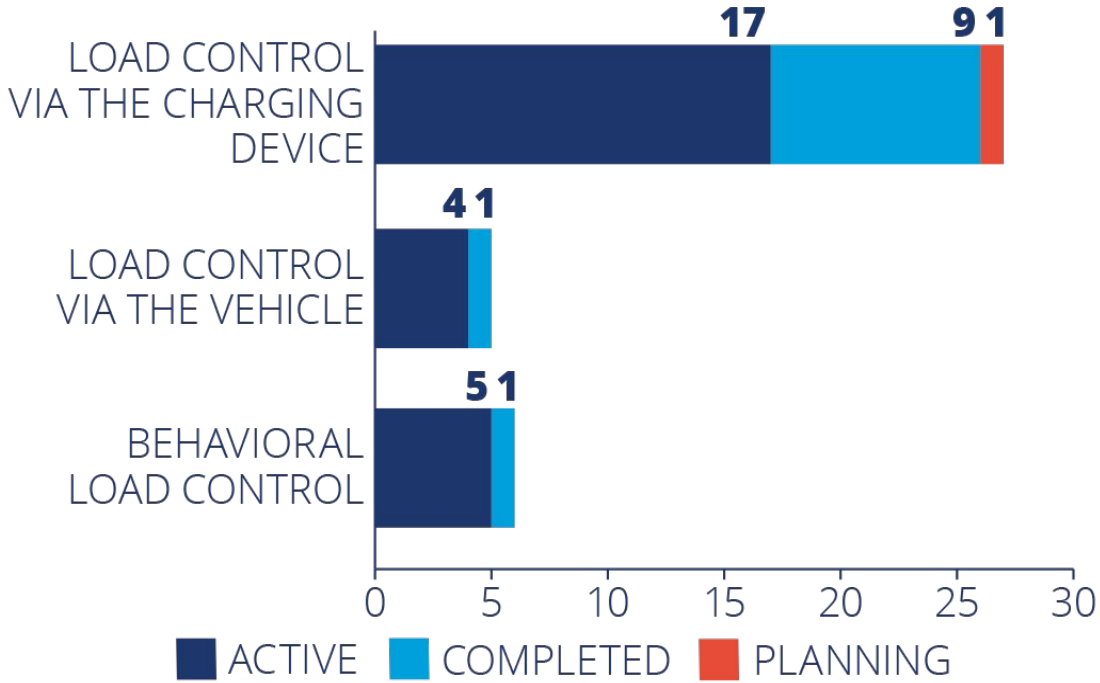


Utility interest in managed charging

Interest grows for managed charging through the EV charger



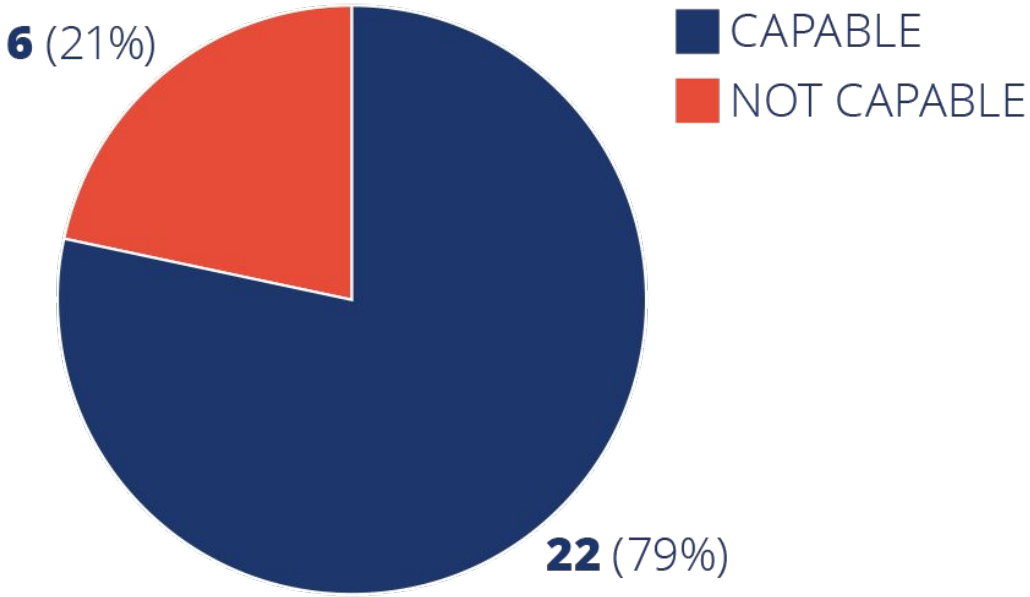
Source: Smart Electric Power Alliance, 2019. n=84



Source: Smart Electric Power Alliance, 2019. See Appendix A for details. n=38

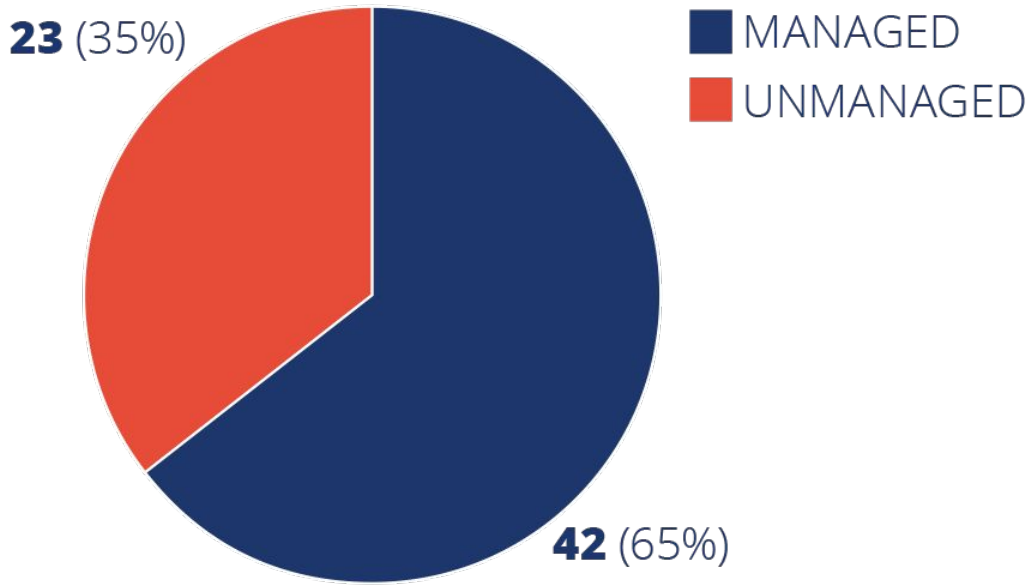
State of the industry

Percentage of Network Service Providers with Managed Charging Capabilities, U.S., 2019



Source: Smart Electric Power Alliance, 2019.

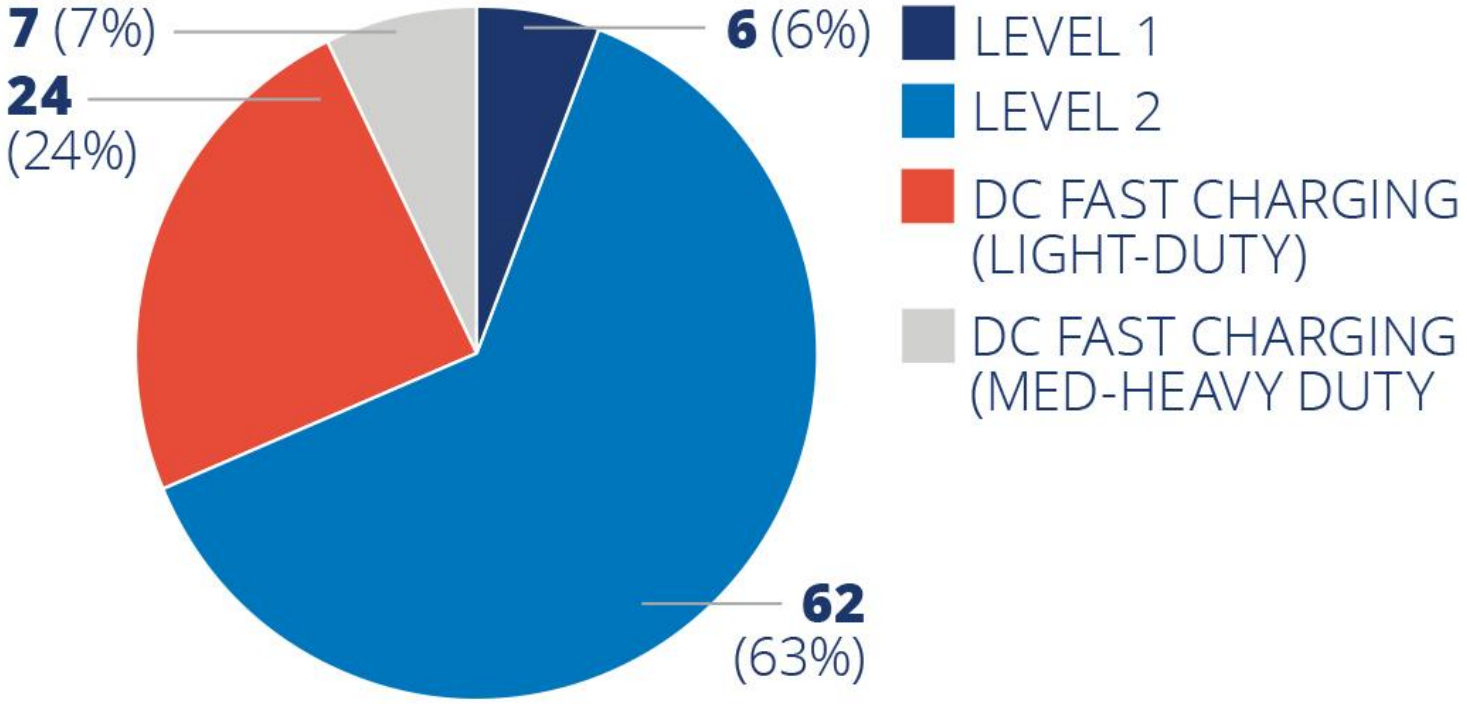
Percentage of EVSE Manufacturers with Managed Charging Capabilities, U.S., 2019



Source: Smart Electric Power Alliance, 2019.

State of the industry (Cont'd)

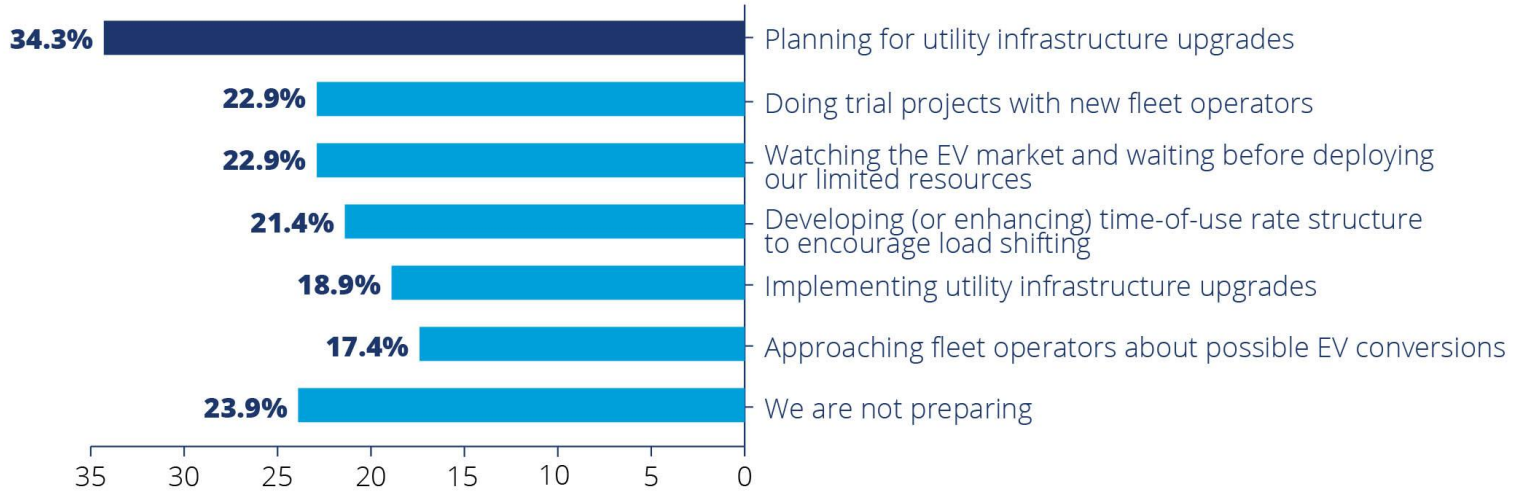
Number of Managed Charging Capable EVSE by Level, U.S., 2019



Source: Smart Electric Power Alliance, 2019. Note: Some manufacturers offer multiple configurations of chargers in a series type. Only one base configuration in a series was included in the tally.

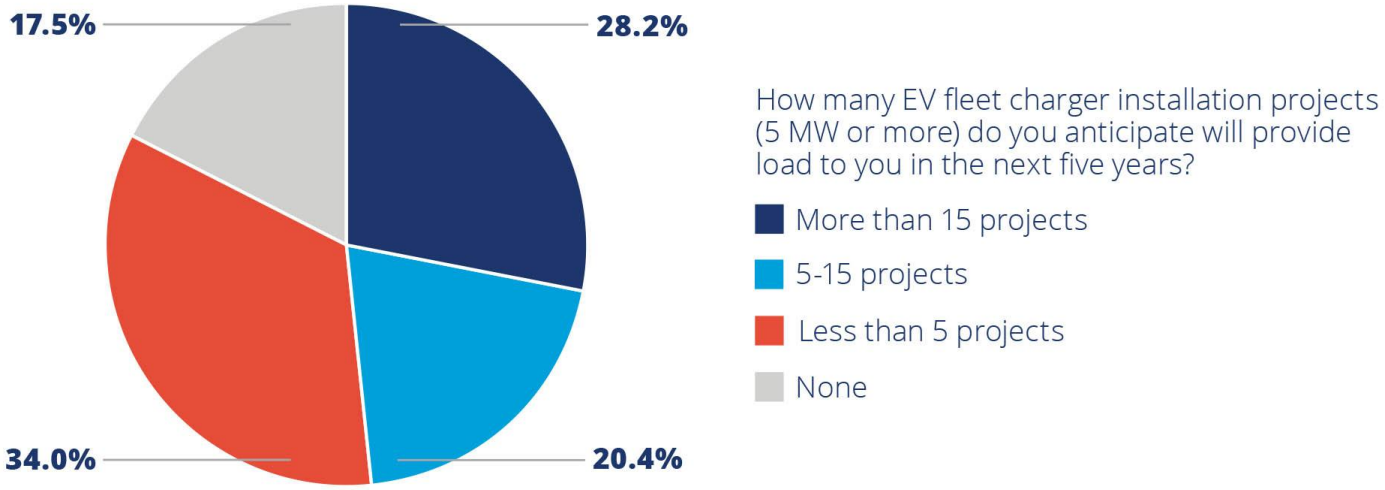
Utilities response to fleet electrification

Most utilities are not adequately preparing…



Source: Black & Veatch, Strategic Directions: Electric Survey Results 2019. N=892.[12]

…even though ¾ of utilities expect >5 EV fleet projects of 5 MW+



Source: Black & Veatch, Strategic Directions: Electric Survey Results 2019.[22]

Distribution planning is key

Steps for success:

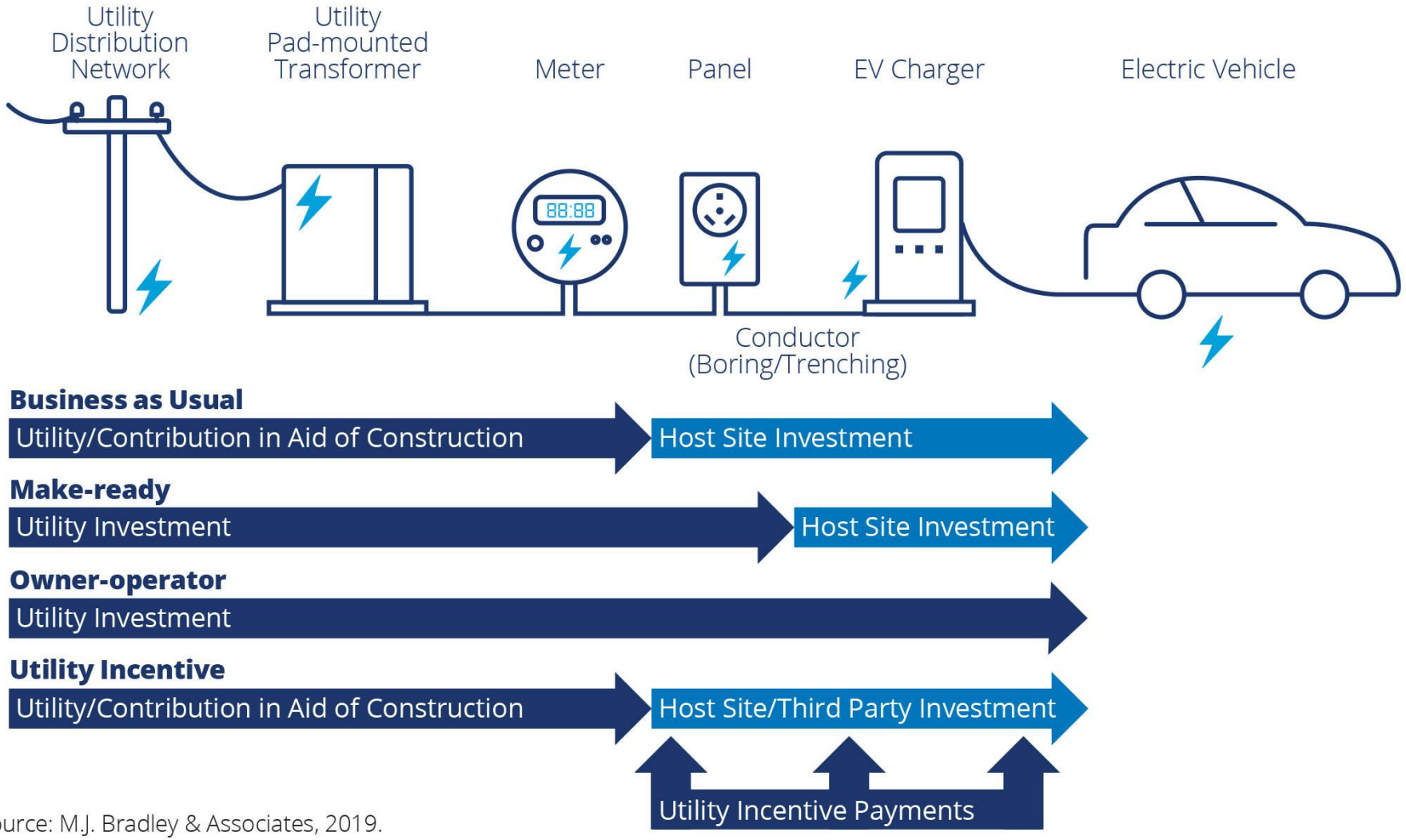
1) Fill data gaps
2) Gather assumptions based on historical data
3) Forecast growth
4) Model propensity by customer type
5) Simulate adoption
6) Assess impacts

Figure 16: A Process to Identify Grid Impact of EVs and Charging Infrastructure

1. Identify Key Drivers and Data Sources	2. Analyze Historical Data	3. Forecast Adoption
▪ Vehicle registration records by zip code, model year and fuel type ▪ Utility data on customers on EV rates ▪ Granular EV charging data ▪ Costs and incentives	▪ Assess adoption patterns over time ▪ Assess geographic concentration ▪ Identify locations with a higher green vehicle penetration ▪ Identify location with a higher share of new vehicles ▪ Assess relationship between hybrids and EV adoption	▪ Used innovation diffusion curves with uncertainty ▪ Applied to EVs over time
4. Model Propensity Score Adoption	**5. Simulate Adoption and 8760 Load Shapes**	**6. Assess Impacts on Local Grids**
▪ Model the probability of adoption for each customer ▪ Calibrate over time so it totals aggregate forecast over time	▪ Load patterns vary across customers and are not homogenous ▪ Different vehicle types have different load shapes ▪ Identify clustering of adopters	▪ Cost with active monitoring and load management ▪ Costs without active monitoring and management

Source: Demand Side Analytics, 2019.

Examine utility investment options



Source: M.J. Bradley & Associates, 2019.

Collaborative teams of member SMEs addressing important industry issues

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

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

HEADQUARTERS

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