Smart Electric Power Alliance

# Transportation Electrification: New Technology Implications

U.S. Department of Energy Workshop Series
An EV Future: Navigating the Transition
August 13, 2020
Erika H. Myers

**Clean + Modern Grid**

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

# Who Are We?

Smart Electric Power Alliance

- A membership organization
- Staff of ~50
  Budget of ~$10M
- Based in Washington, D.C.
- No Advocacy – 501c3

- Founded in 1992
- Research, Education, Collaboration & Standards
- Unbiased
- Technology Agnostic

# Pathways

## Utility Business Models

Utilities actively engaging in new technologies and partnerships for sustainable value creation, as both Integrators and Accelerants for a clean energy future.

## Grid Integration

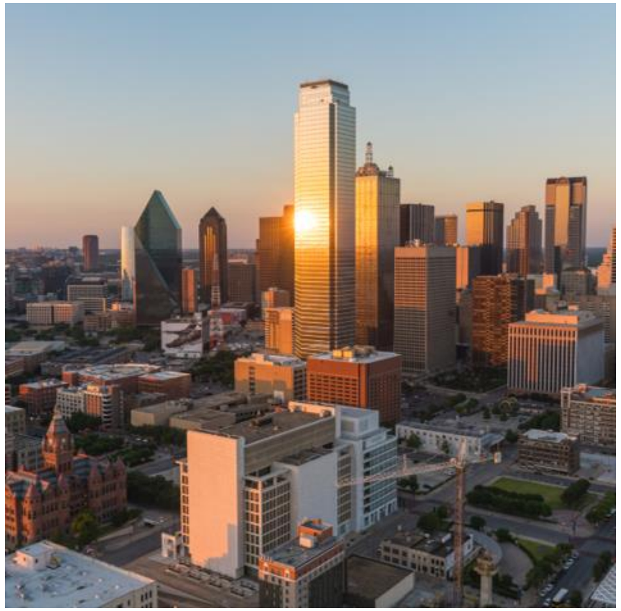
Seamless integration of clean energy yielding maintained or improved levels of affordability, safety, security, reliability, resiliency and customer satisfaction.

## 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.



# Leveraging advanced technology to support EV Infrastructure

1. Co-location of EVSE with DERs
2. DERMS for EVSE aggregation
3. AMI for Residential EV Rates
4. Active Managed Charging Technologies
5. Microgrids for Fleet Electrification

Utilities and Electric Vehicles

EVOLVING TO UNLOCK GRID VALUE

Residential Electric Vehicle Rates That Work

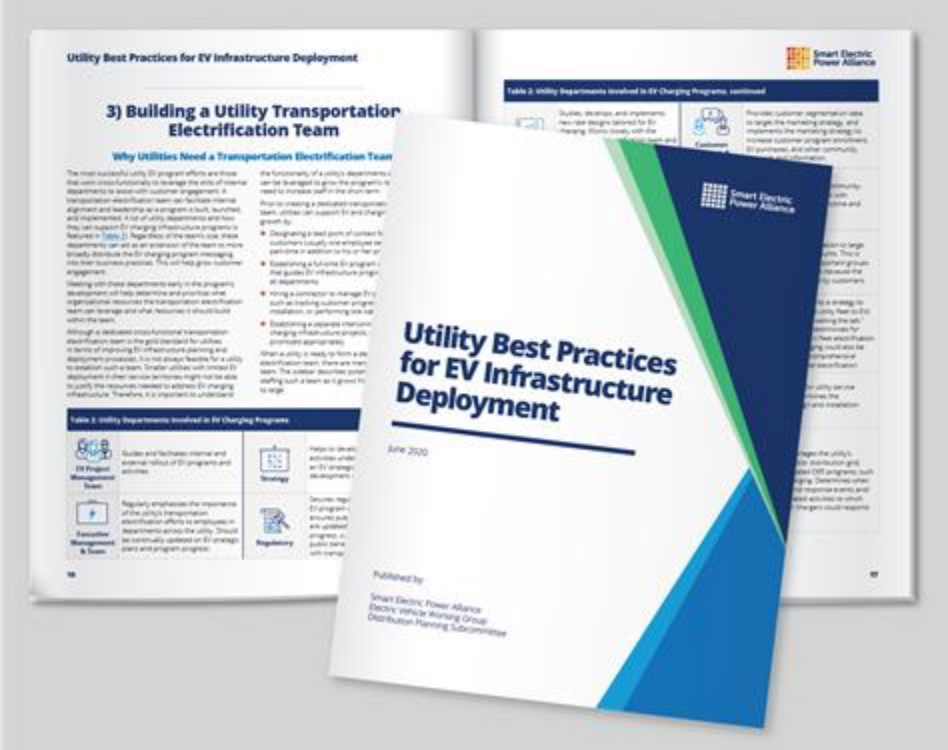
ATTRIBUTES THAT INCREASE ENROLLMENT

Utility Best Practices for EV Infrastructure Deployment

A Comprehensive Guide to Electric Vehicle Managed Charging

Preparing for an Electric Vehicle Future: How Utilities Can Succeed

Guidelines for Selecting a Communications Protocol for Vehicle-Grid Integration



Utility Best Practices for EV Infrastructure Deployment

June 2020

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Smart Electric Power Alliance
Electric Vehicle Working Group
Distribution Planning Subcommittee

Smart Electric
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# Co-location of EVSE with DERs

# Utility EV Program Development: Walk, Jog, Run

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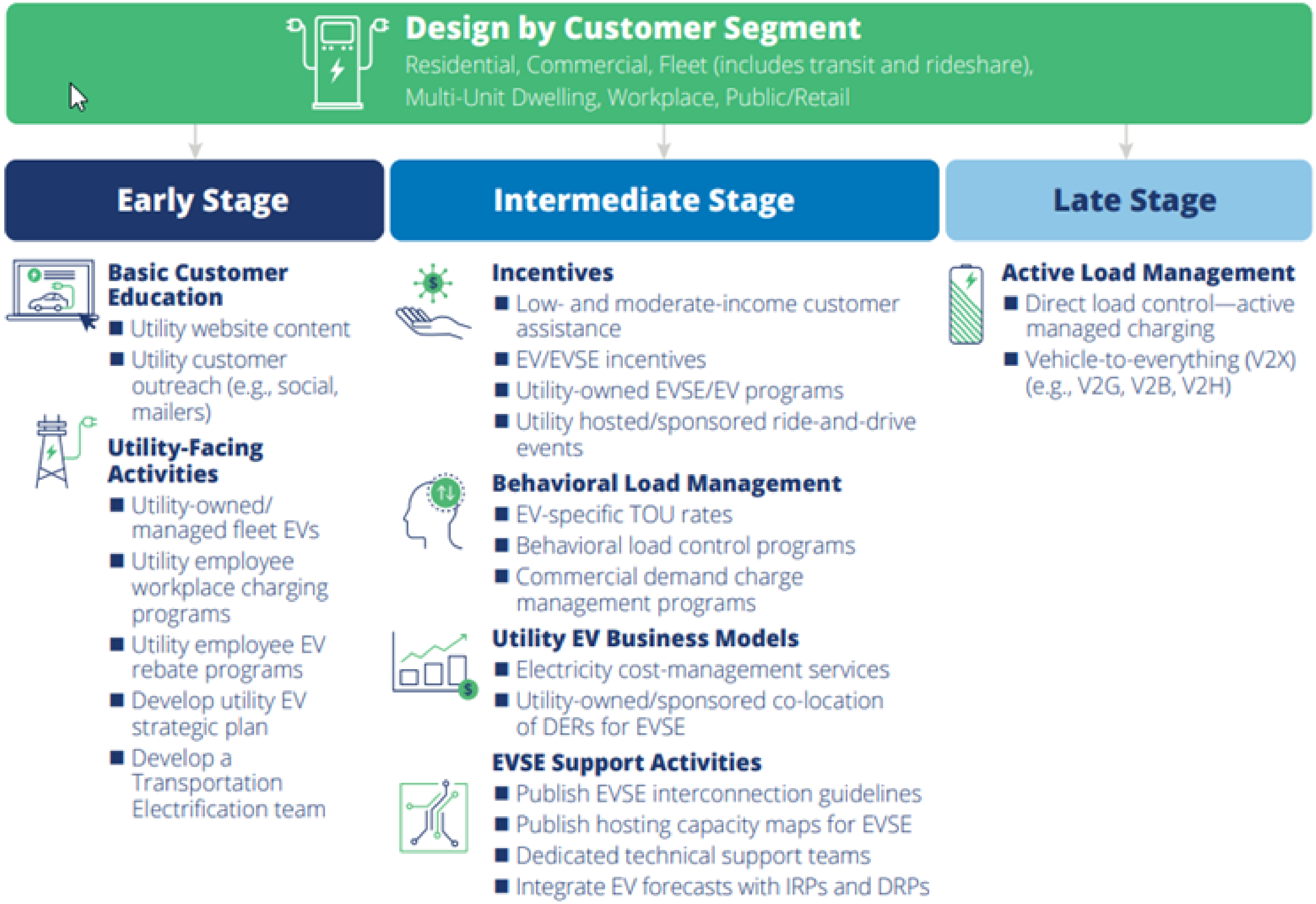
- Transportation electrification will require a reimagining of how utilities provide power
- Utility programs will depend on EV penetration, local/regional constraints, program goals, and prioritization
- Load management and co-location of DERs are essential as EVs scale



**Design by Customer Segment**

Residential, Commercial, Fleet (includes transit and rideshare), Multi-Unit Dwelling, Workplace, Public/Retail

**Early Stage**

**Basic Customer Education**
- Utility website content
- Utility customer outreach (e.g., social, mailers)

**Utility-Facing Activities**
- Utility-owned/ managed fleet EVs
- Utility employee workplace charging programs
- Utility employee EV rebate programs
- Develop utility EV strategic plan
- Develop a Transportation Electrification team

**Intermediate Stage**

**Incentives**
- Low- and moderate-income customer assistance
- EV/EVSE incentives
- Utility-owned EVSE/EV programs
- Utility hosted/sponsored ride-and-drive events

**Behavioral Load Management**
- EV-specific TOU rates
- Behavioral load control programs
- Commercial demand charge management programs

**Utility EV Business Models**
- Electricity cost-management services
- Utility-owned/sponsored co-location of DERs for EVSE

**EVSE Support Activities**
- Publish EVSE interconnection guidelines
- Publish hosting capacity maps for EVSE
- Dedicated technical support teams
- Integrate EV forecasts with IRPs and DRPs

**Late Stage**

**Active Load Management**
- Direct load control—active managed charging
- Vehicle-to-everything (V2X) (e.g., V2G, V2B, V2H)

Source: Smart Electric Power Alliance, 2020.

# EVSE Challenge: Long lead times & high energy service upgrade costs

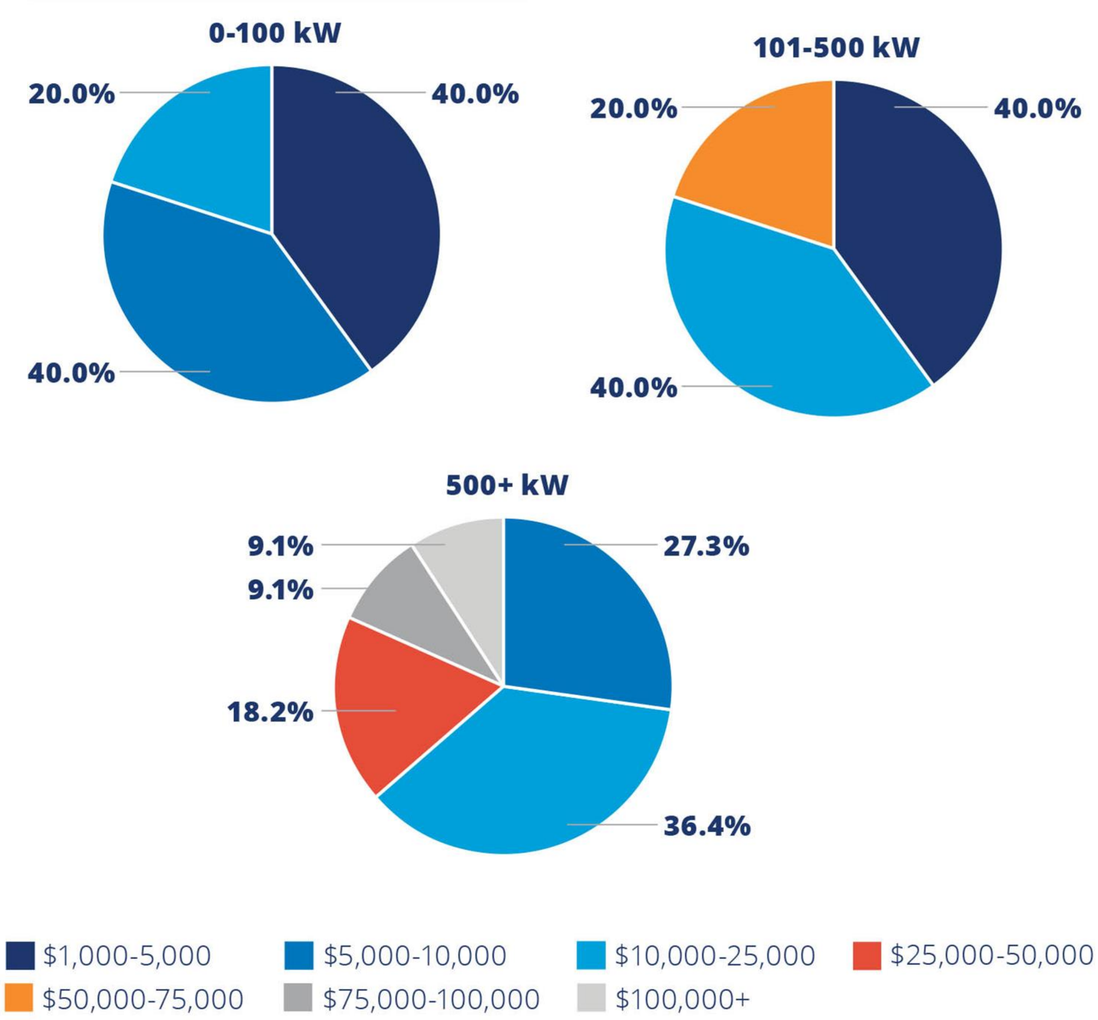


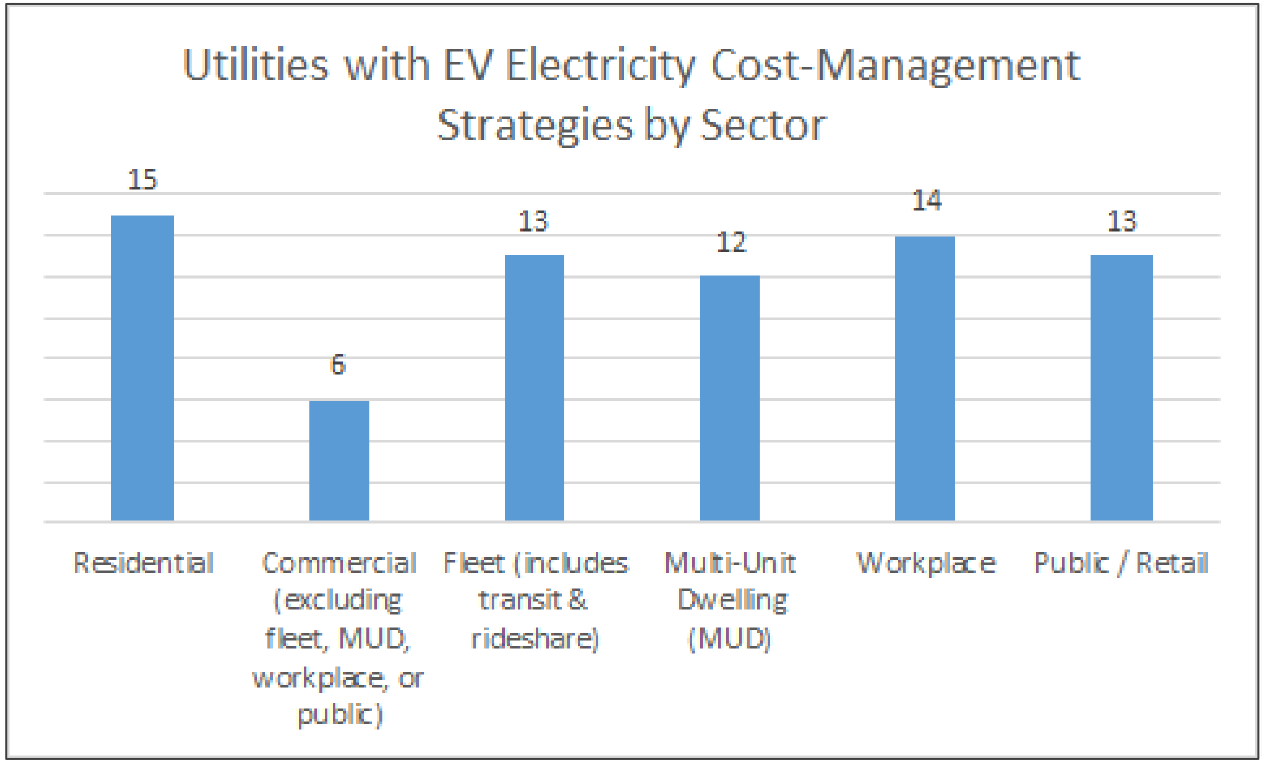
**Table 3: Power Delivery Schedules**

| Potential Power Delivery Upgrades | What is Involved | Typical Ranges (Months) |
|---|---|---|
| **No Distribution Circuit Upgrades (up to 1 MW)** | Often, site loads below 1 MW can be supported with a new service transformer connected to the local distribution grid. | 0-2 |
| **Supply Conductor Upgrade, No Grid Upgrades (up to 1 MW)** | The supply conductor upgrade may require replacement to serve the increased load. The service transformer may also be replaced with a larger size. | 0-2 |
| **Medium Voltage Service, No Grid Upgrade (up to 2 MW)** | The manager may have to take primary service at medium voltage to allow for multiple service transformers (customer-owned) behind the meter if the site load exceeds standard service transformer and low voltage switchboard ratings (typically around 3,000 A). | 0-5 |
| **Grid Upgrade Deployment: Re-conductor or New Line Equipment (over 1 MW)** | The overhead or underground wire may require upsizing to increase the load capacity and improve voltage regulation on the feeder if the charging load overloads the distribution circuit. | 6-36 |
| **Substation Upgrade: New Transformer Bank (over 10 MW)** | An overloaded transformer bank is either replaced by a larger bank in the substation or an additional bank is added. | 18-36 |
| **New Substation (over 20 MW)** | A new utility or dedicated high voltage substation may be required for very large installations. | 24-48 |

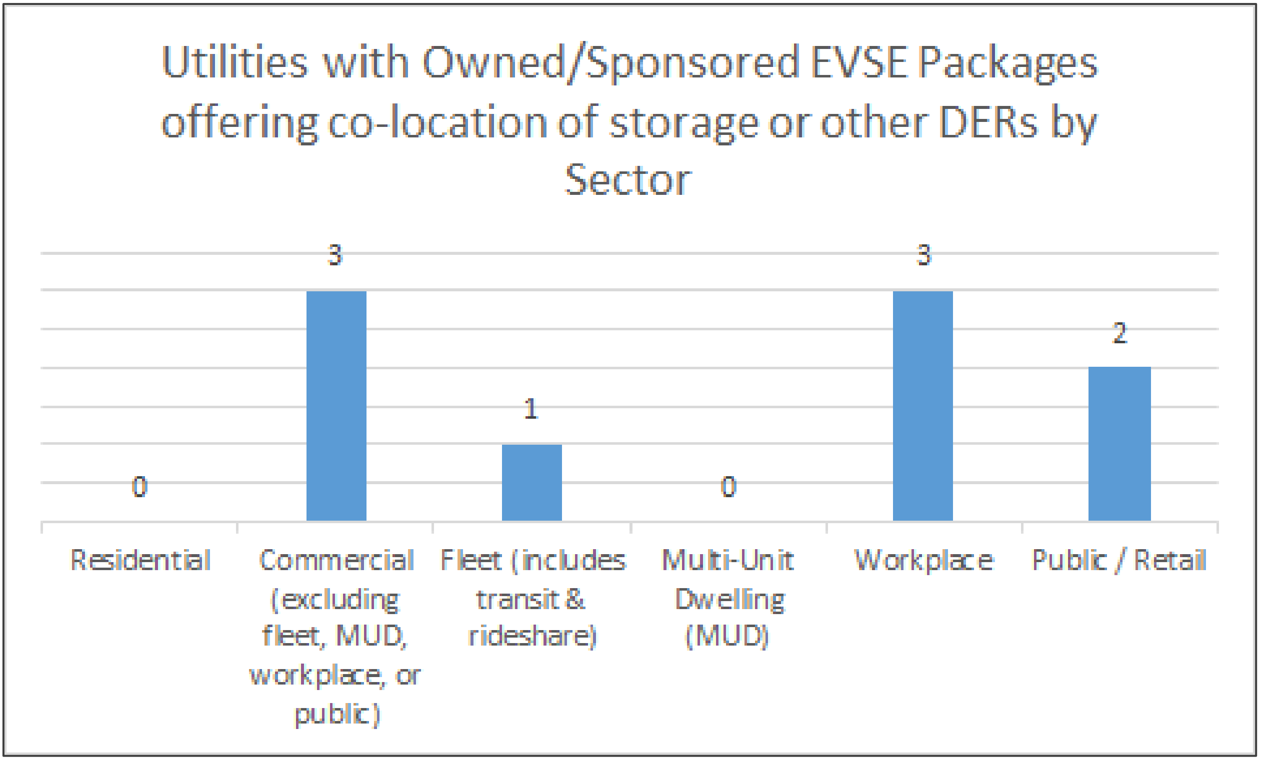
Source: Black & Veatch. 2019. Electric Fleets: 8 Steps to Medium and Heavy-Duty Fleet Electrification.[28]

Note: Example ranges—all power delivery scenarios are specific to a location, feeder access, existing, in queue projects and utility operating/ power provisioning standards, and available land/ right of ways.

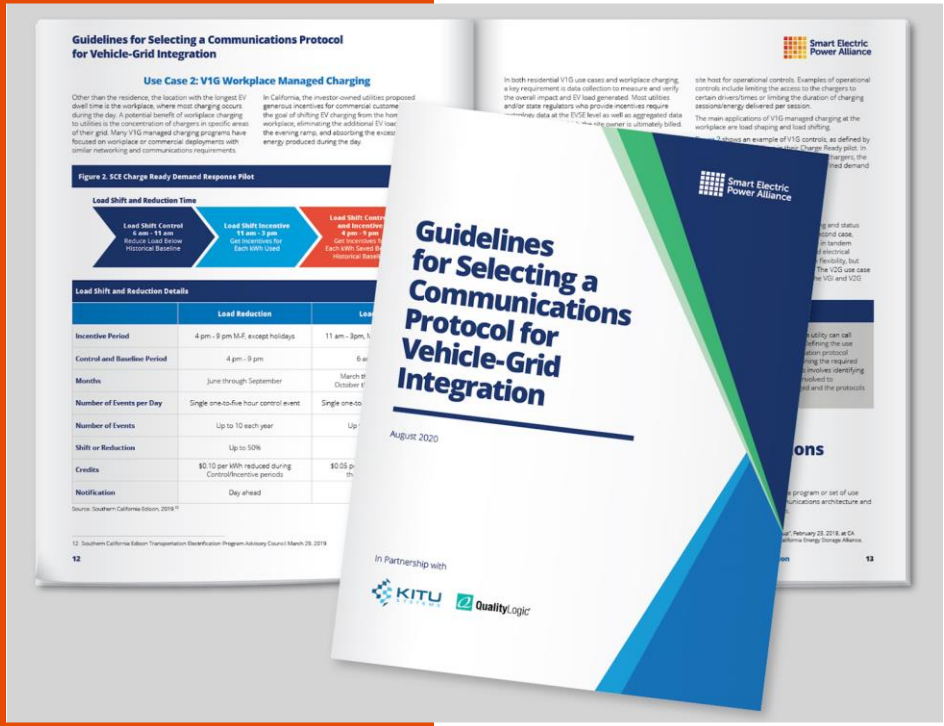
# Consider new utility business models



Source: Smart Electric Power Alliance, 2020. N=128
*Includes charging-as-a-service, DR/DSM, consulting services



Source: Smart Electric Power Alliance, 2020. N=128



Guidelines for Selecting a Communications Protocol for Vehicle-Grid Integration

Use Case 2: V1G Workplace Managed Charging

Figure 2. SCE Charge Ready Demand Response Pilot

Load Shift and Reduction Details

Guidelines for Selecting a Communications Protocol for Vehicle-Grid Integration

August 2020

In Partnership with KITU QualityLogic

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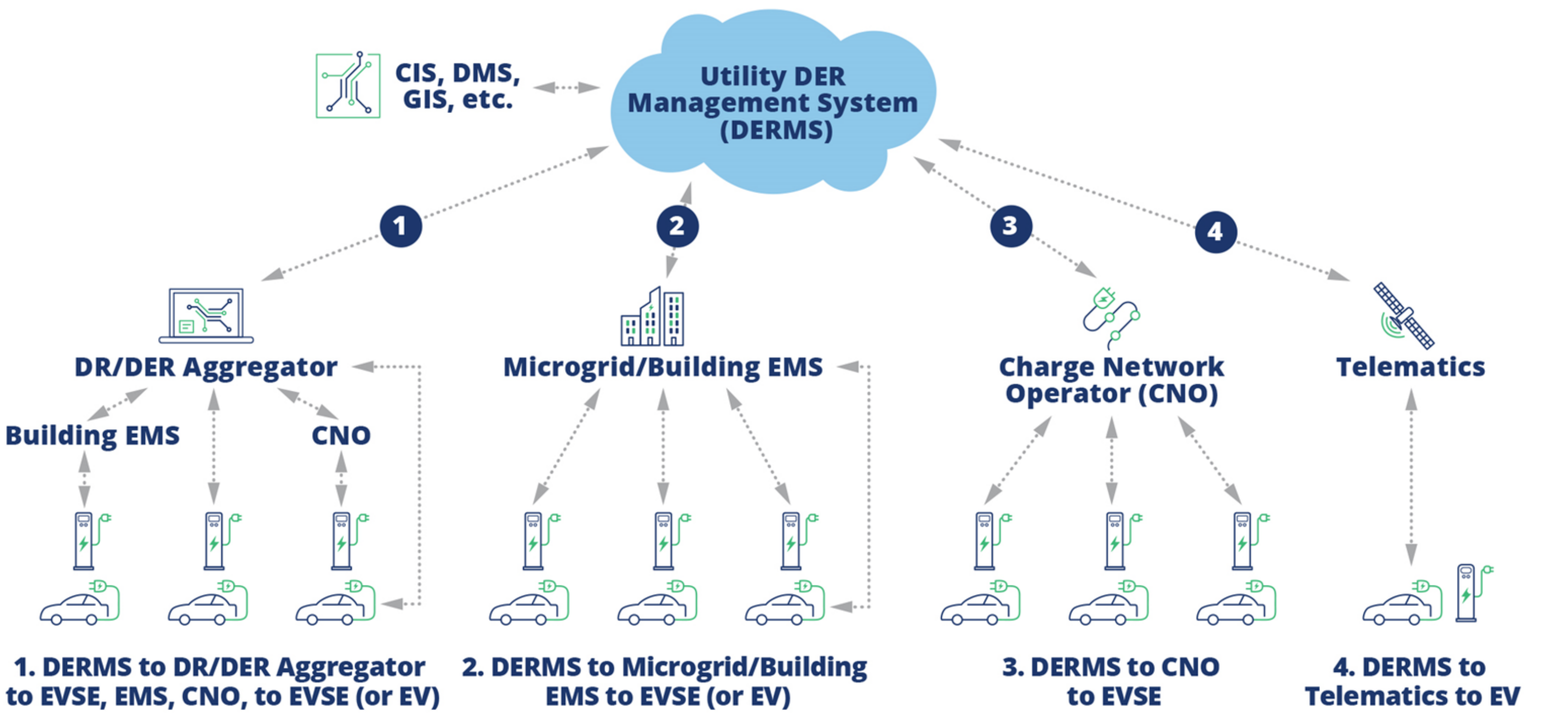
# DERMS for EVSE aggregation

# EV aggregation via DERMS

- DERMS: A hardware and software platform to monitor and control DERs in a manner that maintains or improves the reliability, efficiency, and overall performance of the electric distribution system.

**Figure 3: Grid to EV Communications Architectures**



- **Distribution Utility:** determines grid requirements; specific device or Group DER settings; communicates to DER
- **DER/DER Aggregator:** receives grid requirements; specific device or Group DER settings; communicates to DER; monitors and reports to DERMS
- **Building EMS:** receives grid requirements; determines how to implement; reports results to DERMS
- **Charge Network Operator:** receives grid requirements; determines how to implement; reports results to DERMS
- **EV:** with off-board, on-board or spilt inverter, uni- or bi-directions, AC or DC
- **EVSE:** with off-board, on-board or split inverter, uni- or bi-directional, AC or DC
- **Telematics:** Vehicle Telematics System—receives grid requirements; determines how to use EVs to meet grid needs

Source: Smart Electric Power Alliance, 2020.

# EV Aggregation via DERMS (Cont'd)

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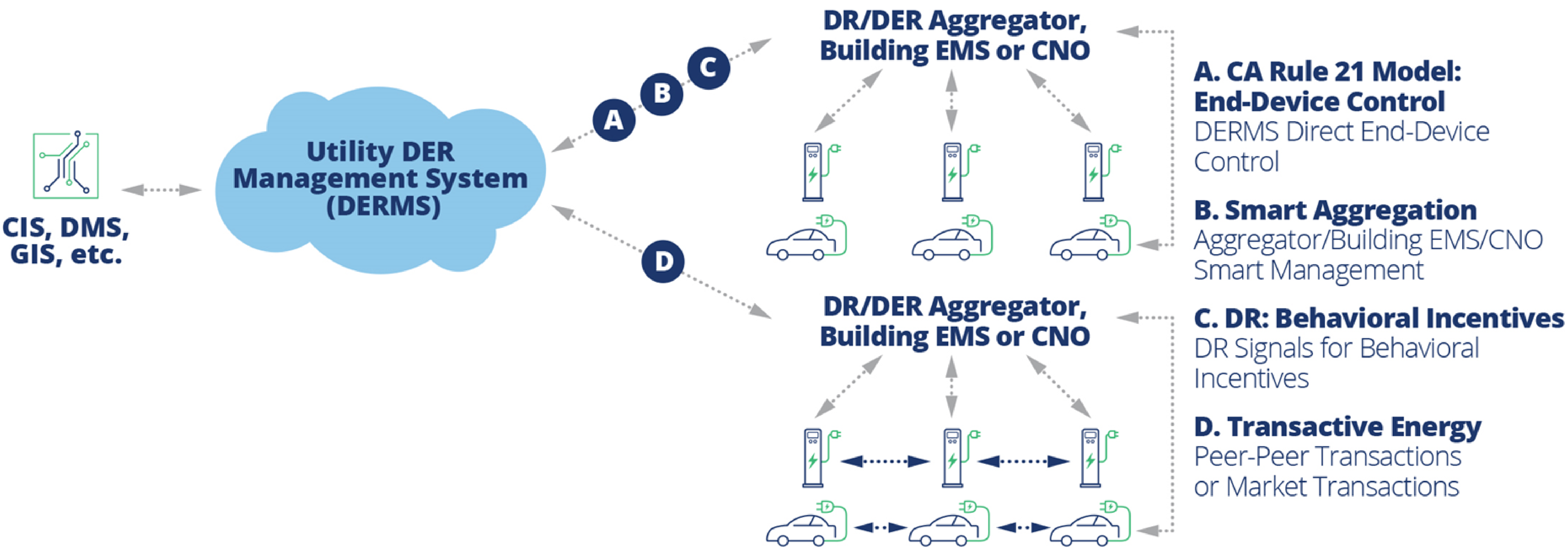
**Figure 4: Grid-EV Communications Architectures: Where Decisions Are Made**



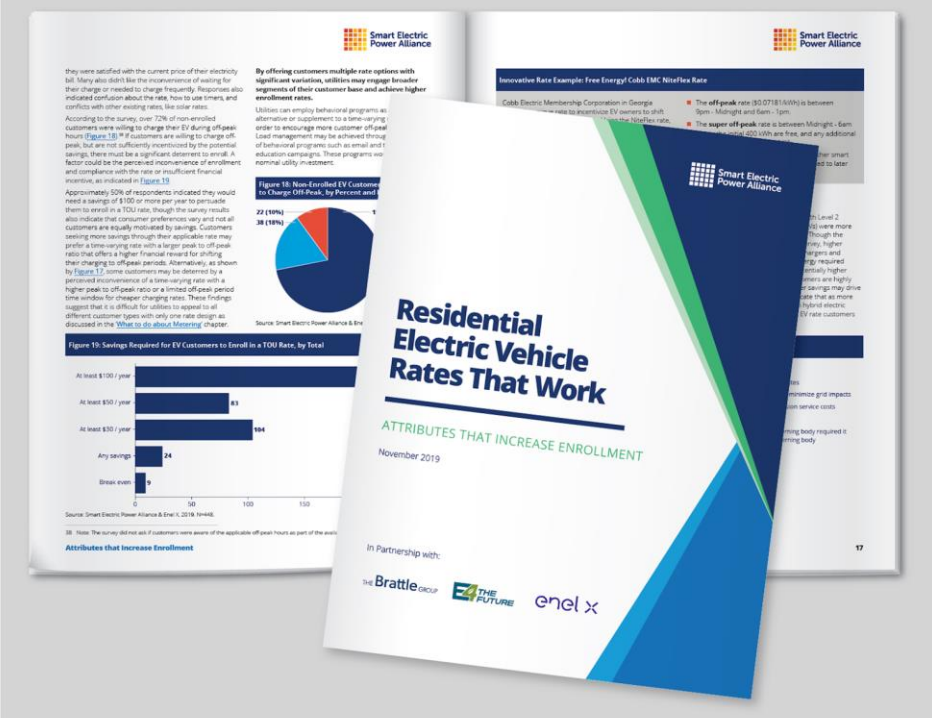
**A. CA Rule 21 Model: End-Device Control**
DERMS Direct End-Device Control

**B. Smart Aggregation**
Aggregator/Building EMS/CNO Smart Management

**C. DR: Behavioral Incentives**
DR Signals for Behavioral Incentives

**D. Transactive Energy**
Peer-Peer Transactions or Market Transactions

Source: Smart Electric Power Alliance, 2020.



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Residential Electric Vehicle Rates That Work

ATTRIBUTES THAT INCREASE ENROLLMENT

November 2019

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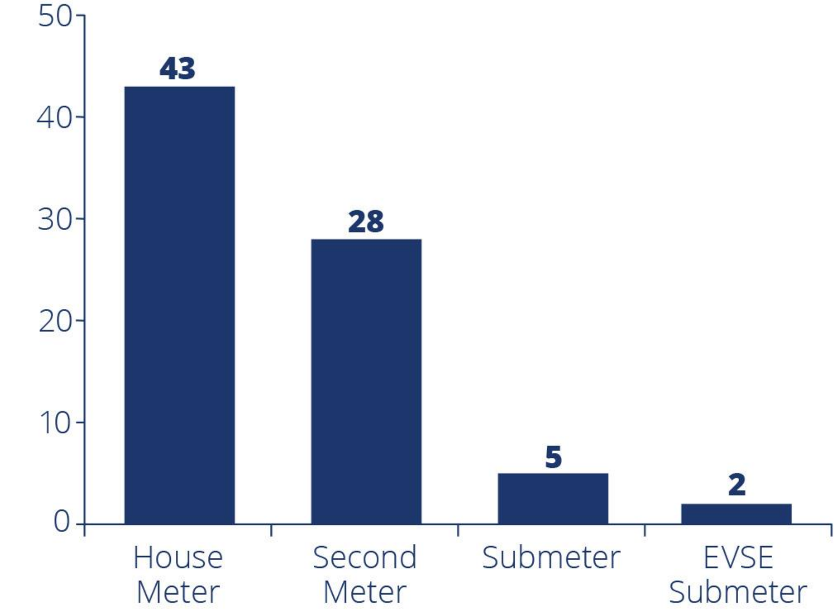
# AMI for Residential EV Rates

# Residential EV Rates: Metering Strategies

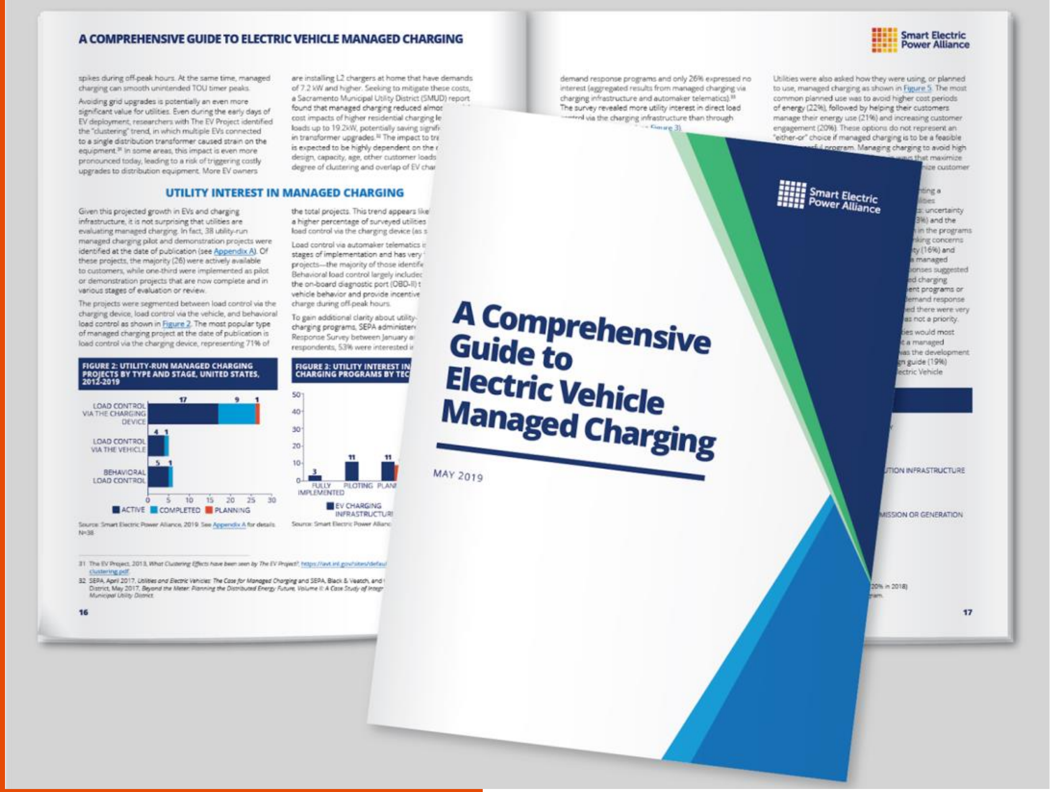
**Figure 24: Metering Configuration for EV Rate Population**



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

**Table 7: Pros and Cons of Different Metering Approaches**

| | 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 |



A COMPREHENSIVE GUIDE TO ELECTRIC VEHICLE MANAGED CHARGING

UTILITY INTEREST IN MANAGED CHARGING

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A Comprehensive Guide to Electric Vehicle Managed Charging

MAY 2019

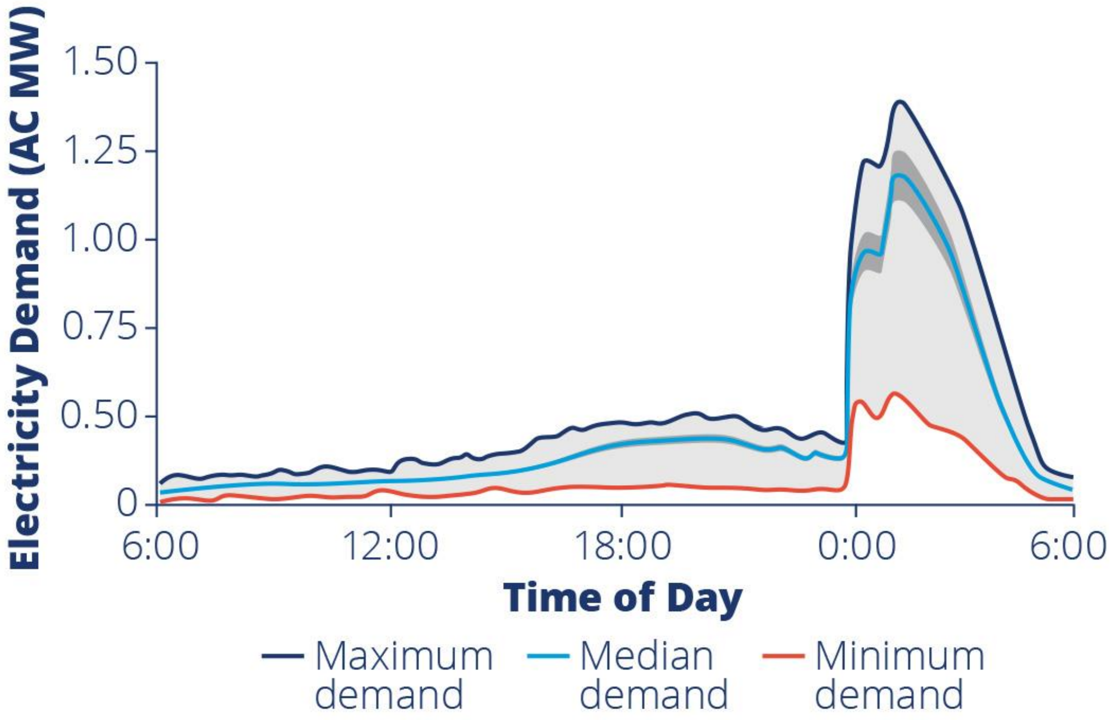
Smart Electric Power Alliance

# Active Managed Charging Technologies

# Active Load Management Strategies

- Vehicle Telematics
- EVSE
- Building Energy Management System (Adaptive Load Management)/ Microgrids
- On-board diagnostic interface (OBD-II port)
- Smart circuit breakers/ smart panels
- Smart plugs
- Meter collars
- Distributed ledgers/ transactive energy

**Figure 3: Illustration of San Diego Gas and Electric Weekday "Timer Peak"**



Source: MJ Bradley & Associates, 2017[24]
Note: This is a rendition of the original graphic.

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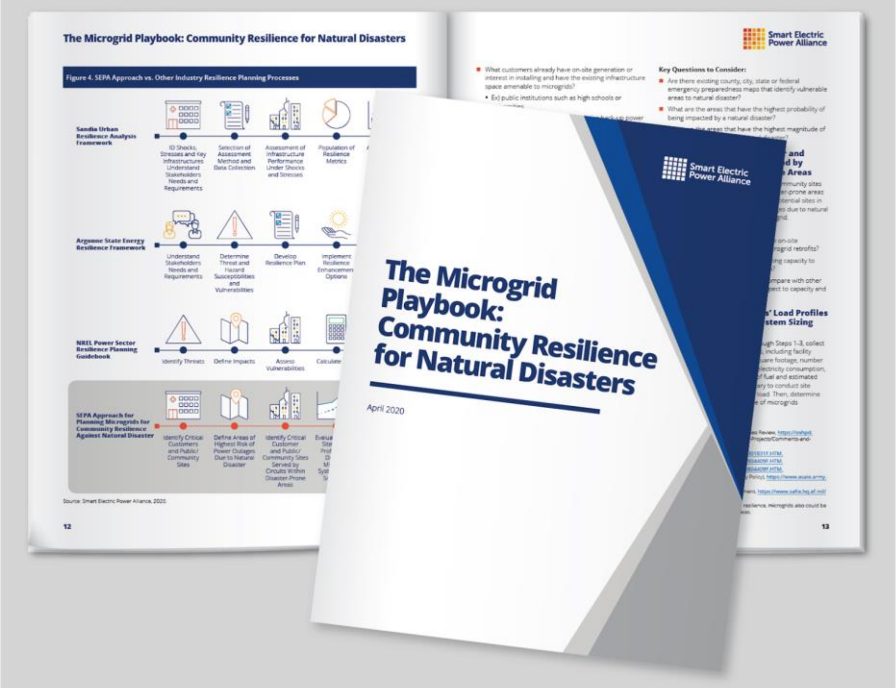
# Microgrids for Fleet Electrification



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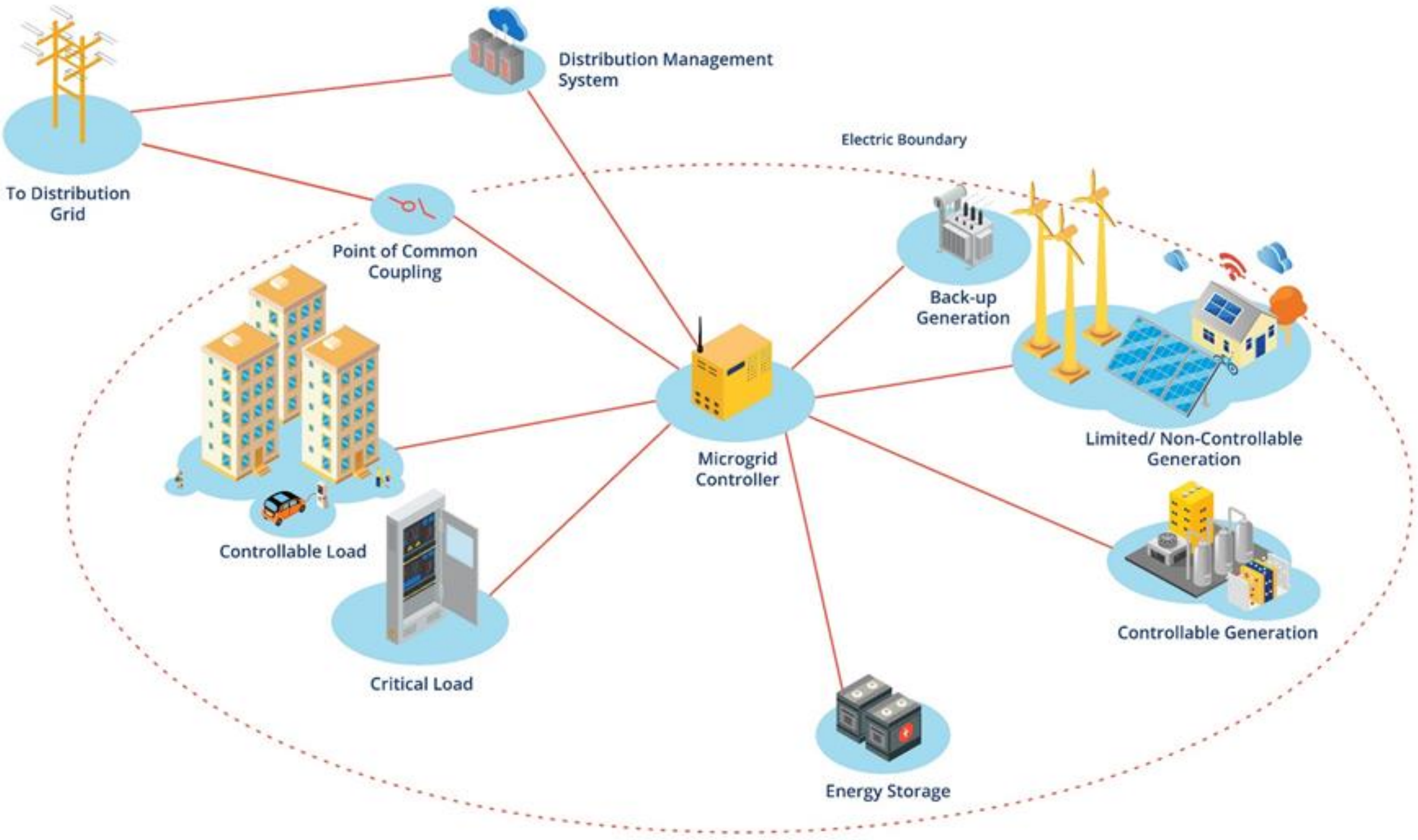
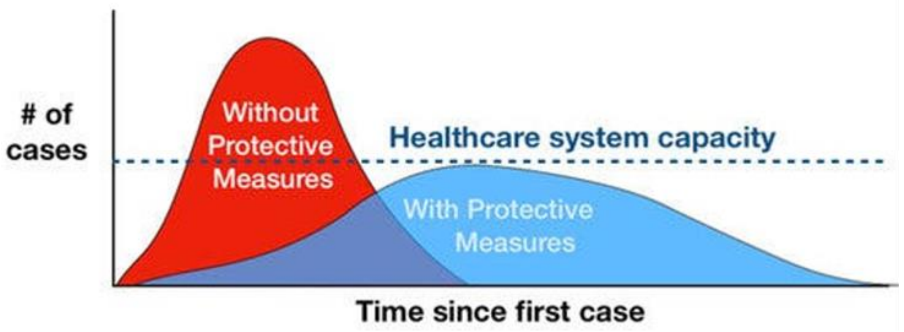
The Microgrid Playbook: Community Resilience for Natural Disasters

April 2020

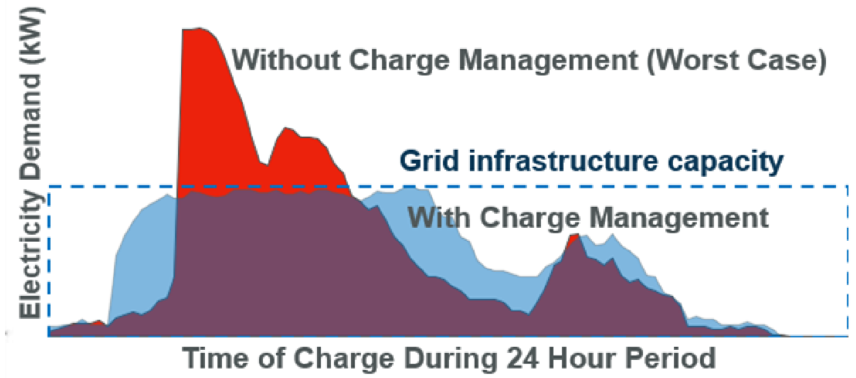
# Resilience, Reliability, and Demand Charge Management



COVID-19 INFECTION RATE CURVES



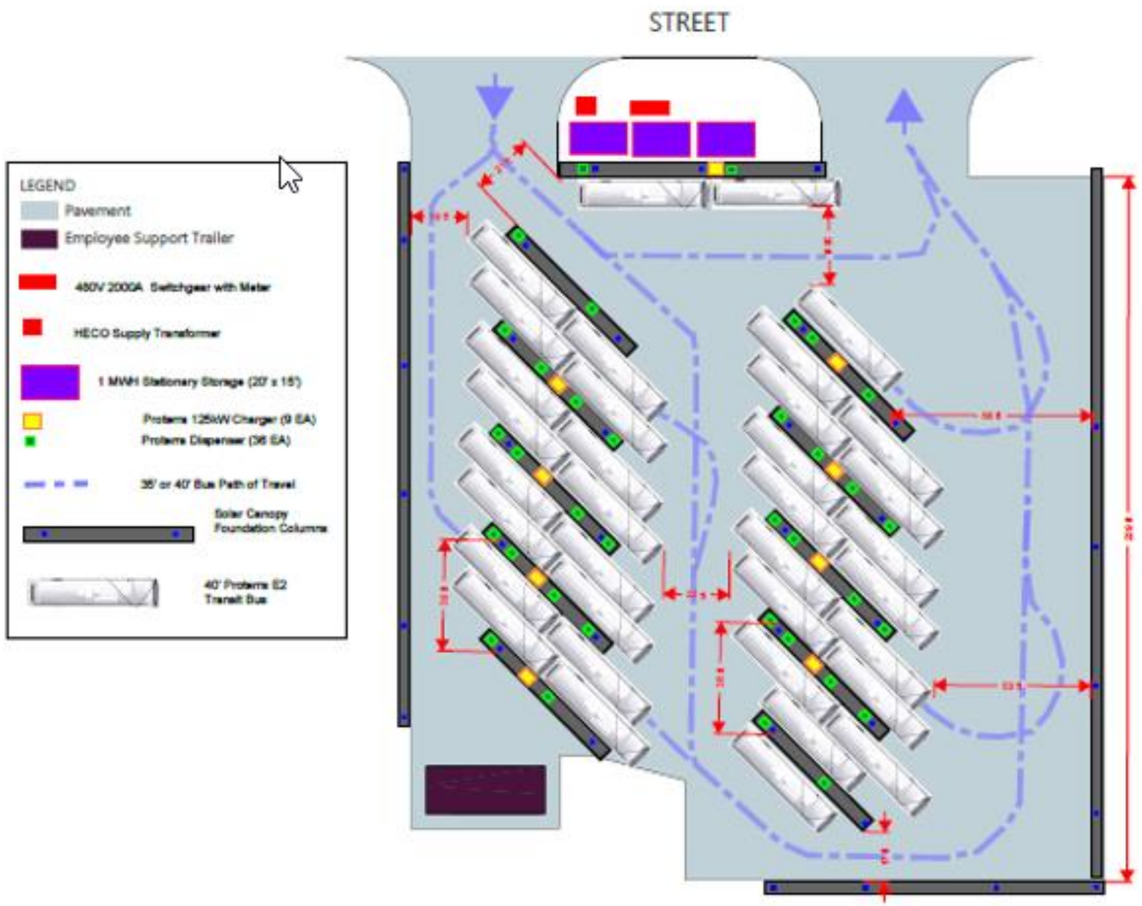
FLEET CHARGING ENERGY CURVES



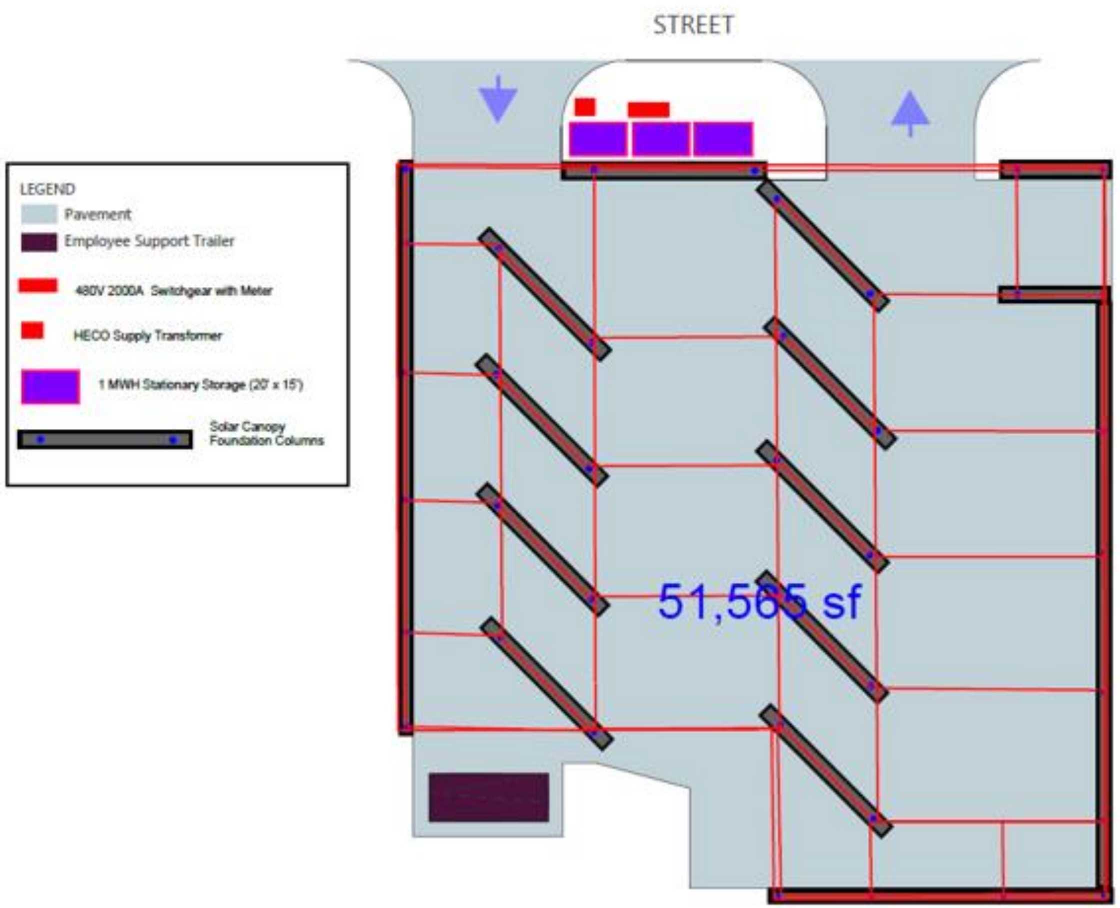
Source: Smart Electric Power Alliance, 2020.

# Proterra: Bus Depot Modeling

## Bus Depot Space and Charging Layout



## Microgrid Solar and Storage Layout



Source: Proterra, 2020.

# Working Groups

Collaborative teams of member SMEs addressing important industry issues

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

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