



A Snapshot of EV-Specific Rate Designs Among U.S. Investor-Owned Electric Utilities

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How are EV-Specific Electric Utility Rates Designed Presently?

Objective

- Provide regulators, utilities, and the EV industry with a more robust understanding of **how EV-specific electric utility rates could be designed** and **how they are actually being designed presently in the United States**

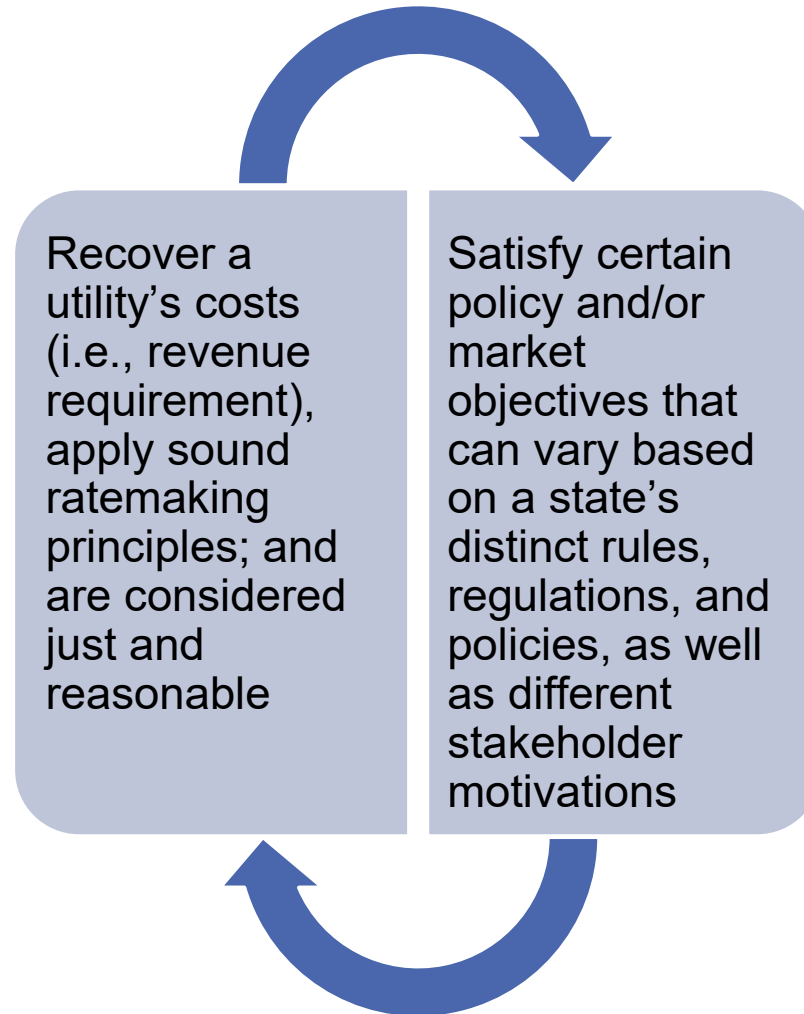
Caveat

- **Focused on IOUs**, excluded energy marketers, municipal utilities, and cooperative utilities
- **Did not assess customer enrollment or response** to EV-specific rate designs

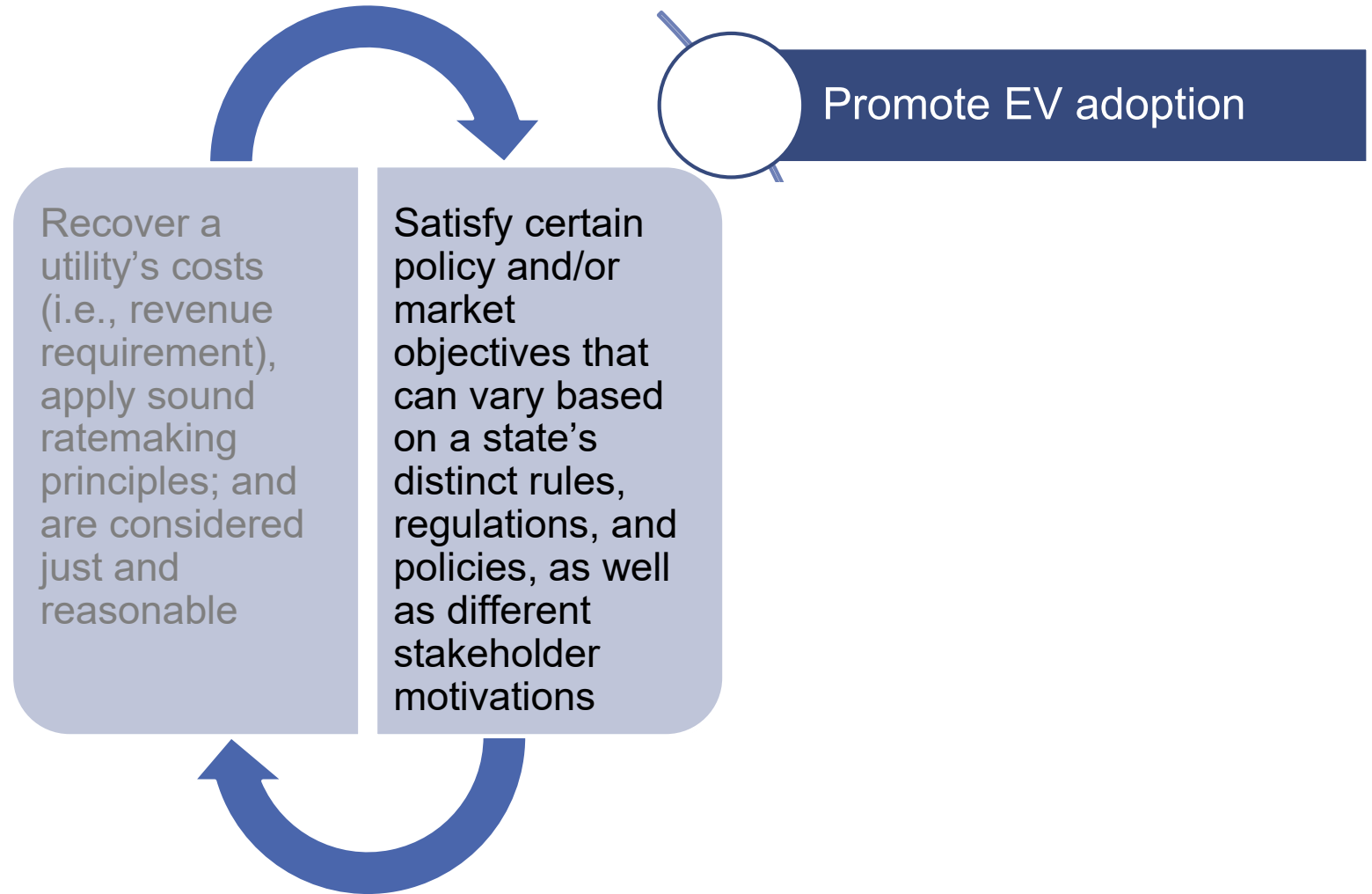
Methods

- Develop a **framework** for identifying the **design elements** of EV-specific rates
- Collect **electric utility tariff filings** with state utility regulators of EV-specific rates
- Apply the framework to the tariff filings to develop a **database** that categorizes EV-specific rates
- Evaluate the database to characterize the **landscape** of EV-specific rate designs

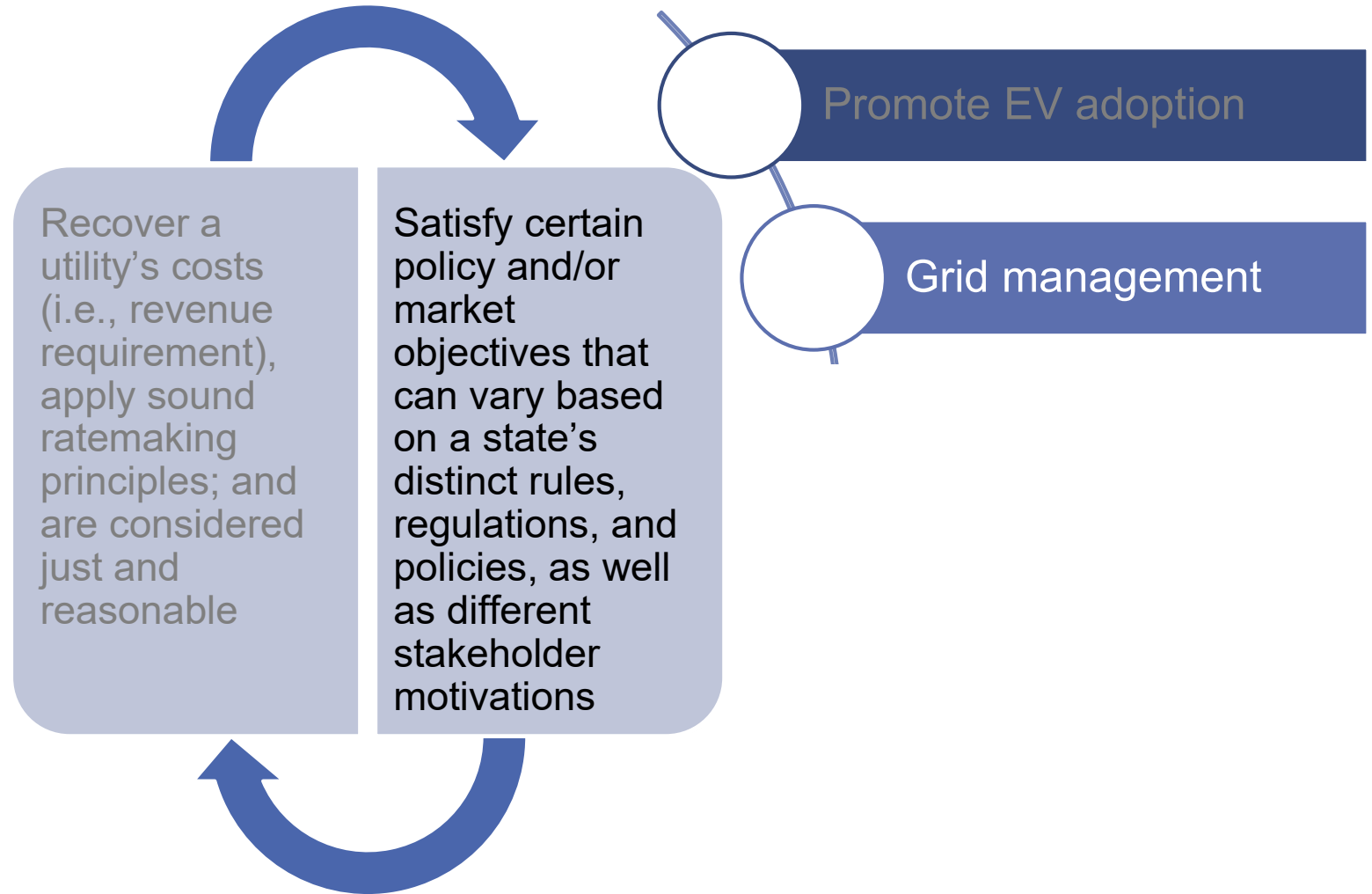
Retail Rates are Designed Based on Two (2) Broad Concepts



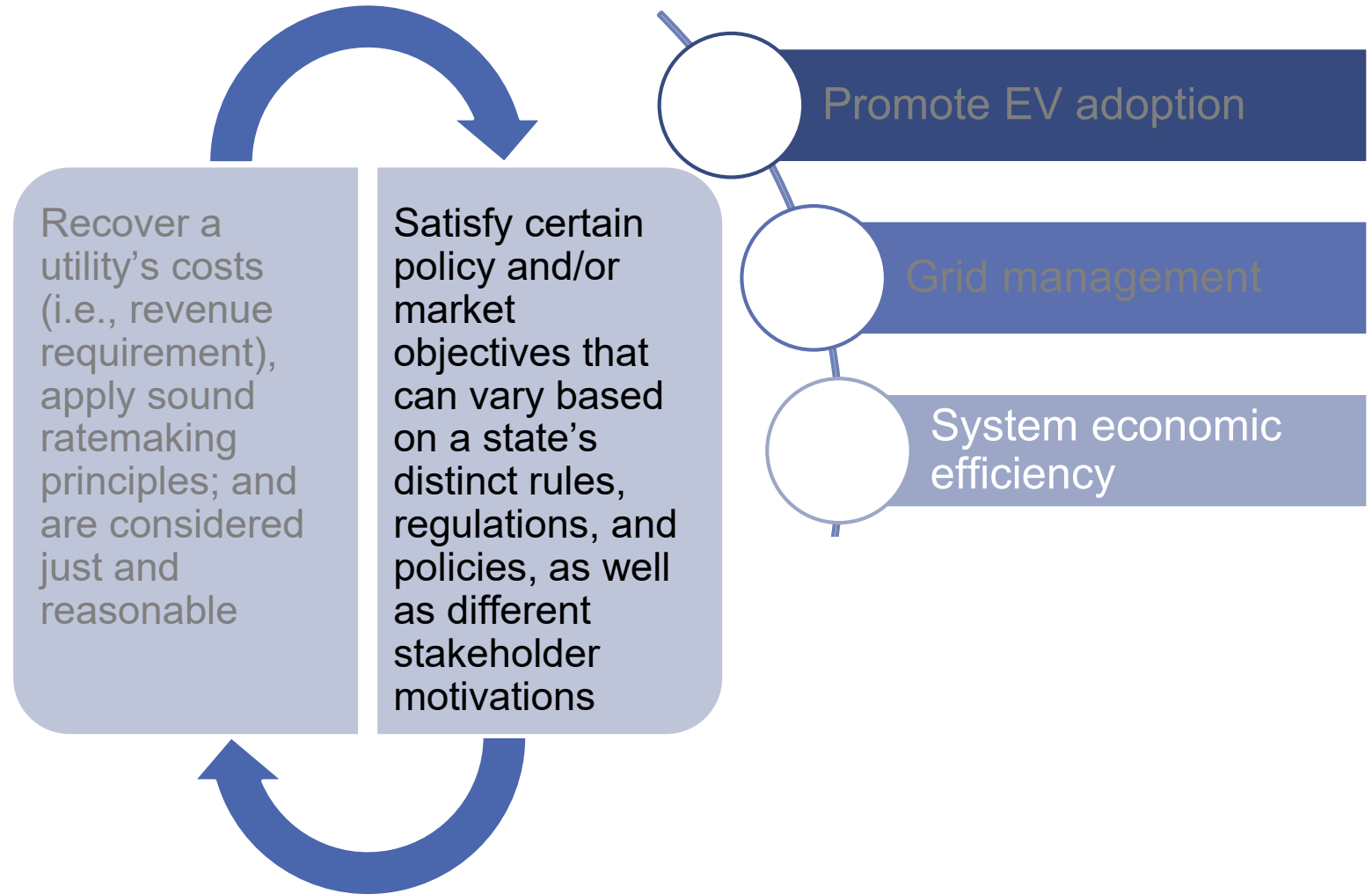
Five (5) Policy-Driven Objectives Potentially Used as the Basis for EV-Specific Rate Designs



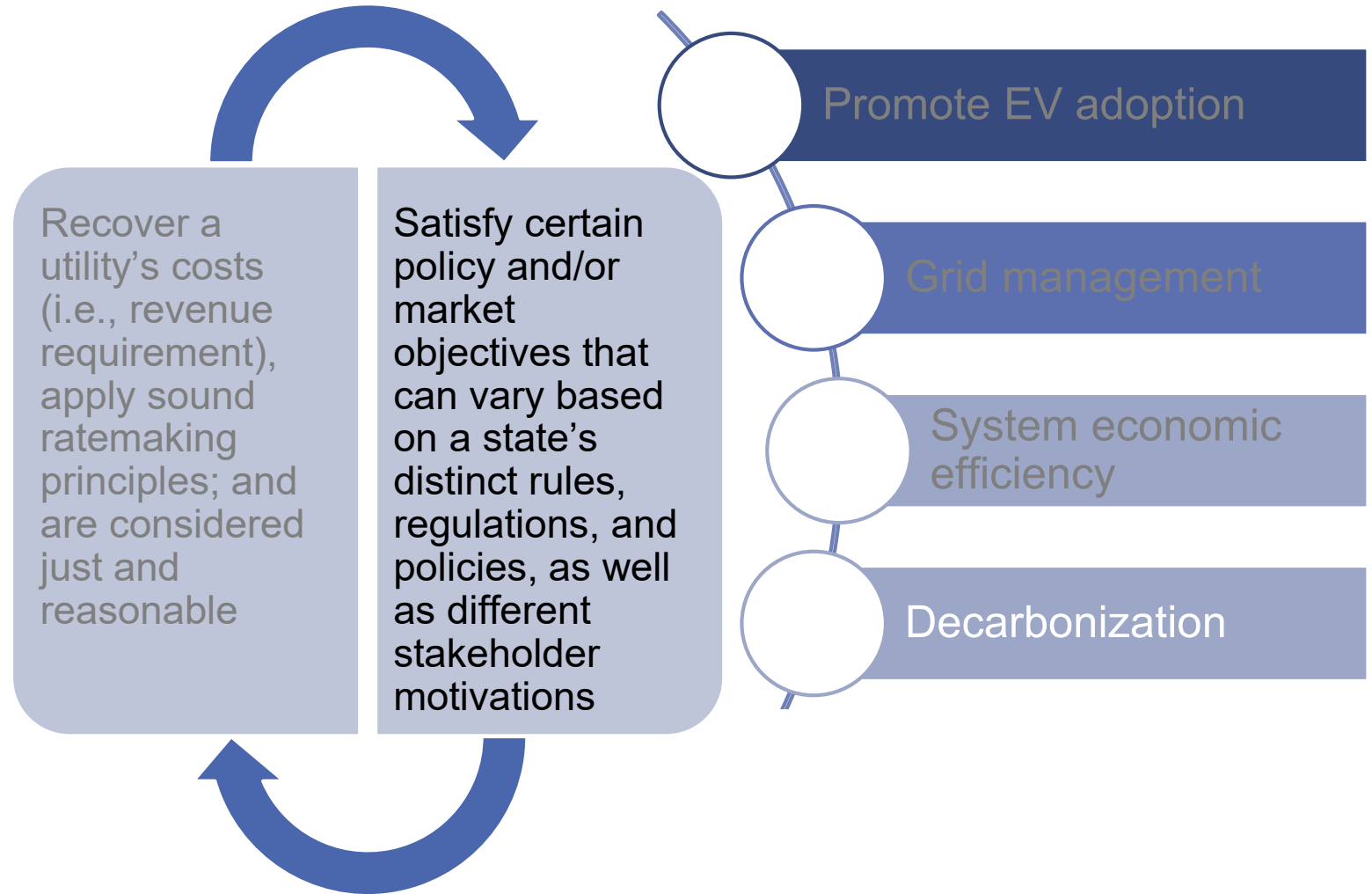
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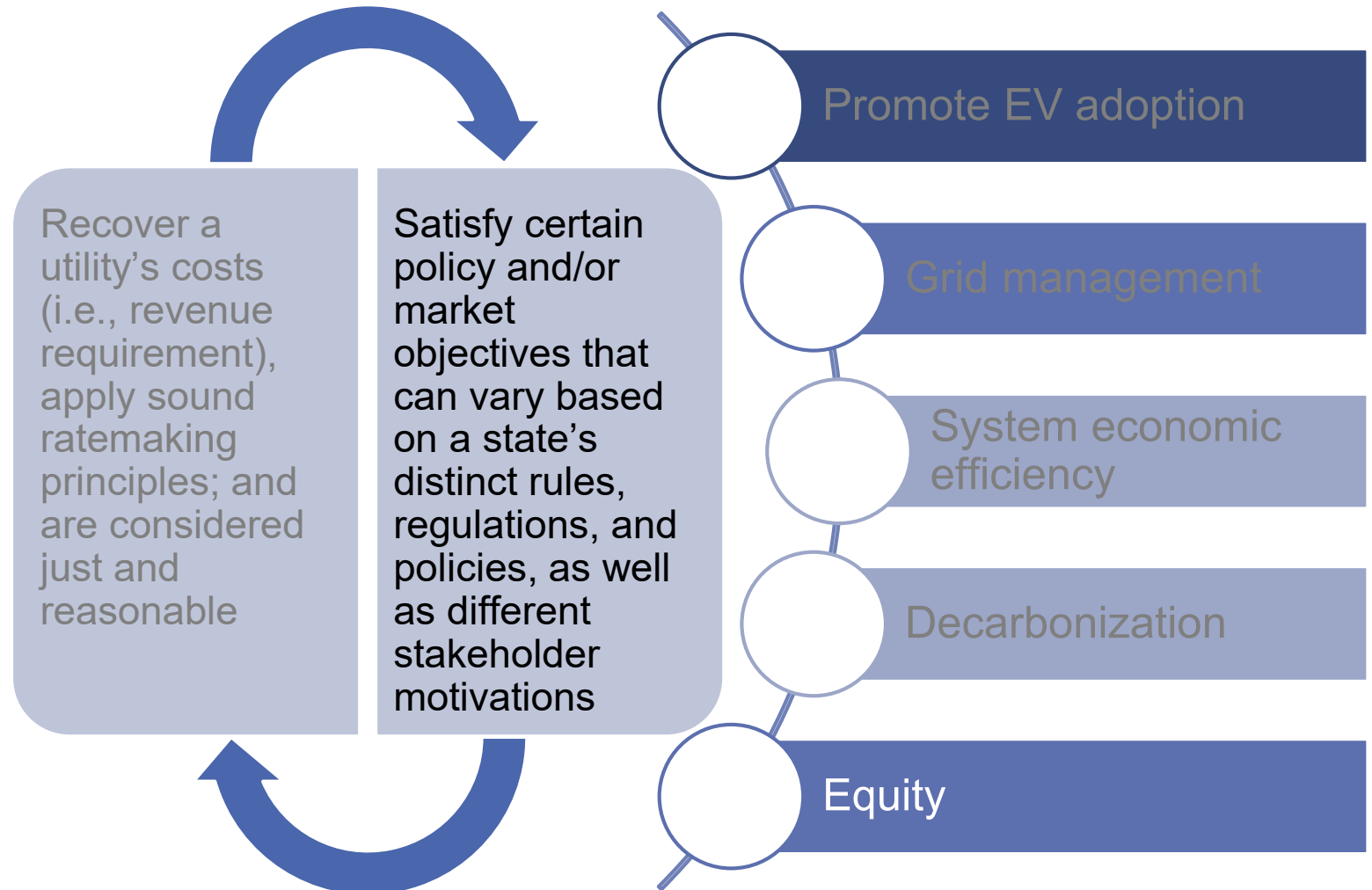
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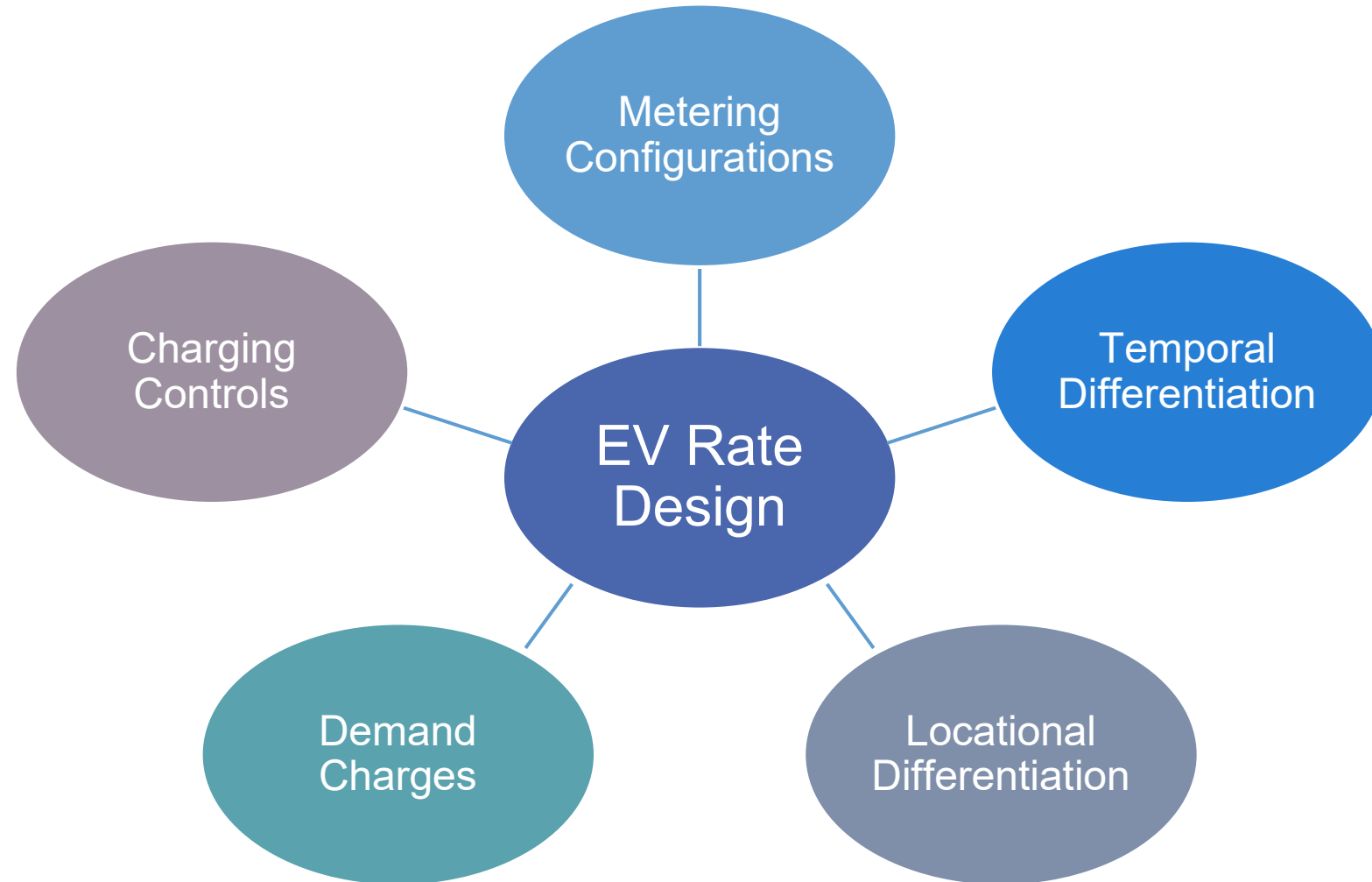
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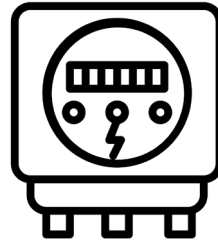
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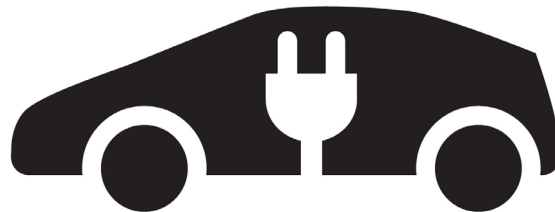
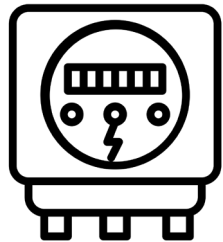
EV rate design typically comprised of five (5) different components



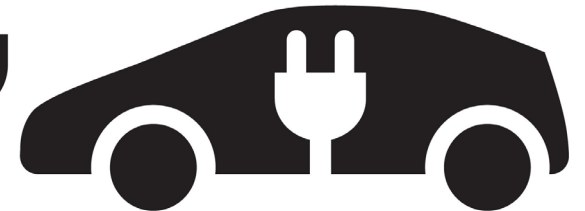
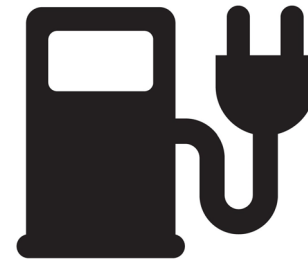
Metering Configurations



Whole home/facility consumption
via account meter



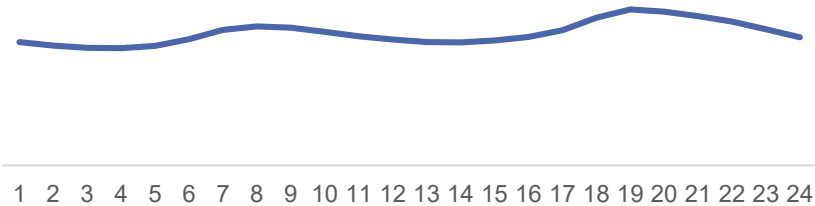
EV charging consumption
via account meter



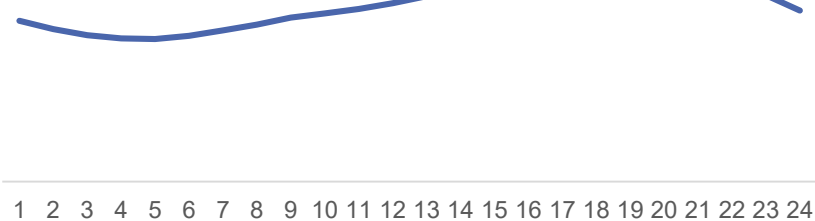
Submetering via EVSE or vehicle

Temporal Differentiation of Volumetric Energy Charge

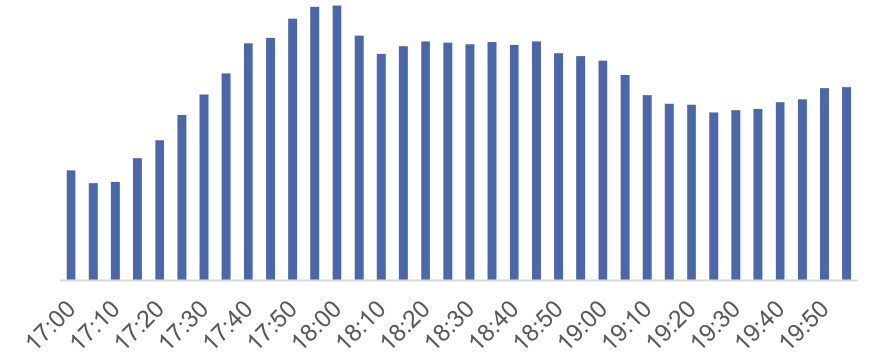
Average Winter Day



Average Summer Day

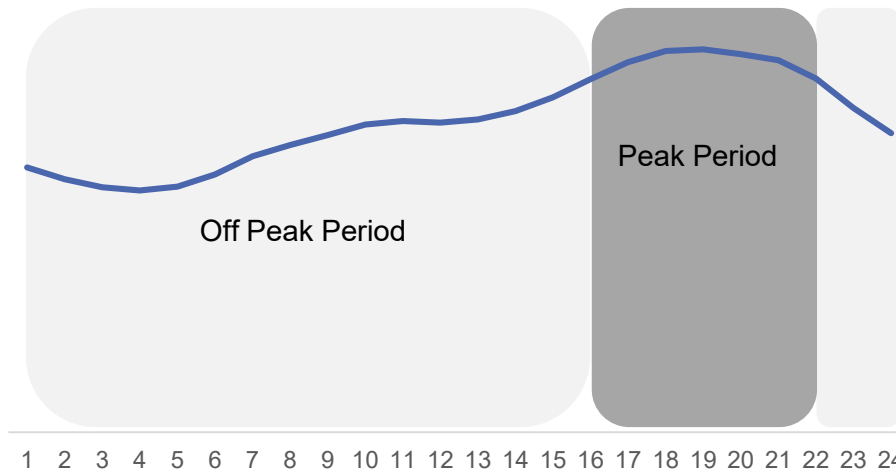


Seasonal Differentiation



Sub-hourly Differentiation

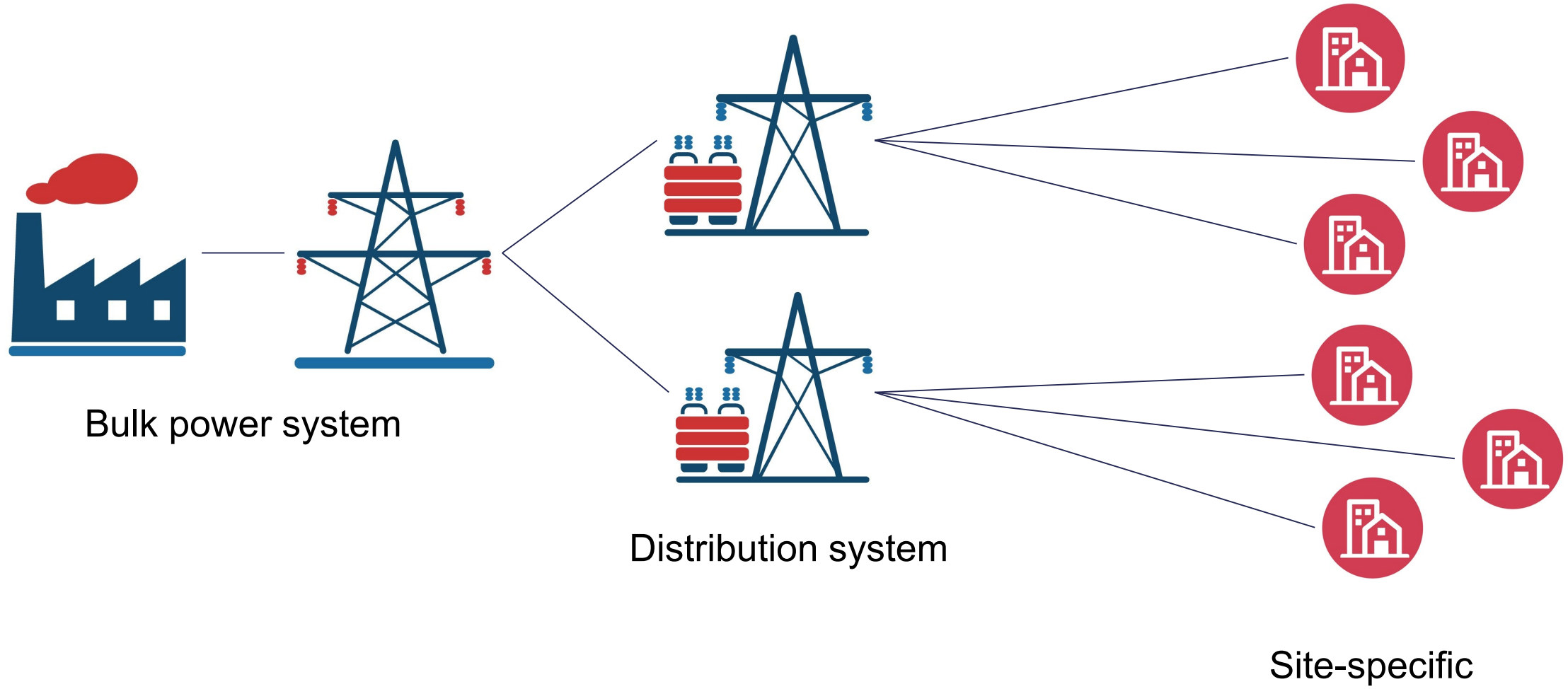
August Day




Hourly and Period Differentiation

Note that figures show temporal differentiation in *load* but there is also temporal differentiation in system *costs* and *emissions* that could be used as the design basis

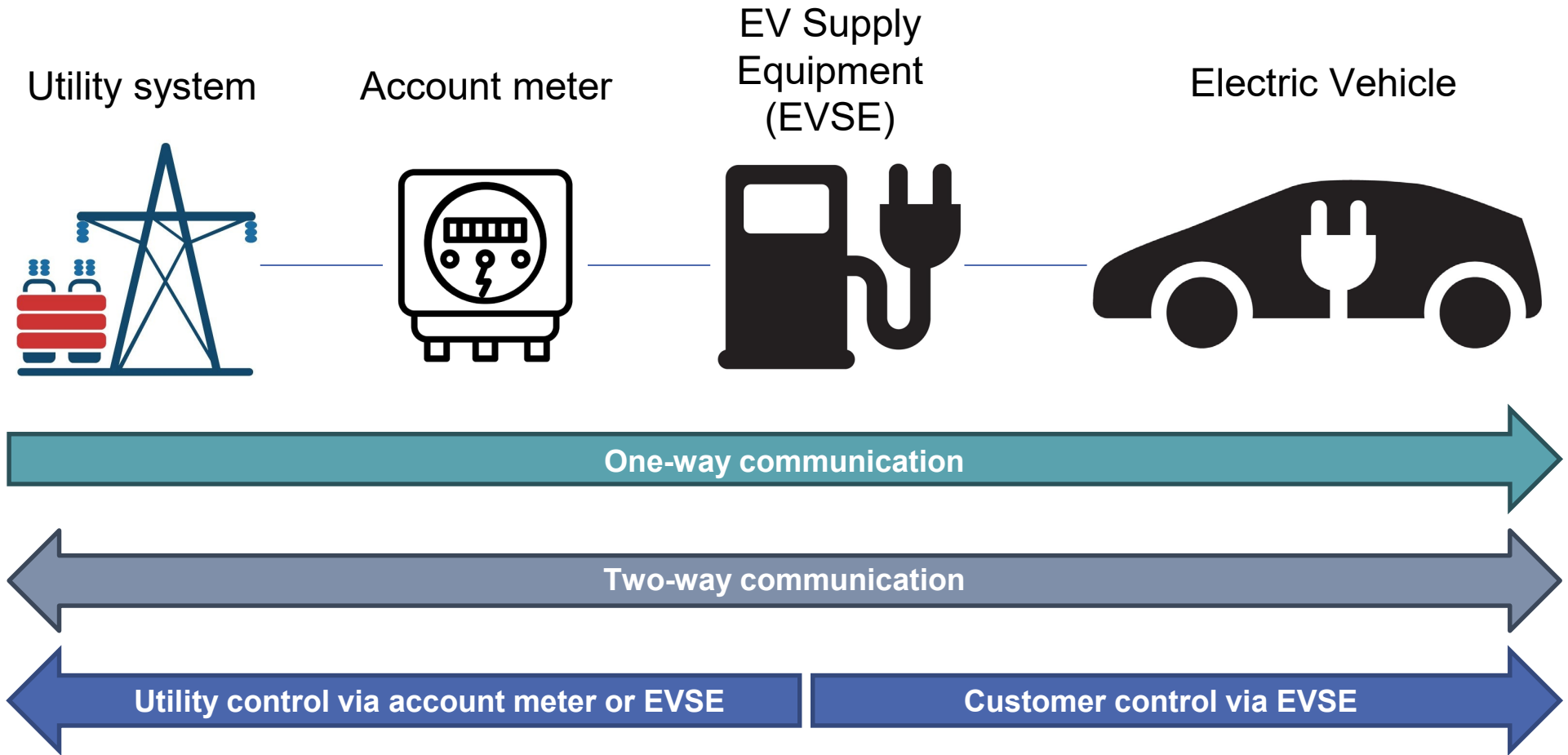
Locational Differentiation of Volumetric Energy Charge



Demand Charges

- 
- ✓ Seasonal or period-based charges
 - ✓ Timing of measured demand
 - ✓ Interval of measured demand
 - ✓ Demand ratchet

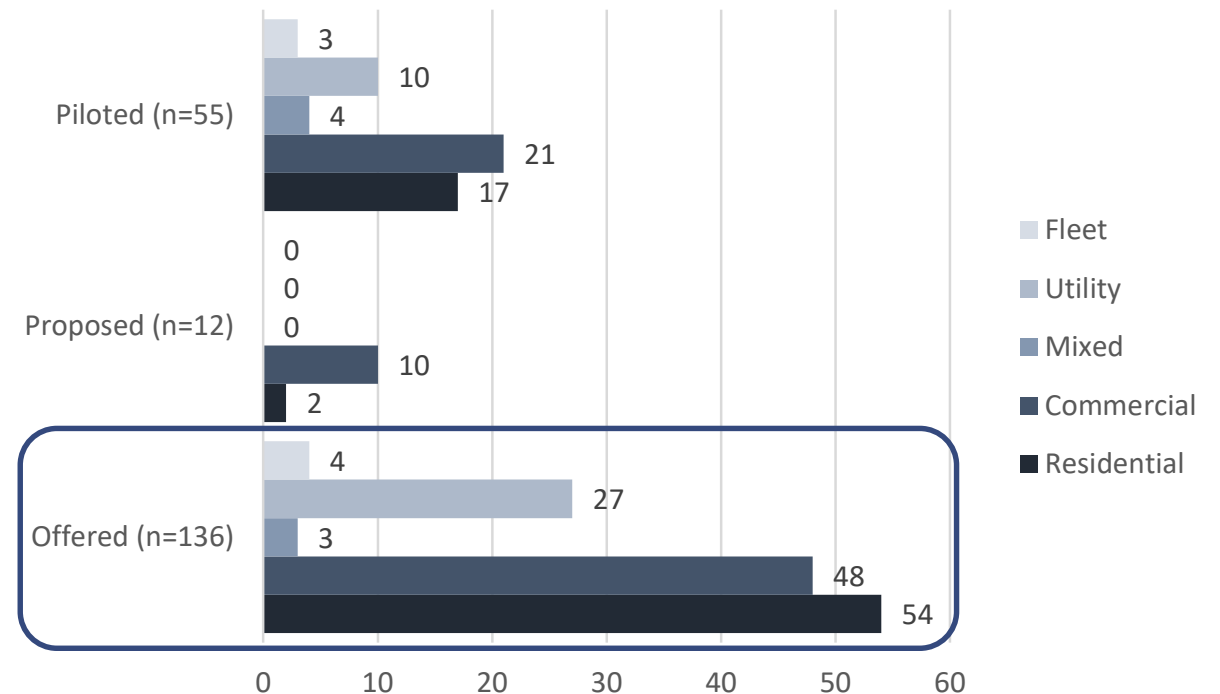
Charging Controls



Currently Offered EV-Specific Rates are Almost Evenly Split Between Residential and Commercial Customers

Customer Class Categories

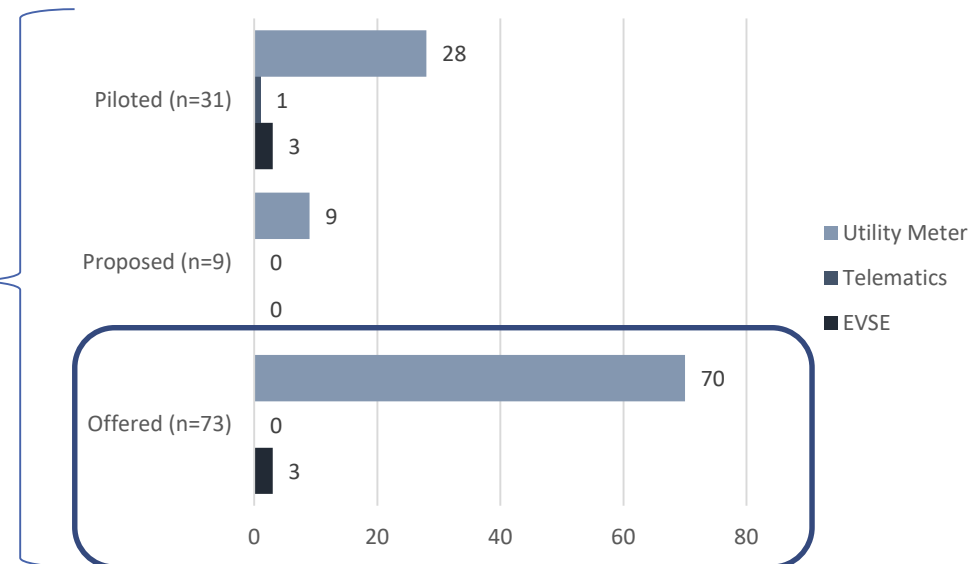
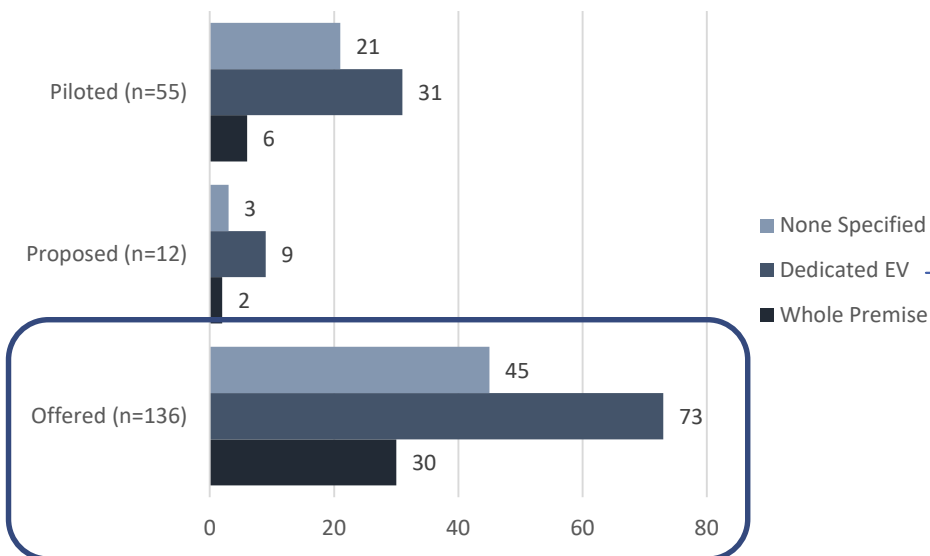
- **Fleet:** Intended for specific use by public or private fleets (e.g., commercial fleets, school bus fleets)
- **Utility-owned:** Intended for use at utility-owned charging equipment that is primarily deployed for public use, although examples at private multi-unit dwellings do exist
- **Mixed:** Intended for use by both residential and commercial customers
- **Commercial:** Intended for use by commercial, industrial, or general service classes of customers, as well as those who were not included in any other category
- **Residential:** Intended for use by typical residential class customers, including multi-family



Currently Offered EV Rates are Evenly Split Between Measuring Premise and EV Load w/ Utility Grade Meters

Meter Configuration Categories

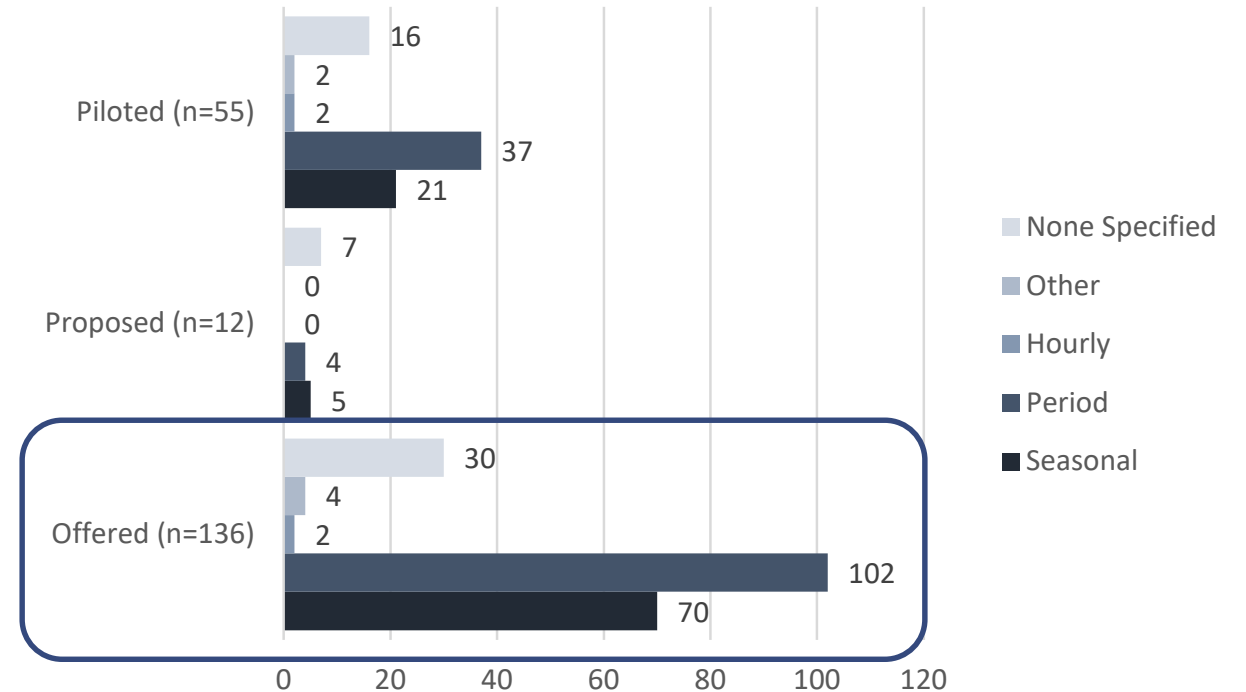
- **Dedicated EV:** The meter measured electricity consumption strictly for the EV
- **Whole Premise:** The meter measured electricity consumption for the entire premise
- **Utility Meter:** An additional utility-grade meter was used to measure EV charging load
- **Telematics:** The EV's own internal telematics were used to measure EV charging load
- **EVSE:** The EV supply equipment's internal measurement capabilities were used to measure charging load



Currently Offered EV Rates Overwhelmingly Include Period (TOU) and Seasonally Differentiated Designs

Temporal Differentiation Categories

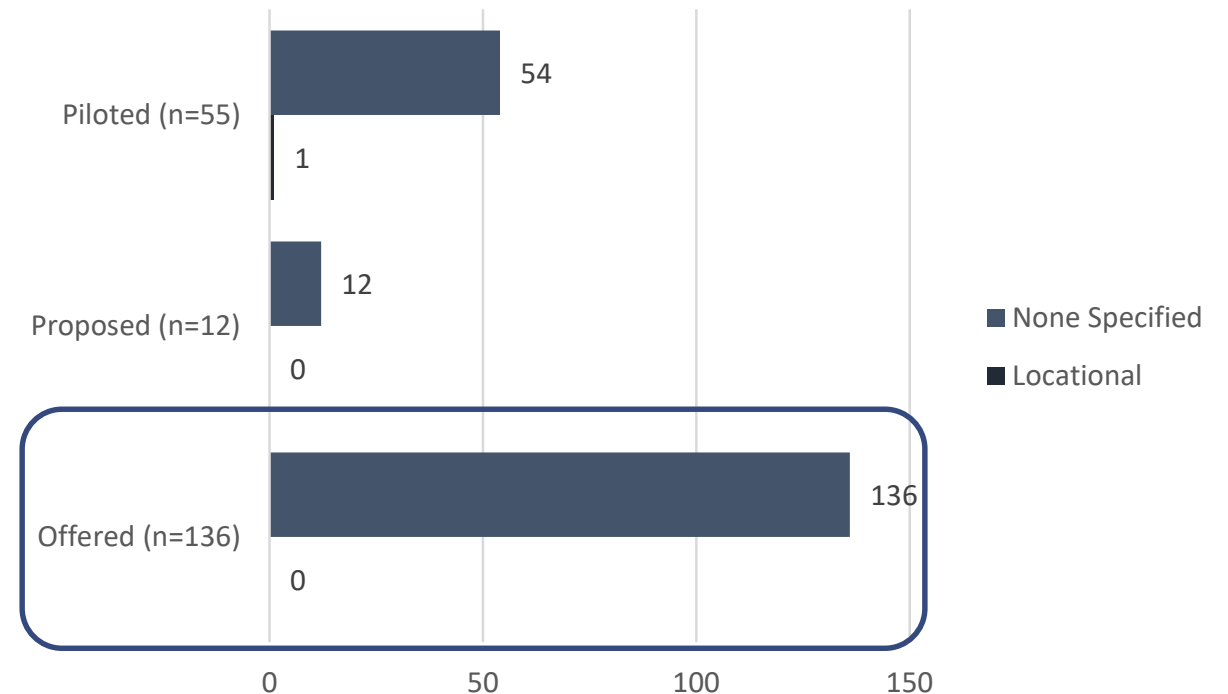
- **Seasonal:** Rate schedules that differed by season (e.g., summer and non-summer)
- **Period:** Rate schedules that varied according to two or more multi-hour periods of the day (e.g., TOU rates)
- **Hourly:** Rate schedules that varied according to the hour of the day (e.g., RTP)
- **Other:** Rate schedules that varied temporally in any other way (e.g., as monthly load factors increase the cost per kWh charge decreases, critical peak energy charge overlay)



No IOU Currently Offered a Locationally Differentiated EV-Specific Rate

Locational Differentiation Categories

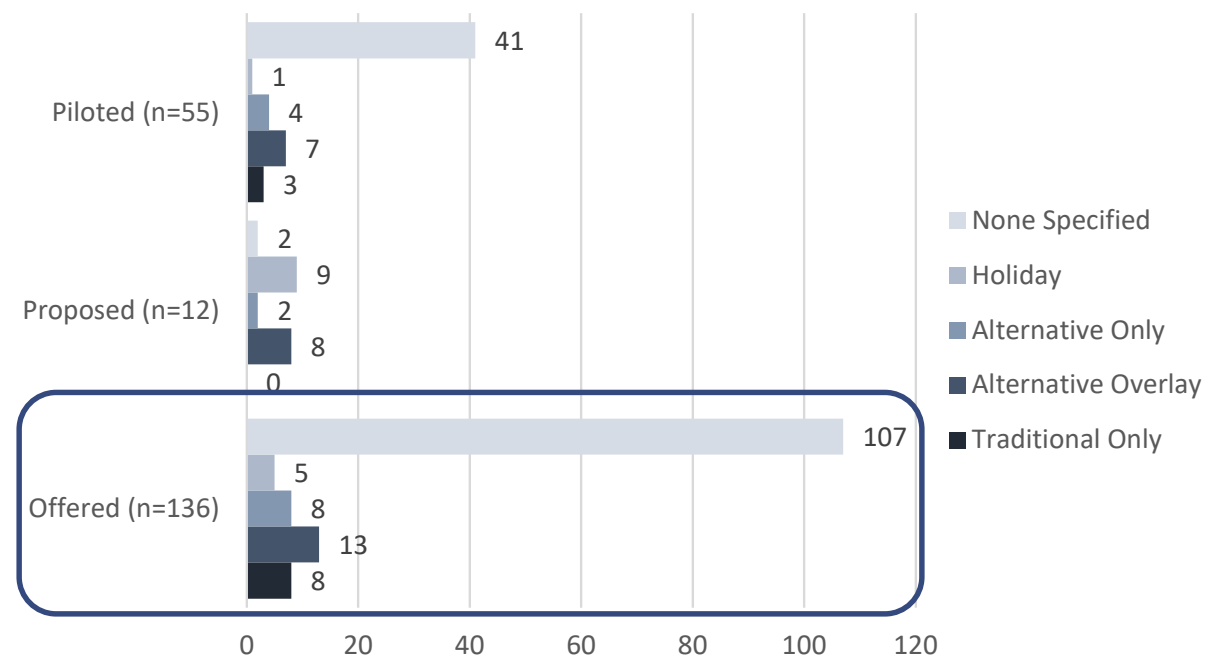
- Rate designs with locational differentiation can be as simple as volumetric energy charges that vary by location on the subtransmission (e.g., 34.5-69.0 kV) grid, or more complex differential coincident peak demand charges that are based on congestion of local distribution lines (e.g., below 34.5 kV).
- For this analysis, rate levels reflective of cost differences at the bulk power system (e.g., above 69 kV) were not considered to have any locational differentiation.



A Handful of Currently Offered EV Rates Included Traditionally or Alternatively Designed Demand Charges

Demand Charge Categories

- **Alternative Only:** Rates that only included an alternative to a traditionally designed demand charge (e.g., demand subscription model, monthly upper limits on billed demand, level of demand charge tied to monthly load factor/station utilization)
- **Alternative Overlay:** Rates that under particular conditions specified in the tariff overlaid an alternative to a traditional demand charge on top of a traditionally designed demand charge, both which were included in the tariff filing (e.g., discounted demand charge applied as a credit, reduced demand charge for off-peak usage, phasing out the \$/kW demand charge in favor of a \$/kWh volumetric energy charge based on station utilization)
- **Traditional Only:** Rates that included a typical, traditional design for a demand charge

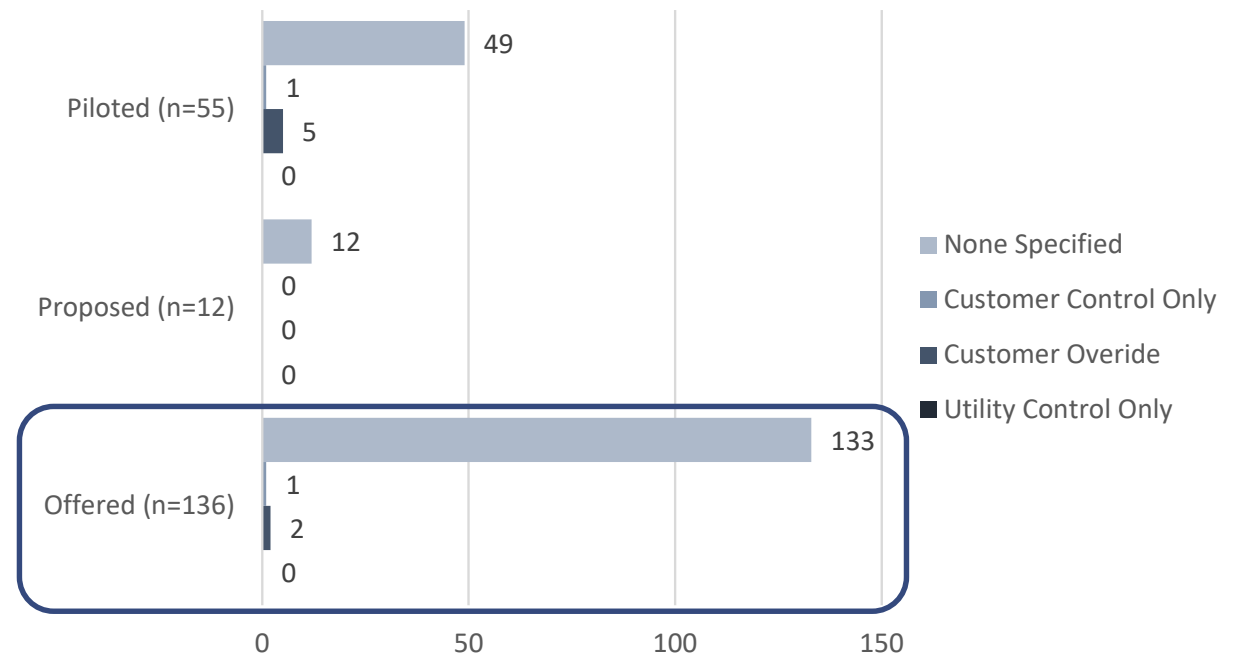


- **Holiday:** Rates that included some version of a demand charge holiday, where the demand charge would be suspended for a period of time or where the holiday would otherwise be scheduled to sunset.

Very Few Currently Offered EV-Specific Rates Explicitly Included Any Form of Charging Controls

Charging Control Categories

- **Utility Control Only:** Rates that exclusively allow the utility to directly control the charging equipment, under specified circumstances, without the ability for a customer to override the utility control signals
- **Customer Override:** Rates that give the customer the ability to override utility control signals, under specified circumstances
- **Customer Control Only:** Rates that exclusively give the customer the ability to directly control charging equipment



Dominant Offered EV-Specific Rate Designs Among U.S. IOUs

	Residential		Commercial		Utility-Owned	
	1 st Most Offered	2 nd Most Offered	1 st Most Offered	2 nd Most Offered	1 st Most Offered	2 nd Most Offered
Whole Premise Metering	○	●	○	○	○	○
Dedicated EV Metering	●	○	●	●	○	○
Flat or Block Energy Charge	○	○	○	○	●	○
TOU Energy Charge	●	●	●	●	○	●
Traditional Demand Charge	○	○	○	○	○	○
Alternative Demand Charge	○	○	●	○	○	○
Geographic Differentiation	○	○	○	○	○	○
Control Tech Requirement	○	○	○	○	○	○
Count / % of Class Total	25 / 46%	16 / 30%	13 / 27%	13 / 27%	16 / 60%	8 / 30%

Proposed and Piloted EV-Specific Rate Designs Were Generally Not All that Different From Offered Rates

- The metering configurations, temporal differentiation, and locational differentiation observed in proposed and piloted rate designs were generally consistent with offered rates
 - Commercial customer rate pilots generally included TOU rate designs with a handful testing different types of demand charge alternatives
 - Residential customer rate pilots generally included TOU rate designs, but tested different ratios of peak to off-peak rate levels.
 - Utility-owned charging station rate pilots commonly avoided the application of a demand charge and relied on volumetric energy rates set at a “competitive market” level
- Limited degree of experimentation in more novel design elements was observed in a small number of pilots
 - Handful of commercial rate pilots tested more granular temporal differentiation
 - A few residential rate pilots tied the volumetric energy charges to different metering configurations

Key Conclusions

- Utilities and regulators may be highly motivated to currently promote EV adoption through simple rate designs while seeking broad management of grid impacts from the additional electric demand associated with charging loads (e.g., by encouraging off-peak charging)
- The additional complexity introduced by alternatives to traditionally designed demand charges or outright holidays from them were deemed acceptable, by some, in order to support an industry at the beginning stages of a transition
- The absence of highly dynamic temporal or locational rate designs suggests that, as in other utility applications, achieving the greatest level of economic efficiency is likely not as high a priority at the present time as other issues or may not be feasible or cost-effective due a variety of reasons (e.g., the existing metering infrastructure is too limited or nonexistent)
- The general similarities between rates currently offered and those either proposed or piloted suggests limited interest in moving beyond the status quo in EV retail rate design

Key Considerations for the Future

- The implications of EV rate design objectives vis-à-vis other distributed energy resources (DERs) should be carefully considered, especially because states typically have different rate designs and policies/goals for different types of DERs (e.g., EV, PV)
- Regulators and utilities should consider the frequency with which EV-specific rate designs are updated or altered to reflect changing grid, economic and/or environmental conditions as well as their effectiveness in achieving the stated (or, more likely, implicit) objective
- Future research opportunities on EV-specific rates include:
 - Assessing why particular rate design elements were proposed and approved, or why others were not
 - Collecting and analyzing enrollment in and response to different rates offered at the same utility
 - Understanding how recently enacted federal non-rate incentives are affecting rate design
 - Identifying and categorizing utility EV program designs

Questions/Comments



Contact

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