Vehicle-Grid Integration
Use Cases and Regulatory Issues

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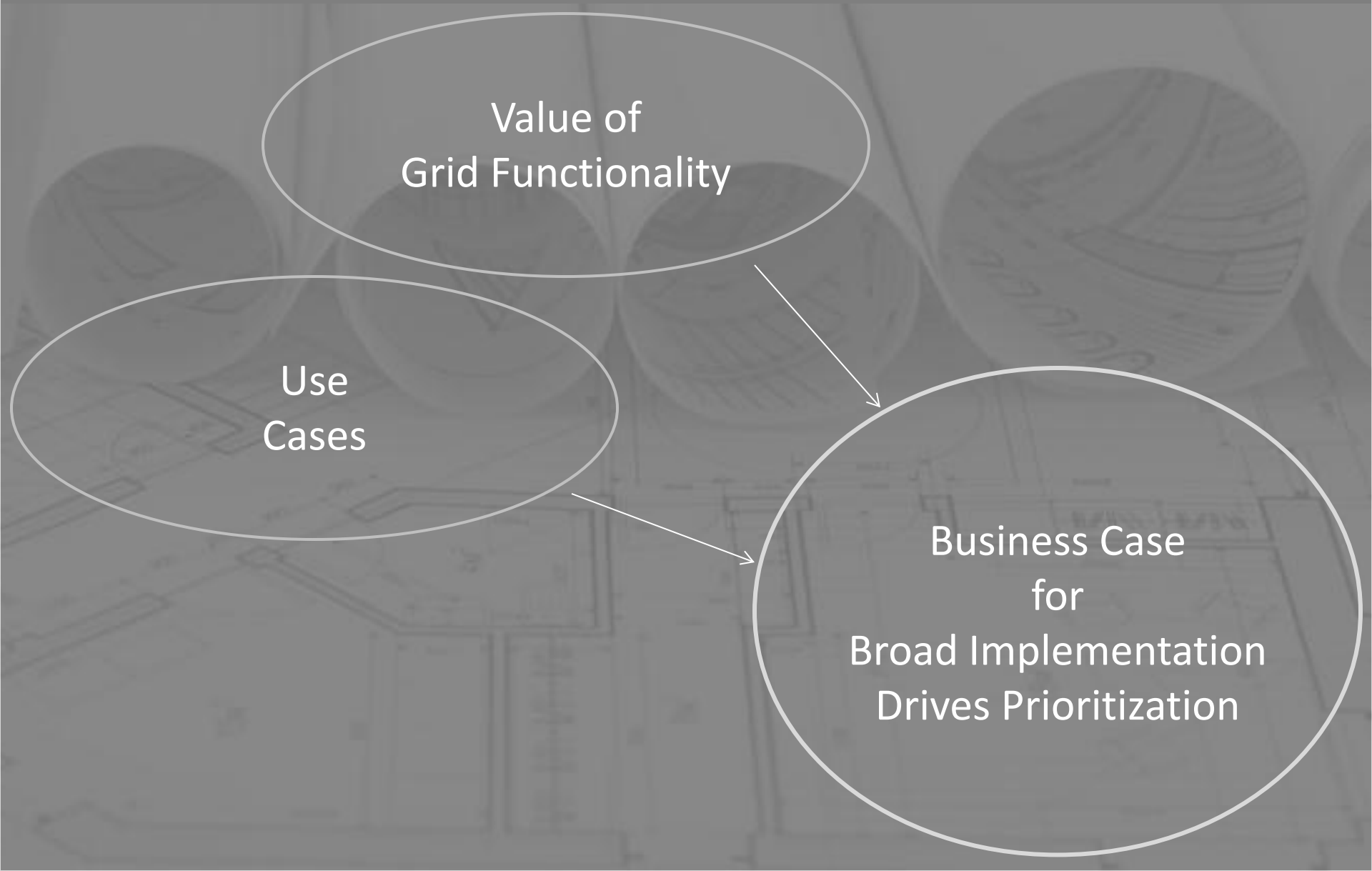
CEC VGI Research Workshop
November 2014

Presentation Topics

- Draft Use Case Framework
- Valuing Grid Functionality
- Relationship to Storage Procurement
- Next Steps in CPUC alternative-fueled vehicle proceeding

Implementing VGI



VGI
Use Cases

- Identify Characteristics critical to functionality and communication
- Group into Use Case Families
- Prioritize implementation based on business case

Use Case Characteristics

Performance Signal

Service Destination

Power Flow Characteristics

Aggregation

…Sub use-cases incorporate actor complexity and communication richness

Performance Signal

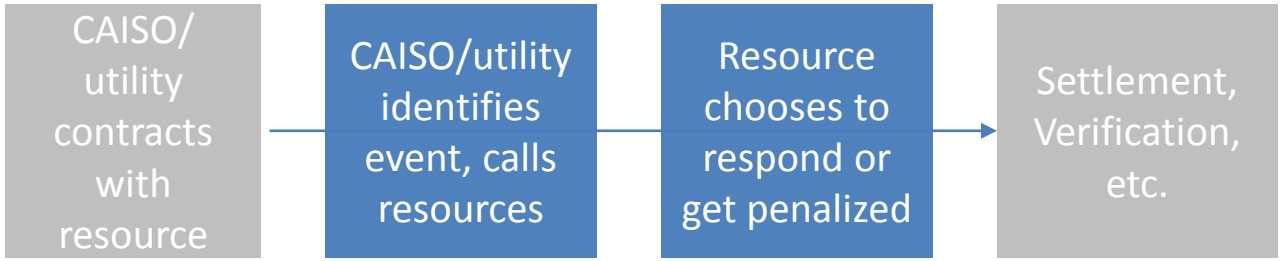
Event-Based

Automatic Communication

Reservation-Based

Performance Signal

Event-Based



Performance is triggered by a message from the grid in real-time as an event is occurring

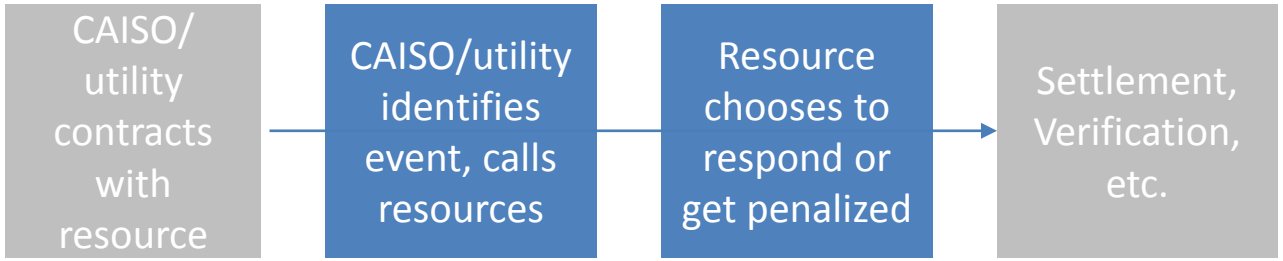
Utility/CAISO indicates magnitude and duration

Automatic Communication

Reservation-Based

Performance Signal

Event-Based



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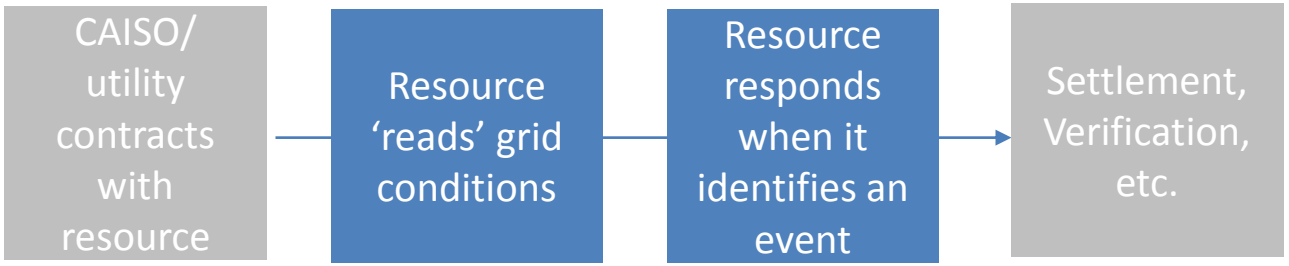


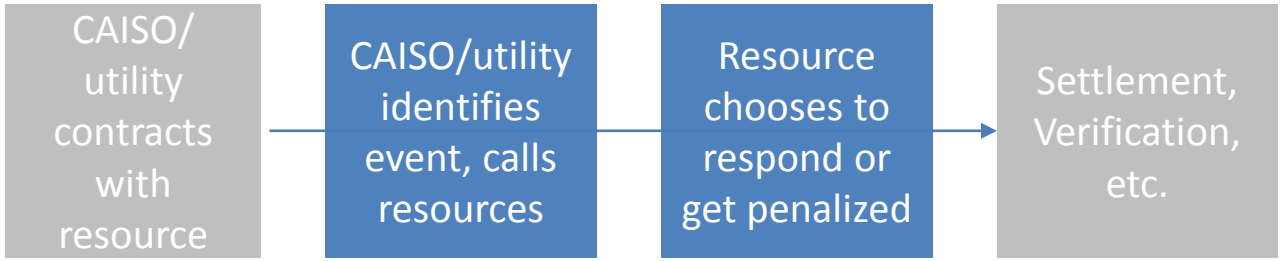
Performance is triggered by conditions read from the grid

Performance occurs in real-time, following pre-determined rules

Reservation-Based

Performance Signal

Event-Based



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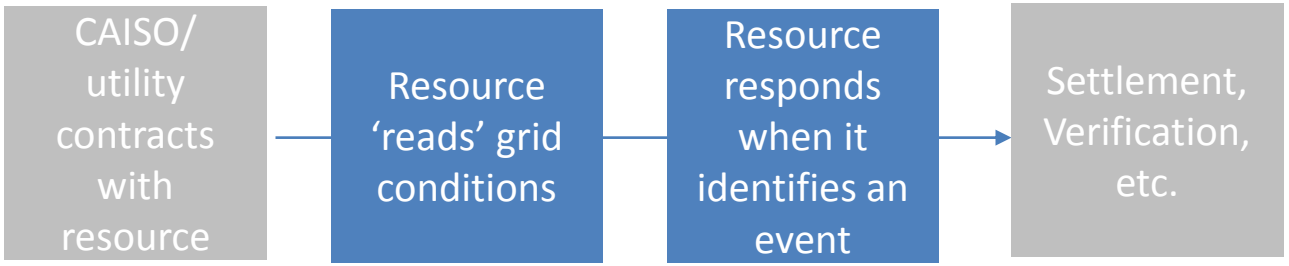
Automatic Communication



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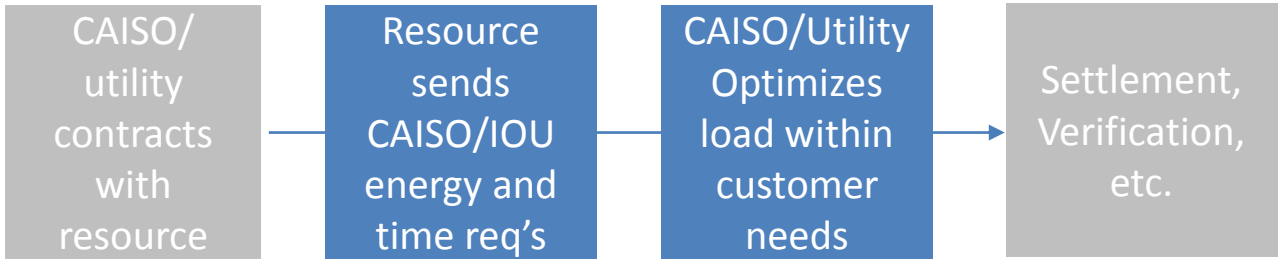
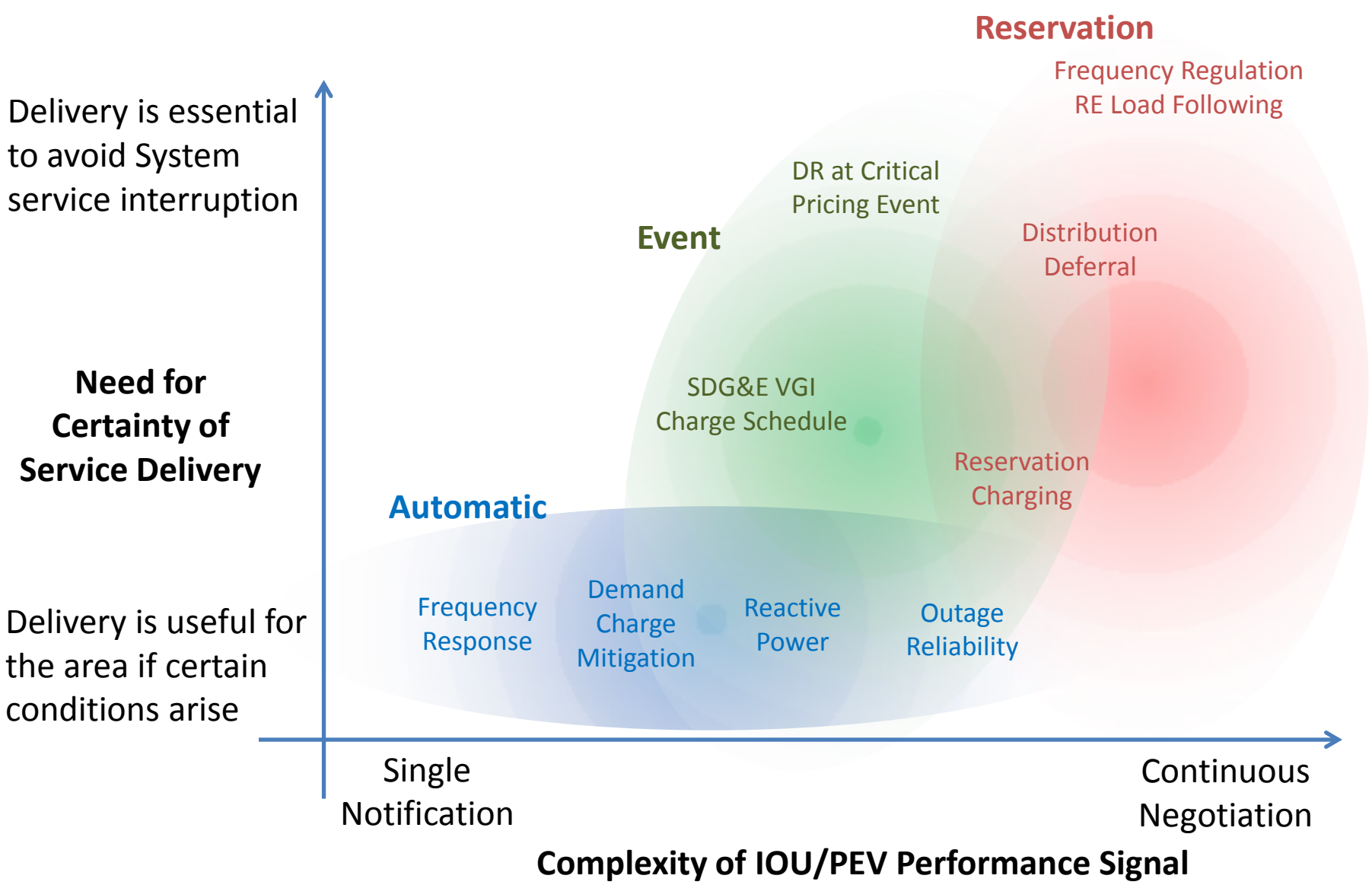
Reservation-Based



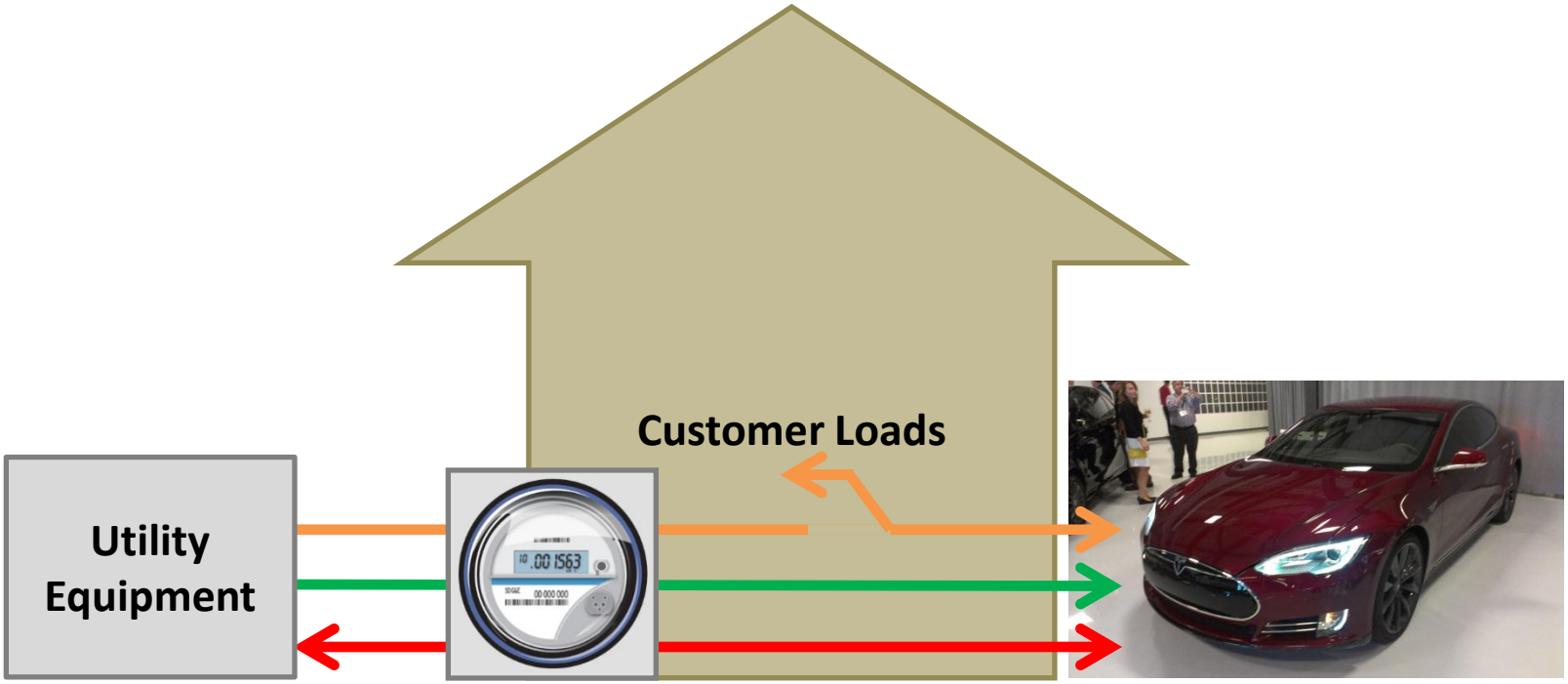
Customer gives utility control over its resource under specified terms

CAISO/utility determines performance based on expected and real-time grid conditions

Performance Signal type may implicate the development of grid services and affect their value.



Vehicle Power Flow



V1G: Unidirectional power into PEV charging
Load-Modifying V1G: service behind the meter
V2G: Bi-directional power in front of the meter

Aggregation Type

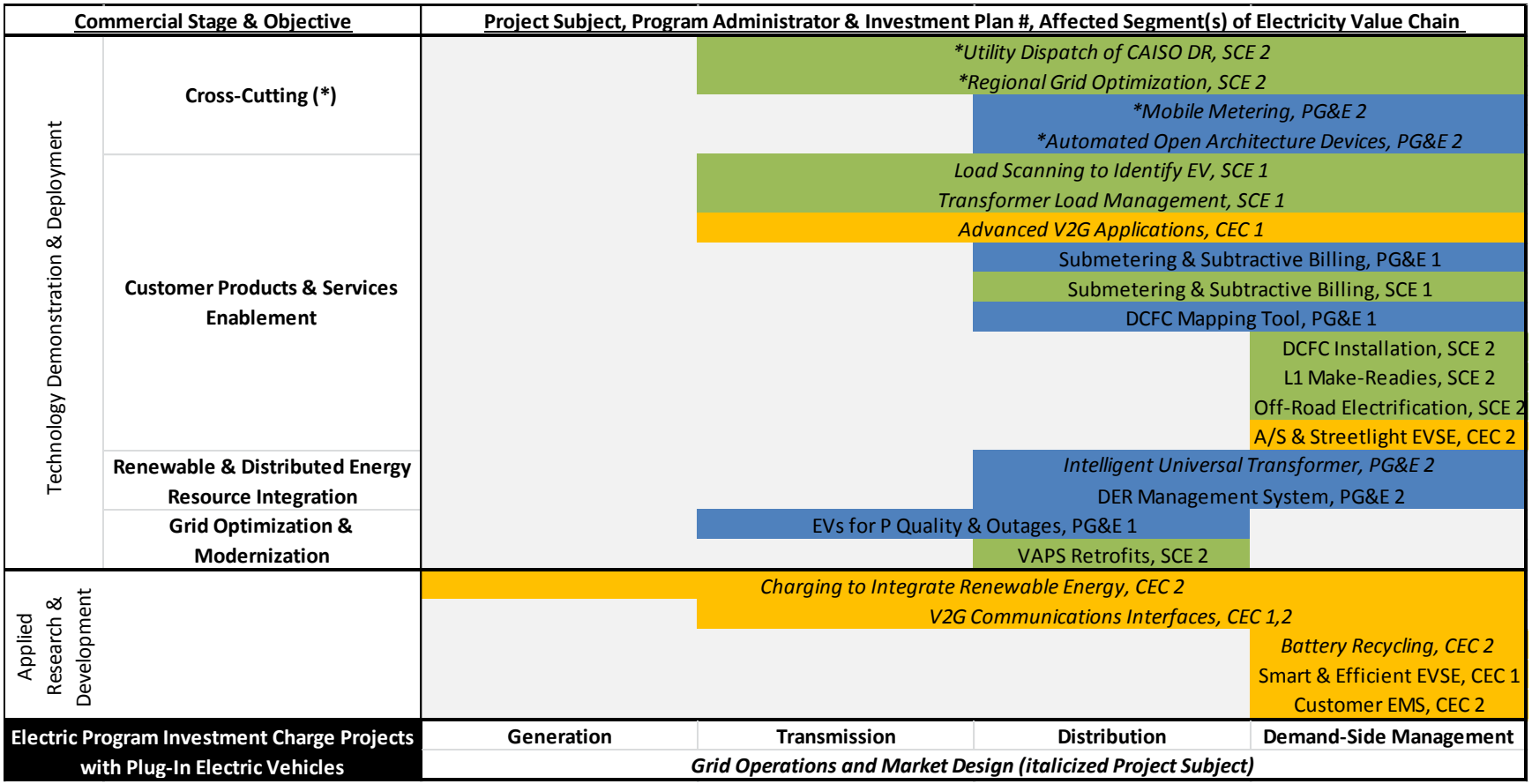
Single Site

- Can be multiple vehicles, but must be at one grid location
- Capable of delivering local distribution benefits

Geographic Site Aggregation

- Multiple vehicles at multiple grid locations
- Maybe Capable of delivering local distribution benefits

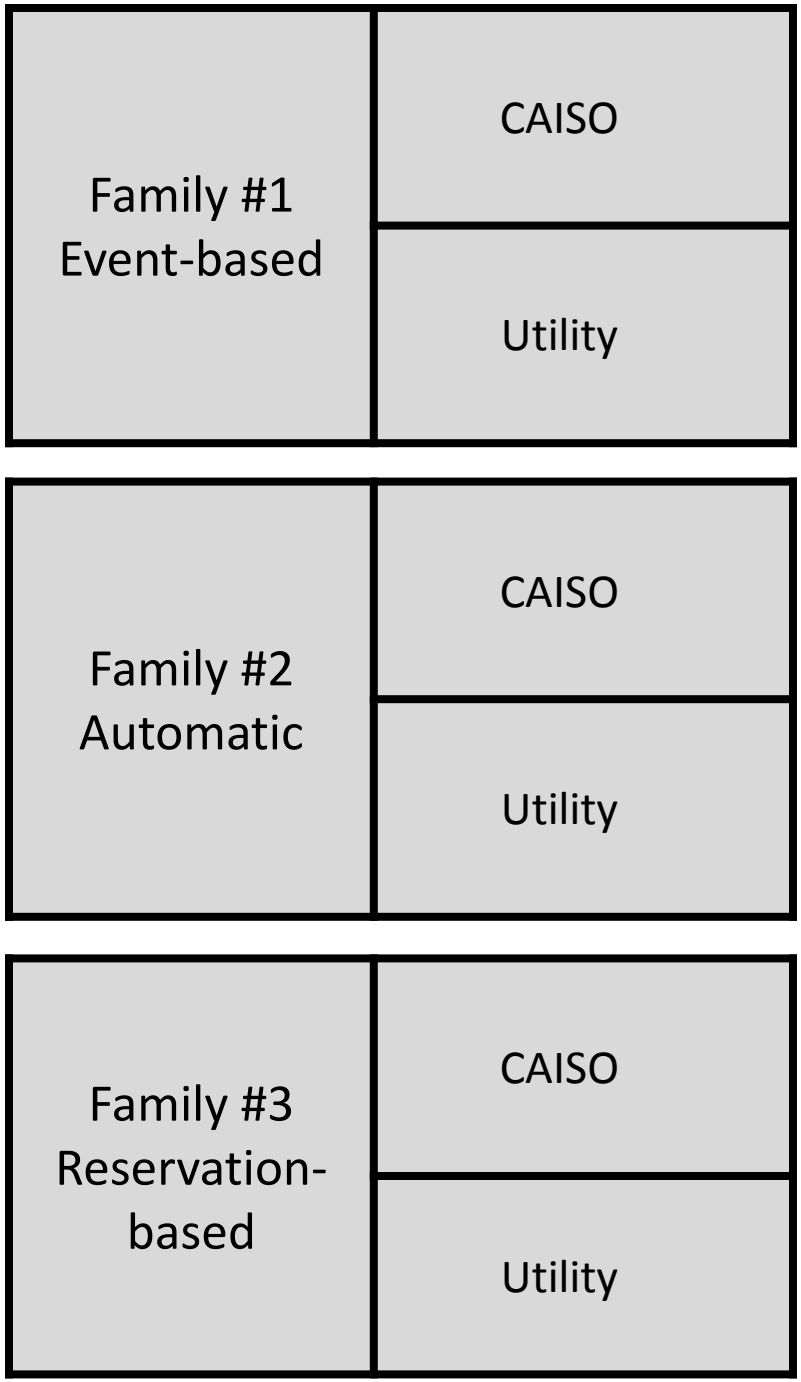
Research can help us understand how tariffs and rules that govern reliability might be modernized to open customer value unlocked by new technology.



Family #1
Event-based

Family #2
Automatic

Family #3
Reservation-based


Family #1
Event-based
CAISO
Utility
Family #2
Automatic
CAISO
Utility
Family #3
Reservation-
based
CAISO
Utility

Family #1 Event-based	CAISO	Controlled Charging No Aggregation	Load Modification No Aggregation	Bi-directional Power Flow No Aggregation
		Controlled Charging Geographic Aggregation	Load Modification Geographic Aggregation	Bi-directional Power Geographic Aggregation
	Utility	Controlled Charging No Aggregation	Load Modification No Aggregation	Bi-directional Power Flow No Aggregation
		Controlled Charging Geographic Aggregation	Load Modification Geographic Aggregation	Bi-directional Power Geographic Aggregation
Family #2 Automatic	CAISO	Controlled Charging No Aggregation	Load Modification No Aggregation	Bi-directional Power Flow No Aggregation
		Controlled Charging Geographic Aggregation	Load Modification Geographic Aggregation	Bi-directional Power Geographic Aggregation
	Utility	Controlled Charging No Aggregation	Load Modification No Aggregation	Bi-directional Power Flow No Aggregation
		Controlled Charging Geographic Aggregation	Load Modification Geographic Aggregation	Bi-directional Power Geographic Aggregation
Family #3 Reservation-based	CAISO	Controlled Charging No Aggregation	Load Modification No Aggregation	Bi-directional Power Flow No Aggregation
		Controlled Charging Geographic Aggregation	Load Modification Geographic Aggregation	Bi-directional Power Geographic Aggregation
	Utility	Controlled Charging Geographic Aggregation	Load Modification Geographic Aggregation	Bi-directional Power Geographic Aggregation
		Controlled Charging Geographic Aggregation	Load Modification Geographic Aggregation	Bi-directional Power Geographic Aggregation

VGI Services

Wholesale Market Services	Distribution Infrastructure Services	Customer-Facing Services
Frequency Regulation	Upgrade Deferral	Power Quality
Spin/Non-Spinning Reserves	Voltage Support	Power Reliability
Load Following/Ramping		Retail Energy Time-Shift
		Demand Charge Mitigation

Stakeholders need to understand:

- the value of each service ($/kW/yr)
- the frequency that it is called
- the duration of a given service
- whether or not aggregation can be used
- which performance signal is needed for each

VGI and Storage Procurement

Bi-Directional Power Flow and Load Modification VGI resources are eligible technologies for utility storage procurement.

At this time, Controlled Charging is not considered a storage resource

Controlled Charging will be revisited for inclusion in the 2016 procurement cycle

Solicitations issued or pending release:

SDG&E 9/5/14

SCE and PG&E 12/1/14

CPUC VGI Process Updates

July 16: R.13-11-007 AFV OIR Scoping Memo

- Phase 1: Guiding Principles, Infrastructure Questions, Demand Charges, Education and Outreach
- Phase 2: VGI Implementation

September 29: Consolidation of AFV OIR and SDG&E's VGI Pilot proceedings

Questions? Thank You

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CPUC Alternative Fuel Vehicles Page
http://www.cpuc.ca.gov/PUC/energy/altvehicles/

Recent Activities in AFVs

July 16: R.13-11-007 AFV OIR Scoping Memo

- Phase 1: Guiding Principles, Infrastructure Questions, Demand Charges, Education and Outreach
- Phase 2: VGI Implementation

September 1: PEV Submetering Pilot open for customer enrollment, until 2/28/2015

September 29: Consolidation of AFV OIR and SDG&E's VGI Pilot proceedings

October 30: SCE files application for Charge Ready and Market Education Programs

November 14: Proposed Decision addressing utilities' role in development of electric vehicle infrastructure

November 18: Proposed Decision adopting Low Carbon Fuel Standard Revenue Allocation Methodology for the IOUs