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CalETC Preliminary Comments on VGI Roadmap Update Webinar Attachment 3

Attachment 3

Additional submitted attachment is included below.

	DRAFT				DRAFT
Beneficiary (framework source)	**Benefit (framework source)**	**Implementation (framework source)**	**Metric**	**Type of benefit (competitive service, non-competitive service, policy change, behind-the meter investment/program and non-monetized benefit)**	**Mechanism for Benefit**
Who needs?	**What is the need**	**What meets the need?**	**How is it measured?**	**How to meet the need? (category)**	**How to meet the need? (details)**
Customer	TOU bill management (8,5,9,10)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			kW	competitive	Wholesale market
			KW	eventually competive / non-monetary benefit today	Distribution market
		Improved - TOU rate design (7)	KWh	policy change	TOU Bill- volumetric
		V1G (7)	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			KWh and KW	non-competitive service	Dynamic VGI rates
			kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
		V2G (7)	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			KWh and KW	non-competitive service	Dynamic VGI rates
			kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
	Demand charge management (8,1,10)	Charging level incentives (7)	KW	policy change	Changed allowance policy
			KW	policy change	Charging station incentives (e.g. lower level or charge-sharing, charge-sequencing, similar)
		Improved - demand charge rate design	KW	policy change	Bill- demand charges
		Special LCFS funded rates	KW and/or kWh	policy change	Bill TOU or demand
	Increased PV self consumption (8,10) (localized overgen of solar)	V1G (7)	kWh	eventually competive / non-monetary benefit today	Distribution market
		V2G (7)	kWh	eventually competive / non-monetary benefit today	Distribution market
	Reduce backflow on distribution system from high solar penetration	V1G (7)	kWh	eventually competive / non-monetary benefit today	Distribution market
	Back-up power (8,5,1,10)		KWh and KW	other	no market, depends on alternative
	Power quality (1)		kVa	other	no market, depends on alternative
	Market education and outreach (ME&O) regarding bill savings, charging and EV options	TE Advisory Services for business customers, utility web resources, rate analyses, broad and targeted ME&O, dealer program, 3rd party education	NA	non-monetized benefit	NA
Distribution	Distribution capacity/deferral (8,5,1,6,10)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			kW	competitive	Wholesale market
			KW	eventually competive / non-	Distribution market
		Charging level incentives (7)	KW	policy change	Changed allowance policy
			KW	policy change	Charging station incentives (e.g. lower level or charge-sharing, charge-sequencing, similar)
		Add Residential demand charge		policy change	for over 10 kW
		Improved demand charge design		policy change	bill - demand charge
		Improved - TOU rate design (7)	KWh	policy change	TOU Bill- volumetric
		Special LCFS funded rates	KW and/or kWh	policy change	Bill TOU or demand
		V1G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market

		V2G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
	Reliability (back-tie) services (8,5,1,9,10)	V2G (7)	kW	eventually competitive	Distribution market
	Voltage support (8,5,10)	V2G (7)	KW		
	Resiliency/microgrid/islanding (8,5,1,10)	V1G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
		V2G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
	Renewable integration (1,6,9)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
		Improved demand charge design	kW	policy change	bill - demand charge
		Special LCFS funded rates	KW and/or kWh	policy change	Bill TOU or demand
		Improved - TOU rate design (7)	KWh	policy change	TOU Bill- volumetric
	Increased PV self consumption (8,10) (localized overgen of solar)	V1G (7)	kWh	eventually competive / non-monetary benefit today	Distribution market
	Reduce backflow on distribution system from high solar penetration	V1G (7)	kWh	eventually competive / non-monetary benefit today	Distribution market
		V1G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
		V2G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
Large IOUs in CA	Storage mandate compliance	V2G (7)	kW	competitive	Wholesale market
		V1G (7)	kW	policy change	Wholesale market
Transmission	Transmission capacity/deferral (8, 5,1,6,10)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			kW	competitive	Wholesale market
			KW	eventually competive / non-	Distribution market
		Charging level incentives (7)	KW	policy change	Changed allowance policy
			KW	policy change	Charging station incentives (e.g. lower level or charge-sharing, charge-sequencing, similar)
		Improved demand charge design	kW	policy change	bill - demand charge
		Special LCFS funded rates	KW and/or kWh	policy change	Bill TOU or demand
		Improved - TOU rate design (7)	KWh	policy change	TOU Bill- volumetric
		V1G (7)	kW	competitive	Wholesale market
			KW	eventually competitive	Distribution market
		V2G (7)	kW	competitive	Wholesale market
	Black start (8,1,10)	NA		NA	NA
	Voltage support (8,5,1,10)	V2G (7)	kVa / kVar	eventually competitive	???
	Inertia primary frequency response (8, 5,10)	V2G (7)	kVa / kVar	???	???
	Renewable integration (1,6,9)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			kW	competitive	Wholesale market
			KW	eventually competive / non-	Distribution market
		Charging level incentives (7)	KW	policy change	Changed allowance policy
			KW	policy change	Charging station incentives (e.g. lower level or charge-sharing, charge-sequencing, similar)
		Improved - TOU rate design (7)	KWh	policy change	TOU Bill- volumetric
		Improved demand charge design	kW	policy change	bill - demand charge
		Special LCFS funded rates	KW and/or kWh	policy change	Bill TOU or demand
		V1G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market

		V2G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
Wholesale market (ISO-ancillary services and energy markets)	Frequency regulation (8,5,1,6,10), primary and secondary	V2G (7)	kW/kWh	competitive	Wholesale market
		V1G (7)	kW/kWh	competitive	Wholesale market
	Reactive power support (8,6)	V2G (7)	kVa / kVar	competitive	Wholesale market
		V1G (7)	kVa / kVar	competitive	Wholesale market
	Spinning reserves (8, 5,1,10)	V2G (7)	kW	competitive	Wholesale market
		V1G (7)	kW	competitive	Wholesale market
	Non-spinning reserves (8, 5,1,10)	V2G (7)	KW	competitive	Wholesale market
		V1G (7)	kW	competitive	Wholesale market
	Replacement reserve (5)	V2G (7)	kW	competitive	Wholesale market
	Day Ahead Energy Market	V2G (7)	kWh	competitive	Wholesale market
		V1G (7)	kWh	competitive	Wholesale market
	Real Time/Imbalance energy (8,5,1,6)	V2G (7)	kWh	competitive	Wholesale market
		V1G (7)	kWh	competitive	Wholesale market
Generation Resource adequacy	System RA capacity (8,1,6,10)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			kW	competitive	Wholesale market
			KW	eventually competive / non-	Distribution market
		Charging level incentives (7)	KW	policy change	Changed allowance policy
			KW	policy change	Charging station incentives (e.g. lower level or charge-sharing, charge-sequencing, similar)
		Improved demand charge design	kW	policy change	bill - demand charge
		Special LCFS funded rates	KW and/or kWh	policy change	Bill TOU or demand
		Improved - TOU rate design (7)	KWh	policy change	TOU Bill- volumetric
		V1G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
		V2G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
	Local RA capacity (8,1,6,10)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges
			KWh and KW	non-competitive service	TOU Bill- volumetric
			kW	competitive	Wholesale market
			KW	eventually competive / non-monetary benefit today	Distribution market
		Charging level incentives (7)	KW	policy change	Changed allowance policy
			KW	policy change	Charging station incentives (e.g. lower level or charge-sharing, charge-sequencing, similar)
		Improved demand charge design	kW	policy change	bill - demand charge
		Special LCFS funded rates	KW and/or kWh	policy change	Bill TOU or demand
		Improved - TOU rate design (7)	KWh	policy change	TOU Bill- volumetric
		V1G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
			kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
	Flexible RA capacity (8, 5,1,6,10) (famping or load following services)	V1G (7)	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
		V2G	kW	competitive	Wholesale market
			KW	eventually competive	Distribution market
	Reduced system operating costs with flexible EV loads as a dispatchable resource	V1G (7)	kWh	competitive	Wholesale market
		V2G	kWh	competitive	Wholesale market
	Reduced Integrated Resource Planning procurement costs with flexible EV loads as a dispatchable resource	V1G (7)	kWh	competitive	Wholesale market
		V2G	kWh	competitive	Wholesale market
Societal/Environmental	GHG reductions (1,6)	passive / optimized response to education (bill, EV dashboard, app, etc) - Load shifting (5,1) or load ramp down / ramp up	kW	non-competitive service	Bill- demand charges

			KWh and KW	non-competitive service	TOU Bill- volumetric
			kW	competitive	Wholesale market
			KW	eventually competive / non-monetary benefit today	Distribution market
		Improved TOU rate design (7) to encourage adoption	Energy (10)		
		Improved demand charge design			
		Charging level incentives	KW	policy change	Charging station incentives (e.g. lower level or charge-sharing, charge-sequencing, similar)
			kW	policy change	changed allowance policy
		special GHG programs	kWh	behind-the-meter investment	invest in Curbside charging
		special GHG programs	kWh	behind-the-meter programs	EV rideshire incentives
		special GHG programs	kWh	behind-the-meter investment	invest in work lots for street-parkers and MUD parkers
		special GHG programs	KWh	behind-the-meter investment	invest in urban DC fast charge plazas
		special GHG programs	kWh	behind-the-meter investments and programs	receive LCFS rate discount for charging at night or daytime overgen periods
		special GHG programs	kWh	behind-the-meter investments and programs	receive LCFS rebate or rate discount only if on rate designed with EVs in mind
		Encourage EV adoption		behind-the-meter investments and programs	charging stations at home, fleet, away-from home
		Encourage EV adoption		behind-the meter investments and	Market-education programs
		Encourage EV adoption		behind-the meter investments and	LCFS programs
	Local pollutants (1,6)	same as environmental section			
	Economic Growth (1,6)	same as environmental section	$		
	Job growth (1,6)	same as environmental section	$		

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Mechanism or policy proceeding in place (yes/no/ pending)	comments	
Y		
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
P (SCE proposed rates)		
Y	aggregator could take some or even all benefit	
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y		
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y - AFV OIR proceeding		
Y - SB 350 TE applications or AFV OIR		
P (SCE proposed rates)		
Y - AFV OIR or GRCs phase 2		
N (for now)		
N (for now)		
N (for now)		
Y		
Y		
Y		
Y	note - EV dashboards, or cell phones or charging stations all can educate or even help program a response	
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y - AFV OIR proceeding		
Y - SB 350 TE applications or AFV OIR		
Y - AFV OIR		
Y - GRC phase 2 process		
P (SCE proposed rates)		
Y - AFV OIR or GRCs phase 2		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	

Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
N (for now)	discussed on CSWG Framework	
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y		
Y		
Y - GRC phase 2 process		
Y - AFV OIR or GRCs phase 2		
P (SCE proposed rates)		
N (for now)		
N (for now)		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y (eliglible)		
N (not eligible)		
Y		
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y - AFV OIR proceeding		
Y - SB 350 TE applications or AFV OIR		
Y - GRC phase 2 process		
Y - AFV OIR or GRCs phase 2		
P (SCE proposed rates)		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y	Aggregators could do this, few customers	
N	not enough information provided	
N (for now)		
???		
Y		
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y - AFV OIR proceeding		
Y - SB 350 TE applications or AFV OIR		
P (SCE proposed rates)		
Y - GRC phase 2 process		
Y - AFV OIR or GRCs phase 2		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	

Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y		
Y		
Y		
Y		
Y		
Y		
y		
y		
y		
y		
y		
Y		
Y		
Y		
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y - AFV OIR proceeding		
Y - SB 350 TE applications or AFV OIR		
Y - GRC phase 2 process		
Y - AFV OIR or GRCs phase 2		
P (SCE proposed rates)		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y		
Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y - AFV OIR proceeding		
Y - SB 350 TE applications or AFV OIR		
Y - GRC phase 2 process		
Y - AFV OIR or GRCs phase 2		
P (SCE proposed rates)		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
y		
y		
y		
y		
Y		

Y		
Y	Aggregators could do this, few customers	
N (for now)	Aggregators could do this, few customers	
Y - SB 350 TE applications or AFV OIR		
Y - SB 350 TE applications or		
Y - SB 350 applications		
Y - SB 350 applications		
Y - SB 350 applications		
Y- GHG OIR or SB 350 proceeding		
Y- GHG OIR or SB 350 proceeding		
Y		
Y		

- VGI Benefit framework: answers the following questions 1) who needs the benefit, 2) what is the need, 3) what meets the need, and 4) how to meet the need (broadly and exactly)
- VGI Benefit: any type of benefit whether monetized or not.
- VGI Service: a subset of VGI benefits and includes monetized benefits on the utility customer of record's electricity bill and in wholesale markets. Eventually many include monetized benefits in distribution markets when they are [illegible]
- Customer Facing VGI Benefits (EV Driver or Site host): include TOU bill management, demand charge management, back-up power, power quality, market education regarding bill savings, charging and EV options, and increased solar self-consumption to address localized over-generation of solar energy. TOU bill management benefits can be provided by V1G, V2G, improved TOU rate design for EVs, design special rates funded by the Low Carbon Fuel Standard proceeds and passive optimized customer response to education from bills, EV dashboards, apps and other means. Demand charge management benefits can be provided by policy changes to improve demand charge rate design, change allowance policy, or changing utility rebates for charging stations to reward lower kW charging or charging stations with charge-sharing, charge sequencing or similar technologies. Increased solar self-consumption to address localized over-generation of solar energy can be provided by V1G or V2G. The
- Distribution System VGI benefits: include deferral of distribution capacity upgrades, integration of renewables, reducing backflow on distribution system from high solar penetration, voltage support and resiliency services provided by microgrids that can island and eventually reliability services that include back tie functions. Deferral of distribution capacity upgrades can be provided by V1G, V2G, passive optimized customer response to education from bills, EV dashboards, apps and other means and by policy changes to improve demand charge rate design, improve TOU rate design for EVs, change allowance policy, design special rates funded by the Low Carbon Fuel Standard proceeds, offer new residential demand charges, or change utility rebates for charging stations to reward lower kW charging or charging stations with charge-sharing, charge sequencing or similar technologies.
- Transmission System VGI benefits: include deferral of transmission capacity, integration of renewables, voltage support, and inertia primary frequency response and eventually other benefits such operational efficiency and black start services,. Deferral of transmission capacity and integration of renewables can can be provided by V1G, V2G, passive optimized customer response to education from bills, EV dashboards, apps and other means and by policy changes to improve demand charge rate design, improve TOU rate design for EVs, change allowance policy, design special rates funded by the Low Carbon Fuel Standard proceeds, offer new residential demand charges, or change utility rebates for charging stations to reward lower kW charging or charging stations with charge-sharing
- Wholesale market Services: include ISO market services such as primary and secondary frequency regulation (response), reactive power support, imbalance energy; spinning reserves, non-spinning reserves and replacement reserves as well as day-ahead and real-time energy markets. These services can be provided by V1G or V2G.
- Generation Resource Adequacy VGI benefits: include system resource adequacy capacity, local resource adequacy capacity, and flexible resource adequacy capacity which is sometimes called ramping or load following service. Generation resource adequacy benefits also include reduced system operating costs with flexible EV loads as a dispatchable resource and reduced Integrated Resource Planning procurement costs with flexible EV loads as a dispatchable resource. System resource adequacy capacity service and local resource adequacy capacity service can be provided by V1G, V2G, passive optimized customer response to education from bills, EV dashboards, apps and other means and by policy changes to improve demand charge rate design, improve TOU rate design for EVs, change allowance policy, design special rates funded by the Low Carbon Fuel Standard proceeds, offer new residential demand charges, or change utility rebates for charging stations to reward lower kW
- Compliance VGI benefits: Investor-owned utilities can meet an electricity storage mandate with V2G, and potentially (with rule changes) by other means such as V1G.

○ Societal and Environmental VGI benefits: Include providing net reductions in greenhouse cases (GHG), criteria air pollutants, air toxics and net additions in economic growth and jobs. GHG reduction benefits (net) can be provided by passive optimized customer response to education from bills, EV dashboards, apps and other means and by policy changes to improve demand charge rate design, improve TOU rate design for EVs, change allowance policy, design special rates or rebates funded by the Low Carbon Fuel Standard proceeds, offer new residential demand charges, or change utility rebates for charging stations to reward lower kW charging or charging stations with charge-sharing, charge sequencing or similar technologies. GHG reduction benefits can be provided by utility programs and behind the meter investments to encourage EV adoption generally as well as special targeted programs designed for people who don't have a consistent place to charge overnight including urban

Framework section on Benefits (parts of several were used in proposed framework)

- VGI benefit groupings (**Option 1)** or value category
  - **Wholesale market services (ISO / RTO)**: 1) frequency regulation, 2) spinning, non-spinning and supplemental reserve, 3) load following / ramping support for renewables 4) capacity markets 5) Demand Response Auction Mechanism 6) real-time and day-ahead energy markets 7) Energy Arbitrage 8) black start 9) voltage support
  - **DSO or utility market services**: 1) DERMS load and generation management (see four phase diagram at end) 2) ADMS advanced load management only 3) rule 21 smart inverter management is a subset of DERMS and ADMS
  - **Distribution and transmission infrastructure benefits**: 1)) local distributed generation support 2) peak load shedding: 3) Distribution and Transmission capacity/deferral, 4) reliability (back-tie) services 5) voltage support 6) Resiliency/microgrid (islanding 7) Primary frequency response
  - **Resource Adequacy benefits**: 1) System RA capacity 2) Local RA capacity 3) Flexible RA capacity
  - **Customer facing benefits:** 1) retail energy time shift with rates, 2) demand leveling with rates or controls, 3) power quality, 4) power reliability, 5) monetizing of GHG and air pollution reduction benefits, 6) increased EV adoption
  - **Societal benefits due to accelerated EV adoption**: 1) reductions in GHG and air pollutants, 2) net State Domestic Product (economic growth) , 3) net jobs

- VGI Beneficiary groupings **(option 2**) by level
  - Site host / customer benefits - includes commercial and residential situations including homes
  - All utility customer benefits – TBD
  - ISO whole sale market benefits - TBD
  - DSO / utility markets
  - Societal benefits – TBD

- VGI grouping **(option 3)**
  - Wholesale market solutions TBD
  - Non-market solutions – TBD

- VGI benefit grouping **(option 4)** by value category
  - Reducing energy generation cost - TBD
  - Reducing site hosts and EV driver's electric bills - TBD
  - Deferring distribution upgrades - TBD
  - Improving reliability - TBD
  - Aligning EV load with renewable integration - TBD
  - Measuring fuel switching – gasoline to EV (required by Low Carbon Fuel Standard for non-residential charging)

- VGI benefit grouping **– Option 5** (based on storage benefit matrix by E3 presented June 12)
  - Planning and Procurement benefits includes reducing long-term distribution resource plan costs, bringing benefits to the transmission system through reduced procurement of ancillary services, and
  - Reliability benefits includes providing reliability for back-up power during outages to the customer, providing islanding, providing deferral of distribution system upgrades to provide reliability, and
  - Capacity benefits includes providing demand charge reduction to the customer, reducing load-growth-related infrastructure upgrade costs, providing targeted placement for high value deferrals, reducing transmission access charges, providing modularity services, addition of flexible capacity, providing system or local capacity (reduce LOLP), and provide renewable firming (increase NQC / ELCC)

- Time Shift benefits includes TOU energy charge reduction, distribution peak shaving, transmission congestion reduction, volatility services, wholesale energy arbitrage, renewable generation time shift
- Generation Operation benefits include backflow prevention, loss reduction, O&M reduction, reduction in renewable curtailment, start-up cost reduction, efficiency improvements to reduce system
- T&D Operation benefits include customer power factor improvement, customer power quality improvement, voltage and VAR support, distribution infrastructure deferral to improve power quality, generation power factor improvement and loss reduction, renewable power smoothing and power
- Operating Anomaly services benefit includes inertia frequency response, primary frequency response, fast/accurate frequency regulation, secondary frequency regulation, real-time balancing
- Contingency services benefit includes spinning reserve, non-spinning reserve and replacement ramp reserve

- VGI grouping – **Option 6** (based on storage benefit matrix by E3)
  - Ancillary Service: see option 5 list
  - Renewable integration includes renewable firming (increase NQC/ELCC), renewable generation time
  - Generation benefit includes reduced cost of system or flexible capacity, reduced LOLP, deferring system or local generation capacity, adding flexible capacity, wholesale energy arbitrage, volatility
  - Transmission benefit includes reduced procurement of ancillary services, reduced need for NERC N-1 contingency, deferral of transmission investment deferral, reduction in transmission access charges,
  - Distribution benefit includes reduced utility asset cost and demand benefits, deferring distribution investments for reliability or capacity, distribution peak shaving, volatility services, and modularity services
  - Customer Benefit includes improving customer power reliability with back-up power, reducing demand charges, and reducing TOU energy charges, volatility services, and modularity services
  - Societal Benefits includes other benefits such as net job creation and reducing GHG and air pollution by securing new markets for EV adoption (rather than just shifting charging to other times of day)

- VGI types (**grouping 7)**
  - Charging level incentives
    - Tools include rebates for lower level charging, modifying current allowance policy, demand charge design
  - TOU Rate Design and Adoption Policy
    - Tools include TOU rate design and policies to require or encourage TOU rate adoption
  - V1G (or managed or controlled charging): Unidirectional power flow under central or customer control enabling vehicles to charge and provide wholesale market services. Includes varying the charge rate at the charging station, EV management system, parking lot EV Energy management system or building management system in order to provide demand response, ancillary services or other services
  - V2G Similar to V1G but bidirectional power flow to the grid.

- CPUC 2017 Framework for Multiple Application of Energy Storage Table 1 on Service Domains & Services **(option 8)**
  - Customer
    - TOU bill management, 2) Demand charge management, 3) Increased PV self-consumption, 4) Back-up power
  - Distribution
    - Distribution capacity/deferral, 2) reliability (back-tie) services 3) voltage support 4) Resiliency/microgrid/islanding
  - Transmission
    - Transmission deferral 2) Black start 3) Voltage Support 4) Inertia Primary frequency response
  - Wholesale Market

- Frequency regulation 2) Imbalance energy 3) Spinning Reserves 4) Non-spinning reserves

○ Resource Adequacy

- System RA capacity 2) Local RA capacity 3) Flexible RA capacity

- VGI Higher level needs Grouping **(option 9) –** From Dave McCreadie at Ford

○ System/Market Integrators (ISO)

- Needs: 1) Maintain proper/efficient system operation through market mechanisms 2) Integrate renewables

○ Utility (gen/trans/distrib)

- Needs: 1) reduce cost of gen/trans/dist (Variable and Fixed/Capital) and 2) maintain service reliability

○ End Use - Consumer (individuals, businesses, etc)

- Needs: 1) Reduce electricity costs 2) Generate value from purchased asset (vehicle battery) when not used for Driving and 3) Charging assurance/confidence/convenience

- Services for the California Market: (12) **(option 10)**

○ TOU Bill Management – Storage device located behind the meter enables a customer to minimize its exposure to high electricity rates. The customer can charge the storage device when rates are low and discharge the storage device when rates are high, thereby offsetting high electricity rates for the

○ Demand Charge Management – Storage device located behind the meter enables a customer to minimize its exposure to demand charges. The customer can use the discharge of the storage device to manage the periods of the highest peaks in electricity usage.

○ Increased PV Self-Consumption – Storage paired with solar PV, behind the meter, allows for a customer to maximize its on-site consumption of solar energy by allowing the customer to store any excess energy on-site to use during hours when the PV system is not generating.

○ Back-up Power – A storage device located behind the customer meter may enable a customer to have "back-up" power for a period of time in the event of a black out or brown out.

○ Distribution Capacity/Deferral – Load-modifying or supply services that distributed energy resources provide via the dispatch of power output for generators or reduction in load that is capable of reliably and consistently reducing net loading on desired distribution infrastructure.

○ Reliability (Back-Tie) Services – Load-modifying or supply services capable of improving local distribution reliability and/or resiliency. Specifically, this service provides a fast reconnection and availability of excess reserves to reduce demand when restoring customers during abnormal

○ Voltage Support – Distribution and/or transmission – Substation and/or feeder-level dynamic voltage management services provided by an individual resource and/or aggregated resources capable of dynamically correcting excursions outside voltage limits as well as supporting conservation voltage reduction strategies in coordination with utility voltage/reactive power control strategies

○ Resiliency/Microgrid/Islanding – Load-modifying or supply services capable of improving local distribution reliability and/or resiliency. This service provides a fast reconnectionand availability of excess reserves to reduce demand when restoring customers during abnormal configurations."

○ Transmission Deferral – Not an ISO tariff defined service at this time

○ Black Start – The procedure by which a Generating Unit self-starts without an external source of electricity thereby restoring a source of power to the CAISO Balancing Authority Area following system or local area blackouts.

○ Inertia – Not an ISO tariff defined service at this time

○ Primary Frequency Response – Not an ISO tariff defined service at this time

○ Energy - The electrical energy produced, flowing or supplied by generation, transmission or distribution facilities, being the integral with respect to time of the instantaneous power, measured in units of watt-hours or standard multiples thereof, e.g., 1,000 Wh=1 kWh, 1,000 kWh=1MWh.

○ Spinning Reserve – The portion of unloaded synchronized resource capacity that is immediately responsive to system frequency and that is capable of being loaded in ten (10) minutes, and that is capable of running for at least thirty (30) minutes from the time it reaches its award capacity.

○ Non-Spinning Reserve – The portion of resource capacity that is capable of being synchronized and Ramping to a specified load in ten minutes (or that is capable of being interrupted in ten (10) minutes) and that is capable of running (or being interrupted) for at least thirty (30) minutes from the time it

- Regulation – The service provided either by resources certified by the CAISO as equipped and capable of responding to the CAISO's direct digital control signals, or by System Resources that have been certified by the CAISO as capable of delivering such service to the CAISO Balancing Authority Area, in an upward and downward direction to match, on a Real-Time basis, Demand and resources, consistent with established NERC and WECC reliability standards, and any requirements of the NRC. Regulation is used to control the operating level of a resource within a prescribed area in response to a change in system frequency, tie line loading, or the relation of these to each other so as to maintain the target system frequency and/or the established Interchange with other Balancing Authority Areas within the predetermined Regulation limits. Regulation includes both an increase Energy production
- Resource Adequacy Resource – A resource that is designated in a Supply Plan to provide resource Adequacy Capacity. The criteria for determining the types of resources that are eligible to provide
- System RA Capacity – CPUC Decision (D.) 05-10-042 first defined and established System RA for utilities and
- Local RA Capacity – CPUC Decision (D.) 06-06-064 first defined and established Local RA for utilities under the jurisdiction of the CPUC
- Flexible RA Resource – CPUC Decision (D.) 13-06-024 recognized a need for flexible capacity in the RA fleet and defined flexible capacity for utilities under the jurisdiction of the CPUC.

- Other options
- Market services: TBD
- Non-market services and benefits: TBD
- Technical solutions: EV grid solutions that need a communication protocol.
- Non-Technical solutions: EV grid solutions that do not need a communication protocol (e.g. rates, charging station rebates, allowances, fuel switching measurement)