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19- MISC-01 - Comments on Draft DER Technical Assessment

Additional submitted attachment is included below.

Lawrence Berkeley National Laboratory (Berkeley Lab) Comments responding to the CEC's "*Draft DER Roadmap – Technical Assessment*"

April 08, 2019

California Energy Commission
Docket Unit, MS-4
Re: Docket No. 19-MISC-01
1516 Ninth Street
Sacramento, CA 95814-5512

Thank you for the opportunity to submit comments from Lawrence Berkeley National Laboratory (Berkeley Lab), Energy Technologies Area (ETA) in response to the "***Draft DER Roadmap – Technical Assessment"***.

We have been privileged to support the State of California in research, design, development and demonstration (RDD&D) of innovation technologies, program design and evaluation, code compliance strategies, water-energy dynamics, demand response and other research efforts that have, over the past 30 years, contributed nearly $484 billion in economic value to the US economy.

We respect California's RDD&D funding as unique in the world. We have organized our comments around the CECs format followed in the Request for Comments document questions/format:

CEC Questions and Responses:

1. Are there additional DER technologies and strategies that should be added to those already listed in the Draft Technical Assessment?

General comments on the needs listed in the report:

A critical current need is to create simulations of how diverse end-use devices could be responsive to highly dynamic pricing, to then discern how the grid can utilize them for the best advantage of the grid and the building. In parallel, a selection of real devices can be created that implement the same price-responsive control algorithms to demonstrate how practical the feature is.

DER coordination is almost always done from the perspective of the utility grid. A project is needed that analyzes the topic from the perspective of the building and its owners, managers, and occupants. This should also be done for the next version of this report.

Other comments:

- There is no clear need for lower-grade meters. Utility meters are enough.
- The part for less expensive and more capable sensing and actuation is important. Utility meters already aggregate the effect of DER so no further development is needed for utility coordination.
- The CEC has funded work on "Energy Reporting". More is needed on that area

- It isn't clear that there is a significant problem of DER being confused by what grid service they can/should supply.

<u>Comments on Section 3: Grid Optimal Load Assets</u>

The table on Page 45 is limited to the technologies in the CPUC Berkeley Lab's Demand Response Potential Study. Other technologies that could be included are:

- Electrification loads – dispatchable space and water heating systems
- Thermal storage – ice, chilled water, phase change materials
- Appliances, refrigerators, washers, dryers, dishwashers
- Miscellaneous Equipment loads – TVs, computers, printers, etc.

For the technology and strategy status and performance attributes that are listed, are there any publicly available and citable sources with more recent data?

- Page 48 CTA-2045 is the correct name, not CEA-2045
- Page 56, Fig. 29. + Page 57, Fig. 31 are for OpenADR 1.0 costs that are old. That should be clarified.

2. Are there additional metrics that can be used to judge progress of DERs towards California's energy policy goals? Are there intermediate DER performance metrics that should be used to assess the performance of a technology?

<u>Comments on Section 3: Grid Optimal Load Assets</u>

The table on Page 51 is limited. Please consider other metrics to be include such as:

- **Latency** - Not just device, but whole system, including communications architecture. This needs to be developed for different communication architectures and control latencies.
- **Load Ramp** – MW/Min
- **Data Granularity** – Seasonal, Time of Day, Day of Week
- **Participation** – Include tariffs not just programs – need R&D on elasticity of electricity – how does demand vary with price
- **DR Enablement** - $/kW not just $/customer and customer incentives and program costs
- **Number of devices** – Also % of customer load that is responsive – like whole building power percentage
- **Amount of modifiable load** – Need to understand this – is this for an entire sector, aggregated? By customer segment – building type?

While metrics are useful and needed for aspects of this topic, for the individual DER themselves, their responsiveness is highly variant on their application context (which may vary each day), and the amount of price differential offered. To characterize this, we recommend analysis of individual DER in detail to see what summary methods are most useful; since it is unclear what those are.

3. For all technologies and strategies, what other research activities would provide the most benefit to California and progress in meeting the state's clean energy goals?

Comments on Section 3: Grid Optimal Load Assets

- **Tariffs** - Machine readable electricity tariffs to better communicate the cost of electricity are needed. The concept here moves beyond OpenADR to a more continuous estimate of costs related to real-time consumption. We can't expect elastic demand unless we communicate electricity prices to devices.
- **New Buildings**- Special attention to DR and energy flexible loads in new construction is needed for new buildings because they have DR capabilities from Title 24. New buildings have no idea how to get into DR programs + CPP (VEN, VTN so buildings can be test-driven before participating in markets)
- **Costs and persistence** - Better data on persistence of savings and costs for DR is needed. Current DR programs have limited understanding of how much it cost to install and configure automation. Such data needs to be collected and published. We also need to understand how long customers say on DR programs and DR measure lifetimes.
- Using dynamic prices at the meter is the most practical and effective way to use transactive principles to improve building/DER coordination. This needs to be a top priority for research and demonstration, so we can determine what gaps there might be between what is needed and what pricing can deliver. Many other proposed mechanisms are simply unnecessary once effective pricing is in place.

Proposed breakdown to classify building loads/generation

Advanced categories for each of the aforementioned main classes are described in Table below.

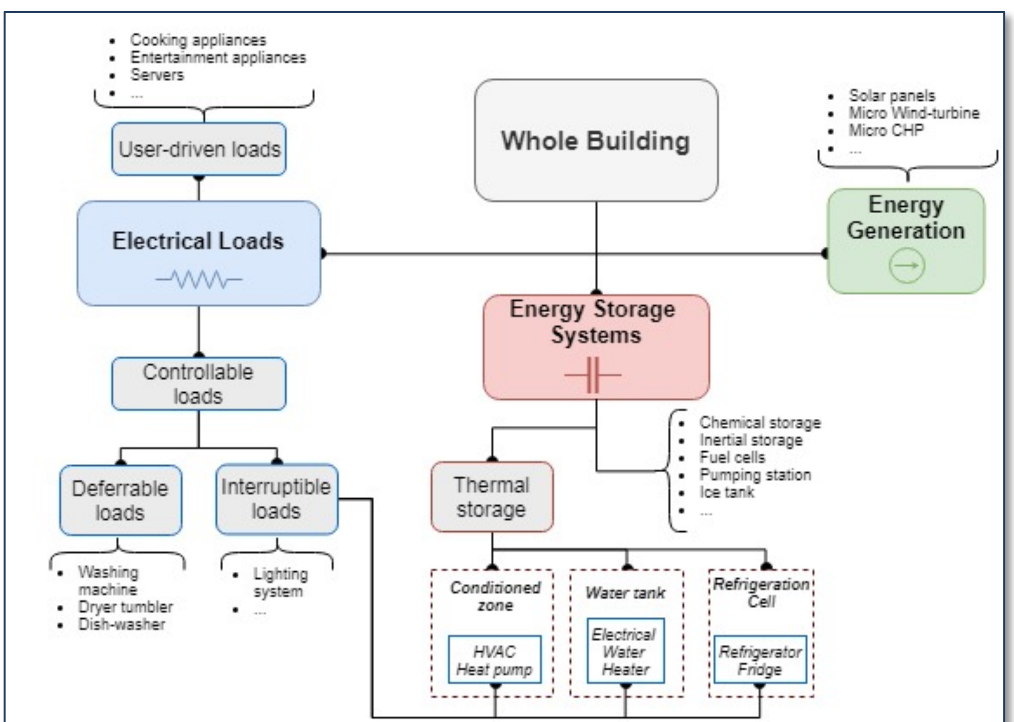

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Table: ***Definition and common instance of building entities categorization***

Category		Definition	Instances
Load	User-driven/non-flexible	A load whose power behavior is entirely driven by the user and its intrinsic nature.	Office load (e.g. computer, screen), kitchen appliance, entertainment
Load	Controllable	A load whose power behavior can be influenced by a cyber-physical system, such as a central BMS or local controller.	*See Deferrable/Shiftable and Interruptible*
Load	Deferrable/Shiftable	A controllable load whose starting time can be decided by the cyber-physical system, and cannot be interrupted once switched on.	Washing machine, Washer, Dryer,
Load	Interruptible	A controllable load whose power consumption can be dimmed, either continuous or discretely (on/off). This process can be done indirectly through influential variables (e.g. setpoints).	Heat Pump, HVAC, Electrical Water Heater, Lighting, Electrical Vehicle, pumps, fridge
ESS	Non-thermal	An ESS whose primary purpose is to consume electric energy at specific periods of time to further release it in the form of electric energy.	Chemical Li-ion storage, fuel cells, kinetic energy accumulator
ESS	Thermal	A thermal load coupled with a constrained environment (e.g. air zone, water tank), whose primary goal is to provide comfort via a baseline power and whose power can vary from this baseline to provide virtual storage as a by-product.	Heat Pump/HVAC + air/hydronic zones, Heat Pump + hot water tank, Electrical Water heater + hot water tank, Refrigerator + refrigeration cell
Energy generation		*See "main class" definition*	Behind-the-meter PV, small windmill, fuel cells, back-up generator