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DER research needs

Please see the attached comments from Berkeley Lab.

Additional submitted attachment is included below.

Berkeley Lab's comments for DER Research Needs

DER Research Roadmap Topic	Brief Description of proposed research	EPIC Investment Area	Policy Goals Addressed	Barriers Resolved	Metrics Impacted	Benefit to Ratepayers	Level of Effort
Other	Need to examine and address hardware resiliency of solar PV arrays that are regularly failing when exposed to high winds, snows and wind driven rains.	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG adoption, Resiliency, GHG reduction.	Clear codes, standards, engineering practices, contruction methods and operations and maintenance.	DG availability, demand management, resiliency	1i,2a,2d,2e,2g,3a,4c,4g	Moderate
Other	Need to examine and address solar PV resiliency toward forest fires beyond Cal-Fire and UL-1703 recommendations. Two facets to examine and address: 1. Solar PV as a potential ignition source (electrical faults) and resistence to encroaching fires and embers.	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG adoption, Resiliency, GHG reduction.	Clear codes, standards, engineering practices, contruction methods and operations and maintenance.	DG availability, demand management, resiliency	1i,2a,2d,2e,2g,3a,4c,4g	Moderate
Smart Inverters	Need to develop representative reduced order models of inverters for dynamic PV modelingand increased DER adoption scenarios	Applied Research and DevelopmentTechnology Demonstration and Deployment	Resiliency, Increased PV adoption and integration	Dynamic PV modeling for the utility grid	Distributed PV integration, resiliency. management of resources	1e, 2a, 2g. 3a. 4b, 4g	High
Energy Storage	With wide adoption of DERS that include storage, new storage chemistries, common set of saftey standards need to get developed and validated. New safety protocols such as UL 3001 need to be looked at . Technology developers typycallydonot have access to sophisticated insitu tools to discern what may be happening	Market Facilitation	Resiliency, Increased PV adoption and integration	Integration of new storage assets	DER penetration, resiliency	1b, 1c, 1i, 2a, 2f, 2g, 4c, 4d, 4f, 4g	High
Distribution Grid Management	High fidelity, low cost sensors for slective deenergization of circuits	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG, Resiliency, Cost Savings, Outage Management	Localized deenergization of circuits	Resiliency	2a, 2b, 2c, 2d, 2e, 2f, 2g, 4a, 4c, 4d, 4f, 4g	high
DER Aggregation as non-wire alternatives	High fidelity matching platform for distributed energy transactions (local)	Market Facilitation	Incresed DG, Resiliency, Savings, Capital efficiency	Increase utilization of deploed DER assets amd new assets	DER penetration, adoption, resiliency	1a, 1b, 1c, 1d, 1h, 1i, 2e, 2f, 2g, 3a, 4b	Moderate
Distribution Grid Management	Realtime estimation of total PV power on a circuit	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG, Resiliency, Distribution mnagement	Increased integration of unmonitored behind the meter PV systems reduces situational awareness for utilitiy networks	Increased DER pnetration, SB 100	1a, 1b, 1c, 1d, 1e, 1f, 2a, 2b, 2d, 2f, 4b, 4f	Moderate
Electric Vehicles	Modeling of EV charging behavior for distribution grid stability and cybersecurity	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG, Resiliency, distribution management, energy security	ensuring electrification of EVs properly interacts with large populations of smart inverters	Increased DER penetration, SB 100	1b, 1i, 2a, 2b, 2d, 2e, 2f, 2g, 4a, 4c, 4d, 4e, 4g	Moderate
DER Aggregation as non-wire alternatives	Modeling of DER price-response as the fundamental coordination between the grid and DER, including locational prices	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG adoption, Resiliency, GHG reduction.	Interoperability, costs and other problems with complex communication and business arrangements, microgrid integration	Increased DER penetration, S	1c, 1d, 1e, 1f, 1g, 1h, 1i, 2f, 2g, 3a, 4c, 4g, 5a	High
DER Aggregation as non-wire alternatives	Simplifying and improving DER coordination protocols between the grid and buildings, and within buildings	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG adoption, Resiliency, GHG reduction.	Interoperability, costs and other problems with complex communication and business arrangements, microgrid integration	Increased DER penetration, S	1c, 1d, 1e, 1f, 1g, 1h, 1i, 2f, 2g, 3a, 4c, 4g, 5a	Moderate

Electric Vehicles	Development of communication protocols for managing local capacity constraints in the face of high levels of EV charging	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG adoption, Resiliency, GHG reduction.	EV integration, local capacity constraints from limited transformer and cable capacity on distribution lines	Increased EV charging, distri	1e, 1g, 1h, 2a, 2b, 2c, 2e, 2f, 4e, 5	Moderate
Other	Small DC microgrid (including PV) for critical residential loads	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG adoption, Resiliency, GHG reduction.	Local reliability/resiliency, DER integration cost, storage integration cost, energy efficiency	GHG reduction, cost reduction	1c, 1e, 1f, 1g, 1h, 2a, 2b, 2c, 2f, 2g, 3a, 4c, 4e, 4g	Moderate
Other	Plug-and-play power distribution (PV, storage, and loads)	Applied Research and DevelopmentTechnology Demonstration and Deployment	Increased DG adoption, Resiliency, GHG reduction.	Local reliability/resiliency, DER integration cost, storage integration cost, energy efficiency	Increased DER penetration, !	1c, 1f, 1g, 1h, 2a, 2b, 2c, 2e, 2f, 2g, 4c, 4d, 4f	High
DER Aggregation as non-wire alternatives	The portfolio of tariffs offered by utilities in California is a main driver for adoption of DERs by private consumers, who are seeing these tariffs as opportunities to decrease their energy bill through behind the meter investments in DER technologies. However, an uncontrolled mass adoption of DERs can lead to significant grid hosting capacity costs, which may trigger the so called "utility death spiral", where a sequence of consumers' decisions to adopt more DERs (and eventually go off-grid) and utility hosting capacity costs can collapse the utility business. Thus, new methods/tools capable to provide quantitative information to utilities and regulators to help them manage and avoid this problem and use the rate design process to influence adoption of DERs, incentivizing locational and technological adoption patterns that benefit the system.	Applied Research and DevelopmentTechnology Demonstration and Deployment	SB 1339 – Standardization of Microgrid Tariffs; R. 18-12-006 – Rates and Infrastructure for Vehicle Electrification; SB 100 – 100 percent RPS; AB 2868 – 500 MW of Behind-the-meter Storage; SB 338 - Meet peak loads w/ DER's	Valuation – Increases the locational value of DER adoption through the rate; Valuation – The locational impact of DER adoption on the distribution grid; Cost – decrease overall ratepayers/utility costs by a more adequate rate design process; Coordination – use rate design as a mean to coordinate private adoption of DERs;	Sustainability: increasing the penetration of renewable base DERs; Sustainability: of the utility business in scenarios of high penetration of DERs; Reliability/Resiliency : how rate design can influence DER adoption to increase resilience/reliability of the distribution system	1c, 1f, 1g, 1h, 2a, 2b, 2c, 2e, 2f, 2g, 4c, 4d, 4f	Moderate
Grid Optimal Load Asset	High-impact, low-probability (HILP) events are a real threat to the security of the distribution grid and they should be included in the utility infrastructural planning, especially when considering 100% renewable penetration. Metrics to deal with risk-based decisions (such as CVar) need to be included in the utility DER planning tools in order to improve long-term resilience and reliability of distribution grids. This requires methods capable of providing adequate information regarding risk mitigation during HILP events and increase the overall awareness and transparency of utility decisions regarding resilience/reliability plans.	Applied Research and DevelopmentTechnology Demonstration and Deployment	SB 100 – 100 percent RPS; SB 338 - Meet peak loads w/ DER's	Uncertainty – Increases the locational value of DER adoption; Cost – Better decisions regarding cost of utility assets allocated for resilience/reliability purposes.	Reliability/Resiliency – improve long-term resilience/reliability of the distribution grids.	1c, 1f, 1g, 1h, 2a, 2b, 2c, 2e, 2f, 2g, 4c, 4d, 4f	Moderate
Grid Optimal Load Asset	Commercial: Loads in commercial buildings are significantly more controllable and tunable than in years past because of a number of enabling technologies (e.g. dimming systems for lighting, variable speed drives for HVAC, wireless communication networks, etc). At the same time, only modest advances have been made determining HOW and WHEN to control/tune building systems. We believe there are great opportunities associated with developing building systems that gather a greater granularity of data on the built environment (e.g. 10 temperature sensors in a room rather than one at the thermostat) as well as a greater granularity of the needs/desires of humans that occupy them (e.g. what temperatures the specific users currently occupying the space desire rather than a generalized ASHRAE standard might specify). The opportunities include both energy efficiency (e.g turning off building systems in unoccupied spaces) as well as in areas related to DERs (e.g. developing grid-optimal algorithms that consider grid status, user needs, and/or building environmental sensors).	Applied Research and DevelopmentTechnology Demonstration and Deployment	California SB 350 – Double the rate of efficiency, California SB 338 - Meet peak loads w/ DER's	Coordination – fully integrated w/ DER assets, Uncertainty – interfacing w/ legacy systems, Uncertainty – insitu verification of interoperability	Resiliency-grid impacts from integrated/aggregated dispatchable assets, Flexibility – load arbitrage (shifted/balanced/consumed) to improve system efficacy, Sustainability – Maintain performance over time w/ changing load assets.	1c,1d,1e,1f,1g,1h,2a,2b, 2e,2f,3a,4c	Moderate

Grid Optimal Load Asset	Residential: Residential loads have traditionally been too small and/or too widely distributed to make them attractive to grid-responsive programs such as DR load shedding. But now the rapidly expanding use of residential home automation systems - most notably systems in the Amazon Alexa ecosystem - might present new opportunities to connect, aggregate, and control residential loads at scales that are consequential for the grid. We recommend exploring the oppurtunites presented by residential grid-responsive systems that are based on controlling loads connected to home automation networks.	Applied Research and DevelopmentTechnology Demonstration and Deployment	California SB 350 – Double the rate of efficiency, California SB 338 - Meet peak loads w/ DER's	Coordination – fully integrated w/ DER assets, Uncertainty – interfacing w/ legacy systems, Uncertainty – insitu verification of interoperability	Resiliency-grid impacts from integrated/aggregated dispatchable assets, Flexibility – load arbitrage (shifted/balanced/consumed) to improve system efficacy, Sustainability – Maintain performance over time w/ changing load assets.	1c,1d,1e,1f,1g,1h,2a,2b,2e,2f,3a,4c	Moderate
Grid Optimal Load Asset	Project goal is to develop, implement, and validate classes of office lighting solutions that efficiently provide light for vision and circadian stimulus without discomfort glare, and to quantify energy performance, including comparison against a hypothetical alternative circadian lighting scenario at higher energy intensity (i.e. potential practice in absence of this project's methods). Performance metrics and targets will be laid out in a Performance Specification at the outset, which the experimental lighting systems will be judged against to assess success or failure.	Applied Research and DevelopmentTechnology Demonstration and Deployment	California SB 350 – Double the rate of efficiency, California SB 338 - Meet peak loads w/ DER's	Coordination – fully integrated w/ DER assets, Uncertainty – interfacing w/ legacy systems, Uncertainty – insitu verification of interoperability	Resiliency-grid impacts from integrated/aggregated dispatchable assets, Flexibility – load arbitrage (shifted/balanced/consumed) to improve system efficacy, Sustainability – Maintain performance over time w/ changing load assets.	1c,1d,1e,1f,1g,1h,2a,2b,2e,2f,3a,4c	Moderate

Benefit Categories

1a. Number and total nameplate capacity of distributed generation facilities
1b. Total electricity deliveries from grid-connected distributed generation facilities
1c. Avoided procurement and generation costs
1d. Number and percentage of customers on time variant or dynamic pricing tariffs
1e. Peak load reduction (MW) from summer and winter programs
1f. Avoided customer energy use (kWh saved)
1g. Percentage of demand response enabled by automated demand response technology (e.g. Auto DR)
1h. Customer bill savings (dollars saved)
1i. Nameplate capacity (MW) of grid-connected energy storage
2a. Maintain / Reduce operations and maintenance costs
2b. Maintain / Reduce capital costs
2c. Reduction in electrical losses
2d. Number of operation of distribution grid devices
2e. Non-energy economic benefits
2f. Improvements in system operation efficiency from increased flexibility
2g. Energy security
3a. GHG emissions reduction
3b. Criteria air pollution emission reductions
4a. Outage number, frequency, duration reductions
4b. Forecast accuracy improvement
4c. Public safety improvement
4d. Utility worker safety improvement
4e. Reduced flicker and other power quality improvements
4f. Increase in system monitoring capabilities
4g. Support for energy system resiliency in the face of de-energizations
5a. Other metrics