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QQForward DER Research Need--Building Sociotechnical Capacity for Demand Response (DR)

Additional submitted attachment is included below.

DER Research Needs Template

Summary

The California Energy Commission (CEC) is collecting research topic suggestions for the DER Research Roadmap that will guide the CEC's short (1-2 year), medium (3-5 year) and long (5-10 year) term DER strategy. While these suggestions will be used to inform the DER Research Roadmap, they are preliminary guidance and do not need extensive detail. However, the most successful suggestions will demonstrate alignment with California's energy goals and support ratepayer benefit claims. The process by which these Research Needs will be evaluated will be described in the presentation for the 7/25/19 Public Workshop located at the link below: https://www.energy.ca.gov/research/distributed-energy-resource-roadmap/

Instructions

1. Brief Description: Please provide a brief summary of the suggested research.
2. EPIC Investment Area: Please select which of the three historical CEC EPIC program areas this research would be expected to fall under.
3. Policy Goals Addressed: Please identify any regulatory mandates, legislative requirements or other state goals that this research would support.
4. Barriers Resolved: Please describe what current technical DER limitations the research is expected to alleviate. The Technical Assessment at the link above has identified some barriers, but feel free to describe additional ones.
5. Metrics Impacted: Please describe how the research will measurably improve DER cost or performance.
6. Benefit to Ratepayers: Please identify how the projected DER improvements will benefit California ratepayers using the categories on the next tab.
7. Level of Effort: Please provide a rough budget and timing estimate for the research idea, as well as any pre-requisite research or further research it enables.

1. Brief Description

Demand response (DR) is based on people or institutions doing or experiencing something different than they would have otherwise, even when responses are automated. If much higher levels of DR are required for implementation of renewables-dominated DER, people will need to make much bigger changes than in the past to achieve these higher levels of DR.
The suggested research extends the current framework for DR to recognize how the social and the technological combine to create DR capacity, and to take advantage of this knowledge toward achieving higher levels of flexibility in the timing, quantity, and type of energy use . This is necessary because the existing technology-price model of DR, on its own, black-boxes this activity into market mechanisms, giving little support for thinking ahead on how to foster flexibility, or the risks and unintended effects of such current DR strategies. *The results will include examples and an initial set of tools by which the DR community and society at large can more strategically plan DR, tackle risks, and anticipate problems, including those related to equity* . For example, what changes to the technological landscape (such as low- or no-electricity alternatives) can enable people and organizations to be more willing and able to provide DR? How and why might societal load patterns evolve to complement generation? What do the DER barriers summarized in the roadmap look from the perspective of the parties who are expected to provide DR?
Method relies on a combination of empirical case studies analyzed quantitatively and qualitatively, consultations with current DR responders and non-responders in residential, commercial, and industrial sectors to understand their logics, barriers, and motivations, and collaboration with existing DR, DER, energy supply, and technology innovation communities. Beyond increasing DR capacity, progressing in this extended framework can also increase societal resilience during de-energizations, since it helps steer development to ensure that more critical systems can work longer with little or no grid energy, which has the benefit of decreasing the costs of planned and unplanned de-energizations.

2. EPIC Investment Area

Applied Research and Development

3. Policy Goals Addressed

SB100 60% of electricity supply from renewables by 2030; 100% by 2045	Increases societal load flexibility; reduces strength of duck curve; promotes positive adaptation

4. Barriers Resolved

Capability	Increases the ability of people and institutions to provide DR by strategically providing lower and no-energy alternatives
Uncertainty	Helps realistic identification of risks associated with specfic DR/DER strategies using empirical analysis of past and current DR efforts

5. Metrics Impacted

Flexibility	Increases capacity for DR through supporting the development of social/technical systems that reduce respondent costs for providing DR
Resiliency	Providing no- and low-energy alternatives helps society function relatively well during disruptions

6. Benefit to Ratepayers

2f. Improvements in system operation efficiency from increased flexibility	Highlights real-world mechanisms of energy use flexibility, so that the capacity for flexibility can be built in to energy demand.
4g. Support for energy system resiliency in the face of de-energizations	Fosters development of no- and low-energy alternatives that can readily be used during de-energizations.
2e. Non-energy economic benefits	Recognizes DR as more than a simple economic transaction. Helps reduce the economic and non-economic costs of flexibility.
1f. Avoided customer energy use (kWh saved)	Low- and no-energy alternatives to standard higher-energy systems of provision save kWh.

7. Level of Effort

$400-650K (phase 1) + possible $500-800K (phase 2) depending on number of quantitative examples integrated. Research team is social scientists, systems engineers, and statisticians/data analysts. The first phase (years 1-2) builds an analytic framework in close collaboration with technology designers/engineers, economics-centered DR specialists, and energy providers, and using available DR data sets. The second phase builds and extends this framework through qualitative-quantitative case studies (years 3-5). The results of this project are of broad benefit to designing strong and effective DR techniques and to supporting societal resilience beyond DR.