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Proposed initiative for EPIC 2018-2020 Triennial Investment Plan

Please see the attached comments. Thank you for your consideration.

Additional submitted attachment is included below.

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The Energy Commission is currently soliciting ideas and stakeholder input for the 2018 – 2020 EPIC Triennial Investment Plan. For those that would like to submit an idea for consideration in the 2018-2020 EPIC Triennial Plan, we ask that you complete the form below. Submittals are due by **5:00 p.m. on February 10, 2017.**

Part 1. Initiative Description and Purpose:

1. Please provide a brief description of the proposed initiative:

Title: Thermal Microgrids & Local Energy System Optimization

Summary: This proposed initiative focuses on a technology we call “thermal microgrids”, which are all-electric, fossil-free district energy systems that utilize heat-recovery and distributed energy resources to provide both power and thermal services to a community. The inspiration for this initiative is the recently-commissioned Stanford Energy System Innovations (SESI) project, in which their campus-wide cogeneration system was transformed into to renewable electricity powered heat recovery with low temperature hot water distribution. The proposed initiative builds on existing optimization and control technologies to harmonize thermal and power systems to efficiently and safely maximize the penetration of distributed energy resources (DERs), and facilitate the interoperability of the thermal microgrid with the surrounding distribution system and larger grid by enhancing their flexibility and responsiveness.

2. What technical and/or market barriers would the proposed initiative help overcome? For scientific analysis and tools, what knowledge gaps would the proposed initiative help fill?

There are a number of technical and market barriers inhibiting systems similar to SESI from being deployed elsewhere including for instance, any district energy system requires very large up-front capital expenditures which may be challenging to accommodate, and such a system deployed outside of a campus setting would require cooperation and ultimately approval from a larger set of diverse stakeholders.

The proposed initiative focuses on integrating high penetrations of DERs within a thermal microgrid and enhancing the interoperability with the rest of the distribution network. We believe technical advancements in this area will facilitate the deployment of these technologies by enhancing overall system efficiency, reducing costs for the end user, and better leveraging local energy systems to provide flexibility and therefore value to the larger grid.

Part 2. Benefits and Impacts

3. If this initiative is successful, either fully or partially, what would be the expected impact? Who are the primary users and/or beneficiaries?

As we all know, technical feasibility studies have shown that electrification of California's building sector is needed to achieve our scientifically-based deep decarbonization goal of 80% below 1990 levels by 2050. Yet today, the vast majority of space and water heating in California remains powered by natural gas. If this initiative is successful, either fully or partially, it will help facilitate systems similar to SESI being deployed elsewhere in the state to achieve GHG emissions reductions, and it will do so in a way that further maximizes the penetration of DERs into the thermal microgrid and the value the system can provide to the larger grid. The primary beneficiaries include 1) those customers within the area of the thermal microgrid, given the system would be providing decarbonized, reliable, highly-efficient, cost-effective local power and community resiliency, 2) those within the larger service territory, given the advanced algorithms will facilitate optimizing the interface between the local energy system and larger distribution network, to the benefit of all customers, and 3) the entire global community, given the contribution the system would make to reducing global GHG emissions.

4. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed initiative:

The following metrics could be utilized to evaluate the impacts of the performance of the thermal microgrid and distribution system, utilizing improved local energy system optimization algorithms:
- Energy costs over the system lifetime, from a customer perspective and a societal perspective
- GHG reduction and resultant marginal abatement cost
- Penetration of DERs within the thermal microgrid
- Reliability of power and thermal services to customers
- Avoided distribution system upgrades resulting from the optimization of the thermal microgrid within the larger distribution system

5. Please provide a list of peer-reviewed references that support the responses for questions 3 and 4. Proposed initiatives that include peer-reviewed references will be given stronger consideration.

Peer-reviewed references supporting the need to decarbonize buildings to achieve California's 2050 GHG targets (question 3):

1. "California's Energy Future – The View to 2050", California Council on Science and Technology (2011).

2. "The Technology Pathway to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity", James H. Williams, et al. (2012).

6. (For technologies only) What competitive advantages does the proposed technology solution have over current benchmark technologies? If the technology is beyond the prototype stage, what strategies do you suggest to bring to scale?

The benchmark technology for a thermal microgrid like SESI is either cogeneration or a non-district system composted of building-level energy systems. Key competitive advantages of thermal microgrids over cogeneration include: 1) they enable decarbonization, 2) they are highly efficient given the incorporation of heat-recovery technologies, 3) they incorporate significant local renewable energy production. Key competitive advantages of thermal microgrids over non-district systems include: 1) greater potential for overall efficiency through optimization over a larger set of system resources and diverse customer needs, 2) favorable economics of district-scale energy systems compared to single-unit systems, and 3) enhanced community resiliency.

Part 3. Connection to Energy Commission's EPIC Framework
Energy Commission staff have developed a draft strategic framework to guide the CEC's planning and implementation of EPIC across triennial investment cycles. One of the objectives of the draft strategic framework is to communicate a consistent set of priorities for organizing current and future EPIC investments.

7. Please indicate which of the following strategic framework themes you feel the proposed initiative best fits within:
    - Advance Technology Solutions for Deep Energy Savings in Building and Facilities
    - Accelerate Widespread Customer Adoption of Distributed Energy Resources
    - Increase System Flexibility from Low-Carbon Resources
    - Increase the Cost-Competiveness of Renewable Generation
    - Create a Statewide Ecosystem for Incubating New Energy Innovations
    - Maximize Synergies in the Water-Energy-Food Nexus
    - Develop Tools and Analysis to Inform Energy Policy and Planning Decisions
    - Catalyze Clean Energy Investments in California's Underrepresented and Disadvantaged Communities

If Other, Please Specify