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Low-cost Microgrid Controller

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:

Develop and demonstrate cost effective solar + storage + genset technology packages that can be deployed at fire and police stations and other critical facilities throughout the State to provide energy resiliency for critical services, reduce GHG emissions, and reduce energy bills. The packages should feature low cost controllers that will allow for safe and reliable islanded operation, as well as basic cost saving features during blue sky operation (e.g., peak shaving, load shifting, energy arbitrage). Prepare plans for scaling-up this technology, including: a market assessment, standardized design package, energy efficiency upgrade strategy, standardized permitting/interconnection package, potential funding strategies, and a technology/knowledge transfer plan.

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?

Grid-connected solar electric systems are now standardized and have made great strides toward becoming cost-effective. However, when you add batteries and a controller to allow islanded operation, the system cost increases substantially and standardized systems are not readily available. This initiative would help establish a market-ready solution that can allow critical emergency service facilities to cost-effectively lower their carbon footprints and greatly increase their energy resiliency.

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?

There are over 500 law enforcement agencies and nearly 900 fire departments in CA that could benefit from this technology. A successful initiative could result in technology deployment in many of these facilities, and all of the citizenry in these jurisdictions would benefit from the increased energy resiliency. In addition, these emergency service facilities would lower their energy costs and their carbon footprints, again benefiting all of their local citizens. This initiative will support the goals of the CA Energy Assurance Plan and Local Energy Assurance Planning efforts, and will serve to increase the penetration of distributed generation, distributed energy storage and smart inverters, thereby forwarding other State energy policy goals. These systems can also potentially offer distribution system support via flexible loads and other ancillary services.

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

Metrics for evaluating impacts of the initiative include:
-- The achievable $/kW cost for an installed system that meets basic system requirements (i.e., energy storage capacity, island and grid connected control features, shedding of non-critical loads).
-- The energy cost savings and GHG emission reductions associated with the installed systems compared to their costs.
-- The effectiveness of the technology/knowledge transfer campaign to reach the intended audience and the number of stakeholders reached/engaged.
-- The potential and plan for scale up.

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.

The White House, Executive Office of the President (2013), Economic Benefits of Increasing Electric Grid Resilience to Weather Outages.

Edison Electric Institute (2014), Before and After the Storm - A compilation of recent studies, programs, and policies related to storm hardening and resiliency.

Longoria, Steve, Dan Voreyer, Dave Pucci, Rick Cruz, Mohammad Khan, and Gerald Williams. (Aanko Technologies Inc.). 2014. Energy Assurance Plan. California Energy Commission Publication Number: CEC-600-2014-006.

Fennimore, T., A, Gould & L. Wright (2016), Implementing a Microgrid Using Standard Utility Control Equipment, presented at Power and Energy Automation Conference, March 2016.

Oakridge National Laboratory (2016), Microgrid Controller and Advanced Distribution Management System Survey Report, ORNL/TM-2016/288.

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?

Current on-grid solar + battery energy systems typically rely on charge controllers and inverters, cannot operate PV, batteries and a back-up generator in parallel, and rely on a sub-panel to supply critical loads. Alternatively, new microgrid controller technology can provide smart control of generators to achieve safe, efficient and reliable islanded power generation. In addition, microgrid controllers can help optimize grid-connected operation. However, a simple microgrid controller and design is not yet standardized nor readily available to serve the small commercial market. More sophisticated microgrid controllers are expensive and require custom engineering. In small building applications, the added value of more sophisticated microgrid controllers is not adequate to make up for the added cost. What is needed is a simple, low-cost, effective microgrid control system that can serve the small commercial building market. The standardization and knowledge/technology efforts listed above will help bring this to scale.

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