DOCKETED

Docket Number:	17-EPIC-01
Project Title:	Development of the California Energy Commission Electric Program Investment Charge 2018 â€“ 2020 Triennial Investment Plan
TN #:	215953
Document Title:	Bruce Nordman Comments: Local Power Distribution
Description:	N/A
Filer:	System
Organization:	Lawrence Berkeley National Laboratory
Submitter Role:	Public Agency
Submission Date:	2/13/2017 1:04:56 PM
Docketed Date:	2/13/2017

Comment Received From: Bruce Nordman
Submitted On: 2/13/2017
Docket Number: 17-EPIC-01

Local Power Distribution

Additional submitted attachment is included below.

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY EDMUND G. BROWN JR., *Governor*

CALIFORNIA ENERGY COMMISSION 1516 NINTH STREET

SACRAMENTO, CA 95814-5512 www.energy.ca.gov

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:

Local Power Distribution. As a stand-alone initiative, or a broader effort on microgrids, conduct research to develop technologies for organizing and managing electricity production, use, and distribution in buildings from the bottom-up, on a network model, fully digitally controlled. This in contrast to the current approach of top-down organization of power systems, derivative of our 19th century grid model and legacy utility technologies. These are useful and necessary for the utility grid but not for cost-effective and flexible technologies within buildings. Production and storage of electricity should be plug-and-play the way electronics are for communications are and end-use devices are for electricity.

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?

Dramatically reduce costs for deployment of storage and generation within buildings. Enable more optimal use of local generation and storage. Make microgrids actually cost-effective for a large number of buildings. Gain energy savings from appropriate use of "Direct DC" power. Enables local generation to be deployed at any scale, including one or a few panels, to enable low-cost entry for those with limited resources.

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?

Dramatically reduce costs for deployment of storage and generation within buildings. Enable more optimal use of local generation and storage. Make microgrids actually cost-effective for a

large number of buildings. Gain energy savings from appropriate use of "Direct DC" power. Enables local generation to be deployed at any scale, including one or a few panels, to enable low-cost entry for those with limited resources.

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

How difficult and expensive it is to purchase a solar panel, bring it home, and install it. How difficult and expensive it is to attain local microgrid capability, to enable operation at all when the utility grid is down, and to have devices change their behavior in response to the availability of power during off-grid times.

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.

Bruce Nordman, Ken Christensen, and Alan Meier, “Think Globally, Distribute Power Locally: The Promise of Nanogrids,” (Green IT column) IEEE Computer, Vol. 44, No. 9, pp. 89-91, September 2012.

Bruce Nordman and Ken Christensen, “Local Power Distribution with Nanogrids,” Proceedings of the International Green Computing Conference, June 2013.

Chris Marnay, Bruce Nordman, and Judy Lai, “Future Roles of Milli-, Micro-, and Nano- Grids,” presented at the CIGRE International Symposium The Electric Power System of The Future- Integrating Supergrids and Microgrids, Bologna, Italy, LBNL-4927E, 2011.

Bruce Nordman and Ken Christensen, DC Local Power Distribution with Microgrids and Nanogrids, First International Conference on DC Microgrids, Atlanta, GA, June 2015.

Bruce Nordman and Ken Christensen, The Need for Communications to Enable DC Power to be Successful, First International Conference on DC Microgrids, Atlanta, GA, June 2015.

Nordman, Bruce and Ken Christensen, “DC Local Power Distribution: Technology, deployment, and pathways to success”, IEEE Electrification Magazine, June 2016.

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 "Local Power Distribution" approach can accomplish some capabilities that are impossible with current technologies, in terms of plug-and-play operation. By starting with components and devices that are relatively small in scale, they can be produced at mass scale and so be

inexpensive and therefore attractive to consumers. LPD can enable reliable power within buildings (i.e. a microgrid) at low cost by making reliable only those devices and end uses for which reliability is valuable. It can be added to and modified by anyone at any time to be flexible as needs and technologies change. California led development of networked communications; California should lead the development of networked electricity.

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

Well-applies to 2. (DER), 3. (Flexibility), 4. (cost-effective renewables), and 8. (disadvantaged communities). Also helpful for 1. (savings) and 5 (innovations).