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Docket Number:	16-EPIC-01
Project Title:	EPIC Idea Exchange
TN #:	216538
Document Title:	Berkeley Lab Comments responding to the CECâ€™s â€œIncrease Adoption of Emerging Clean Energy Technologies through Procurement"
Description:	N/A
Filer:	Purabi Thakre
Organization:	LBNL
Submitter Role:	Public Agency
Submission Date:	3/13/2017 4:50:35 PM
Docketed Date:	3/13/2017

Lawrence Berkeley National Laboratory Comments responding to the CEC's *"Increase Adoption of Emerging Clean Energy Technologies through Procurement"*

March 13th, 2017

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Thank you for the opportunity to submit comments from Lawrence Berkeley National Lab (Berkeley Lab), Energy Technologies Area (ETA) in response to the "EPIC Request for Comments: Increase Adoption of Emerging Clean Energy Technologies through Procurement".

Berkeley Lab supports the ambitious policy goals of the State of California to achieve maximum energy savings and market transformation of the existing buildings market. Berkeley Lab, and particularly ETA within Berkeley Lab, shares a deeply-rooted commitment with the State of California's energy goals.

We have been privileged to support the State of California in research, design, development and demonstration (RDD&D) of innovation technologies, program design and evaluation, code compliance strategies, water-energy dynamics, demand response and other research efforts that have, over the past 30 years, contributed nearly $484 billion in economic value to the US economy.

We respect California's RDD&D funding as unique in the world. As a fulcrum of numerous CEC applications we have perspectives based on our extensive experience applying for a wide variety of EPIC funding.

These comments are merely offered as an opportunity to improve private sector participation in the EPIC program based on our extensive experience applying to and participating in EPIC-funded projects. We have organized our comments around the CEC's format followed in the Request for Comments document questions/format:

CEC Questions and Responses:

1. What are barriers that large-scale customers face when procuring emerging energy technology solutions? Would projects funded from this solicitation help address those barriers? If not, what specific changes would you recommend to help ensure the resulting projects meet large-scale customer procurement needs?

(General)
Barriers that large-scale customers face include:

- Concern for the validity of performance claims, raising uncertainty of product performance. Emerging technologies are often backed solely through supplier claims that are not based on standardized testing protocols. The intent of this solicitation to develop objective third-party test beds addresses this issue.

- Lack of standardized technical specifications for solicitations. Emerging technologies often procured through contract solicitation and specification language that is created ad hoc for each purchase. This (a) significantly drives up legal and contracting costs for the procurement entity and (b) makes it difficult for vendors to provide consistent responses to solicitations. The lack of standardized terms and conditions significantly increases transaction costs. Group 4 could be enhanced to strengthen work in this area.
- Lack of standard contract terms and conditions and technical specifications add costs as financiers adjust terms to reflect project risks. Mature developers often choose not to submit bids which leads to poor competition.
- Large institutions are often reluctant to procure (or even prohibited from procuring) technologies that are only available through a single manufacturer manifesting as lack of supplier competition. The solicitation can help address these barriers by including activities to set aggressive performance targets for specific systems and demonstrating multiple technologies that can meet them.
- Some large-scale customers may require performance against a known baseline, such as Title 24. This solicitation could require testing against minimum energy code conditions as a baseline. This testing requirement could have the additional advantage of providing performance data of technologies that could be used to support codes and standards development, or development of utility incentive programs.

(Regarding Group 2) LBNL has participated in a number of negotiated rulemakings during which manufacturers, contractors, installers and users of equipment have provided detailed feedback on their perceptions of market barriers to new technologies that improve efficiency. The most commonly noted problems are:

- Higher efficiency equipment requires more complex installation and additional maintenance: for example, many new technologies use more sophisticated control systems that require additional time for installation and commissioning.
- Equipment failures can be extremely costly so buyers place a high premium on reliability, which may not be established for new technologies.
- Buyers are not convinced that the energy savings displayed under test procedure conditions will materialize under field conditions.
- Buyers frequently purchase equipment from installers/contractors rather than from the manufacturer; installers have limited incentives to offer more efficient equipment.
- Equipment is often acquired as a component of a larger system, only part of which is upgraded at any given time. In this case it may not be possible to integrate new technology features without expensive retrofits.

2. (For all groups) What are specific recommendations you can provide for improving the purpose of the solicitation outlined in this RFC? Please explain the rationale behind the recommendations.

(General)
The solicitation could be improved by including aspects of integration such as product interoperability, vendor capability and expertise in implementing integration, and performance of products controlled in an integrated as opposed to independent manner.

(Regarding Group 1)

- Successful administration of a technology test-bed hub could require a degree of technical expertise that may be located at the prospective test facilities themselves;
    - CEC could provide additional clarity to define the boundaries between members of technical advisory committees, testbed operators, and hub administrators.
    - Is the recipient anticipated to help define test methodologies, scope, measurement requirements, etc, or will the recipient's role be limited to administration as suggested in the three bullets in the RFC?
- Clarification on the process of the administrator in creating the hub would be beneficial - are they expected to bring the set of test facilities with them in their proposal, or would they administer a competitive process for test facilities to be selected?

(Regarding Group 2)

- The program could benefit from an initial evaluation of whether the bottleneck in increasing market penetration really lies with procurement, and more specifically with the quality of product information available. LBNL has extensive experience working on procurement programs for the federal government, and has encountered a broad range of issues that complicate the procurement process. Some initial interaction with bulk purchasers would be very useful in identifying the type of information that would be of value to them.
- Include installers/contractors as part of the target audience; these frequently purchase large quantities of equipment; this would also extend the program impacts to the small/medium business market.
- Clarify whether the end goal is to provide a broad review of different technology options and their potential trade-offs (e.g., a "buyer's guide" for efficient water heating options), or comparative performance reviews and ratings for specific products offered by specific manufacturers, or both. The two options serve different purposes and have different implications in terms of the ability to be comprehensive and the potential response from manufacturers.
- Clarify the definition of emerging technologies, and whether the program would also consider technologies already on the market but with low penetration. For example, variable speed drives (in a range of applications) have significant energy savings potential and low market share, but are not really an emerging technology.
- Clarify the relationship between the testing under group 1 and the product evaluation under group 2.
    - Is the product evaluation under group 2 intended to focus on the products tested as part of group 1? Or is the aim a broader assessment of new products or technologies available on the market? If the latter, is the expectation that there will be additional testing conducted under group 2 or that an analytical approach will be taken to estimating "real world" usage (e.g. testing under a specific application)?
    - Note that LBNL has had experience using its testbed facilities to support technology R&D efforts (i.e. Group 1) and to support deployment efforts (i.e. Group 2). Suggest that Group 2 allow for testbed testing capabilities to help support the procurement process. Examples of the role in testbeds in supporting deployment efforts include but are not limited to:

        - Streamlined testing of products under controlled conditions under different permutations of application, including different controls strategies
        - Comparison test results against a baseline requirement such as Title 24, or an equivalent condition representative of standard/typical existing buildings
        - Testing of technology under a range of different conditions such as enclosed perimeter office vs open perimeter offices, different solar orientations and different baseline technology conditions. These can be mocked up, and permutations tested across a climate condition of interest (eg. solstice to solstice) and provide a range of product performance results across the range of possible applications. We have used empirical data from these tests to provide simplified assessment methods for customers to determine their energy savings for their application.
- The end uses listed under the product categories for group 2 have existing, well-established test procedures and metrics to assess performance, but some of the other product categories (e.g., distributed PV) could benefit from a more systematic assessment approach. Clarify if the intention is that part of the work under group 2 would be to develop test procedures and metrics for these product categories.
- The scope of Group 2 evaluations can be improved by including consideration of benefits associated with grid integration capabilities, i.e. load flexibility, demand response, and peak demand management.
    - The DER agenda in CA is increasingly critical to considerations of ratepayer benefits and utility needs.
    - This is relevant to the included "distributed PV systems" listed in Group 2, as well as other related technologies.
    - We note that existing test procedures may not accommodate DER requirements

(Regarding Groups 1 and 2)

- We note that energy management systems are listed as a product category for Group 2. For non-widget, human in the loop process tools as well as controls, increased adoption and successful application requires considerations beyond standardized testing, such as organizational process, and service contracting.

(Regarding Group 4)

- Recommend quantification of project risks (failures) and the subsequent impact project developers and finance community. Quantification of frequency and costs to stakeholder of past project failures. Need to collect project risks from perspective of financier and developers and look for ways to align customer, developer and financiers objectives.

3. (For all groups) Are there existing efforts that complement the groups identified in this RFC? What specific changes to this proposed solicitation would you suggest to best leverage these existing efforts?

- California Irrigation Management System (CIMIS) provides extensive support to the Ag sector on irrigation efficiency, as does the Center for Irrigation Technology at UC Fresno.

- DOE's High Impact Technology program focuses on emerging technology demonstrations, issuing stretch performance specifications, and technology adoption campaigns. GSA's Green Proving ground also supports emerging technology demonstrations with an eye toward deployment throughout the GSA footprint. To leverage these efforts, CEC might directly engage these programs to transfer lessons learned, and to explore opportunities to coordinate CA efforts with these nationally-focused complementary programs.
- Noted the aggregation effort done by EPA/Optony in Washington DC in Group 4 references. Recommend adding the lessons learned from the large Federal Bay Area aggregation that occurred in 2016.

4. (For all groups) Are the proposed funding amounts identified in this RFC appropriate for the work requested? Please explain the rationale behind the recommendations, and, if applicable, what would the expected cost be to adequately test and evaluate the technology types identified in this draft solicitation?

- (Regarding Group 1) The budget depends heavily on the number of technologies and applications to be tested. Some technologies might only require short term testing to validate performance (e.g. efficient power supplies), whereas others might require longer testing (e.g. HVAC systems requiring seasonal variation). Depending on the technology, test length, level of complexity and deliverables, costs could range from 100k to 750k for some technologies, and perhaps higher for some applications.

- (Regarding Group 2) The budget depends on the extent of activities envisioned for Cal-EPE. In our opinion compilation of product reviews and ratings could probably be done for a budget of about $5-$6M, or roughly half of that proposed. This would include analytic work to adjust test procedure ratings to account for field conditions, and to compile data on installation and maintenance costs for a more complete cost analysis. The full $13M budget could broaden the scope to include independent field-testing and/or to compile and a publicly accessible database on installation and performance of new technologies, case studies, results of demonstration projects of new technologies.

5. (For Group 1) Should the Energy Commission require test bed locations in both Northern and Southern California? Please explain the rationale behind the recommendations.

- Yes.
    - Test beds of high value to CA, and the described intent of Group 1, are located in both Southern and Northern CA.
    - There are several conditions that influence technology performance that would vary between northern and southern California. These include climate, latitude and electricity grid conditions.

6. (Groups 1 and 2) Are there additional technologies we should consider or technologies we should remove from the lists provided in this RFC? Please explain the rationale behind the recommendations.

- We would recommend including technologies for the end-uses listed below. All of these represent significant end-use energy consumption, have new technologies available, and are also purchased in bulk.
    - Add commercial refrigeration (e.g., for supermarkets)
    - Add electronics (screens, cable boxes (e.g. for hotels), computers)
    - Add commercial equipment (pumps, fans, compressors)
    - Add behind the meter storage as a technology of focus in Group 1
- We would recommend including systems level strategies, as well as integrated systems that span across different end use systems. Systems technologies enable deeper levels of energy savings than individual 'widget' level technologies, and are required in order to cost effectively reach deep levels of building savings. Some examples include:
    - HVAC airside or wetside distribution systems
    - Lighting systems
    - Integrated envelope daylighting strategies, coupled with daylight dimming systems
- We would recommend also including some applications for study (e.g. controls) that target specific energy or IDSM performance metrics. Some technologies by themselves (e.g. storage) create more or less benefit depending on their application.
- Please clearly define what is meant by "emerging clean energy technologies" as some group refer to a broad set a building technologies while for example Group 4 seems to refer to onsite solar PV systems. For example, solar plus storage and or the technology lists from the other groups be included?

7. (Group 3) How can Group 3 most effectively build trust with target customers to ensure that the target customers are buying high quality products?

One important metric for high quality is prior performance. Developing a mechanism for collecting and disseminating the results of emerging technology procurements will (a) allow companies to iterate and scale when conducting their own purchases and (b) allow other companies access to the lessons learned. It is therefore critical to develop feedback loops that allow procurement data to be made publicly available, analyzed, and disseminated.

8. (For Group 4) What are the largest impediments to successful deployment of solutions that can facilitate successful procurement of emerging energy technologies? Are there solutions not addressed under this proposed solicitation that would address these impediments? Please explain the rationale behind the recommendations.

- Common solicitation language with specifications that become widely recognized by all stakeholders.
- Reduce the "reinvention-of-the-wheel" and reduce time, effort, costs while improving outcomes.
- Larger clean energy projects need to become standardized for solicitation terms and conditions and processes.
- LBNL has developed tools for the Federal sector aimed to "de-risk" projects while greatly reducing the time invested by procurement officers and energy managers. Federal technical specifications can be found here and the contract

terms and conditions document to be released this spring. Is this kind of effort that might be part of Group 4?

- LBNL in partnership with the US EPA Region 9 (San Francisco) completed a large multi-agency bay area aggregation effort in 2016. The same team is working on another generation of aggregated efforts built on lessons learned from the first phase, the Capital Solar Challenge (CSC) and the handful of other aggregation efforts that have taken place. The lessons learned might be of interest to this solicitation.

Should you need any clarification on the comments above we would be delighted to provide it.

California is home to four national laboratories - Berkeley Lab, Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories/California (SNL/CA) and SLAC National Accelerator Laboratory - who combine to employ more than 13,000 California residents, represent more than $2 billion in payroll base and who have produced more than 20 Nobel prizes in recognition of the stellar science that is incubated in the national laboratory system and commercialized at scale to affect the lives of millions.

Berkeley Lab looks forward to continuing to engage with the CEC and other key stakeholders in helping adoption of clean energy technologies. It has been our privilege to work with the State of California on critical issues affecting the State and our environment. As a representative member of our country's National Laboratory system, Berkeley Lab greatly values the opportunity to participate as a stakeholder in this process.

Respectfully,

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