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Berkeley Lab Response - 23-ERDD-01 RFI Solar on Uneven Terrain

Please see response attached.

Additional submitted attachment is included below.

BERKELEY LAB
Bringing Science Solutions to the World

July 8th, 2024

Jonah Steinbuck
Director of the Energy Research and Development Division
California Energy Commission
Re: Docket No. 23-ERDD-01
715 P Street
Sacramento, California 95814

Re: Lawrence Berkeley National Laboratory Comments CEC RFI: Solar on Uneven Terrain

Director Jonah Steinbuck,

Berkeley Lab is pleased to present our comments in response to the Commission's Request for information: Solar on Uneven Terrain. Please see comments below:

Question 1: Technology innovations needed to expand solar PV deployment on uneven terrain may include: 1) non-intrusive mounting options for slopes, grades, and hills; 2) improved preliminary site surveying and topographic data collection methods optimized for uneven terrain; and 3) artificial intelligence, remote monitoring, or predictive maintenance software applications designed to reduce the cost of solar PV O&M on slopes. To what extent would advancing these technology areas expand cost-effective solar PV deployment on uneven terrain? Which of these areas is most crucial to advance the industry? Which could result in California ratepayer benefits?

Berkeley Lab sees value in identifying technologies that have simple installation requirements and that can be locally optimized without having to presolve before hillside installation. While digital topographic scanning is promising for planning, the expectation of flexibility for the real-world installations often make them less reliable.

Additionally, Berkeley Lab comments that tools taking the following design requirements into consideration would be helpful:

- Developing wind profiles and wind speed tools that are unique to sloped topology where wind often speeds up and/or can form eddy currents. Produce design guidance that would supplement ASCE 7-22.
- Understanding the dynamic load paths through racking systems that would result from mounting on steep terrain due to wind patterns and steep slopes. Produce design guidance.
- Applying agrovoltaic concepts focusing on native plants to slopes needing soil retention.
- Expanding existing work on hydrology studies done at the Great Plains Institute to sloped terrain - produce guidance.

Question 2: In addition to the examples listed in Question #1, are there other novel technologies (including software and hardware) needed to facilitate field installation and/or O&M of solar PV on uneven terrain in California? How can research and development (R&D) funding be most effectively applied to help increase deployments of solar PV on uneven terrain in California?

One possible novel technology is bi-facial vertical PV. While this technology has lower efficiency than an optimized "horizontal" panel, there are several details that could benefit for installations on uneven ground:

a. A central post erected with panels attached minimizes the area needed to be prepared. This could specifically benefit the agriculture applications, i.e., agrivoltaic.
b. Based on calculations from Berkeley Lab researchers, east-west orientations received the highest solar energy for vertical bi-facial PV, which agrees well with the electricity demand.
c. Vertical PV with identical orientation avoids the connection problems for PV panels with different orientations and tilt angles, which requires specific strategies for series and parallel connections for maximum efficiency.
d. There is less soiling with vertical PVs than with horizontal which should result in lower frequency of maintenance needed for vertical PVs. Additionally, vertical PVs could avoid snow cover problems in cold climates.

Question 4: Should EPIC funds be used for projects optimized for utility-scale (>5 megawatts alternating current (MWAC)) or a smaller scale (e.g., community solar)? With limited funding, what scale would be more impactful to Californians in terms of cost savings, environmental benefits, and/or community benefits?

When considering PV targeted for uneven terrain, smaller scale projects seem more impactful. For example, servicing smaller and more isolated communities can increase resiliency. Utility scale projects make more sense where maintenance can be scaled up.

Berkeley Lab appreciates the opportunity to provide these comments in response to the following CEC Request for information: Solar on Uneven Terrain.

The following individuals contributed comments: Jacob C. Jonsson and Yuan Gao.

Sincerely,
Alecia Ward
Leader, Program and Business Development
Energy Technologies Area
award@lbl.gov