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Request for Information: Integrating Energy Efficiency and Carbon Management in Indoor Farming Systems Docket # 23-ERDD-01.

The California Energy Commission (CEC) is issuing this Request for Information (RFI) to gather market intelligence on energy efficiency, load flexibility, and greenhouse gas (GHG) emission reduction opportunities in controlled-environment agriculture (CEA) in California and on the potential for these measures to support electric grid reliability.

The CEC primarily seeks input from CEA solution providers and developers of energy efficiency, environmental control, automation and controls, carbon management, and load-flexibility technologies. Input is also welcome from indoor farming operators, research institutions, utilities, renewable energy developers, manufacturers, community-based organizations, workforce training providers, and others with relevant expertise. Respondents need not answer every question.

Relative to other forms of agriculture, CEA can cut water use per unit of product, raise yields per unit of land, sustain year-round production, and shorten farm-to-consumer distances. It is also among the most electricity-intensive: lighting; heating, ventilation, and air conditioning (HVAC); and dehumidification dominate energy use, electricity can represent a substantial share of operating cost, and the most intensive facilities carry electric demand ranging from several hundred kilowatts to well over ten megawatts.

The CEC seeks input on research, development, and demonstration opportunities for technologies and approaches that would:

- **Increase electrical efficiency** by reducing energy per unit of product while reducing water use and increasing yield through technologies such as:
  - advanced lighting hardware, controls, and operational techniques;
  - high-efficiency air conditioning and dehumidification;
  - integrated temperature, humidity, and CO_2 control;
  - waste-heat recovery and thermal energy reuse; and
  - automation and AI-driven optimization of environmental control systems.

- **Enable load shifting and demand flexibility** that delivers grid value (e.g., reducing electricity use in a defined peak window (e.g., 4:00–8:00 p.m.) or responding to grid signals) through demand response hardware and software, thermal and electrical energy storage, and operational strategies that support flexibility, thereby lowering operators' demand and time-of-use charges and creating potential revenue through demand response or wholesale market participation.

- **Reduce greenhouse gas emissions** associated with CEA operations, primarily through the efficiency and load-flexibility measures above and potentially through onsite carbon capture and utilization from HVAC exhaust or other internal process streams, where such approaches may also create emerging value through low-carbon positioning or carbon markets (see Question 6).

Through this RFI, the CEC seeks information on the following questions. Respondents are encouraged to provide quantitative data wherever applicable and to cite sources. Sub-questions are provided as prompts, not requirements.

1. **Technology readiness and performance**: Describe the pre-commercial technologies, controls, or operational procedures your organization offers or studies that increase CEA electrical efficiency.
    a. Current TRL, the basis for that assessment, and what demonstration would advance it.
    b. Measured performance data: lighting efficacy (micromole/Joule), HVAC and dehumidification efficiency, and energy per unit of product (kilowatt-hour/pound).
    c. Which claims are backed by third-party field data, and which are modeled?
    d. Which of these do you consider most impactful or closest to commercial readiness, and why?
2. **Load shifting and demand flexibility**: What is the demonstrated capability of your technology or facility to shift, shed, or modulate load?
    a. Quantify: kilowatts shifted, event duration, percent reduction in a 4:00–8:00 p.m. window, ramp rate, notification required, and recovery load.
    b. Which constraints bound this flexibility, and what evidence shows it can be exercised without loss of yield or quality?
    c. Which end uses are flexible, and which are must-run?
    d. Which load-flexibility approaches do you see as most promising for CEA, and where are the gaps?
3. **California market and load profiles:** Characterize the size, segments[1] and electrical load profiles of indoor farming in California.
    a. Facility counts, square footage, connected load, energy use intensity, and representative daily and seasonal load shapes.

[1] Segments refer to crop type (e.g., leafy greens, tomatoes, berries, mushrooms, cannabis); facility type and scale (greenhouse, warehouse/vertical, container; small vs. large); degree of environmental control (full climate control vs. light and ventilation only); and growing method (soil, hydroponic, aquaponic). Respondents may use other segmentation that better fits their data.

b. The source and vintage of any data provided, and whether it is measured or estimated.

c. Which segments are growing or contracting, and why?

4. **Costs and payback**: What are the capital costs, operating costs, and payback periods for the technologies you describe, and what share of operating expense is energy?
5. **Business-model viability:** What role does energy cost and load inflexibility play relative to capital cost, produce pricing, and labor?
    a. Which business models, crops, and facility types are viable in California, and which are not?
    b. How much of the viability gap could efficiency, flexibility, and demand response revenue close?
6. **Carbon management.** If you use or develop CO_2 enrichment or other carbon-management approaches, describe the CO_2 source and purity, setpoints, measured yield response, energy penalty, leakage and venting rates, and MRV methods.
    a. Indicative costs ($/ton CO_2, $/square foot, or $/kilogram crop output)
7. **Barriers:** What barriers impede efficient, grid-flexible CEA in California?
8. **Grid value and ratepayer benefits:** How do your technologies create grid value, and how does that translate into benefits for the electric system and ratepayers?
    a. Quantify: peak demand reduction, avoided capacity, distribution upgrade deferral, demand response or California Independent System Operator market participation, and resilience value.
    b. Document any cases of CEA earning demand response revenue, capacity payments, or bill savings, with results.
9. **Community engagement and benefits:** How could California communities, particularly under-resourced communities, be engaged in these projects, and what benefits should flow in both directions?
    a. Which engagement models have succeeded or failed? Who should be involved, and when?
    b. What local benefits could a demonstration deliver, e.g., produce access, quality jobs, training pathways, local manufacturing, reuse of vacant buildings, or reduced environmental burden?
    c. What can communities offer that improves a project's viability e.g., local workforce, host sites or vacant buildings, offtake and market demand, or local partnerships that ease siting and permitting?
    d. What workforce skills and training pathways does the sector require, and who can provide them?

e. How should benefits be defined, measured, and verified?

How to Provide Information

Respondents to this RFI should not include any proprietary or confidential information. The RFI currently has no set end date, but to maximize engagement with the CEC, please submit responses by **5:00 p.m. on August 7th, 2026**. Any future end date for the RFI will be announced with at least 30 days' notice. Comments must be submitted using the e-commenting feature California Energy Commission : e-comment : Submit Comment to submit to Docket 23-ERDD-01.

To use the e-commenting system, respondents will be asked for a full name, email address, comment title, and either a comment or an attached document (.doc, .docx, or .pdf format). After a challenge-response test is used by the system to ensure that responses are generated by a human user and not a computer, click on the "Agree & Submit Your Comment" button to submit the information to the CEC's Docket Unit. Written comments, attachments, and associated contact information included within the documents and attachments will become part of the viewable public record and searchable on the internet.

Interested parties are encouraged to use the electronic filing system described above to submit information. If you are unable to submit electronically, a paper copy of your information may be sent to:

California Energy Commission
Docket Unit, MS-4
Re: Docket No. 23-ERDD-01
715 P Street
Sacramento, CA 95814-5512

Alternatively, you may email responses to docket@energy.ca.gov with the subject line "Integrating Energy Efficiency and Carbon Management in Indoor Farming Request for Information."

Technical Subject Inquiries. Email Mohamad El Hajj Younes; mohamad.younes@energy.ca.gov.