

# RII Market Characterization Survey: Controlled Environment Agriculture

Resource Innovation Institute (RII) and American Council for an Energy-Efficient Economy (ACEEE) are surveying controlled environment agriculture (CEA) subject matter experts to inform our three-year USDA-funded scope of work entitled, "Data-Driven Market Transformation for Sustainable, Efficient Controlled Environment Agriculture." Our research will address a range of issues designed to inform our market transformation strategy, from the composition of the supply chain serving CEA producers to the sources of energy serving vertical and greenhouse cultivation facilities. We thank you for sharing your knowledge. We expect it to require 15-20 minutes of your time.

\* Required

1. 1) Name \*

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2. 2) Company Affiliation \*

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3. 3) In NEW CONSTRUCTION projects which supply chain actors serve CEA operations for the following purchases? Mark all that apply.

*Check all that apply.*

	Manufacturers	Manufacturer Sales Reps	Distributors	Independent Contractors/Installers	Design Professional
Electric Infrastructure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lighting Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HVAC Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dehumidification Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Controls & Automation Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Management Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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4. 4) In RETROFIT projects which supply chain actors serve CEA operations for the following purchases? Mark all that apply.

*Check all that apply.*

	Manufacturers	Manufacturer Sales Reps	Distributors	Independent Contractors/Installers	Design Professional
Electric Infrastructure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lighting Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HVAC Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dehumidification Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Controls & Automation Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Management Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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5. 5) With regard to HVACD, rank these market actors in terms of their influence on the purchasing behaviors of CEA producers. Select one ranking per row. (1 = most influential, 9 = least influential)

*Mark only one oval per row.*

	1	2	3	4	5	6	7	8	9
Facility staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technology Manufacturers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design & Construction Professionals (e.g., engineers, architects)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distributors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Utilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trade Associations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
State Departments of Agriculture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Agricultural Extension Offices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financing Partners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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6. 6) With regard to LIGHTING, rank these market actors in terms of their influence on the purchasing behaviors of CEA producers. Select one ranking per row. (1 = most influential, 9 = least influential)

*Mark only one oval per row.*

	1	2	3	4	5	6	7	8	9
Facility staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technology Manufacturers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design & Construction Professionals (e.g., engineers, architects)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distributors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Utilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trade Associations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
State Departments of Agriculture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Agricultural Extension Offices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financing Partners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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7. 7) With regard to OVERALL FACILITY DESIGN, rank these market actors in terms of their influence on the purchasing behaviors of CEA producers (1 = most influential, 9 = least influential) :

*Mark only one oval per row.*

	1	2	3	4	5	6	7	8	9
Facility staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technology Manufacturers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Design & Construction Professionals (e.g., engineers, architects)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distributors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Utilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trade Associations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
State Departments of Agriculture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Agricultural Extension Offices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financing Partners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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8. 8) Which barriers to energy efficiency would you say are most important to address, with the goal of accelerating successful adoption of efficient technologies? Select up to three (3).

*Check all that apply.*

- ☐ Upfront costs
- ☐ Lack of financing / Access to capital
- ☐ Executive support for trying something new
- ☐ General lack of knowledge of efficient technologies
- ☐ Cultivator training on how to effectively use technologies
- ☐ Skepticism and lack of trust in product performance

Other: ☐ \_\_\_\_\_

9. 9a) Which types of producers are most open to energy efficiency projects? Select up to four (4) Facilities Types and up to four (4) Crop Types. \*

*Check all that apply.*

- ☐ Facilities Types - Small indoor vertical
- ☐ Facilities Types - Large indoor vertical
- ☐ Facilities Types - Small greenhouse (<10 acres)
- ☐ Facilities Types - Medium greenhouse (10-49 acres)
- ☐ Facilities Types - Large greenhouse (50+ acres)
- ☐ Facilities Types - Propagators
- ☐ Crop Types - Leafy greens (lettuce, spinach, herbs ...)
- ☐ Crop Types - Specialty greens (purslane, orach, , vegetable amaranth, tetragonia, celtuce ...)
- ☐ Crop Types - Vine crops (tomatoes, cucumber, peppers, squash, melons ...)
- ☐ Crop Types - Fruits
- ☐ Crop Types - Floriculture (ornamentals, potted plants, foliage plants, cut flowers ...)
- ☐ Crop Types - Cole crops (broccoli, Brussels sprouts, cabbage, cauliflower, kale ...)
- ☐ Crop Types - Mushrooms

Other: ☐ \_\_\_\_\_

10. 9b) Please help us understand why you made those selections in the previous question (9a).

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11. 10) In INDOOR facilities, what is the primary source of energy used?

*Mark only one oval.*

- ☐ Grid Electricity
- ☐ On-site Solar
- ☐ Geothermal
- ☐ Natural Gas
- ☐ Propane
- ☐ Biofuels
- ☐ Co-gen / Microgrid

12. 11) In INDOOR facilities, What sources of energy, including for backup power, are used?

*Check all that apply.*

- ☐ Grid Electricity
- ☐ On-site Solar
- ☐ Geothermal
- ☐ Natural Gas
- ☐ Propane
- ☐ Biofuels
- ☐ Co-gen / Microgrid

Other: ☐ \_\_\_\_\_

13. 12) In GREENHOUSE facilities, what is the primary source of energy used?

*Mark only one oval.*

- ☐ Grid Electricity
- ☐ On-site Solar
- ☐ Geothermal
- ☐ Natural Gas
- ☐ Propane
- ☐ Biofuels
- ☐ Co-gen / Microgrid

14. 13) In GREENHOUSE facilities, What sources of energy, including for backup power, are used?

*Check all that apply.*

- ☐ Grid Electricity
- ☐ On-site Solar
- ☐ Geothermal
- ☐ Natural Gas
- ☐ Propane
- ☐ Biofuels
- ☐ Co-gen / Microgrid

Other: ☐ \_\_\_\_\_

15. 14) Which of the following appear to be the most valuable benefits realized by producers through implementation of efficiency projects and high performance technologies, generally across all crop and facility types? Select up to three (3).

*Check all that apply.*

- ☐ CapEx Savings  
☐ OpEx Savings  
☐ Yield Improvements  
☐ Maintenance Savings  
☐ Quality Expressions (e.g., color, taste, smell)

Other: ☐ \_\_\_\_\_

16. 15) For our literature review, we've identified these publications as particularly helpful: a) Studies by leading universities (e.g., Wageningen, McGill, Utah State), b) California Energy Commission / Title 24 / CASE Report resources, c) IESO greenhouse energy profile study. To address our research questions, what other materials should we be reviewing to inform the market characterization report?

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17. 16) In addition to published resources, are there specific experts you would recommend we interview? Please provide names and contact information below.

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18. 17) Is there anything else we should consider as we develop a strategy to transform the CEA market toward more efficient production?

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**Thank You!**

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