

Agriculture Market Evaluation

Advancing Agriculture Energy Technologies (AAET), Agriculture Technical Services, and Greenhouse Lighting and Systems Engineering (GLASE) Consortium

Market Update 1

Executive Summary

Prepared for:

New York State Energy Research and Development Authority

Albany, New York

Jeremy Simpson, Project Manager

Carley Murray, Senior Project Manager

Prepared by:

Guidehouse Inc.

Boulder, Colorado

Beth Davis, Associate Director

Annelise Huber, Managing Consultant

Matt Rankins, Managing Consultant

Brent Barkett, Director

APPRISE

Princeton, New Jersey

David Carroll, Managing Director

Dan Bausch, Project Director

NYSERDA Record of Revision

Document Title
<p>Agriculture Market Evaluation: Market Update 1 Executive Summary Advancing Agriculture Energy Technologies (AAET), Agriculture Energy Audit Program, and Greenhouse Lighting and Systems Engineering (GLASE) Consortium</p> <p>September 2023</p>

Revision Date	Description of Changes	Revision on Page(s)
September 2023	Original Issue	Original Issue

Notice

This report was prepared by Guidehouse in the course of performing work contracted for and sponsored by the New York State Energy Research and Development Authority (hereafter “NYSERDA”). The opinions expressed in this report do not necessarily reflect those of NYSEDA or the State of New York, and reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement of it. Further, NYSEDA, the State of New York, and the contractor make no warranties or representations, expressed or implied, as to the fitness for particular purpose or merchantability of any product, apparatus, or service, or the usefulness, completeness, or accuracy of any processes, methods, or other information contained, described, disclosed, or referred to in this report. NYSEDA, the State of New York, and the contractor make no representation that the use of any product, apparatus, process, method, or other information will not infringe privately owned rights and will assume no liability for any loss, injury, or damage resulting from, or occurring in connection with, the use of information contained, described, disclosed, or referred to in this report.

NYSERDA makes every effort to provide accurate information about copyright owners and related matters in the reports we publish. Contractors are responsible for determining and satisfying copyright or other use restrictions regarding the content of reports that they write, in compliance with NYSEDA’s policies and federal law. If you are the copyright owner and believe a NYSEDA report has not properly attributed your work to you or has used it without permission, please email print@nyserda.ny.gov.

Information contained in this document, such as web page addresses, are current at the time of publication.

Executive Summary

The New York State Public Service Commission approved the Clean Energy Fund (CEF) in January 2016—modified in September 2021—to commit to clean energy and efficiency measures in recognition that deploying programs at scale can address pressing environmental and energy challenges while providing opportunity for New York State. Based on agriculture-related objectives laid out in the CEF Compiled Investment Plan, New York State Energy Research and Development Authority (NYSERDA) developed three major CEF initiatives¹:

- **Advancing Agriculture Energy Technologies (AAET)²**: The AAET initiative aims to “accelerate the adoption and market penetration of underused and emerging technologies by animal- and crop-production farms and demonstrate the value proposition of advanced, underused, or emerging energy efficient technologies or processes on farms.” The initiative issues competitive solicitations for technology vendors and farm teams to demonstrate technologies in the market. The initiative also develops case studies to share with the market.
- **Technical Services³**: This initiative “engages energy consultants, solution providers and farm owners to provide objective, decision-quality analyses, information, and project pre-development support to advance efficiency, electrification and electrification-readiness solution assessment, scoping, implementation, and replication.” It includes two components: Agriculture Energy Audit Program, which provides comprehensive audits to farmers, and Best Practices, which provides information, tools, and resources to the agriculture market.
- **Greenhouse Lighting and Systems Engineering (GLASE) Consortium⁴**: The GLASE Consortium “brings together academia and marketplace knowledge and experience to enable new control systems, lighting products, and technical services” to “target energy-related improvements in greenhouse system operations by optimizing energy efficiency, crop yield and quality.” The consortium recruits market actors in the controlled environment agriculture market to become members.

¹ More information about the Clean Energy Fund is available at <https://www.nyserdera.ny.gov/About/Funding/Clean-Energy-Fund>.

² Additional details on AAET located in the *Clean Energy Fund Compiled Investment Plans*: <https://www.nyserdera.ny.gov/About/Funding/Clean-Energy-Fund>.

³ Additional details on Technical Services are located in the *Clean Energy Fund Compiled Investment Plans*: <https://www.nyserdera.ny.gov/About/Funding/Clean-Energy-Fund>.

⁴ Additional details on GLASE are located in the *Clean Energy Fund Compiled Investment Plans*: <https://www.nyserdera.ny.gov/About/Funding/Clean-Energy-Fund>.

The market evaluation conducted in 2022 and 2023 of these programs had three core objectives: 1) to evaluate program processes and identify opportunities for improvement for the Agriculture Energy Audit Program and the GLASE Consortium, 2) to characterize measures recommended and adopted through the Agriculture Energy Audit Program, and 3) to estimate the indirect impacts from the GLASE Consortium. Table 1 outlines the high-level objectives and evaluation questions prioritized in this study and findings for each evaluation question. Projects in the Advancing Agricultural Energy Technologies program were not sufficiently complete at the time of this study to be evaluable, and so process and market evaluation of this program was not conducted through this study.

Table 1. Agriculture Market Update 1 Evaluation Questions and Findings

The evaluation objectives included process improvements, measure characterization, and indirect impacts.

Source: Market Evaluation Team

Objective	Evaluation Question	Finding
Evaluate program processes and improvements for the Agriculture Energy Audit Program and the GLASE Consortium	Are there any process improvement opportunities for the Agriculture Energy Audit Program?	<ul style="list-style-type: none"> • 23% reported more financial information and assistance, 14% desire auditor changes, 11% desire more advertisement of the audit program, and 11% reported that they would like to see more follow-up from NYSERDA.
	Are there any differences in attitudinal responses from farms in disadvantaged communities (DACs) and non-DACs (if data available to compare)?	<ul style="list-style-type: none"> • Not included in this report
	Are Agriculture Energy Audit Program audit participants aware of and interested in solar siting opportunities?	<ul style="list-style-type: none"> • 70% of respondents reported being approached by a renewable energy developer. • 21% of respondents reported installation of wind or solar renewables technology. • 36% of respondents reported interest in speaking with a renewables representative.
	What was the impact of COVID on participants/members related to the initiatives?	<ul style="list-style-type: none"> • Row Crops (82%) and Orchards & Vineyards (79%) respondents were most likely to report COVID-19-related business impacts while half or more of all other commodity respondents reported COVID-19 impacting their agricultural or business operations. • Respondents most frequently cited (85%) the supply of materials to operate as negatively or very negatively impacting their business. Financial standing (55%) was the second-highest reported negatively impacted business aspect. • 28% of respondents reported product demand as a business aspect positively impacted by COVID.
	What are the answers to some program-specific questions for GLASE around member experiences, preferred communications, lighting approaches, and familiarity with and benefits of GLASE products and services?	<ul style="list-style-type: none"> • Growers reported membership cost and awareness and non-growers reported only membership cost as barriers to joining. • Non-growers were highly likely to cite access to, and building relationships with, growers as a benefit of GLASE membership. • All growers reported using LEDs. • Growers were most aware of and likely to have installed the greenhouse light spectrum sensing system and were least aware of day-ahead market price and tunable LED light modules. Non-growers were most aware of light and shade system implementation (LASSI), CO2-LASSI, and tunable LED light modules.
Characterize recommended measures adopted in the Agriculture Energy Audit Program	Characterize measures adopted within the first year, second year, and third-plus years after audit completion in the Agriculture Energy Audit Program	<ul style="list-style-type: none"> • Of the recommended measures that were installed, 21% were within one year after, 8% between one and two years after, and 7% more than two years after the audit.
Estimate indirect impacts from the GLASE Consortium	Estimate the effects of intervention on the Consortium members	<ul style="list-style-type: none"> • GLASE Consortium members mostly reported positive impacts on their organizations via improved relationships within the industry, increased technical knowledge, and market influence for increased energy efficiency.

Findings and Recommendations

This section presents high-level findings and recommendations from Market Update 1 of NYSERDA's Agriculture Initiatives.

Agricultural Energy Audit Program

In addition to the below findings, the evaluation also inquired about measure adoption rate and found survey respondents installed 36% of measures recommended in audits. Of the installed measures, most (21%) were installed within one year after the audit. The remaining measures were installed between one and two years (8%) and more than two years after the audit (7%). A more in-depth analysis of measure adoption rate is being undertaken through a separate impact evaluation study and future reports will detail results particularly as they relate to energy savings for installed measures.

Finding 1: There was a reported high level of satisfaction with the auditor's performance (80% of 297 respondents); however, 15 verbatim responses reported that the audits do not provide information that farmers do not know already, and that farmers expect custom solutions to properly encapsulate the complexity of farms but receive prescriptive solutions and do not experience savings. Some respondents reported the size of a farming operation can impact the helpfulness of an audit such that large farms may find value, via savings and cost compared to benefits, where small farms cannot (10% of 31 respondents).

Recommendation 1: NYSERDA and EnSave should work to identify more auditors that have agriculture sector expertise and use those auditors for farms such as small-scale farms or farms that indicate a need for agriculture expertise. For farms that note facilities resembling commercial/industrial facilities, an auditor without agriculture expertise may suffice.

Expected Result of Implementing Recommendation: This recommendation could increase audit report relevance to the participant, increase participant satisfaction, increase installation of recommendations, and increase energy savings.

NYSERDA Response to Recommendation: Implemented. The Agricultural Energy Audit program already selects auditor contractors to audit agricultural sites dependent on their expertise in agricultural sites in particular, to the extent possible while ensuring auditors are based in close proximity to the audit site.

Finding 2: Some respondents reported that the audit report took too long to receive (9%).

Recommendation 2: The NYSERDA Agriculture team should follow up with EnSave to troubleshoot why audit reports were delayed in getting to the recipient. From this information, NYSERDA should establish and reinforce expectations and timelines from application to audit to report to follow-up (e.g., internal flow diagram) among NYSERDA staff, EnSave staff, auditors, and participants to facilitate the delivery of audit report results quickly so that farmers can benefit as much as possible. During the site visit, auditors should clearly communicate when participants will receive the audit report.

Expected Result of Implementing Recommendation: This recommendation could increase the usefulness of the audit and program, increase participation, increase energy savings, and increase program satisfaction.

Initial NYSERDA Response to Recommendation: Implemented. Currently, NYSERDA has ongoing conversations with EnSave and the FlexTech Consultants regarding our expectations, including expectations for timing of review and distribution of audit reports.

Finding 3: When asked about why respondents had reported dissatisfaction with the program, 47 substantive responses were given, including that the audit did not suggest grants or financial resources to pay for recommendations (11%) and unrealistic recommendations and/or payback periods (9%). Eleven verbatim responses reported little guidance and connection between the audit and how measure implementation will save money.

Recommendation 3: As part of the report, NYSERDA and EnSave should take advantage of the opportunity to communicate as much information as possible to participants. On the audit report cover, NYSERDA could display a webpage link that contains dynamic information that NYSERDA can update quickly as offerings change. This link should list program opportunities, details, or links to NYSERDA, federal, state, and utility websites that store information about financial incentives and program incentive offerings, links to become a GLASE member, industry newsletters and associated organizations, best practice guides, and information about the progress and learnings of NYSERDA demonstration sites and case studies. Dynamic links and additional information will assist NYSERDA and EnSave to work with auditors to strengthen the connection between audit, implementation, and savings. This could include promoting the use of a standard, publicly accessible tool such as those available through the Department of Energy and

the National Renewable Energy Laboratory websites, to develop more accurate and standardized payback periods and/or financial impact awareness around recommendations.^{5,6}

Expected Result of Implementing Recommendation: This recommendation could increase the usefulness of the audit and program, increase participation, increase energy savings, and increase program satisfaction.

Initial NYSERDA Response to Recommendation: Pending. NYSERDA is in the process of creating a list of incentive programs and grants to assist farms. This will be posted on NYSERDA’s website and will remain a dynamic document to allow for updates, and the program’s Implementation Contractor points audit participants to this website at the conclusion of an audit.

GLASE Consortium

Finding 4: Growers reported discounts on vendor-member services as an addition to the consortium’s design that would address the high ratio of non-growers to growers. Non-growers reported intentional networking, reducing membership cost, and increasing member diversity as additions to the consortium’s design that would address the high ratio of non-growers to growers. Members who were interviewed noted the need for growers to be more aware of the GLASE Consortium and reported trade shows, publications, newsletters (including publications like HortiDaily.com and Vertical Farm Daily), conferences, and LinkedIn as information sources.

Recommendation 4: NYSERDA should consider marketing the GLASE Consortium more aggressively, especially at trade shows and conferences, on LinkedIn, and in periodicals, newsletters, and technical publications such as HortiDaily.com and Vertical Farm Daily.ⁱ NYSERDA should consider opportunities to cross-promote the Consortium, such as through the Agricultural Energy Audit reports. More aggressive marketing should also include reducing grower membership cost and promoting free audits and greenhouse benchmarking reports offered through the Audit Program.

⁵ Department of Energy. “Building Energy Modeling.” Accessed 30 May 2023 from <https://www.energy.gov/eere/buildings/building-energy-modeling>.

⁶ National Renewable Energy Laboratory. “BEopt: Building Energy Optimization Tool.” Accessed 30 May 2023 from <https://www.nrel.gov/buildings/beopt.html>.

Expected Result of Implementing Recommendation: This recommendation could increase Consortium awareness, increase Consortium membership, increase membership diversity, and increase awareness of GLASE-related products and services.

Initial NYSERDA Response to Recommendation: Implemented. GLASE continues to search for ways to do more outreach. Currently, GLASE is in the process of finding a new Executive Director and this has slowed down some of the marketing in the last six months. Auditors in the Agricultural Energy Audit program already notify greenhouses at the conclusion of their audit of the opportunity to participate in GLASE. GLASE’s board has full autonomy to structure membership fees to encourage participation.

Indirect Impacts

Indirect impacts findings from the GLASE member interviews were qualitative in nature, intending to increase understanding around the indirect benefits of Consortium membership, and were aggregated and summarized. Qualitative responses were not converted into savings values (e.g., MWh, MMBtu). Growers and non-growers indicated their organizations have observed the following positive impacts as a result of their GLASE memberships:

- the development of relationships with other growers, research facilities, and manufacturers;
- networking, research, and gaining industry insight;
- obtaining distributors, suppliers, and customers through GLASE resources; and
- influencing other growers in New York by raising the bar for energy efficiency.

ⁱ A sample of indoor agriculture/greenhouse trade shows include the Northeast Greenhouse Conference and Expo: registration opens in summer 2023, the Indoor Ag-Con (national) in February, and other regional agriculture shows aligned with universities and on ag university campuses.