Agriculture Market Evaluation

Agriculture Technical Services

Market Update 2

Final Report

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1 Introduction

The Market Update 2 (MU2) evaluation was conducted on the New York State Energy Research and Development Authority (NYSERDA) Agricultural Technical Services[1] initiative. This initiative and MU2 evaluation are comprised of Agriculture Energy Audit Program (AEAP), which provides comprehensive audits to farmers and the NYSERDA Energy Best Practices for Agriculture, which provides online information, tools, and resources to agriculture market. This CEF initiative Evaluation activities conducted on the Best Practices as part of MU2 aimed to gain an initial understanding of the penetration of Best Practices information into the agriculture sector in New York State since their launch in 2022.[2]

The Agricultural Technical Services Initiative is one of three initiatives that NYSERDA developed under the Clean Energy Fund[3] to aid the agriculture sector after the Clean Energy for Agriculture Task Force (CEATF)[4] developed a Strategic Plan that identified numerous strategies to address barriers and assist farms. 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. The other two initiatives developed under the Clean Energy Fund are:

1. **Advancing Agriculture Energy Technologies (AAET)**:[5] The AAET initiative aims to "accelerate the adoption and market penetration of underused and emerging technologies by animal- and crop-production farms to demonstrate the value proposition of advanced, underused, or emerging energy efficient technologies or processes on farms." The initiative issues competitive solicitations for technology vendor and farm teams to demonstrate technologies in the market. The initiative also develops case studies to share with the market.

[1] Additional details on Agriculture Technical Services are located in the *Clean Energy Fund Investment Plan: Multi-Sector Solutions Chapter. Portfolio: Market Development*. Matter Number 16-00681, In the Matter of the Clean Energy Fund Investment Plan. Revised November 1, 2017. https://www.nyserda.ny.gov/About/Funding/Clean-Energy-Fund.

[2] This would mean that any reported awareness by farmers would not have occurred through Audit program participation; this method of learning about the Best Practices will be better understood through subsequent market updates.

[3] More information about the Clean Energy Fund is available at https://www.nyserda.ny.gov/About/Funding/Clean-Energy-Fund.

[4] More information about CEATF is available at https://www.nyserda.ny.gov/About/Publications/Clean-Energy-for-Agriculture-Task-Force-Strategic-Plan.

[5] Additional details on AAET are located in the *Clean Energy Fund Investment Plan: Agriculture. Portfolio: Market Development.* Matter Number 16-00681, In the Matter of the Clean Energy Fund Investment Plan. Revised November 1, 2017. https://www.nyserda.ny.gov/About/Funding/Clean-Energy-Fund.

2. **Greenhouse Lighting and Systems Engineering (GLASE) Consortium:** [6] 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.

This report presents the methodology and results from MU2 of NYSERDA's Agriculture Initiatives. This evaluation is a follow-up to a baseline evaluation published in 2019 and the Market Update 1 (MU1) evaluation published in 2023.[7] At the time that this study began, the initiatives were in the process of implementing their plans and were thus still in the "baseline" phase. At the time of this study, AAET and GLASE had not reached maturity to the point where the Market Evaluation Team could evaluate CEF outcome indicators against baseline indicators, but it was possible to evaluate outcome indicators for Tech Services, for which the Market Evaluation Team did. In addition, this evaluation study focused on the Agriculture Energy Audit Program, including conducting interviews with auditors and developing an initial understanding of the uses and potential impacts of NYSERDA's Best Practices for Agriculture.

The Market Evaluation Team had two core objectives: 1) to evaluate the program processes and improvements for the AEAP and 2) to characterize measures adopted that were recommended in the AEAP. Additionally, NYSERDA intended to use this evaluation to understand the Best Practices deployed on NYSERDA's website Best Practices for Agriculture in 2022. Table 1 outlines the high-level objectives, purpose, and methods for the market evaluation.

[6] Additional details on GLASE are located in the *Clean Energy Fund Compiled Investment Plans:* Matter Number 16-00681, In the Matter of the Clean Energy Fund Investment Plan. Revised February 1, 2023. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/About/Clean-Energy-Fund/Matter-1600681NYSERDA-CEF-CIP-Revised-1-February-2023.pdf.

[7] The baseline study (2019 Agriculture Market Evaluation: Advancing Agriculture Energy Technologies (AAET), Agriculture Technical Services, and Greenhouse Lighting and Systems Engineering (GLASE) Consortium) is available at https://www.nyserda.ny.gov/About/Publications/Evaluation-Reports/Commercial-Industrial-Agriculture.

Table 1. Agriculture MU2 Evaluation Questions and Objectives

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

Source: Market Evaluation Team

Objective	Purpose	Method
Evaluate the program processes and improvements for the Agriculture Energy Audit Program	Answer the evaluation questions: • Are there any process improvement opportunities for the Agriculture Energy Audit Program? • How are NYSERDA best practices communicated? • Are NYSERDA best practices helpful to farmers and contractors? • How are participants impacted by climate issues? What site vulnerabilities and opportunities do they identify?[8] • What was the impact of COVID on participants/members related to the initiatives? • What are the answers to some program-specific questions for FlexTech auditors around their experience in the AEAP, their process, participant engagement, preferred communications, familiarity with and use of NYSERDA's website Best Practices for Agriculture, and informing farmers of climate resiliency opportunities?	Agriculture Energy Audit Program Participant Survey; FlexTech Auditor interviews
Characterize measures adopted that were recommended in the Agriculture Energy Audit Program	Characterize measures adopted within the first year, second year, and beyond two years after audit completion in the Agriculture Energy Audit Program	Agriculture Energy Audit Program Participant Survey

[8] This purpose was added after the Evaluation Plan was created at the direction of the NYSERDA Evaluation program manager in response to internal NYSERDA goals around climate resiliency.

2 Program Characterization and Assessment Results

This section presents the results of the survey and interview research conducted to support the Agriculture Energy Audit Program.

2.1 Agriculture Energy Audit Program

2.1.1 Measure characterization

Survey respondents indicated that 26% of audit-recommended measures were installed while 72% of audit-recommended measures were not installed and 2% of measures respondents did not know if they were installed. Of measures that were installed, 10% were within one year after, 7% were installed between one and two years after, and 5% were installed more than two years after the audit, and 4% reported installation prior to the audit date, likely due to a recollection error. Of the measures installed, 0% were uninstalled.[9] Last year's MU1 evaluation, reported 61% of recommended measures were not installed, representing a decrease in installed recommended measures by 11 points. MU1 survey respondents also reported having installed recommended measures within one year of the audit at double the rate of the 2020 and 2021 survey respondents from this MU2 evaluation. Notably, MU2 encompassed participation that occurred during the COVID-19 pandemic which caused economic impacts and financial and business-related constraints for small business owners, including farmers, and may have reduced financial resources and/or willingness to allow outside contractors on-site to install measures.

Measure characterization revealed that 5% of Audit participant survey respondents reported installing all recommended measures; these respondents were recommended one or two measures. Recommended measures overall ranged in quantity of one to 12. The most installed measure for all farm types was lighting, shown in Table 2.

[9] Results only account for measures installed within two years of 2021 audit completion and within three years of 2020 audit completion.

Table 2. Measure Characterization by Farm Type and Measure Type
Installing or upgrading LED lighting was the primary measure installed across all farm types.
Source: Market Evaluation Team

Farm Type	Install or upgrade LED lighting	Variable Speed Drive	Insulation	Other Measure Examples (not inclusive of all measures)
Dairy (n=12)	67%	25%	4%	Compressors (25%), Heat Recovery (8%), Fan Controls (8%)
Greenhouse (n=1)	0%	0%	0%	-
Orchards & Vineyards (n=2)	100%	0%	50%	-
Other (n=23)	52%	4%	0%	Refrigeration (13%), Fans (13%), Solar (4%)
Row Crops (n=1)	0%	0%	0%	DC Motors (100%), Refrigeration (100%)

The top measures installed within one year, between one and two years, and more than two years after the audit stayed had little variation. Of the total measures installed within one year of the audit, 44% were “install or upgrade LED lighting” and 11% were “compressors”. Similarly, of the total measures installed between one and two years after the audit, 57% were “install or upgrade LED lighting” and 14% were “fans” and of the total measures installed more than two years after the audit, 33% were “install or upgrade LED lighting” and 22% were “fans”. Compared to MU1, MU2 respondents reported installing a different measure more frequently—"variable speed drive” measures appeared in the top three primarily installed measures rather than MU1’s reported “hot water heater” installations.

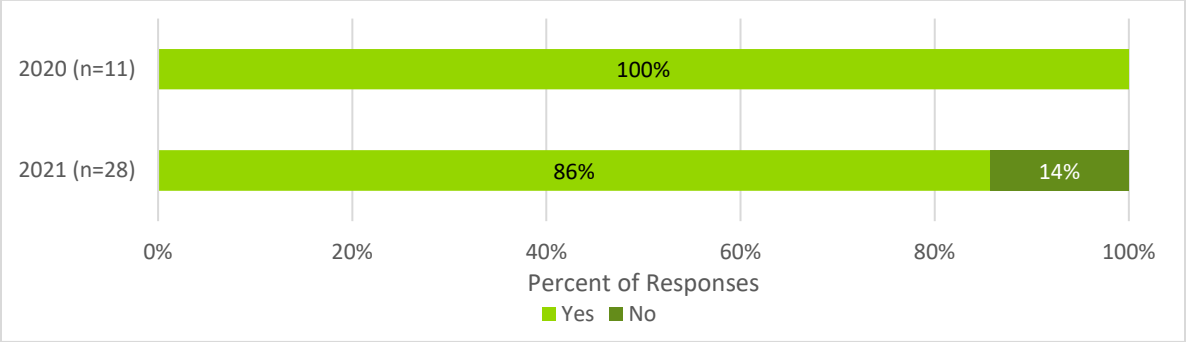
2.1.2 Initiative experiences and process improvement opportunities

To better understand how effective the AEAP was to participants, data was captured on how likely they were to recommend the program. As shown in Figure 1, most participants reported that they would recommend the AEAP. These reports were split by audit years, 2020 and 2021, to see if there were any vast differences in responses. In this case, there was not much of a difference, with only 14% of 2021 respondents not recommending the program and the rest of the respondents reporting that they would recommend it (86% of 2020 and 100% of 2021). Those respondents who would not recommend the program reported that the audit reports lacked follow-up or were delivered late (n=2), the auditor-recommended equipment failed[10] after installation (n=1), and the audit recommendations had a high upfront cost (n=1). The respondents of MU1 also reported similar reasons for not recommending the AEAP. The differences between

[10] The AEAP participant had installed LEDs and fans but did not specify which of the measures had failed.

respondents who would and would not recommend the program could be explained, at least in part, by a farmer's perception of whether or not the program is helpful for some types of farms or commodities, but not all. Another reason could be because of the amount of time between Audit program participation and taking the survey, which results in a shorter window of time to have already recommended the program.

Figure 1. Likelihood to Recommend AEAP[11] by Audit Year
Nearly all participants would recommend the AEAP, however, 2021 respondents were 14 points less likely.
Source: Market Evaluation Team



As a follow-up to the effectiveness of the AEAP, respondents' recommendations of the program were recorded. As shown in Figure 2, 2020 and 2021 survey respondents were equally likely to report that they have recommended the AEAP (36% of 2020 and 36% of 2021). In comparison to the MU1 evaluation, respondents to this survey reported a 7-point decrease in having recommended the program. This could be due to the length of time between years that audits occurred for MU1 respondents and when the survey occurred.[12] This could also indicate that participants are most likely to recommend the program within the first few years after their audit rather than many years after.

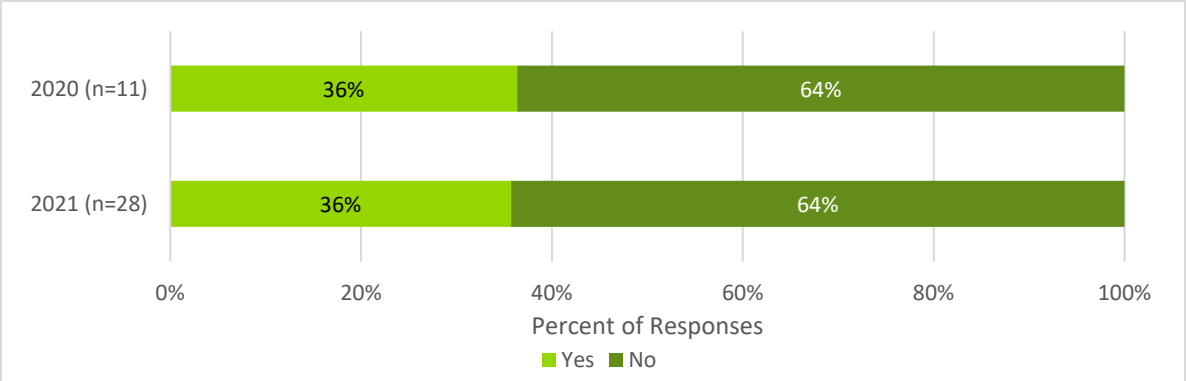
[11] Q19. Would you recommend the NYSERDA Agriculture Energy Audit Program to an agricultural business owner or farmer?

[12] The MU1 evaluation survey took place between October 2022 and January 2023 and covered audit participants between the years 2017 and 2020 which means that they would have had 3 to 6 years, depending on audit year, to recommend the program.

Figure 2. Have Recommended AEAP[13] by Audit Year

Over one-third of 2020 and 2021 respondents reported that they had recommended the program.

Source: Market Evaluation Team



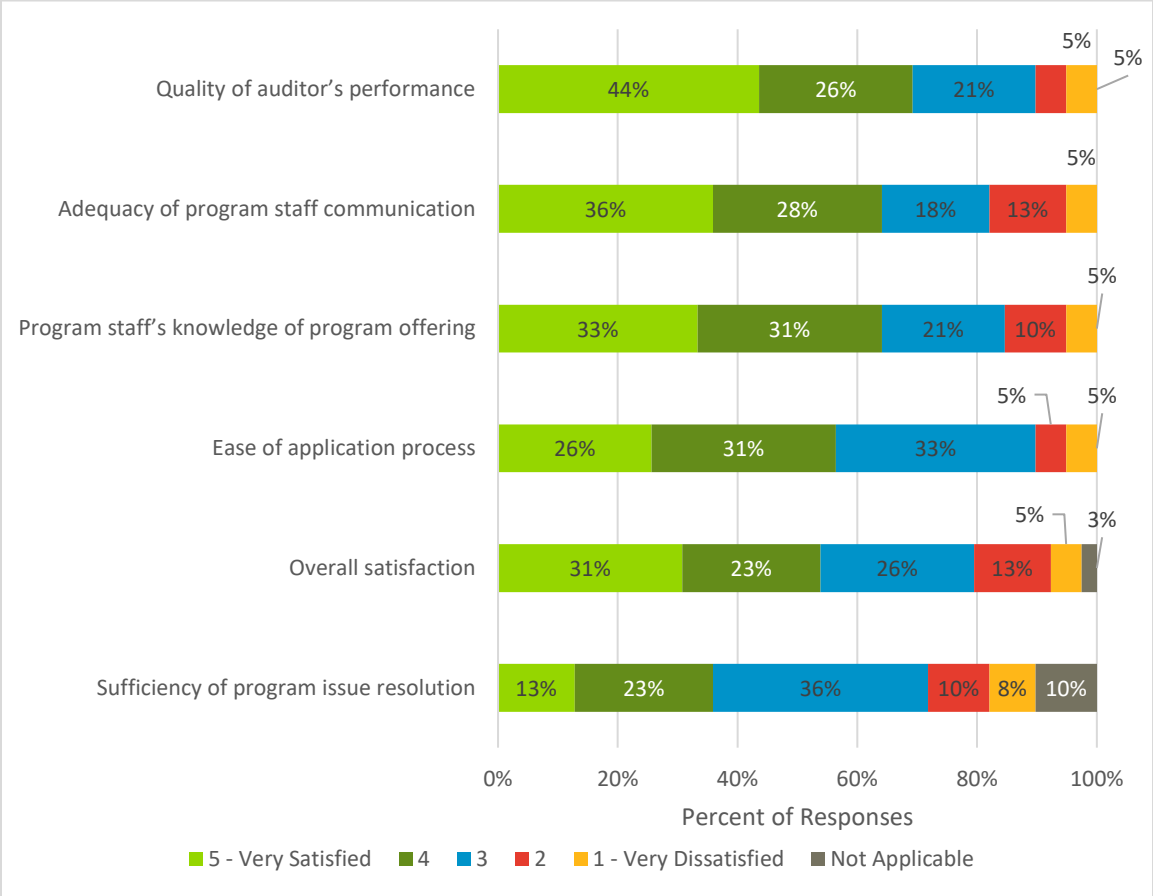
To see how the program served respondents, they were asked to rate their experiences with aspects of the AEAP on a scale from 1 to 5,[14] where 1 is 'very dissatisfied' and 5 is 'very satisfied.' Survey respondents most frequently reported satisfaction (score of 4 or 5) with the quality of the auditor's performance (70%) and the adequacy of the communication from NYSERDA's program staff (64%), as shown in Figure 3. Respondents reported the least satisfaction with sufficiency of program issue resolution (36%) consistent with MU1 findings (31% of 297 respondents) and the open-ended responses (n=11) for respondent dissatisfaction echo MU1 findings (n=47). Respondents from the MU2 and MU1 study both reported that the audit did not provide viable measure recommendations as they were too costly to implement or were an insufficient amount (n=7 of 11 MU2 responses; n=9 of 47 MU1 responses). Additional similarities were that there was little follow-up or lack of communication from auditors (n=2 of 11 MU2 responses; n=5 of 47 MU1 responses), and the audit report took too long to receive (n=2 of 11 MU2 responses; n=5 of 47 MU1 responses)[15]. These responses could indicate that the dissatisfaction with the 'sufficiency of program issue resolution' may include the inability to understand and receive guidance on the next steps in the audit process. Future evaluations can specifically examine participant dissatisfaction with this aspect.

[13] Q20. Have you recommended the NYSERDA Agriculture Energy Audit Program to an agricultural business owner or farmer?

[14] Q17. On a scale from 1 to 5 with '1' being Very Dissatisfied and '5' being Very Satisfied, please indicate your level of satisfaction with the following NYSERDA Agriculture Energy Audit Program elements:

[15] Q18. Please further explain or share your experience that has led to any dissatisfaction (indicated by a '1' or a '2') noted in the previous question.

Figure 3. Program Satisfaction by Program Aspect (n=39)[16]
Respondents were most satisfied with the auditor's performance and NYSERDA program staff communication.
Source: Market Evaluation Team



The respondents were asked to report effective communication methods for learning about the AEAP. Respondents were most likely to report mailers and paper brochures (54%) and agriculture trade shows (49%) as effective communication methods, consistent with MU1 results[17], as shown in Figure 4. 2021 respondents (57%) reported general program emails as effective communications methods at a frequency 39 points higher than 2020 respondents (18%), which could indicate technologically inclined participants. Also, respondents provided other effective communications in the form of media such as farm magazines, newspapers, social media (n=1), and Agriculture industry vendors (n=1)[18]. This is consistent with MU1 responses as

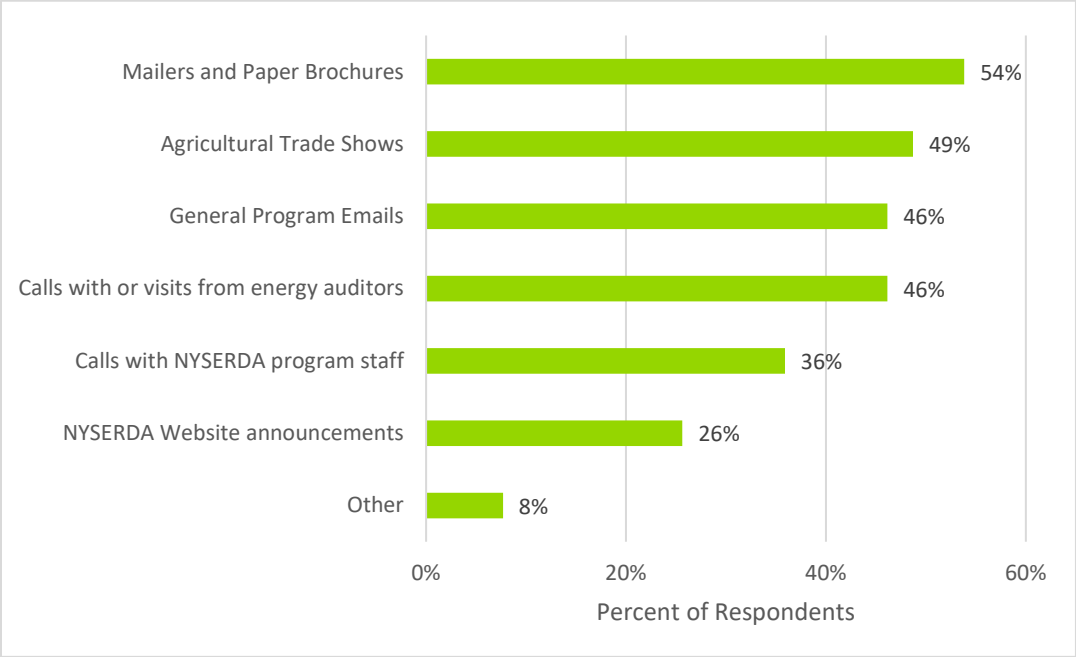
[16] Q17. On a scale from 1 to 5 with '1' being Very Dissatisfied and '5' being Very Satisfied, please indicate your level of satisfaction with the following NYSERDA Agriculture Energy Audit Program elements:

[17] The MU1 evaluation survey took place between October 2022 and January 2023 and covered audit participants between the years 2017 and 2020.

[18] These vendors can look like seed or pesticide suppliers.

19% of 53 responses reported agricultural publications and 19% reported farm bureaus, associations, and adjacent businesses like vendors.

Figure 4. Effective Communication Methods[19](n=39)
Mailers and paper brochures and agricultural trade shows are the most effective communication methods, reported twice as frequently as website announcements.
Source: Market Evaluation Team



Respondents reported which actions NYSERDA could take to improve the program or its processes. As shown in Figure 5, survey respondents would like to see more follow-up from the program (n=8, 21%), also reflective of the MU1 study, in which 11% (16 of 151 responses) reported desiring more follow-up. These reports can inform the auditors and program staff to become informed of equipment failure or to assist farmers with funding opportunities to purchase and install energy-efficient technologies. They also reported wanting more funding assistance (n=7, 18%), like adding funding for high-cost suggestions, connecting to other programs that would help farmers with measure installation, more information on grants to achieve installation, and offering cost shares. These responses reflect the 23% (35 of 151 responses) of MU1 responses that also requested funding assistance, including grants, cost share programs, and awareness of state and federal programs to support implementing recommended measures and energy efficiency changes. Respondents also desired faster feedback from the audit reports via a quicker turnaround time (n=4, 10%), making the applicable process easier and improving

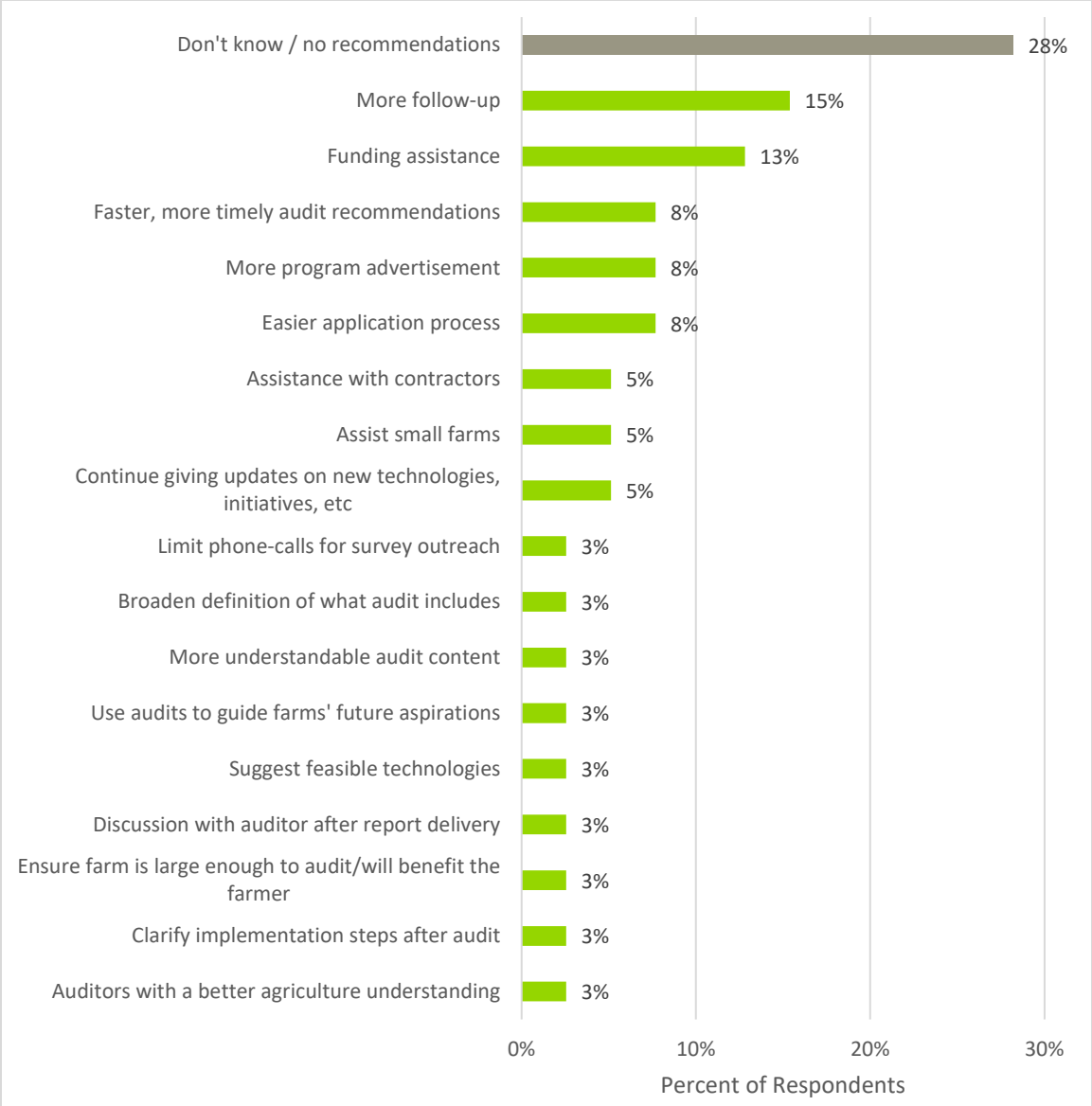
[19] Q22. Please indicate the top three ways that you think NYSERDA should share and communicate information about the Agricultural Audits program with agricultural producers and farmers.

program advertisement, similar to MU1 (9%, n=4 of 47 responses). Lastly, respondents desire more feasible and cost-aware audit recommendations (10%, n=4), as shown in the open-ended responses throughout the surveys, indicating that farmers may want less expensive recommended measures and/or more information about, and assistance, with funding and incentives.

Figure 5. Actions for Improvement[20] (n=39)

One-quarter of respondents had no recommendations; those who did want more follow-up, financing information, and timelier audit reports and recommendations.

Source: Market Evaluation Team



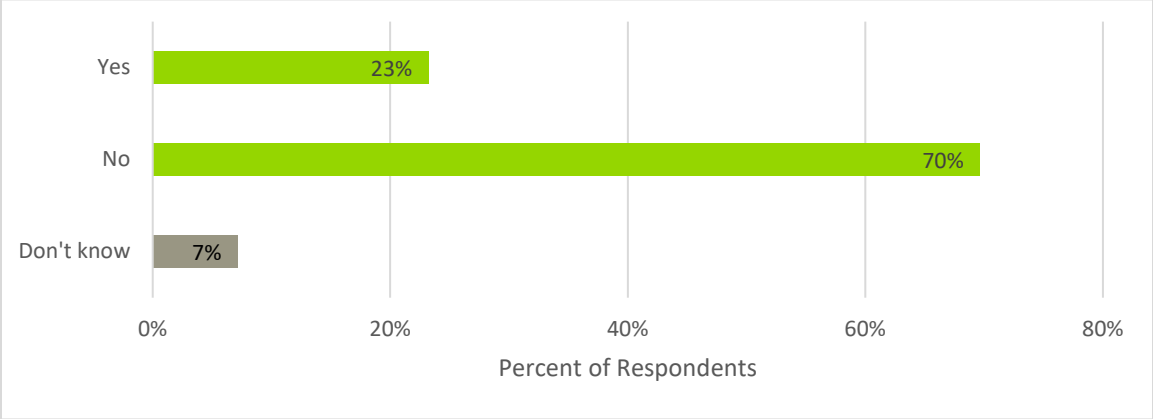
[20] Q21. What action(s) could NYSERDA take to improve the program or its processes?

While the AEAP does not supply grants or incentives for installation, participants continue to report that more incentives or information on incentives would be helpful. This could indicate that participants are not clear on what the AEAP covers or find recommended measures expensive to consider and would like any additional assistance, such as pairing recommendations with funding opportunities. Additionally, these comments likely do not account for NYSERDA's implementation of the MU1 recommendation to include a link to incentives, rebates, and grants on all audit reports as well as in communications to participants who canceled their audits, because NYSERDA implemented this in fall 2023, after the respondents in this survey had received their audit reports, so this could reflect the needs of participants unable to benefit from this change.

2.1.3 Best Practices

Audit participants in the 2020 and 2021 audit years, surveyed in MU2, would not have been aware of Best Practices at the time of their audit because NYSERDA implemented the Best Practices website in 2022. However as shown in Figure 6, despite implementation of the Best Practices after participation in the AEAP, one-quarter of survey respondents (23%, n=56) still reported knowing about NYSERDA's Best Practices website, indicating that they were discovered after Audit program participation.

Figure 6. Aware of NYSERDA Best Practices for Agriculture[21] (n=56)
More than three-quarters of respondents reported that they were not aware of NYSERDA's Best Practices.
Source: Market Evaluation Team



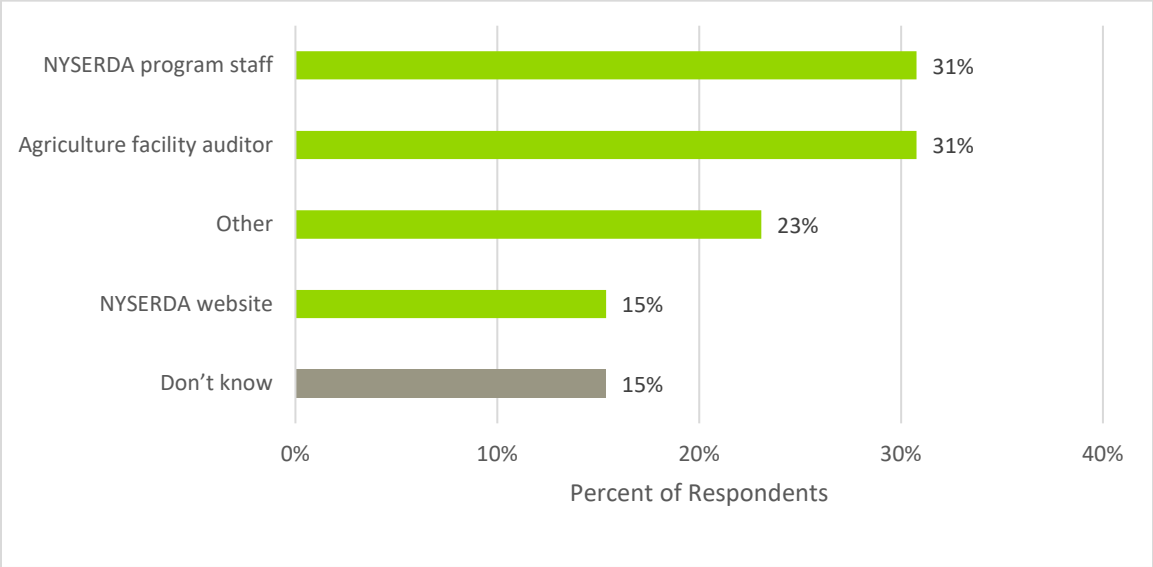
As shown in Figure 7, the respondents who were aware of the Best Practices reported that it was through an agriculture facility auditor (31%) and NYSERDA program staff (31%). It was half as

[21] Q24. Have you heard of NYSERDA's website Energy Best Practices for Agriculture?

likely that respondents learned about Best Practices from the NYSERDA website (15%). The respondents that reported 'Other' (n=3) shared that the communication method they learned about Best Practices was from a trade show, a utility provider (National Grid), and a newspaper. Also, for the respondents that have shared Best Practices[22] (n=3), all shared through in-person events like industry or networking events (n=2), conferences (n=2), and informal conversation (n=1).[23]

Figure 7. Communication Methods for NYSERDA Best Practices for Agriculture[24] (n=13)

Respondents were most likely to receive Best Practices information through one-on-one communications.
Source: Market Evaluation Team



As noted above, the release of Best Practices occurred after MU2 respondents had received audits and reports, but some participants found and may have used Best Practices. As shown in Figure 8, out of the respondents who were aware of the Best Practices, they reported the highest satisfaction (scores of 4 and 5) with the 1-page fact sheets (62%, n=13) and ease of use of Best Practices' resources (62%, n=13). One-quarter to half of respondents reported 'Not Applicable' for each Best Practices aspect when asked about their satisfaction, despite having reported Best Practices awareness. Additionally, more than half of respondents (53%) would not or did not know if they would recommend Best Practices.[25] This could indicate that farmers who are aware of the Best Practices may not be able to use the resources because they may lack applicability to

[22] Q30. Have you shared any information from the Best Practice guides with other farmers and/or agriculture facilities?

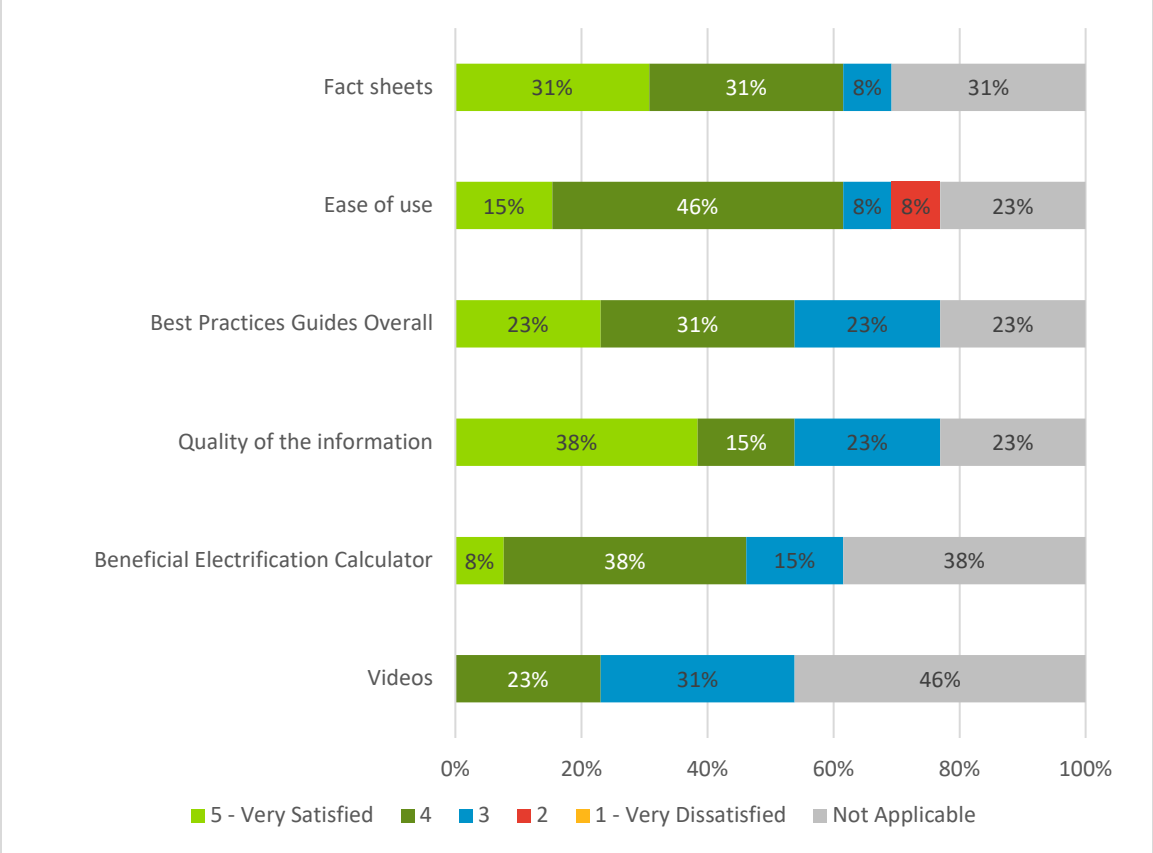
[23] Q30a. Where and/or by what method did you share this information? Select all that apply.

[24] Q25. How did you hear about NYSERDA's Energy Best Practices for Agriculture?

[25] Q29. Would you recommend the Best Practice guides to peer farmers and/or agriculture facilities?

business operations or farmed commodities. Respondents also reported that they would like to see information on small farms (n=1) and harvest technology[26] (n=1) in the Best Practices resources.

Figure 8. Satisfaction with Best Practices Aspects[27] (n=13)
Respondents were most satisfied with Best Practices' fact sheets and ease of use.
Source: Market Evaluation Team



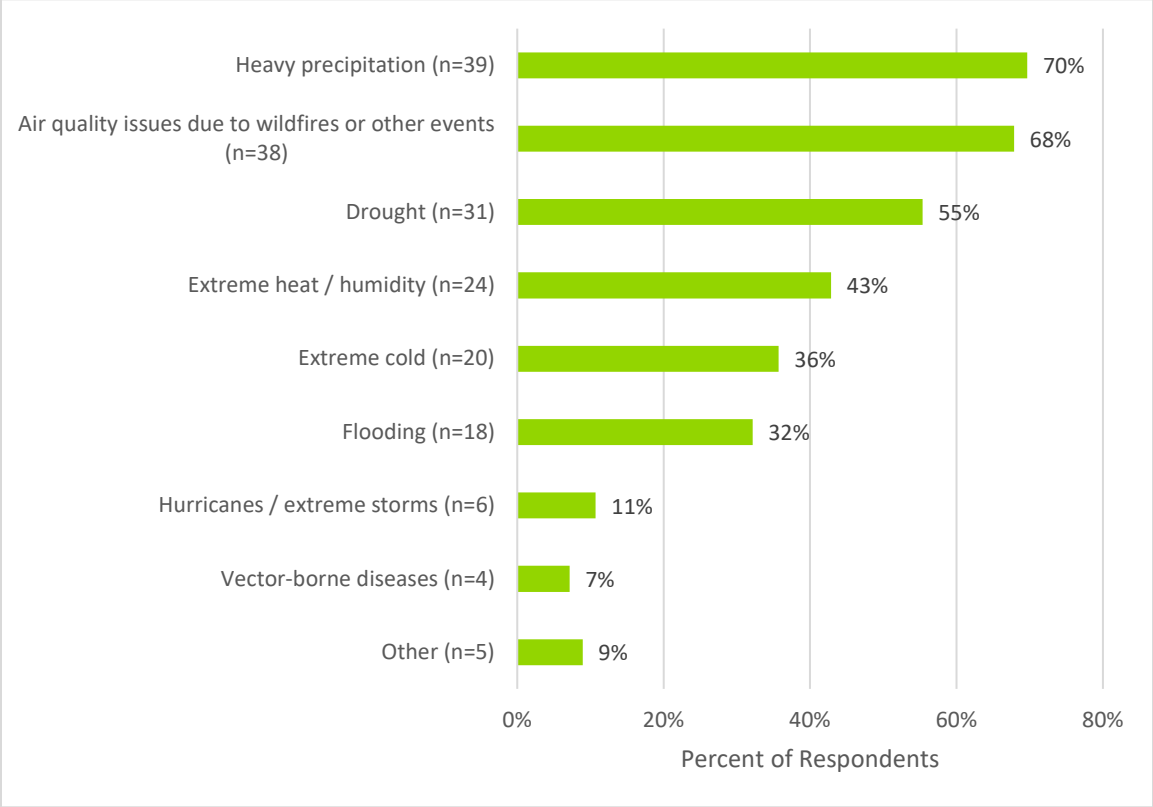
[26] For example, for fruits and vegetables.

[27] Q31. On a scale from 1 to 5 with '1' being Very Dissatisfied and '5' being Very Satisfied, please indicate your level of satisfaction with the following NYSERDA Best Practices information:

2.1.4 Climate Resiliency

Most participants' sites have been affected by climate disasters, with more than two-thirds of the participants having experienced climate disasters related to heavy precipitation (n=39, 70%) and air quality issues due to wildfires, etc. (n=38, 68%), shown in Figure 9. Additional climate disasters reported were hailstorms (n=1) and having an early or late season (n=2).

Figure 9. Climate Disasters Endured[28] (n=56)
Most sites endured heavy precipitation and air quality issues (such as wildfires).
Source: Market Evaluation Team



Because of these detrimental environmental events, some of the consequences respondents reported, shown in Figure 10, were experiencing loss or damage to their crops, animals, equipment, etc. (70%) due to environmental events. Also frequently cited were financial impacts due to environmental events by at least half of respondents (57%). When asked what types of financial impacts the respondents experienced, there were reports of new capital expenditures[29,30]

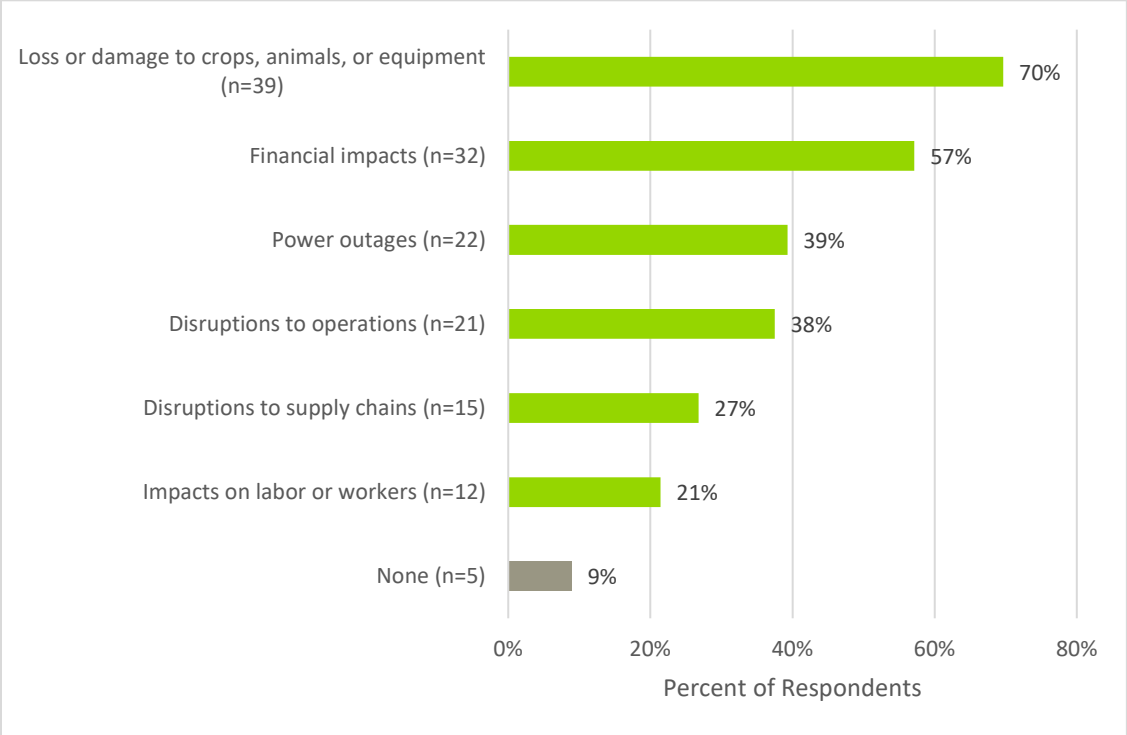
[28] Q33. What types of environmental events have you experienced? Select all that apply.

[29] e.g., flood or storm clean-up

[30] In 2020, 57% of respondents reported new capital expenditures

and expenses for recovery/remediation[31,32]. Another financial impact they reported was new operating expenditures[33], such as changes in insurance and more resilient crop and animal varieties. This could indicate that farmers may benefit from information on and planning for resilient sites as well as on how recommended measures can contribute to site resiliency.

Figure 10. Consequences Experienced due to Environmental Events[34] (n=56)
More than two-thirds of participants reported loss or damage to commodities due to environmental events.
Source: Market Evaluation Team



When asked if they had installed measures or changed energy usage due to environmental events that they have experienced[35], 18% of survey respondents reported that they had. When asked if they planned to install measures or change energy use due to environmental events[36], 23% said that they planned to while 77% did not plan to or did not know if they did. This could indicate a lack of information about how recommended measures can increase site resiliency.

[31] e.g., purchase/install new generator, investments to make business infrastructure/operations more physically robust

[32] In 2021, 56% of respondents reported expenses for recovery/remediation

[33] e.g., new insurance products, new crop/animal varieties that are more climate resilient

[34] Q34. Have you experienced any consequences from the environmental events your site has experienced?

[35] Q36. Have you installed any systems or measures at your site or change energy usage due to any of these environmental events?

[36] Q36a. Do you plan to install any systems or measures at your site or change energy usage due to any of these environmental events?

2.1.5 Direct and indirect impacts

Direct impacts for the AEAP are defined as energy savings from recommended measures installed within one year of the audit, while indirect impacts are defined as energy savings from recommended measures installed more than one year after the audit.[37] EnSave ceases follow-up contacts with audit participants at the 1-year mark, which is a factor of demarcation between direct and indirect impacts. The direct and indirect impacts were accessed for this market update but are published as part of the Impact Team[38] report available on the NYSERDA website. The direct and indirect impact assessment leverages the AEAP participant survey developed and administered by the Market Evaluation Team, as well as customer utility information collected via survey. The methodology employed by the Guidehouse and Michaels for MU2 may differ from the methodology used in the baseline study.

2.2 FlexTech Auditor Interviews

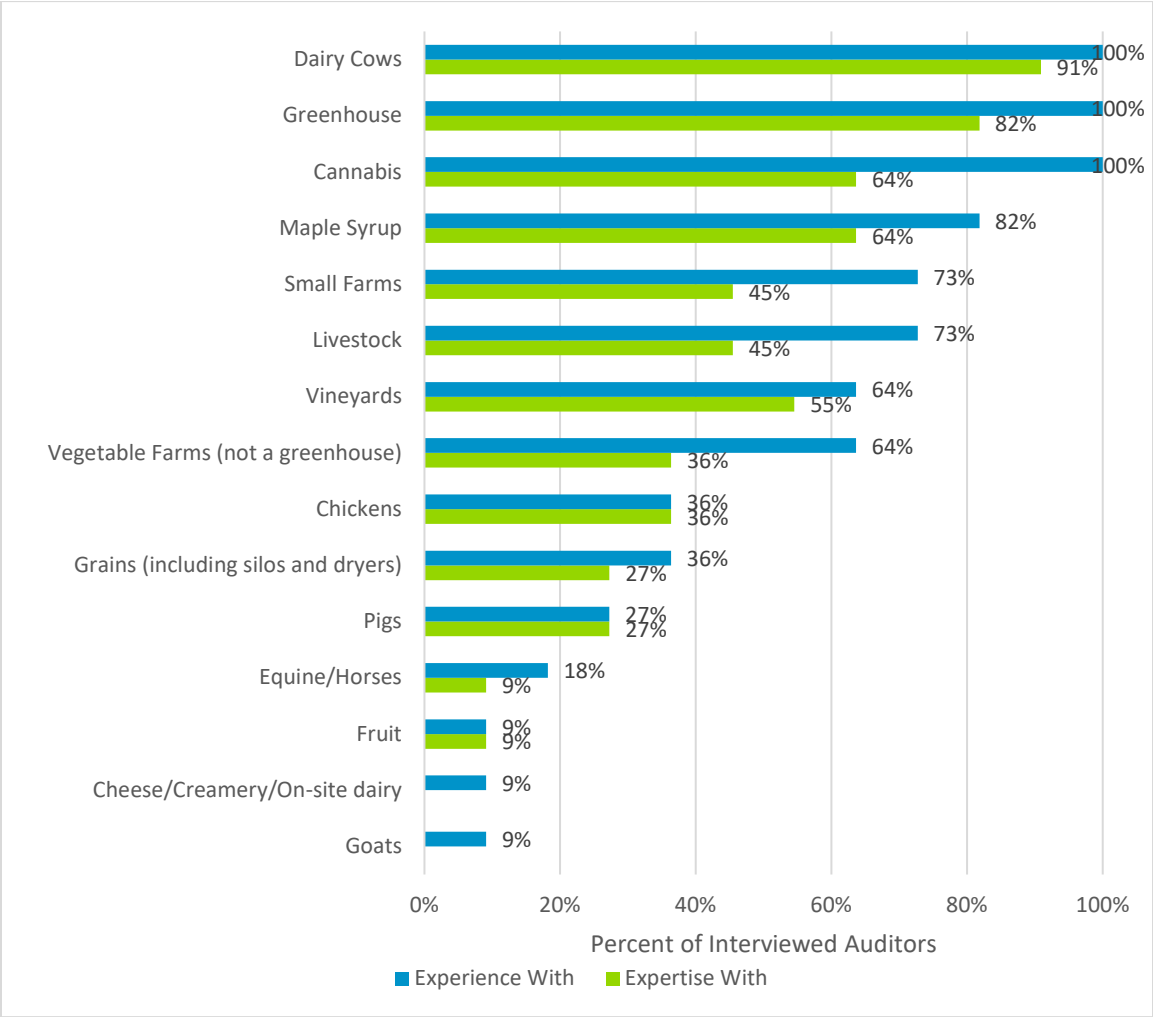
2.2.1 Auditor experience and expertise

Auditors were asked to report their subjective *experience* working with different commodities, identified if they had worked with a commodity at all, and their subjective *expertise* working with those commodities. Auditor-reported experience in farming and agriculture commodities differed from their identified areas of expertise. Most auditors reported having experience working with all commodities, see Figure 11, though many did not report expertise in the same areas. Cannabis had the largest reported differential (36 points) while greenhouses, maple syrup, small farms, livestock, and vegetable farms also varied by 18 points each between reported experience and expertise. This indicates that most auditors may have a knowledge gap with commodities that could impact the effectiveness of their audits, including how to best engage with, and identify all potential energy saving options for, all farmers.

[37] This scenario is unique to this NYSERDA program.

[38] The impact contractor reports and publishes direct and indirect impacts separately from the Market Evaluation Team.

Figure 11. Auditor Commodity Experience and Expertise[39] (n=11)[40,41]
Most auditors reported experience with most commodities, but some auditors did not report expertise in areas where they reported experience—cannabis has the largest auditor-reported difference while maple syrup, livestock, small farms, and greenhouses have the second largest difference.
Source: Market Evaluation Team



Auditors reported challenges[42] were different for cannabis compared to other crops including that cannabis requires different specific and controlled growth environments and crop drying needs which results in significant use of commercial equipment, similar in volume of equipment to dairy as a commodity. Auditors reported the energy-intensive nature of growing cannabis, which

[39] Experience has been defined as what types of farming operations they have conducted audits at, while expertise is which farming operations that auditors reported they are most knowledgeable of.

[40] With which type(s) of agriculture and/or farming do you have experience working with? Select all that apply.

[41] Out of the agriculture and/or farming sectors you have experience with, what types do you feel especially suited to conduct energy audits for?

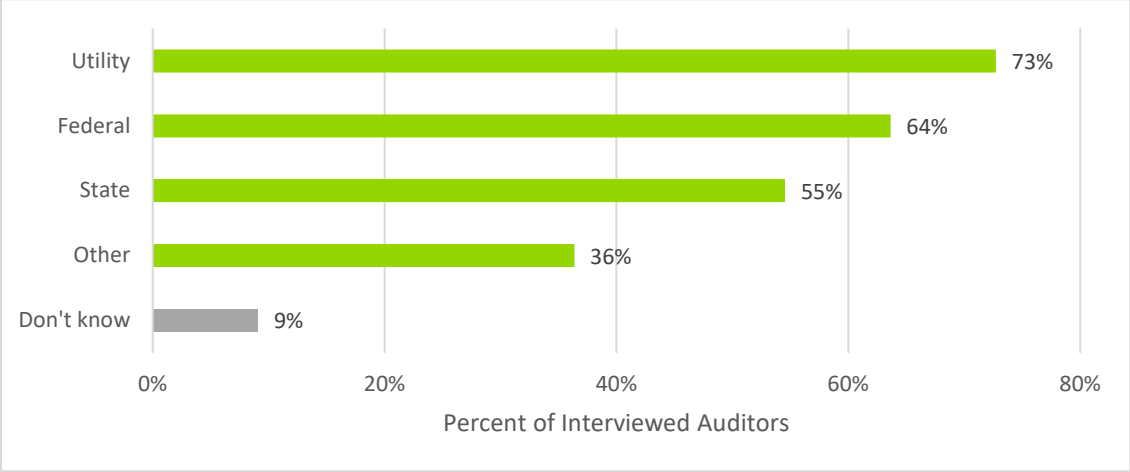
[42] Since cannabis was made (medically and recreationally) legal in New York, have you seen, or do you see, anything changing about how you conduct audits? [Probe: Are there any specific issues related to cannabis and/or energy use pertaining to cannabis production that you have seen?] If yes, please specify.

increases the value of such farms' participation in energy-saving programs. Auditors also reported that due to the newness of the legalization of recreational and medicinal cannabis in New York State, many farmers who grow cannabis are new to farming in general, which leads to auditors experiencing challenges such as a newly built buildings, cannabis production occurring on a shared residential meter which is not covered in the audit, and not having enough energy data—at least 12 months for the auditor to base energy savings calculations and recommendations on. Auditors also reported that cannabis audits are huge, include greenhouses, and often include "many crops on different cycles and that is time consuming and complex."

2.2.2 Auditor awareness of rebates and incentives

Nearly all auditors (91%) reported awareness of some incentives listed on NYSERDA's website[43] though awareness of specific incentives varied by incentive type. Auditors reported the greatest awareness of utility incentives with 73% reporting so (Figure 12). Two auditors reported that they are not encouraged to share specific incentive information with farmers via audit reports because that information can change but farmers responding to the survey reported that they would like more assistance with incentives and rebates (13%).[44]

Figure 12. Rebate and Incentive Awareness (n=11)[45]
Auditors reported the most awareness of utility incentives with 73% reporting such.
Source: Market Evaluation Team



[43] Are you aware that incentives are listed on NYSERDA's website?

[44] What action(s) could NYSERDA take to improve the program or its processes?

[45] Are you aware of any of the following rebates and incentives?

2.2.3 Program Process

Auditors reported that they receive applications from EnSave but little additional information beyond that and must communicate with farmers to obtain other necessary information, including audit expectations and utility bills, ahead of site visits. Auditors would like to have farm design drawings and utility bills before going on-site. Auditors also reported that farmers frequently use farm energy audits to apply to grant opportunities and that these opportunities tend to run on very specific timelines that they generally are not aware of unless they specifically ask a farmer. If auditors are unaware of grant timelines or farmers are unaware of the process and length of time that it may take to obtain an audit for this purpose, that can contribute to decreased usability of the audit report (e.g., comments from survey participants that the report was delivered too late to be helpful – both from MU1 and MU2 surveying) and inability to install audit measures due to financial constraints in the absence of a grant that necessitated the audit, ultimately resulting in decreased participant satisfaction and potentially lower program participation.[46]

Auditors also reported that participants frequently add measures or processes that they would like auditors to examine that were not part of the original application or conversations, such as solar feasibility or discovering once on-site that a farmer has a greenhouse or on-site sugar shack or processing facility which also uses significant energy. When unplanned additions crop up, auditors may be unable to add these due to time or financial constraints—referring to the standard fee offered for comprehensive audits—which can result in a less useful audit report for the farmer, participant dissatisfaction, and ultimately fewer installed recommended measures.

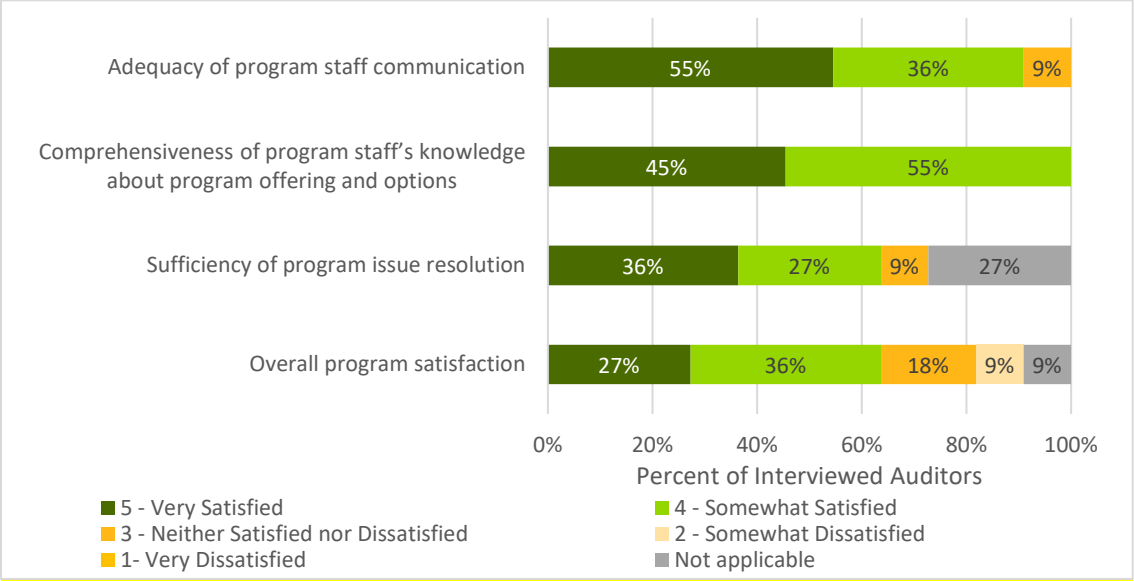
2.2.4 Satisfaction and Opportunities for Improvement

Auditors reported high satisfaction with all program components although overall program satisfaction was impacted by the fee offered for the comprehensive audit. Auditors reported high satisfaction (score of 4 or 5) with the adequacy of program staff communication (91%) and the comprehensiveness of program staff's knowledge about offerings and options (100%), as shown in Figure 13. While auditors generally reported high satisfaction with the overall program (63%), some auditors (n=4, 36%) gave the overall program lower scores citing the fee—$3,000—offered for the comprehensive audit is too low for the effort required and that unclear program parameters communicated to participants may result in less satisfactory participant experiences. The auditor-identified issues around fees are exemplified in one auditor's response who reported that their

[46] Please describe the process that you undertake when conducting an audit with a farmer or agriculture facility. [Probe: How do you contact the farmer? What information do you give them on site? What information follows later?]

firm has declined conducting audits on the basis that the prescribed audits fees are too low, and the amount of work required is too high, for their firm to consistently make any profit off participating in the AEAP.[47]

Figure 13. Program Satisfaction by Component (n=11)[48]
Adequacy of program staff communication and with program staff's knowledge of offerings and options received the highest satisfaction from auditors.
Source: Market Evaluation Team



When asked about the helpfulness of NYSERDA- and FlexTech-provided information and feedback, 91% of auditors reported finding the feedback helpful in their ability to deliver energy audits to agriculture sites.[49] Auditors commonly cited EnSave's tailoring and clean-up of the audit report to fit the ANSI/ASABE S612 standards and for REAP grant applications (n=4), EnSave's audit report review offering an additional quality control measure (n=4), NYSERDA's prompt responses to inquiries (n=3), and NYSERDA's March 2024 webinar detailing the MU1 evaluation (n=3) as helpful aspects. Two auditors each also reported that NYSERDA's Agriculture Best Practices website and the open dialogue between EnSave and NYSERDA with auditors to ask questions and give report feedback.

[47] Please further explain or share your experience that has led to any dissatisfaction (indicated by a '1' or a '2') noted in the previous question.

[48] On a scale from 1 to 5 with '1' being Very Dissatisfied and '5' being Very Satisfied, please indicate your level of satisfaction with the following NYSERDA Agriculture Energy Audit Program elements: Adequacy of program staff communication, Comprehensiveness of program staff's knowledge about program offering and options, Sufficiency of program issue resolution, Overall program satisfaction

[49] Has the information and feedback provided to you by NYSERDA and FlexTech been helpful in your ability to deliver energy audits to agriculture sites?; If Above is Yes, Please specify;

When asked about opportunities for improvement[50], auditors reported the need to collect more information upfront from applicants including utility bills (n=9), if farmers plan to use their audit to obtain grants (n=5) and lists of on-site equipment (n=3). Clear communication with farmers from EnSave and the program about what the audit includes (e.g., not residential buildings or personal vehicles was also mentioned by auditors (n=4) as well as increasing the comprehensive audit fee to encompass the needs of farmers and the depth of required reporting and a better balance between reporting demands and revisions and the fee allocated to achieve this (n=4).

Auditors also reported desiring more timely communication from EnSave (n=3); they explained that EnSave does not ask auditors to work on projects but sends emails with the assumption that auditors will see the project and execute it. This process can lead to missed communications and, along with lacking upfront information, also does not allow for the auditor to plan for the assignment. Similarly, auditors report that streamlined report requirements and reviews from EnSave (n=3) would improve the program from the auditor's side as well as allowing faster delivery of reports to participants, increasing their satisfaction and the usability of the report. Specifically, aspects that could require further investigation include adding to the report tables of typical farm types with activity names laid out for each, equipment inventories and baseline uses, standardized calculators because each auditor has their own process which can lead to EnSave asking for adjustments and EnSave should communicate any report template-related changes quickly to ensure and consistent reporting requirements and swifter EnSave reviews with fewer necessary changes. Finally, auditors reported that NYSERDA could conduct more marketing of the program (n=2), including via billboards, flyers, and television ads to create more industry hype around the program and around rural and farm electrification so that farmers identify themselves as someone in need of this program.

2.2.5 Effective Communications

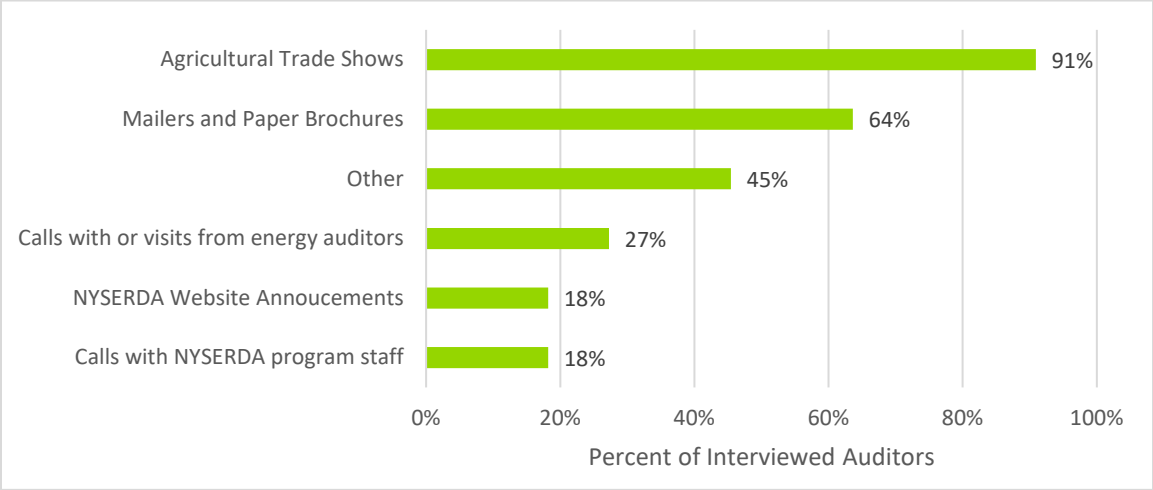
When asked about the most effective methods of communicating information about the AEAP to agricultural producers and farmers, auditors reported agricultural trade shows (91%) as the most impactful method with mailers and paper brochures (64%) as the second most impactful, as shown in Figure 14.

[50] How could NYSERDA improve this information?; What action(s) could NYSERDA take to improve the audit program or its processes, including audit reports given to participants?

Figure 14. Effective Communication Methods (n=11) [51]

Auditors reported agricultural trade shows as the most effective means of communicating with farmers and agricultural producers about the AEAP.

Source: Market Evaluation Team



Auditors (n=5) also offered suggestions for other effective contact methods such as collaborating with agricultural suppliers, farm supply stores, and utilities to share information about the program and its ability to reduce 'utility bills' rather than to save 'energy'. Auditors also reported effective community- and sector-inclined methods of communication such as working with agriculture cooperatives (n=2) and advertising the program in community newsletters (n=3) in rural areas with numerous farms. Finally, one auditor offered another method of in-person contact through engagement at regional farmer meetings, citing specifically a well-attended monthly beef farmer meeting where they discuss challenges and opportunities within the commodity sector.[52,53]

2.2.6 Energy Best Practices for Agriculture

NYSERDA contracted two groups to complete Best Practices resources for the program—EnSave and Cornell Cooperative Extension (CCE)—and listed Best Practices resources on the NYSERDA Energy Best Practices for Agriculture webpage, which auditors were interviewed about their awareness[54] and use of. Most auditors (n=8; 73%) had heard of the Best Practices for

[51] Please indicate the top three ways that you think NYSERDA should share and communicate information about the Agricultural Audits program with agricultural producers and farmers.

[52] Please indicate the top three ways that you think NYSERDA should share and communicate information about the Agricultural Audits program with agricultural producers and farmers.

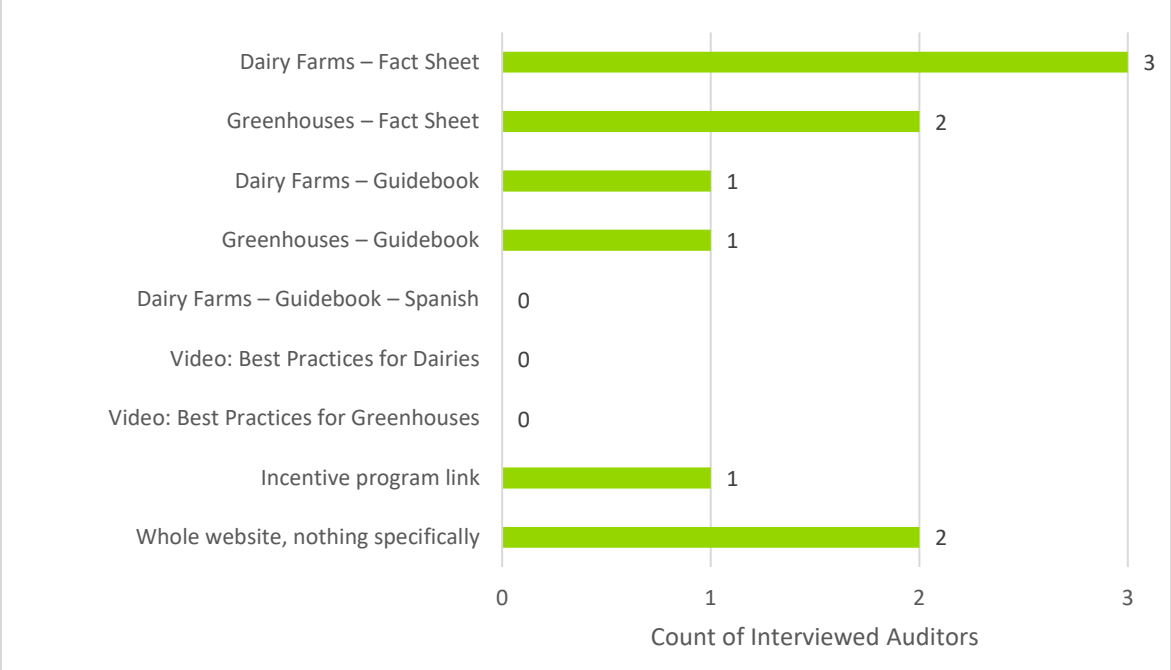
[53] What can be done to improve NYSERDA's communications methods mentioned above?

[54] Have you heard of NYSERDA's website Energy Best Practices for Agriculture?

Agriculture website and five (45%) reported sharing the site with program participants[55] including one who shared the general site with a maple syrup farmer, one auditor who shared the site with 15 to 20 Audit program participants, and one who shared the site at farm shows. One auditor also reported sharing the site with their nine staff members. Additionally, auditors reported sharing the site outside of the program with educators teaching environmental classes and through organizations like the CCE.[56] The auditors' responses reveal awareness of the NYSERDA Best Practices website that was created by EnSave which has only greenhouse and dairy-related best practices, but do not have awareness of the Best Practices website developed by CCE which includes best practices for many other commodities such as maple syrup.

As shown in Figure 15, auditors were more most likely to report sharing[57] fact sheets (n=5) and dairy-related information (n=4) when sharing Best Practices; zero auditors reported sharing Best Practices videos and two reported sharing the website in general.

Figure 15. NYSERDA Best Practices Shared with Farmers (n=5)
Auditors were most likely to share Dairy-related information and fact sheets instead of guidebooks or videos.
Source: Market Evaluation Team



[55] Did you share NYSERDA's website Energy Best Practices for Agriculture with Audit Program participants?; With how many Audit program participants have you shared Best Practices information?

[56] Have you shared Best Practices with anyone outside of the Audit program?; If yes, who? How many?

[57] Which of the Energy Best Practices for Agriculture have you informed farmers or agricultural producers about? Select all that apply.

When asked which aspects of the Best Practices on the NYSERDA Best Practices website were the most helpful to share[58], auditors reported energy-efficient technologies (100%) and access to state, federal, and utility incentive programs as most helpful (80%). Two auditors reported using the Beneficial Electrification Calculator, specifically using of the Engine to Electric Motor, Electric Tractor, and Heat Pump Space Heater calculators. One auditor also reported using the Water Heater calculator.[59]

When asked which technologies should be added to the Beneficial Electrification Calculator to assist farmers and agriculture facilities, auditors reported access to standard calculators, with the caveat that customized equipment frequently occurs at agriculture sites, and recommending information about fuel switching, including a heat pump calculator.[60]

2.2.7 Climate Resiliency

Auditors were asked about their interactions with Audit participants around climate resiliency including if they have provided information or recommendations to agricultural sites to help them to be more resilient to environmental events; only two of 11 interviewed auditors reported discussing climate resiliency with farmers.[61] Those auditors who do discuss climate resiliency with farmers discuss electrification, solar, batteries, getting equipment and generators off the ground, options to make and store their own power (renewables and batteries) but nothing about flooding. One auditor reported discussing options like cover crops to save soil from wind and flood erosion which can also save energy, though this does not appear explicitly in audit reports.[62]

Auditors were asked about the types of resources that NYSERDA could provide to better inform farmers and agricultural producers about site resiliency to extreme weather and environmental events.[63] Auditors reported that promoting, and helping farmers to understand gas-powered equipment as a power source during a grid disruption, encouraging local-well installation in case of drought, and developing or working with other organizations to develop or to disseminate

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[58] Which aspects of the Best Practices did you find most helpful to share? Select all that apply.

[59] You reported that you found the Beneficial Electrification Calculator helpful in the previous question. Which calculators did you use within the tool? Select all that apply.

[60] Are there educational or informational opportunities that NYSERDA could include to improve Energy Best Practices to enhance that knowledge? Please specify topics for inclusion into Best Practices videos and factsheets.

[61] Have you provided information or recommendations to agricultural sites to help them prepare to be more resilient to environmental events, such as measures that improve a site's ability to endure extreme heat or cold events or flooding?

[62] Which measures have you recommended or informed farmers and/or agricultural producers about that improve a site's ability to endure environmental disasters and/or extreme weather events?

[63] What types of resources can NYSERDA provide to better inform farmers/agricultural producers about site resiliency to extreme weather or environmental events?

information on direct utility assistance for farmers. Additionally, auditors reported that adding a climate resiliency section to the audit report with this kind of information and to make recommendations such as getting generators or off-grid equipment would enhance farmers' information about site resiliency. Auditors also reported that NYSERDA could also inform farmers about solar and wind systems as aspects of a climate resilient site because many of these facilities are not connected to a natural gas pipeline and often use on-site propane or bulk fuels.

3 Findings and Recommendations

This section presents high-level findings and recommendations from MU2 of NYSERDA's Agriculture Initiatives which examined only the AEAP.

FINDING 1: Auditors (n=4) consider the audit fee ($3,000) too low to provide a comprehensive assessment for the farmer. Additionally, farmers frequently ask to add measures or calculations to the report which requires more time and effort to conduct the audit.

RECOMMENDATION 1: NYSERDA should seek to integrate enhancement (i.e., add-on) requests within the audit and fee process to address additional project complexity.

NYSERDA Response to Recommendation: Implemented. Agriculture Energy Audit Program (AEAP) auditors may request an audit be upgraded from a Comprehensive to a Targeted Audit. This change in audit type will allow the auditor to present a scope and increased budget (up to $6,000) to address add-ons or additional complexity.

FINDING 2: NYSERDA, together with EnSave and Cornell Cooperative Extension, has published Energy Best Practices for Agriculture, a compilation of tools and resources that farms across New York State can use to aid in making informed decisions that will help save money, boost productivity, and improve operations. However, expanded use of the NYSERDA Energy Best Practices in Agriculture may be hampered by a general lack of awareness by audit participants (n=39) and auditors (n=3) and a limited display of commodity types on the NYSERDA website.

RECOMMENDATION 2: NYSERDA should expand communications for both the NYSERDA Energy Best Practices in Agriculture website built by EnSave and the website created by CCE by including links to these best practices websites in email communications and on audit reports, as well as expanding the commodities and topics offered.

NYSERDA Response to Recommendation: Implemented. Topics offered on the NYSERDA Energy Best Practices website now represent all commodities including maple, crops and vegetables, grain, orchards and vineyards, livestock, and poultry and eggs and are displayed with clearly visible resource links.

FINDING 3: Auditors (n=3) reported not receiving enough information ahead of site visits, such as utility bills, farm design drawings, farmers' goals of the audit, if farmers desire adding new

technologies, or if farmers will use the audit to apply for grants and other incentives, which require auditors to conduct additional legwork to obtain necessary information and can hamper the auditor's timely completion of the audit and report. These obstacles are echoed in survey responses which reported that some participants (n=4) receive the report too late to be useful.

RECOMMENDATION 3: NYSERDA should improve the application by including check boxes that ask if the farmer expects to use the audit results for a grant application, their goals of the audit (adding new technologies, assessing recently built structures or new processes, etc.), and a reminder that promptly providing utility bills and farm design drawings will speed up their audit process and report receipt.

NYSERDA Response to Recommendation: Pending. These questions/notices are given when EnSave makes a welcome call to the applicant. Potentially, these questions/notices could be placed in the welcome letter for greater exposure.

FINDING 4: Survey respondents and auditors reported mailers and paper brochures (n=21, n=7) and agricultural trade shows (n=19, n=10) as the most effective methods for learning about the AEAP. Auditors (n=5) also noted other, successful methods for communicating information and updates about the AEAP to agricultural producers and farmers, including collaborating with agricultural suppliers and farm supply stores; partnerships with utilities and agriculture cooperatives; advertising the program in community newsletters in rural areas; and attending regional farmer meetings to share information about the program.

RECOMMENDATION 4: NYSERDA should assess the dissemination and publicizing of the AEAP program materials and participants' experiences. Such an assessment will highlight the varying effectiveness of methods and channels (e.g., mailers and paper brochures, agricultural trade shows, regional farmer meetings, etc.) to communicate program information, reach the specific target audience, and have the intended outcomes.

NYSERDA Response to Recommendation: Implemented. The use of paper brochures, agricultural trade show and meetings, community newsletters, and regional farm meetings as outreach methods to communicate AEAP program information and experiences to potential program participants are part of the AEAP outreach strategy. Phone outreach has occurred to agriculture suppliers and supply stores and hard-copy information is provided when appropriate. NYSERDA and EnSave will continue to investigate the most impactful approaches to use in promoting AEAP.

FINDING 5: Survey respondents (n=7) want more sharing of funding opportunities and a grants and incentives timeline to help farmers understand how—and when—to leverage an audit for a grant or incentive.

RECOMMENDATION 5: NYSERDA and EnSave should develop distinct incentives opportunity links for the AEAP website and have initial communications with farmers regarding their desire to potentially implement audit recommendations using grant and incentive programs. This will assist farmers and auditors in understanding where and how audit reports will be used to obtain financing assistance.

NYSERDA Response to Recommendation: Implemented. A list of incentive programs for NYS farms has been created and is included with every audit delivered and is posted on the NYSERDA website which is linked on the report cover letter. In addition, EnSave now asks all audit participants, upon receiving an application, if they plan on using the audit as part of a grant application and discuss with the participant the timeline to consider or other necessary information. This information is passed on to the FlexTech Consultant.

4 Methods

This section provides a high-level overview of the primary data collection methods and indirect impacts methods. Additional details are available in the appendices.

4.1 Primary Data Collection Methods

The Market Evaluation Team collected data with participants and members through a survey and interview. This section outlines the data collection method, the respondent profile, and the analysis methods. The appendices contain additional details on the data collection efforts.

Appendix B provides the final Agriculture Energy Audit Program 2021 Participant Survey Instrument
Appendix C provides the final Agriculture Energy Audit Program 2020 Respondent Survey Instrument
Appendix D provides the final Agriculture Energy Audit Program 2020 Non-Respondent Survey Instrument
Appendix E provides the final Agriculture Energy Audit Program Survey Instrument Utility Questions Only
Appendix F provides the final Energy Audit Program Contractor and Best Practices Interview Guide
Appendix G provides the disposition reports for the Agriculture Energy Audit Program Surveys

4.1.1 Agriculture Energy Audit Program participant surveys

The Market Evaluation Team completed 56 surveys with Audit program participants, identified as farms that had participated in AEAP between January 2020 and December 2021.

4.1.1.1 ***Survey summary***

NYSERDA Agriculture Energy Audits Program participants were invited to participate in the surveys via email along with five follow-up reminder emails and follow-up phone calls for the full sample of participants. The Market Evaluation Team contacted 140 NYSERDA Agriculture Energy Audit participants from 2020 to 2021 to participate in a Qualtrics survey to give feedback on the NYSERDA Agriculture Energy Audit Program. Three main surveys were constructed for this evaluation effort with two directed at 2020 audit participants –one for those who did not respond to the MU1 survey (non-respondents) and one for those who responded to the MU1 survey—to capture additional installed technologies and answer questions on Best Practices and climate resiliency and one directed at 2021 audit participants for the continuation of evaluation of the NYSERDA Agriculture Energy Audit Program. Participants were also invited to participate in

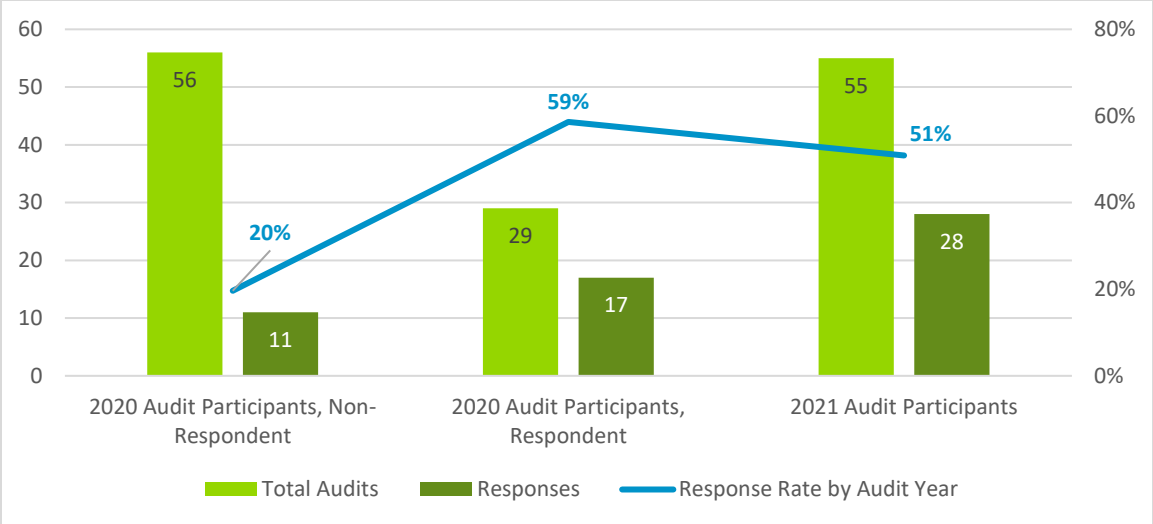
a utility account information follow-up survey that was fielded for 12 weeks between December 2023 and March 2024. The utility account information was used by the Impact Evaluation Team and is not reported in this report.

Participants were offered $25 for the completion of a survey and an additional $25 incentive for sharing their utility account information. Respondents completed the survey online and over the phone, which comprised a significant portion – 89% – of all completed surveys. The Market Evaluation Team fielded this survey for 12 weeks between November 2023 and February 2024 and achieved a response rate of 40% with approximately 39% of survey respondents offering utility information between the original survey and the utility account information follow-up survey. Follow-up phone calls and emails were also utilized to solicit the completion of the utility account information that most survey respondents (45%) reported willingness to share.

4.1.1.2 ***Participant profiles***

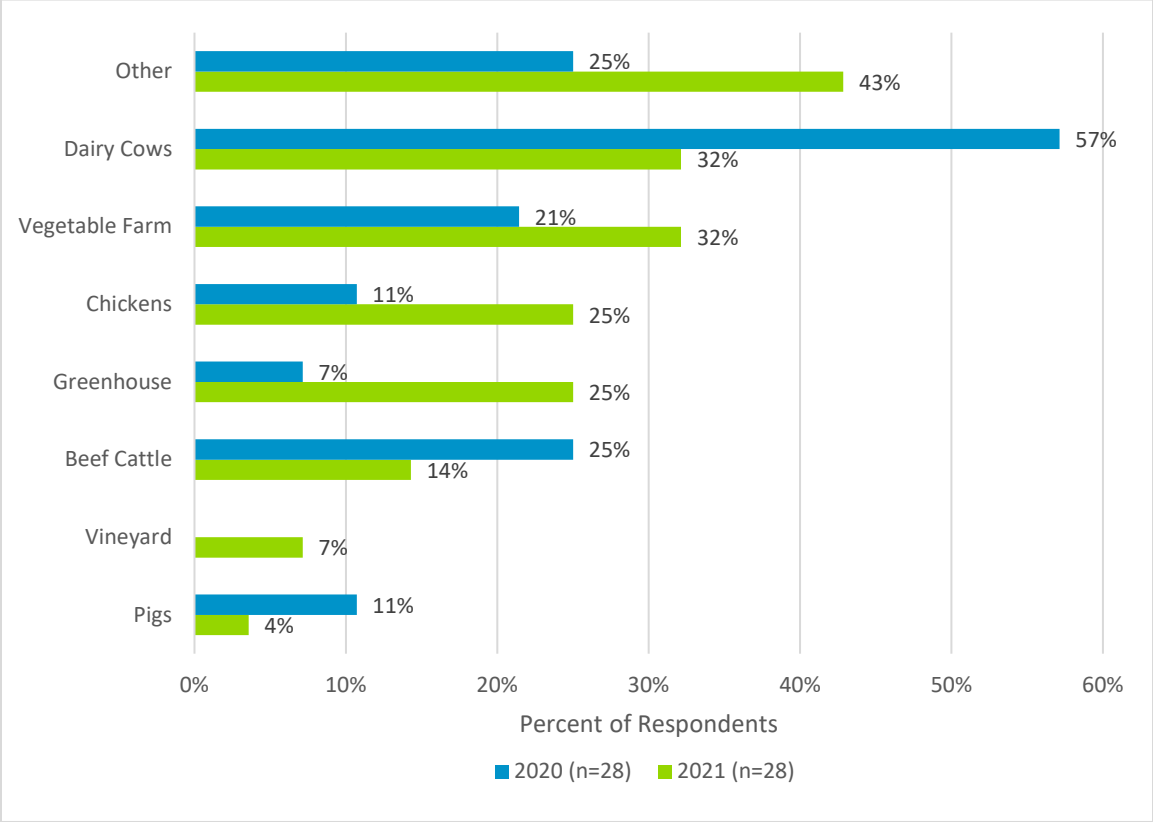
As show in Figure 16, 85 audits were conducted in 2020 and 55 were conducted in 2021, both audit years were impacted by the COVID-19 pandemic and farmer willingness to allow auditors on-site. The 2020 audit participants group was split between respondents to last year's MU1 survey and non-respondents given that enough utility information and responses were not collected for those groups during the MU1 evaluation. In this MU2 survey effort, 2021 respondents achieved the highest response rate (59%).

Figure 16. Survey Responses by Audit Year (n=56)
Both 2020 respondent survey and the 2021 surveys achieved response rates of more than half.
Source: Market Evaluation Team



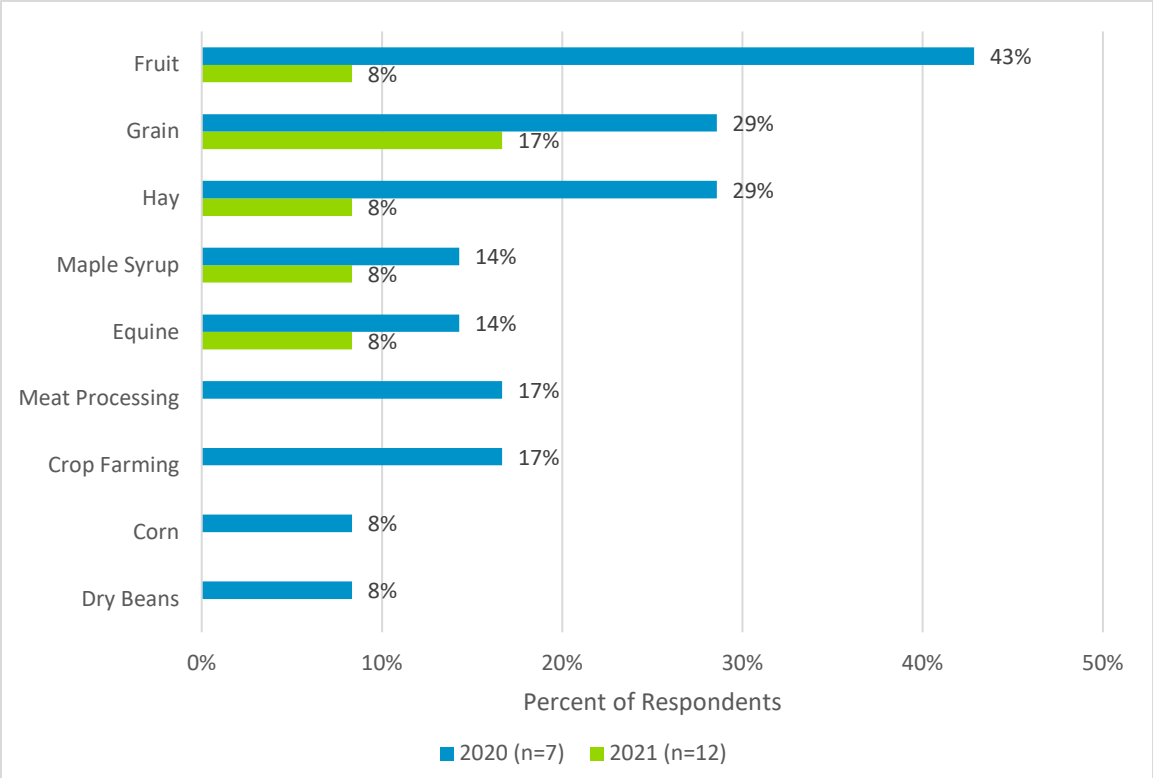
As Figure 17 shows, dairy cows and 'Other' were the most reported commodity by survey respondents. More than half of 2020 respondents reported dairy cows as their commodity, 22 points higher than 'Other' or beef cattle. More than one-third of 2021 respondents made up "Other', 11 points higher than dairy cows or vegetable farms.

Figure 17. Participant Commodities, (n=56)
Respondents gave 95 individual commodity responses, 2020 and 2021 combined, as to the commodities produced at their operation; 'Other', dairy cows, and vegetable farms were the most frequently reported.
Source: Market Evaluation Team



Fruit, grain, hay, and maple syrup were the most frequently reported 'Other' commodities. In Figure 18. it is identified that 2020 respondents were mostly likely to report fruit production (43%), at a frequency 14 points greater than grain (29%) and hay (29%). 2021 respondents who produce 'Other' commodities were most likely to report producing maple syrup (25%), at least 8 points more likely than other commodities.

Figure 18. Participant Commodities – Other (n=19)[64]
Fruit, grain, and hay were the most common reported 'Other' commodities.
Source: Market Evaluation Team



4.1.2 FlexTech Auditor Interviews

NYSERDA uses auditors from their FlexTech Consultant pool to conduct focused and comprehensive farm audits for the AEAP participants. EnSave, as the AEAP implementation contractor, conducts review of the work done and audits provided. As part of MU2, Guidehouse interviewed energy auditors to understand auditor experiences in the program, challenges and barriers to farmer participation, and areas for improvement.

4.1.2.1 Interview Summary

The Market Evaluation Team contacted 27 FlexTech auditors via email to participate in an interview. The Market Evaluation Team conducted 11 interviews, a 41% response rate, with 13 FlexTech auditors over video and phone calls that were conducted over five weeks between late February 2024 and April 2024. The Market Evaluation Team used MS Forms software to collect information from 11 semi-structured interviews using one interviewer and one data collector.

[64] Total responses to the question: Which of the following does your agricultural operation located at [PIPE IN ADDRESS FROM FEAT] have?

*4.1.2.2 **Analysis Summary***

The Market Evaluation Team conducted thematic analysis on qualitative question responses to identify common themes and report the number of respondents who used similar themes where applicable. The team analyzed quantitative question responses for frequency of identical response and converted to a percent of total respondents or responses. The team created charts and tables using MS Excel for qualitative responses that were best represented in a graphical format.

4.2 Analysis

The Market Evaluation Team fielded the surveys using Qualtrics and analyzed survey data in IBM SPSS statistical software (SPSS).[65] The team cleaned the data prior to analysis, including recharacterizing participant commodities to align with survey responses as necessary. The team used SPSS to filter the data to analyze only survey responses with all required completed by eligible respondents (i.e., not screened out due to non-participation, unfamiliarity with the program).

The Market Evaluation Team ran crosstabulations to understand and analyze the relationships and intersections of datapoints within the survey, such as differences in frequencies of responses across farm types and audit years. The team ran a Paired Samples Correlation T-test to test for statistical significance in SPSS. Survey results were found to be statistically significant using a 2-tailed significance test. A p-value or probability value describes how likely it is that data would have occurred by random chance. Results are statistically significant with a p-value of .000 for 2021 responses and a p-value of .002 for 2020 non-respondent survey responses. A p-value of 0.002 means that there is a 0.2% probability that the results are random.

The Market Evaluation Team conducted measure characterization across the measures installed and uninstalled. The team ran statistical analysis for frequencies and crosstabulations as well as calculating statistical significance on 28 to 48[66] substantive survey questions. The team used thematic analysis in MS Excel to analyze and quantify open -ended text responses, calculating frequencies of thematic responses where applicable, and reporting themes brought up by multiple respondents.

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[65] SPSS is the acronym for Statistical Package for the Social Sciences. Research agencies commonly use SPSS to analyze survey data.

[66] The number of questions differed between 2020 respondent survey (28 questions) and 2020 non-respondent and 2021 survey (48 questions).