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Identifying Opportunities and Priorities for Energy Extension

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Abstract. An online survey was administered to all educators and specialists within the University of Maryland Extension to assess client-driven opportunities and priorities for energy-related programming, while in-service training evaluations were used to further assess programmatic needs. Results indicate the need for information related to energy conservation and clean energy technology for agricultural and residential clientele. Primary barriers were perceived as the insufficient understanding and high costs associated with clean energy, while experiential participation and firsthand observation were reported as preferred learning methods. These results provide an understanding of how energy-related programming can expand the role and relevancy of Extension.

INTRODUCTION

While recent publications have emphasized the growing interest and continued relevance of energy-related programming within Extension (Bull et al., 2004; Geiger, 2014; Hamlen, 2012; Romich, 2015; Thomas & Brain, 2016; Wade, 2015; WEDA, 2008; Zoller & Romich, 2020), specific educational opportunities and priorities must be clearly identified before research-based solutions can be provided. The relevance for energy-related programming is quickly growing in Maryland considering that over 500,000 households in the state are faced with unaffordable home energy burdens (Fisher, Sheehan & Colton Public Finance and General Economics, 2017) and up to 16% or more of agricultural production costs are expended on fuel and electricity (Hitaj & Suttles, 2016; Sands et al., 2011; U.S. Department of Agriculture Economic Research Service [USDA ERS], 2020).

Energy efficiency and renewable energy systems, in particular, are receiving significant attention in light of increased energy consumption, high energy costs, and resulting financial strain that many are facing in the agricultural and residential sectors. Energy-related topics are also becoming high priorities due to various economic, legislative, and environmental drivers. Like many states, Maryland has implemented ambitious energy policies, including its Renewable Portfolio Standard (RPS), which requires 50% of the state's electricity to be generated from renewable sources by 2030 and sets further goals for 100% renewable energy and zero carbon emissions by 2040 (Dance, 2019; Maryland Public Service Commission, 2021; Maryland Senate Bill 516, 2019; Spector, 2019).

While the Extension system is uniquely poised to deliver energy-related education addressing these challenges, without the pretext of selling a product or service, limited resources have generally been allocated to energy-related education, with only 22 states having dedicated energy staff (Baye et al., 2018). To address this growing demand for energy-related resources, a mixed-methods needs assessment was conducted to 1) identify Maryland's current engagement and interest in energy-related outreach; 2) identify educational concerns and barriers related to energy programming; and 3) determine the preferred methods for engaging with stakeholders on energy-related programming. As discussed further in this report, the exploratory approach of this needs assessment spanned a wide array of energy topics, including the conservation of traditional energy resources (including fossil fuels), as well as various clean energy technologies.

The results of this study support the expanding role and relevance of Extension by identifying specific opportunities and priorities for energy-related programming. Results were also indicative of the growing public interest in clean energy resources, a trend that may be partially attributed to aforementioned federal and state policies. With that said, any attention given to clean energy technologies within this report is simply given in response to the demand-driven results gathered through the analysis of this needs assessment. While the opportunities and priorities identified in this study directly support energy-related programming in Maryland, the findings are expected to have broader applications for Extension programs in other states.

METHODS AND MATERIALS

An online survey was sent to all Maryland Extension educators and specialists beginning in October 2018 through Qualtrics Survey Software to assess the interest and need for energy-related outreach, education, and programming. A total of 283 eligible educators and specialists received the survey instrument via email. Participants were eligible if they worked for Maryland Extension in any field of programming, outreach, or education. Those who received the survey instrument included those working in the principal areas of agricultural and food systems (33.2%), family health and consumer sciences (27.0%), environment and natural resources (14.5%), youth development (14.5%), and other fields (10.8%). Due to the limited amount of literature on energy-related programming within Extension, the survey used an exploratory approach to identify specific educational needs.

The survey helped in 1) determining Extension's current engagement in energy-related outreach; 2) identifying educational opportunities and barriers related to energy conservation and clean energy technology; and 3) assessing the level of interest and preferred methods for engaging in energy-related education and programming. Educators and specialists were surveyed in this study in order to identify current and potential integration of energy-related outreach into Maryland Extension programs.

The online survey was designed around Dillman's tailored design method (Dillman, 2011) with minor modifications. Participants were electronically sent a pre-notice letter, two follow-up reminder letters, and a post-completion thank-you note (with approval from the University of Maryland Institutional Review Board). The online survey consisted of 11 content-specific questions regarding energy conservation and clean energy technology. Two additional questions were designed to collect brief demographic information, including contact information and the geographic region serviced by the survey respondents. Of the survey's 13 questions, two involved a 4-point Likert agreement (forced choice even-point) scale for response choices. The survey also included ranked-order and multiple-choice question types.

To further identify and assess the reported need for energy programming, a one-day, in-service training program was conducted in October 2019 with 32 participants. Participation represented a cross-section of Maryland Extension working in the areas of agriculture and food systems (33%), environment and natural resources (28%), agricultural, legal, and environmental resource economics (9%), and family health and consumer sciences (5%), with the remaining participants working within government and other services (26%). In-service training sessions were presented by speakers from 18 organizations, including the utilities and energy industry (33%), academia (28%), government and non-profit groups (28%), and legal and financial groups (11%). Sessions addressed the state energy market, energy efficiency and conservation, energy technologies (e.g., biomass, geothermal, solar, anaerobic digestion), and project finance and development. In-service impacts were reported through a post-workshop evaluation at the conclusion of the program. The post-workshop evaluation consisted of five content-specific questions regarding energy conservation and clean energy technology. Question formats included ranked-order and multiple-choice types. All additional questions on the post-workshop survey were designed to collect brief demographic information. Results of both survey instruments were analyzed using the Microsoft Excel software package.

RESULTS AND DISCUSSION

The response rates for the online survey and the in-service training survey were 34.6% (n=98) and 87.5% (n=28), respectively. Several common programmatic themes related to energy conservation and clean energy technology were identified and are discussed here.

STATUS

The results of the online survey indicated a significant need for energy programming within Maryland with respondents expressing a demand for energy-related information directed at public audiences within the state (n=71, 72.4%), as well as internal audiences within Maryland (n=62, 63.3%). In-service evaluations further indicated intentions to help others implement energy measures (n=22; 78.6%) and to incorporate energy into current Maryland Extension programming (n=18, 64.3%). The motivations for these priority initiatives are summarized in Table 1. These results support similar findings that have reported the need for increased energy programming in Extension (Thomas & Brain, 2016).

Maryland Extension educators and specialists working in the area of agriculture and Food systems (n=24, 36.4%) expressed the greatest interest in collaborating on energy-related programming, followed by those working in the areas of environmental and natural resources (n=16, 24.4%) and 4-H (n=11, 16.7%). While results indicated that Maryland Extension is receiving a growing number of questions from the public on energy-related topics, only some educators and specialists reported current engagement with energy conservation (n=10, 16.1%) and/or clean energy technology (n=9, 13.8%). The most common questions received by Maryland Extension educators and specialists regarding energy conservation and clean energy technology are shown

Table 1. Motivations for Implementing Energy-Related Programming as Reported on the Post-in-Service Evaluation

Statement	Rating			Stats	
	1	2	3	No.	Mean
Want to *educate others* through energy programs	8 (33.3%)	14 (58.3%)	2 (8.3%)	24	1.75
Want to *save money* through energy efficiency	12 (46.2%)	6 (23.1%)	8 (30.8%)	26	1.85
Want to support *energy neutrality*	10 (38.5%)	4 (15.4%)	12 (46.2%)	26	2.08

Note. 1 = most important to 3 = least important motivation. The reported percentages may not sum to 100% due to independent rounding.

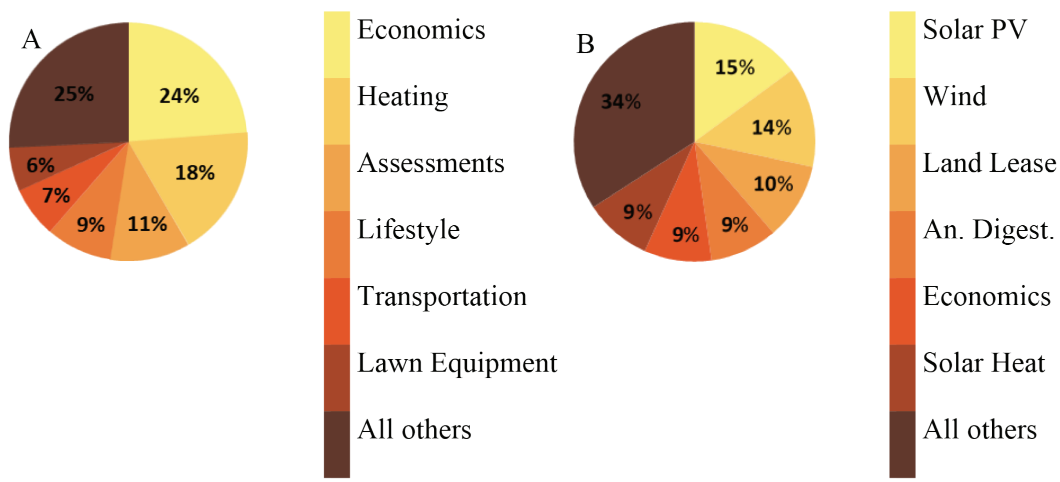

Figure 1. Types of questions currently received by Maryland Extension educators and specialists related to A) energy conservation (n=127 responses); and B) clean energy technology (n=155 responses) based on the responses to the online survey.

in Figure 1. While topics mentioned less frequently should be considered in developing energy-related programming, they are not common enough to support the creation of prescriptive measures at this point in time.

Farmers and ranchers account for a significant portion (n=29, 26.9%) of clientele in Maryland that are currently seeking energy-related information from Extension; residential clientele in rural (n=28, 25.9%) and urban (n=17, 15.7%) regions of the state also represent interested audiences (see Figure 2). Clientele groups mentioned less often include those from private enterprises (e.g., business owners, foresters), volunteer groups (e.g., Master Gardeners, LEAD Maryland Fellows), and youth-oriented groups (e.g., 4-H, teachers). These results suggest that Maryland farmers and residents are already exploring energy-related opportunities within organizations that they are familiar with (i.e., Maryland Extension).

Additionally, Maryland Extension clientele were perceived to be uninformed in regard to several energy-related topics, albeit to varying degrees (Table 2). The most significant area of concern is that 42.4% of clientele were perceived to be 'Not at all informed' in terms of 'Credible sources of information' (M=0.65). Results further indicated that training in clean energy technology (n=63, 32.6%); decision-making tools (n=63, 32.6%); and energy efficiency upgrades (n=62, 32.1%) would enhance programming efforts within Extension. Other training opportunities related to land use issues, energy-efficient landscaping, and/or community-based energy co-ops were also noted in the online survey and in-service evaluations. Once again, these results indicate a growing need for educational programming and resources in the state pertaining to various energy-related topics.

Table 2. Perceived Level of Understanding for Maryland Extension's Clientele Regarding Various Energy-Related Topics Based on the Responses to the Online Survey

Statement	Not at all Informed	Slightly Informed	Informed	Very Informed	No.	Mean
Energy conservation and efficiency	13 (20%)	38 (58%)	13 (20%)	1 (2%)	65	1.03
Clean energy incentives & rebates	21 (32%)	40 (62%)	4 (6%)	0 (0%)	65	0.74
Credible sources of energy information	28 (42%)	33 (50%)	5 (8%)	0 (0%)	66	0.65

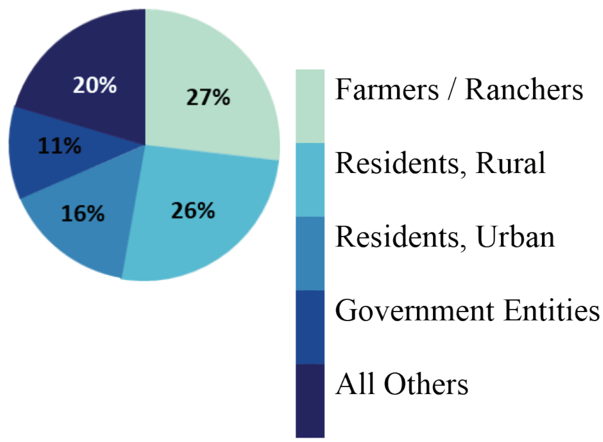

Figure 2. Clientele types currently seeking energy-related information from Maryland Extension based on the responses to the online survey (n=108).

BARRIERS

An immediate way for Extension to provide meaningful energy support to clientele and to find a niche among existing energy organizations within the region is to address the respondents' perceived barriers to clean energy development. The topics reported in Table 3 are those that Maryland Extension employees deemed as the greatest concerns for their clientele. High investment costs for installation (M=2.21) were perceived as the greatest concern for Maryland Extension clientele related to clean energy with 95% (n=58) of respondents agreeing or strongly agreeing with this sentiment. This finding supports previous reports on cost as a principal driver and barrier related to renewable energy decisions (Thomas & Brain, 2016).

As indicated in Table 4, an insufficient understanding of technology (M=2.09) was perceived as the most significant barrier for clientele to transition to clean energy sources, followed by a lack of financial resources (M=2.12). Similar challenges have been reported elsewhere; a lack of knowledge regarding renewable energy systems is commonly cited as an issue (Amin, 2013; Kariuki, 2018; Stigka et al., 2014), and high start-up costs have been reported as a challenging adoption barrier for renewable energy systems (Fratanduono et al., 2013; International Economic Development Council, 2011; Reddy & Painuly, 2004; Thomas & Brain, 2016).

Responses to the online survey were divided into rural and urban-based subgroups to determine the effect of geographic location on these perceived barriers. In this case, the geographic subgroups were based on Maryland Code Section 2–207 (2018). Maryland Extension educators housed in urban and rural counties of the state represented 71.2% and 28.9% of the state population, respectively. A Pearson's Chi-Square test comparing these rural and urban-based subgroups was statistically significant at the $p \leq 0.05$ level for several concerns and barriers, indicating diverging attitudes toward clean energy.

Urban-based locations were perceived to be less suitable for implementing clean energy systems (70.4%) than rural locations (62.5%). This difference may be attributed in part to the perception that rural areas have more land availability for

Table 3. Perceived Concerns for Maryland Extension's Clientele Regarding Clean Energy Based on Responses to the Online Survey

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree	No.	Mean
Upfront installation is too expensive	0 (0%)	3 (5%)	42 (69%)	16 (26%)	2.21	61
Transition process is too complex	1 (2%)	12 (20%)	41 (68%)	6 (10%)	1.87	60
Location is too unsuitable	1 (2%)	20 (34%)	34 (59%)	3 (5%)	1.67	58
Technologies are too risky	2 (3%)	24 (40%)	33 (55%)	1 (2%)	1.55	60

Note. The reported percentages may not sum to 100% due to independent rounding. Clean energy is defined in accordance with the U.S. Department of Energy (n.d.).

Table 4. Perceived Barriers for Maryland Extension's Clientele Related to Transitions Toward Clean Energy Based on Responses to the Online Survey

Barrier Statement	Rating						Stats	
	1	2	3	4	5	6	No.	M
Lack of understanding of technology	24 (36%)	22 (33%)	13 (20%)	4 (6%)	3 (5%)	0 (0%)	66	2.09
Lack of financial resources	29 (44%)	14 (21%)	12 (18%)	9 (14%)	1 (2%)	1 (2%)	66	2.12
Lack of access to the technology	4 (6%)	18 (27%)	23 (35%)	17 (26%)	4 (6%)	0 (0%)	66	2.98
Lack of clean energy sources	0 (0%)	6 (9%)	10 (15%)	26 (39%)	23 (35%)	1 (2%)	66	4.05
Opposed to clean energy sources	6 (9%)	4 (6%)	6 (9%)	10 (15%)	33 (50%)	7 (11%)	66	4.23
Other (please specify)	3 (5%)	2 (3%)	2 (3%)	0 (0%)	2 (3%)	57 (86%)	66	5.53

Note. 1 = most significant barrier to 6 = least significant barrier. The reported percentages may not sum to 100% due to independent rounding.

the installation of energy systems and/or the desire to have energy systems out of sight for those located in urban settings. On the other hand, rural regions reported more significant barriers to clean energy, including a 31.8% higher perception of having insufficient financial resources, as well as a 24.7% lower understanding of various energy technologies. Energy-related programming within Extension should take these factors into account.

OPPORTUNITIES

Educational methods involving experiential participation and firsthand observation were reported as the preferred learning formats. In fact, the preferred means for engaging with, and disseminating, energy-related information and programming was reported as 'in-service training' (M=2.48) as indicated in Table 5. Likewise, the preferred delivery methods for educational programming (see Figure 3) were identified as energy conservation workshops (n=65, 27.4%), clean energy technology workshops (n=62, 26.2%), and technology and site visits (n=47, 19.8%). Somewhat negligible differences were observed for all other reported types of educational programming, including electronic and printed delivery formats. In-service evaluations further indicated a preference for attending workshops or seminars in person

Table 5. Preferred Methods for Disseminating Energy-Related Information as Reported on the Online Survey

Dissemination Method	Rating						Stats	
	1	2	3	4	5	6	No.	M
In-Service Training	29 (43%)	10 (15%)	10 (15%)	4 (6%)	13 (19%)	1 (1%)	67	2.48
Webinar	18 (27%)	14 (21%)	10 (15%)	9 (13%)	15 (22%)	1 (1%)	67	2.88
Publication	8 (12%)	22 (33%)	13 (19%)	13 (19%)	11 (16%)	0 (0%)	67	2.96
Web Material	9 (13%)	12 (18%)	18 (27%)	13 (19%)	15 (22%)	0 (0%)	67	3.19
Video	3 (9%)	9 (6%)	15 (9%)	27 (15%)	13 (50%)	0 (11%)	67	3.57
Other	0 (0%)	0 (0%)	1 (1%)	1 (1%)	0 (0%)	65 (97%)	67	5.93

Note. 1 = greatest need to 6 = least need. The reported percentages may not sum to 100% due to independent rounding.

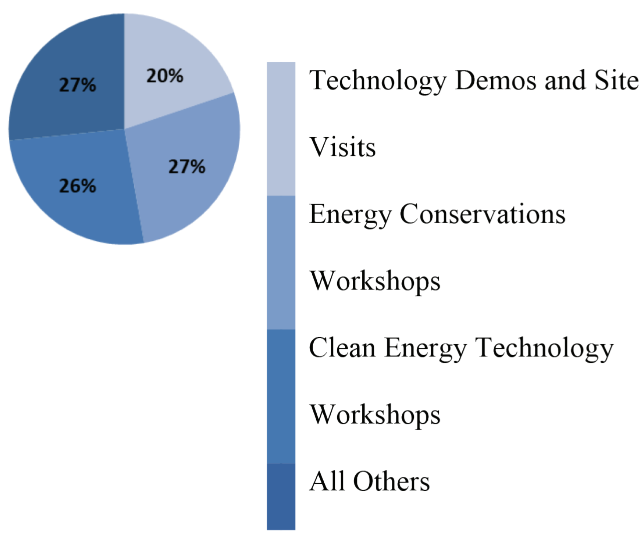

Figure 3. Preferred types of educational programming as reported on the online survey (n= 237).

(29.0%) rather than in the form of online programming (18.4%).

CONCLUSION

A needs assessment was conducted to better understand the opportunities and barriers for implementing energy-related programming through Maryland Extension. An online survey was administered to all Maryland Extension educators and specialists to assess client-driven needs for energy-related programming. Programming needs were further assessed through a post-workshop evaluation conducted at the end of a one-day, energy-related, in-service training program. By surveying educators and specialists, this study was able to reach a wide diversity of audiences while identifying specific ways to incorporate energy-related outreach into Extension programs. Additional studies conducted directly with Extension clientele may be necessary, however, to further understand and design effective outreach since the current study is limited to the perceptions held by Extension educators and specialists.

The online survey achieved a 34.6% response rate (n=98), while 32 in-service participants helped to further identify and address perceived barriers and opportunities associated with energy programming in Extension. The in-service, follow-up survey had an 87.5% response rate (n=28). While in-service evaluations provided additional information and insight into energy-related programming needs and opportunities, the smaller subset of responses were limited in some areas of Extension, such as in 4-H youth development.

Results of both survey instruments indicated the need for programming related to energy conservation and clean energy technology that would engage both agricultural and residential clientele. The primary barriers to energy programming were perceived as an insufficient understanding of clean energy technology and high costs associated with clean energy. These results further substantiate the reported lack of scientific knowledge required to facilitate innovation and diffusion of clean energy technologies (Özçiçek & Ağpak, 2017), as well as the high capital costs of those technologies (Union of Concerned Scientists, 2017). The preferred learning methods involved experiential participation and firsthand observation, including technology demonstrations (19.8%) and various training workshops (53.6%). Previous studies have similarly shown that various project design and hands-on teaching methods are effective for introducing renewable energy concepts and practical skills (Chen et al., 2010; Shyr & Hsu, 2010). Based on this data, clientele would best be served through Extension programming that addressed principal concerns through site and technology demonstrations. While topics reported less frequently in this study may be considered in the development of energy-related Extension programs, they may not be common enough to support the creation of prescriptive measures at this point in time.

The principal needs, barriers, and opportunities for energy-related programming reported in this study represent the immediate needs that Extension can address in helping various clientele make informed decisions on energy production and use. As such, this study highlights the opportunity to expand Extension's role and relevancy within the region through the delivery of unbiased and research-based information related to energy conservation and clean energy technology in order to guide informed decisions. While energy-related expertise, training, and programming may help to address the unique challenges and immediate needs for energy-related programming in Maryland, these programmatic priorities may have broader applications for Extension programs in other states.

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