

Sustainability Efforts on the Alfred University Campus

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Abstract:

After the University President signed the American College and University Presidents' Climate Commitment (ACUPCC) several years ago, the campus has been actively mobilized to address climate issues in facility operations and academic offerings. Related to operations, the facility management was able to reduce energy consumption; for example, natural gas usage decreased by 30%. Related to academic offerings, an undergraduate program in renewable energy engineering is fully functional, and an additional masters' program with emphasis on sustainability is being considered. Accompanying the new initiatives, the investigators conducted surveys to assist planning in course alignments and research projects. This article summarizes the lessons learned and offers suggestions for future activities.

I. Introduction

Sustainability on a university campus typically involves curriculum, research, and operations.¹⁻² Before introducing sustainability into curricula, a survey was conducted to gauge the faculty's willingness.³ Faculty development was considered a key component during curriculum revisions.⁴ Integrated curriculum models were proposed and tested.⁵ Additionally, it is important to strengthen links between HESD (higher education for sustainable development) and the surrounding community.⁶ Focused specifically on engineering education, qualitative studies were conducted to formulate the framework of critical sustainability concepts.⁷⁻⁸

Several years ago, the President of Alfred University signed the American College and University Presidents' Climate Commitment (ACUPCC).⁹ In 2013, the University introduced the Renewable Energy Engineering (RNEW) program and established several new laboratory setups. These setups include a large solar simulator with a panel testing size of about 1.5 m X 1.8 m, a wind tunnel with a sample space of nearly 0.5 m X 0.5 m X 0.8 m, and a water tunnel with a sample space of about 0.3 m X 0.3 m X 1.1 m.

The University needs to find other large experimental bases with solar, wind, and biomass resources for senior design projects and course projects. The University's lack of suitable properties necessitates building such bases off campus. Since this University is situated in Allegany County of New York State, with about 7% of its students coming from the County, the first attempt was to look at the available resources in the County. Allegany County is rural with a low population density.¹⁰ The prevailing land covers are forest of varying stages of maturity, former farmland in various stages of early ecological succession, and active farmland (pasture, hay, and crops). The County is economically

distressed, with very low income levels and a very high unemployment rate.¹¹ This combination of land cover and economic conditions led the researchers to investigate the attitudes of rural property owners toward producing and using biomass for energy, in addition to solar and wind resources. Presuming that biomass production might provide (1) an alternative cash crop to corn, hay, or animal production and (2) a source of on-site energy for electricity production, the researchers developed a survey to measure property owners' awareness of renewable energy technologies, to understand their attitudes toward the use of renewable energy in their community or on their property, and to gauge their interest in future collaborations. The survey was conducted between March and June of 2014 via USPS mailings.¹² After synthesizing the Farmers' Survey results, the researchers saw opportunities to work with local farmers to continuously improve the RNEW curriculum.

Besides the RNEW program, a Sustainability Concentration (SC) is being considered for the MBA (Master of Business Administration) program. The SC concentration and the RNEW program have common needs to seek employers' advice on sustainability as it is the integration of environmental, social, governance, ethics, and economic issues into the culture, decision-making, value-setting, and operational processes of an organization.¹³ Sustainability allows a corporation to manage a cost-effective, efficient, profitable organization; provide long-term competitive advantage; and to create both intangible and tangible value for shareholders, stakeholders, and society.¹⁴⁻¹⁵ Ideally, sustainability leads to invention, innovation, and change.¹⁶ An on-line Employers' Survey was conducted in March 2014. After analyzing the survey results, the researchers saw opportunities to collaboratively and systematically structure curricula in sustainability.

This article presents the Farmers' Survey in Section II, the Employers' Survey in Section III, the Impact on the Curricula in Section IV, Campus Sustainability in Section V, and Conclusions and Discussions in Section VI.

II. Farmers' Survey

Paper questionnaires on renewable energy sent to Allegany County's farmers in March 2014 yielded sixty-five valid replies received between March and June. There are eight multi-choice questions, with the first question related to property size, as illustrated in Figure 1. About forty-nine percent of the families own between 50 and 179 acres, thirty-two percent between 180 and 499 acres, and less than ten percent in other ranges. This land distribution is consistent with the trend documented by Allegany County in 2008.¹⁷ The land ownership profile will be used in our classes for case studies about development of renewable energies.

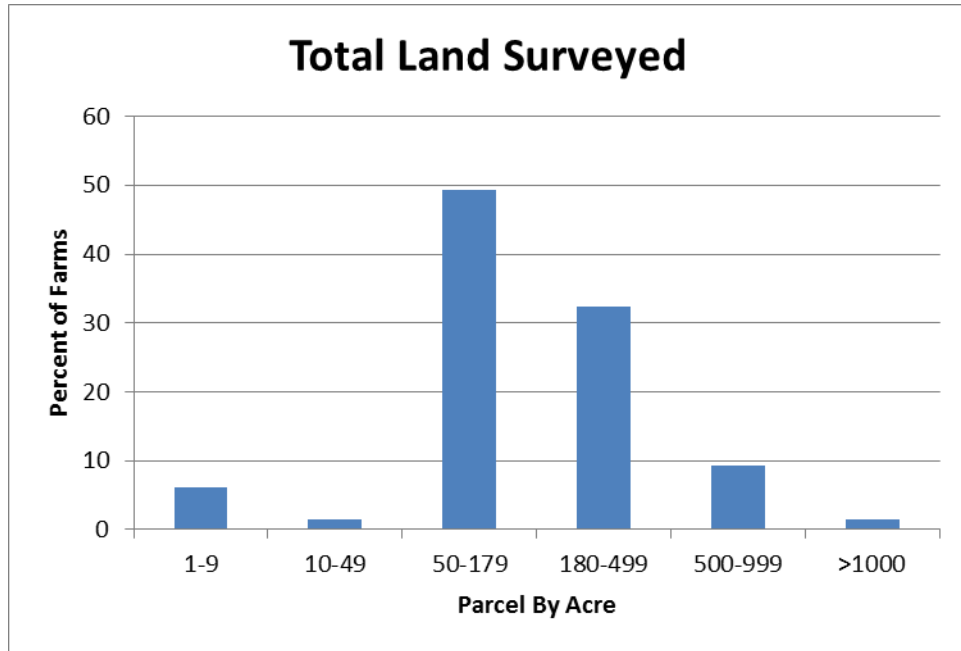


Figure 1. Range of land holdings by surveyed farmers

Since solar, wind and biomass resources are available in Allegany County, respondents' knowledge of harvesting technologies was self-assessed in the second question. This qualitative study bracketed the answers in five categories: "very knowledgeable," "somewhat knowledgeable," "not at all," "not sure," and "blank." Figure 2 shows that the majority of the respondents selected the "somewhat knowledgeable" category, and far fewer selected the other categories. Combining the "somewhat knowledgeable" and "very knowledgeable" categories, most farmers in this county reported having some knowledge, which might be related to systems demonstrated and/or installed in the area.

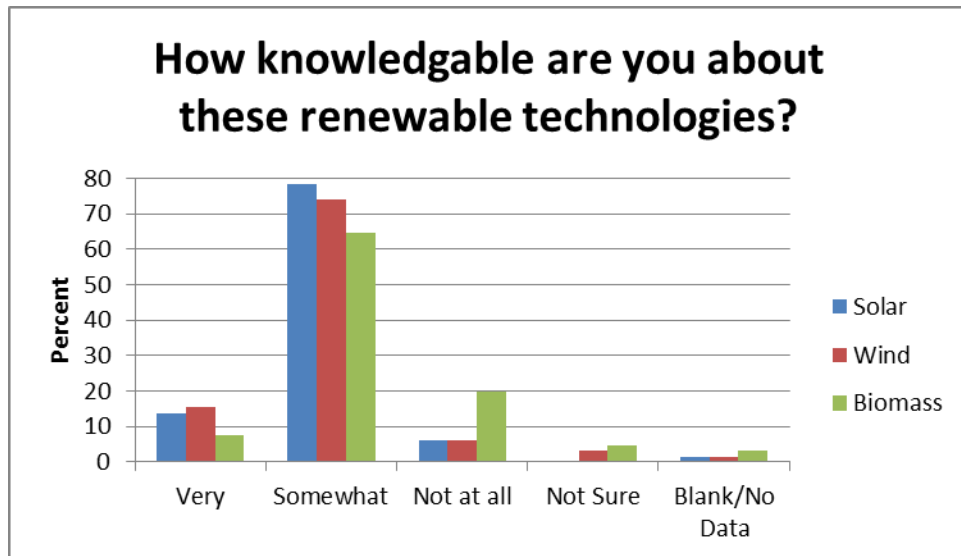


Figure 2. Levels of knowledge pertaining to various renewable energy harvesting technologies

The survey’s third question assessed renewable energy technology utilization, illustrated in Figure 3. A very large percentage said “no” (85% for Solar, 97% for Wind, and 88% for Biomass). Such low utilization rates were consistent with reports by the US and UK governments.¹⁸⁻¹⁹ Reflections on the survey results locally (in Allegany County) and globally suggest opportunities to enhance University curricula and to increase renewable energy utilization. In an optional written comments section, some farmers cited the following difficulties in technology development and system deployment: (1) high costs of the equipment and/or long periods of financial responsibility, and (2) existing regulations inhibiting the sale of surplus electricity back to utility companies after “net zero energy consumptions.” For Allegany County, an energy co-op model may be considered complimentary to the existing utility infrastructures.

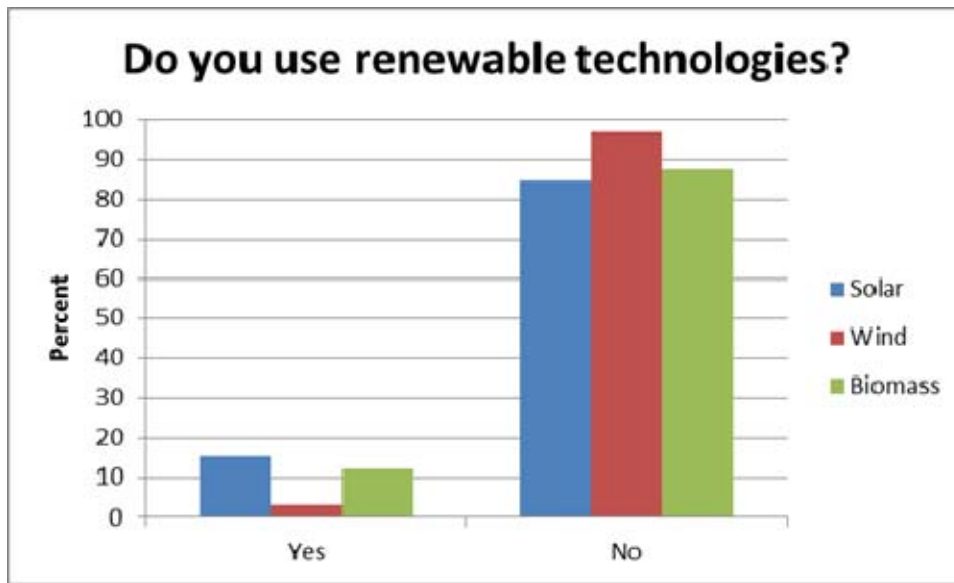


Figure 3. Responses on usage of three renewable technologies

The fourth question asked whether farmers believe that renewable technologies are good energy alternatives for communities. More than 57% answered “yes” for solar or wind; 42% answered “yes” for biomass. The lower percentage for biomass might indicate that some respondents were not familiar with modern harvesting technologies such as gasification and digestion technologies. Presumably, all of the categories together show that the respondents indicated that they are least knowledgeable about biomass. Some respondents in the “no” category clarified their opposing opinions in an optional written comments section, citing “The energy sector should be driven by free market principles” and “existing technologies are too expensive.” In comparison with the solar power, some respondents were less familiar with wind harvesting technologies.

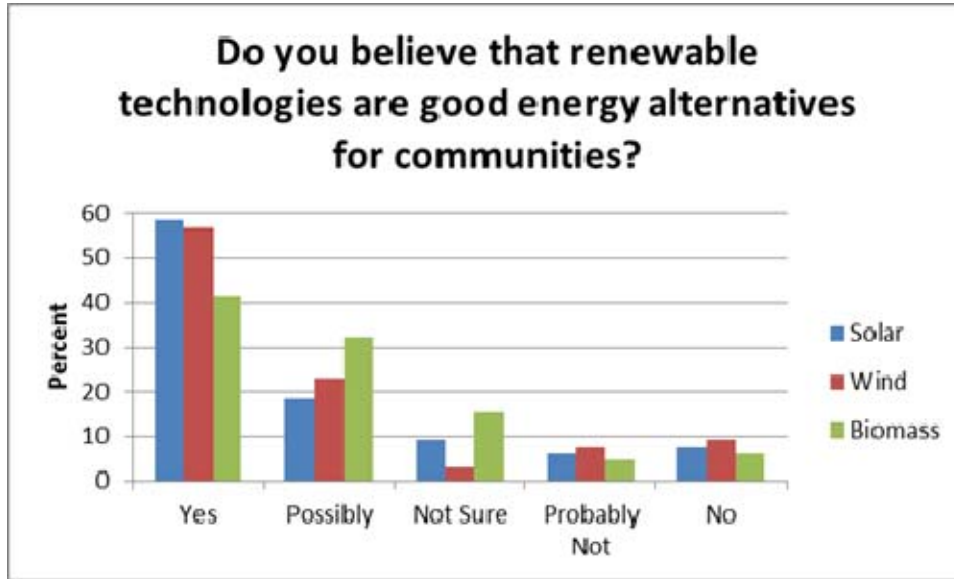


Figure 4. Opinions on renewable technologies as energy alternatives for communities

Answering the fifth question, respondents expressed their opinions on energy alternatives for farms, public facilities, and factories, as illustrated in Figure 5. In comparison with the “yes” category in Figure 4, each technology group received slightly more votes.

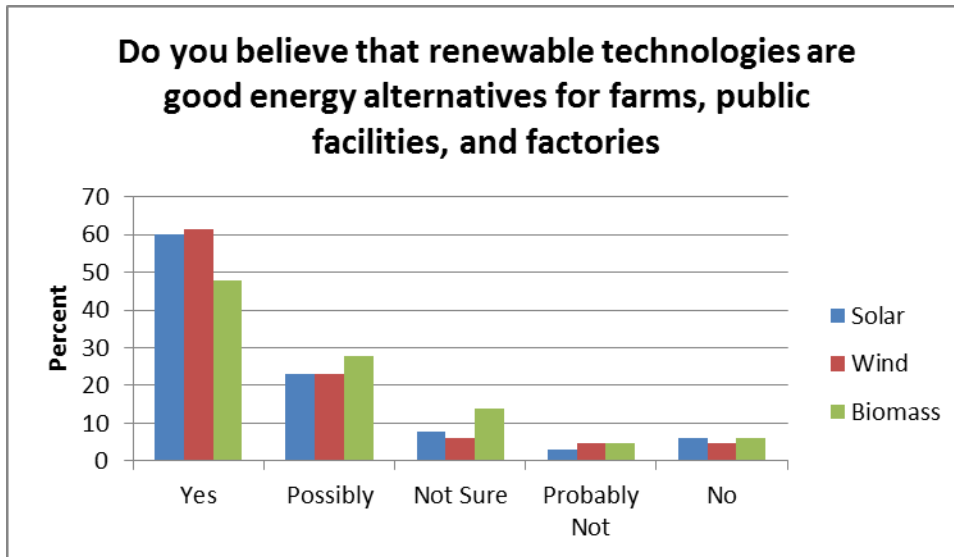


Figure 5. Opinions on renewable technologies as alternatives for farms, public facilities and factories

About funding renewable energy system constructions, the survey asked property owners whether municipal, county, state, or federal government should provide it? As illustrated in Figure 6, more than 32% voted “yes” and more than 14% voted “possibly,” while 23% voted “no” and more than 8% voted “probably not.” In an optional written section, 36%

of the respondents in “yes” category cited “environmental protection” as the main reason for funding. About 3% of the respondents in “no” category suggested that the financing should come from private funding sources.

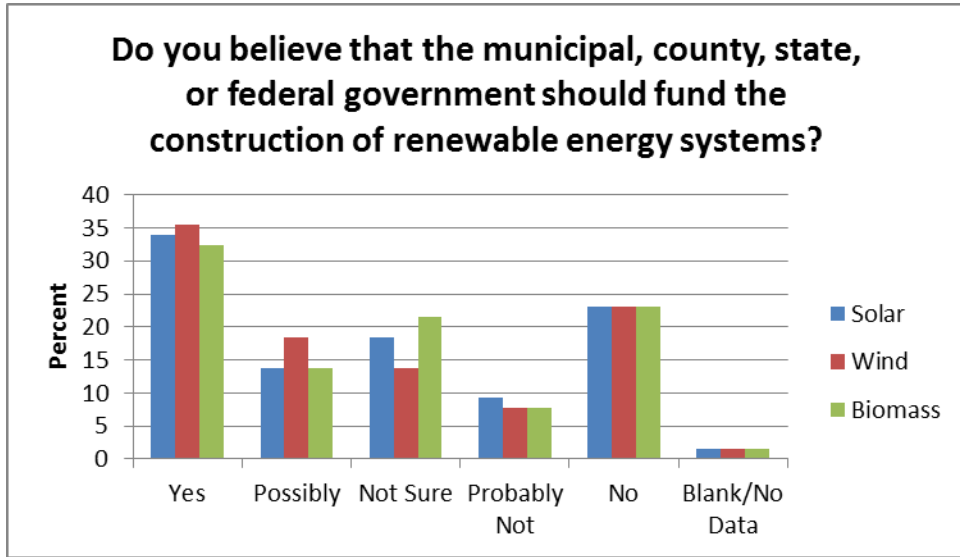


Figure 6. Opinions on funding for constructions of renewable energy systems

Then the survey asked, specifically for biomass, whether farmers would grow timber and/or crops to make money? As shown in Figure 7, 18% said “yes,” 26% “possibly,” 24% “no,” and 12% “not sure” or “probably not.”

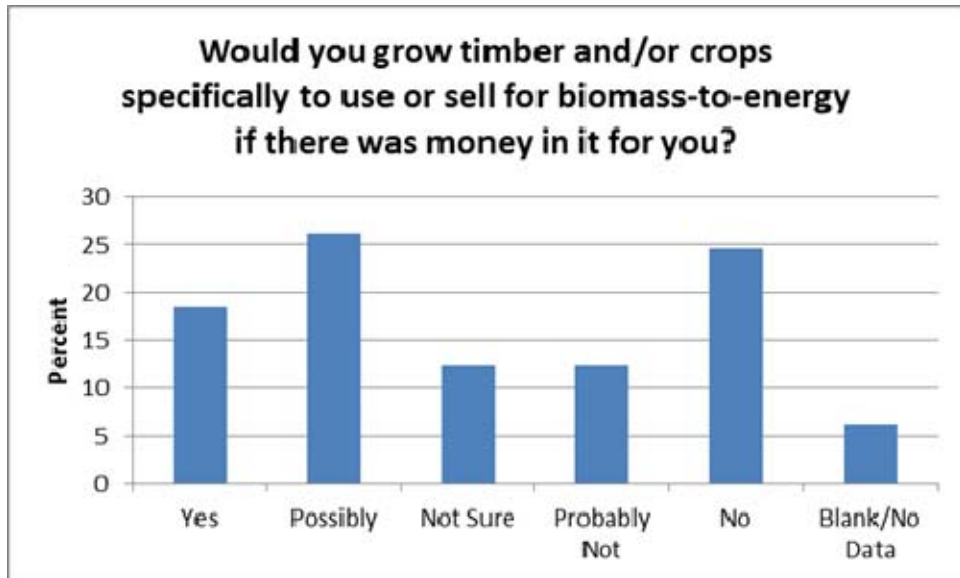


Figure 7. Opinions on growing timber and/or crops

Approaching the idea of collaboration, the survey asked farmers about their interest in hosting a renewable energy technology demonstration project. In the “yes” category,

solar was the most popular selection while biomass was the least popular, with wind in the middle, as illustrated in Figure 8. Such a trend continued in the “possibly” category, where 23% of the respondents said “yes” for biomass. In the “no” category, 28% of the respondents said “no” for biomass. Some farmers were willing to host demonstration projects. In an optional written section, farmers responded that solar technologies appeared to be more mature than biomass technologies.

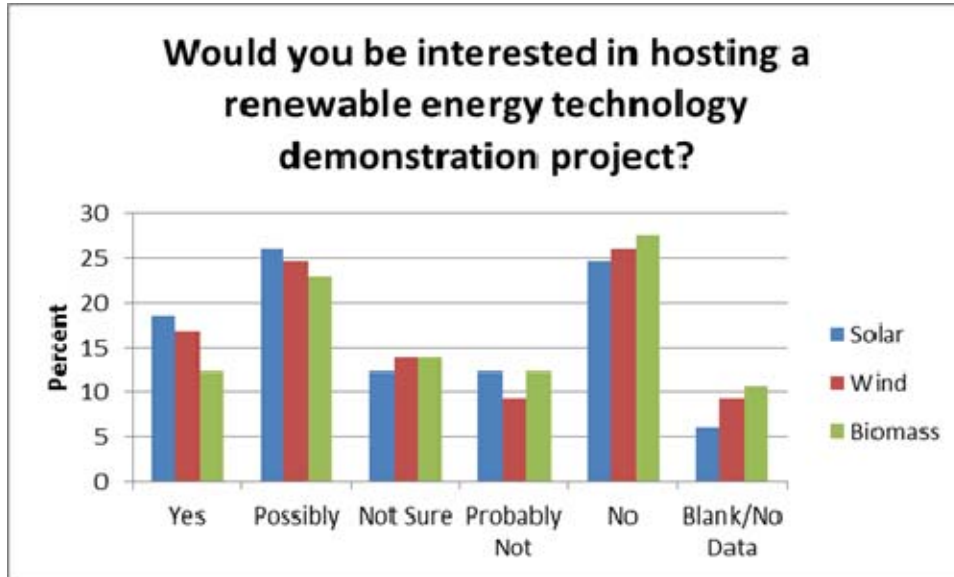


Figure 8. Opinions on hosting a renewable demonstration project

The written section took up three topics. The first topic asked farmers to list three most important benefits of existing renewable energy technologies. The most frequently cited benefit was “positive environmental impact.” Other frequently cited benefits were “independence from foreign oil” and “decreased dependence on fossil fuels.”

The second topic asked farmers to list three most important limitations of existing renewable energy technologies. The most frequently cited limitation was the high cost of installation and/or maintenance. Other frequently cited limitations were “a lack of education on facility operation” and “critical dependence on local climate conditions.”

The third topic asked farmers to provide other comments on the subject of renewable energy. Many wanted to increase the number of renewable projects and to overcome the limitations of existing technologies. Some saw the need for further research and suggested educational workshops to the general public. A few farmers requested technical help with their own projects.

III. Employers' Survey

To obtain input from employers, a survey on sustainability was emailed to for-profit companies on March 17, 2014. Thirty responses arrived within eight days. At a typical career fair on the Alfred University campus, the average number of hiring companies is close to thirty. This response rate suggests that the survey respondents represented an average population of businesses attending a career fair.

The survey posed four questions. First, how would employers describe the need to consider sustainability in their long-term planning? As illustrated in Figure 9, 47% chose the “extremely important” category, 40% “important,” 13% “neutral” and 0% “not important.” The majority of the employers recognized the importance of sustainability, which could be compared with those in earlier surveys in the United Kingdom,²⁰⁻²¹ and are consistent with the trend that sustainability is gradually being integrated into corporate strategies in order to remain competitive.²²⁻²³

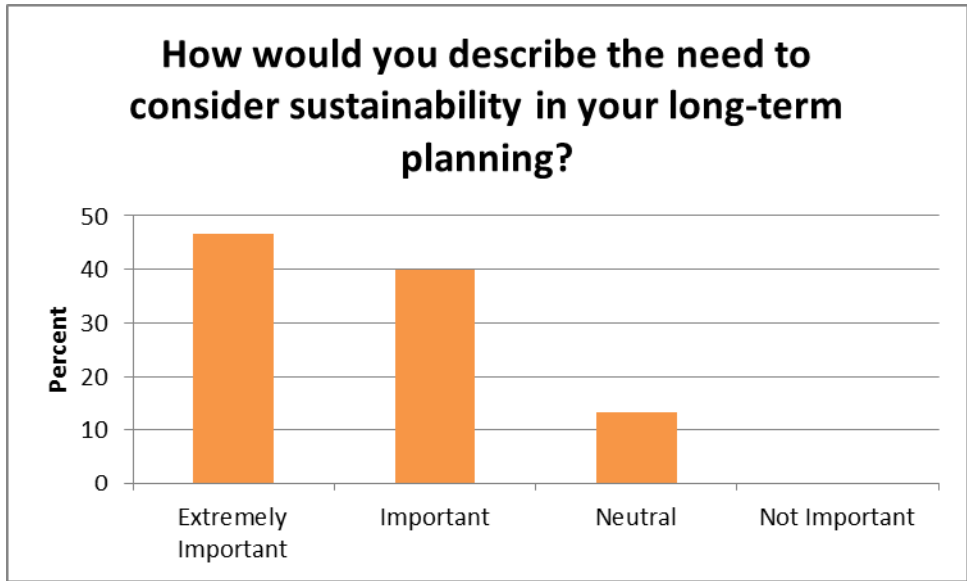


Figure 9. Need to consider sustainability in long-term planning

Second, the survey asked how important employee awareness of sustainability is, based on the needs of the business or organization. As illustrated in Figure 10, 37% chose the “extremely important” category, 40% “important,” 17% “neutral,” and the remaining 6% “not important.” The majority recognized the importance of employee awareness. As discussed by other authors, each corporation should actively raise its employees’ awareness in order to embed sustainability across the organization.^{14,24}



Figure 10. Importance of employee awareness

Third, the survey asked whether employers think that recently hired employees are adequately aware of sustainability concepts or issues? As shown in Figure 11, 37% of the respondents said “no” and 20% said “yes,” and 43% chose the “neutral” category. These numbers may indicate the need for sustainability education as employers may be actively hiring graduates with sustainable skills or a sustainability orientation.²⁵⁻²⁶

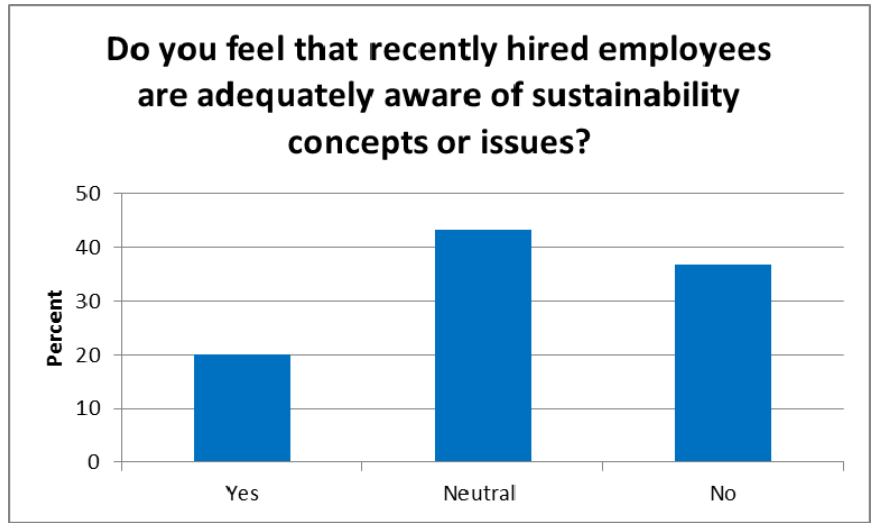


Figure 11. Assessment of recently hired employees

Last, the Employers’ Survey asked employers whether they believe that their clients, constituents, or investors are requiring closer attention to sustainability concepts and issues? As illustrated in Figure 12, 60% chose “yes,” 17% “neutral,” and 23% “no.” The majority believe that their business associates require more attention to sustainability. There are direct correlations between the “yes” respondents for this question and the “extremely important” respondents for the first and second questions. Such responses

can be related to corporate branding efforts,¹³ and corporate policies on sustainable development.²¹

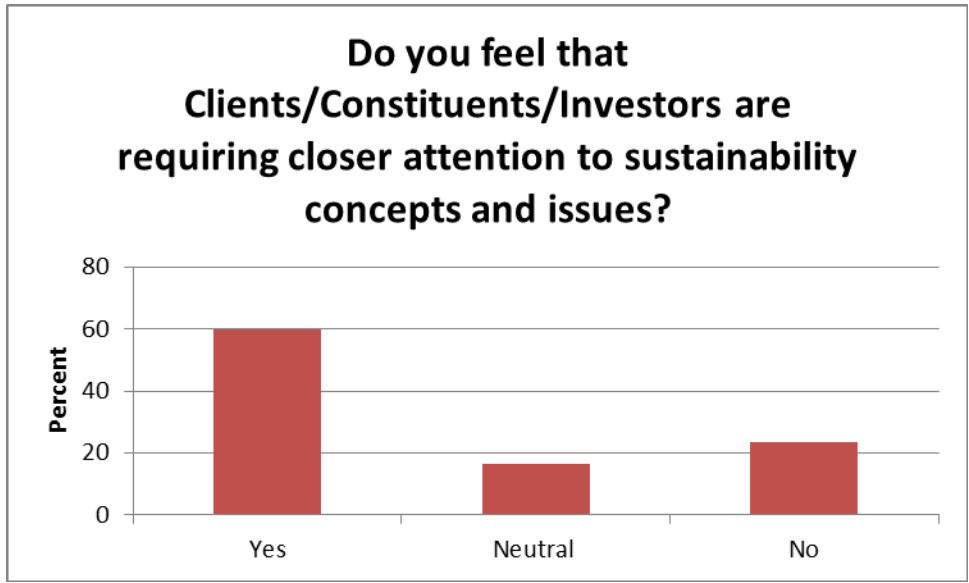


Figure 12. Requirements from clients/consumers/investors

In answering Questions 1, 2, and 4, the majority believe that the sustainability is important to their businesses, customers, and infrastructures. However, based on the answers to Question 3, many of the newly hired employees do not have adequate knowledge. To overcome such deficiency, institutions and businesses need to enhance sustainability education.

IV. Impact on the Curricula

Both survey results will help Alfred University to continuously improve the RNEW and SC curricula. The land ownership profile will be used in courses dealing with “planning for power generation facilities” and “development of energy resources.” For example, gasification or digestion facility sizes are closely related to the available land sizes or available biomass resources nearby, road conditions for transportation, and/or energy densities of biomass materials. Faculty and students in RNEW will have to work with their partners in SC to conduct comprehensive studies in energy economics and planning courses. Local farmers have some knowledge of renewable energy harvesting technologies. Their continuous exposure to demonstration/installation sites will be important to fully utilize the available resources. Currently, Alfred University is planning for the new demonstration stations to be built on and off campus. Some of the off-campus demonstrations should be strategically located near busy highways such as Interstate 86. Particularly, the biomass demonstration should be close to dairy farms and/or wood processing plants.

Renewable energy technology utilization rates are very low in Allegany County and nearby areas. In the course work assignments, students will explore opportunities to increase the utilization rates. They will attempt to overcome the difficulty in technology

development and system deployment. The RNEW students will also work with SC students to study the feasibility of setting up an energy co-op facility in Allegany County, complementary to the existing utility infrastructures. A large portion of the respondents believed that renewable technologies are good energy alternatives for communities, farms, public facilities, and factories. Currently, engineering and business programs are co-developing energy economics and policy courses to seek balances between free market principles and government policies, and to reach compromises between short-term profitability and long-term sustainability.

Certainly, there is a need to provide short courses and workshops on renewable energy. Following the survey, the University has hosted several day camps for students from local middle and high schools. In the future, the University intends to work with BOCES, Cornell University Extension, and the Allegany County legislature to deliver short courses off campus. Both RNEW and SC scholars can work together to conduct research to address the issues of the costs for the installations and maintenance of renewable energy systems. The interdisciplinary research can examine the issues related to financing, policies, market development and innovations. Encouraged by the farmers' survey, professors are adding a few new research topics for senior projects and graduate theses to address the needs of the agricultural community. In one project, Alfred University students are working with Alfred State College students to design an affordable solar house in Allegany County, which will be displayed in the US DOE Solar Decathlon competition in the fall of 2015.

V. Campus Sustainability

Similar to other higher education institutions and not-for-profit organizations, input from the business world is valuable in Alfred University's mission to provide excellent "products and service" to society and to its customers. Implementing sustainability in curricula can benefit students and their future employers. Practicing sustainability in facility operations can provide valuable lessons to faculty, staff, students, and local community members. The development of Alfred-brand "business" or operating models that include policies and practices to impart sustainability will likely be influenced by the students and their potential employers. This effort's drivers need to purposefully observe attitudes, policies, and practices regarding sustainability. Particularly, there is a continuous need to learn the best practices in operations and public relations and to gain skills and knowledge useful to the next generation of scholars and workforce (i.e., our products). On the operations side, the University added solar energy to its energy profile and reduced fossil fuel usage,²⁷⁻²⁸ achieving a reduction in natural gas usage of thirty percent. At Alfred University, the administration, faculty, staff, and students attempt to integrate environmental, social, governance, ethics, and economic issues into the culture and all of the decision-making and value-setting processes. If done properly, this University can be more cost-effective and efficient, with sustainable and competitive advantages. Thus, it can create both tangible and intangible value for the students and society because "sustainability is the primary moral and economic imperative of the 21st century."²⁹

With 179 years of history, Alfred University is continuously reinventing itself. Both RNEW and SC are exploring unique partnerships. For example, the administration is looking at 4+1 programs in which undergraduate students will pursue the four-year BS degrees in RNEW with business minors and then a one-year master's degree program. Many new courses become feasible: (1) Energy Economics, (2) Sustainability in Engineering and Business, and (3) New Business Models for Renewable Energy Developments. For SC, the drivers can consider "the 3 Ps": people, planet, and profit. This new emphasis should include ethics and corporate governance; leadership and management; sustainable business; and corporate finance. Based on other universities' experiences, integrating sustainability requires an interdisciplinary approach. The Employers' Survey here, along with other surveys,³⁰ will encourage us to explore other modes of collaboration with other departments such as education and psychology.

VI. Conclusions and Discussions

The survey results are helping this effort's drivers to develop curricula individually and collaboratively. Within the RNEW curriculum, solutions are sought to overcome the problems cited in the Farmers' Survey. Since the local farmers are more interested in solar and wind energies than biomass energy, new courses are added correspondingly. To fully understand the needs of employers, Alfred held a sustainability forum in November 2014. During the forum, potential employers provided detailed guidelines and wish-lists for sustainability education.

Most importantly, the University is beginning to see project opportunities between RNEW and SC. The professors are actively involving students in energy sustainability efforts in our courses. Specifically, the current study revealed some limitations of postal and email surveys. The sample sizes were small for such pilot studies. In future studies, researchers need to conduct hybrid surveys by combining postal, email, phone and social-media communications. Based on the qualitative studies here, the brackets will be better defined for future quantitative or semi-quantitative analysis. For example, refining the "somewhat knowledgeable" bracket into several more specific categories should enable better analytical work after amassing the survey data. In summary, the researchers are encouraged by the preliminary survey studies, and intend to expand their collaboration to other research projects on sustainability.

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