ISSN: 3065-0437

Columbia Journal of Engineering and Technology

Research Article

CULTIVATING KNOWLEDGE FOR SUSTAINABLE AGRICULTURE: THE ROLE OF RENEWABLE ENERGY IN EDUCATION

Michael Andrew Davis

Eastern Kentucky University, Department of Agriculture, 521 Lancaster Avenue, Richmond, KY 40475, USA

Abstract

Agriculture is a substantial consumer of energy, encompassing not only fuel usage in food and fiber production but also in the manufacturing of critical inputs like pesticides and fertilizers. In 2012, the U.S. agricultural sector devoured an astounding 800 trillion British thermal units (Btu), mirroring the primary energy consumption of an entire state, Utah. Renewable energy sources contributed 12.2% to the nation's energy consumption, with renewable electricity generation comprising 14.94% of domestically produced electricity in 2016. An extensive study by the Department of Energy's National Renewable Energy Laboratory (NREL) even envisages the potential to derive 80% of U.S. electricity from renewable sources by 2050. This substantial energy consumption and the potential shift towards renewables prompts an essential question: Are consumers prepared for such a transformation in electricity generation sources? Public sentiment regarding new energy sources predominantly hinges on personal values, experiences, and the influence of trusted social networks. Notably, public opinion regarding energy issues overwhelmingly supports the expansion of both solar and wind power. As our society and electricity production stride towards greater dependence on renewable energy, the imperative lies in educating the next generation and providing them with hands-on experiences in renewable technologies. This multifaceted approach promises to bridge the gap between energy consumption and sustainability, heralding a greener future.

Keywords: Energy consumption, Renewable energy, public opinion, Sustainability, Education.

1. Introduction

Agriculture consumes a tremendous amount of energy. Besides the fuel used in the food and fiber production, great amounts of energy are used to produce inputs such pesticides and fertilizers. The U.S. agriculture industry used nearly 800 trillion British thermal units (Btu) of energy in 2012, or about as much primary energy as the entire state of Utah. (EIA 2014) Energy from renewable sources accounted for 12.2% of the energy consumption in the United States. Electricity generated from renewable sources accounted for 14.94% of the total domestically produced electricity in the United States. (EIA 2016) A comprehensive study by the Department of Energy's National Renewable Energy Laboratory (NREL) reports the U.S. can generate up to 80 percent of its electricity from renewable energy by 2050. (NREL 2019) Given the tremendous amount of energy consumed and the potential for a greater percent coming from renewable energy sources, will the consumers be ready for the potential shift in the source of energy for electricity generation?

Support or disapproval for new energy sources is more likely to be based on personal values and experiences, as well as what we perceive to be the stances of others we trust. As a result, it's important to understand that people

may harbor different views concerning new energy technologies based on their personal values and experiences, as well as the views held within their social networks, (Boudet 2019). Public opinion about energy issues is widely supportive of expanding both solar and wind power. (Pew 2016) As our society and electricity production progresses towards more renewable energy, educating students and providing them experiences with renewables will assist in the shift.

Research question(s):

Will Kentucky agriculture teachers find the teaching of renewable energy important?

Null Hypothesis(s):

Kentucky agriculture teachers will not find the teaching of renewable energy topics important.

2. Methods

The survey instrument was distributed to Kentucky agriculture teachers during a statewide conference session. The researcher utilized this method to obtain the highest response rate, (62%). The survey contained a series of questions where participants could answer, using a Likert Scale, by stating that they strongly agree, agree, neutral, disagree, or strongly disagree. Demographic questions were also asked to determine if there were differences among the demographic groups and their responses. The survey data was compiled utilizing Microsoft Excel and the statistical analysis was conducted using SPSS program.

3. Results

Fifty eight percent of the respondents were male agriculture instructors and forty two percent were female. Years of teaching experience for the respondents are shown in Table 1. Thirty nine percent and fifty eight percent responded it was important and very important to teach renewable energy. Sixty seven percent of the agriculture teachers are not currently teaching any renewable energy topics. Thirty two percent responded they were.

Table 1: Teaching Experience

Years of Teaching Experience	Percent
1-5	40
6-10	20
11-15	12
16-20	12
21-25	11
30+	5

The results of the following research questions are displayed in Table 2.

1. How important is renewable energy to the World's future energy demand?
2. How important is renewable energy for Kentucky's future energy demand?

ISSN: 3065-0437
Columbia Journal of Engineering and Technology
Research Article

3. How important is renewable energy for creating jobs in the agriculture industry?
4. How important is it to introduce grades 5-12 students to the concept of renewable energy?

Table 2: Renewable Energy Importance

Response	World	Kentucky	Jobs	Introduce
Some Importance		2.3	7.0	2.3
Important	34.9	41.9	44.2	39.5
Very Important	65.1	55.8	48.8	58.1

When asked how many class periods the respondent would dedicate to teaching renewable energy instruction the results were fifty eight percent would dedicate 1-3 instructional periods. Twenty three percent stated 4-6. Seven percent answered 7-9 periods and nine point five percent indicated 10 or more periods of renewable energy instruction. The respondents were asked to rank the renewable energy topics appearing in Table 3 according to their importance to Kentucky. Table 3 displays the mean rank by the agriculture instructors.

Table 3: Renewable Energy Importance to Kentucky

Topic	Mean Rank	Rank
Comparison of fossil fuels vs. renewable energy	2.6	1
Solar	4.0	3
Wind	6.3	8
Geothermal	5.0	6
Oil crop/Biofuel	3.4	2
Biomass	4.9	5
Hydroelectricity	5.3	7
Ethanol Production	4.4	4

4. Conclusion

The majority of the Kentucky agriculture instructors perceived the teaching of renewable energy topics to be important or very important. The majority of the teachers would dedicate up to three instructional periods to teach renewable energy topics. Two-thirds of the agriculture teachers currently do not teach any renewable energy topics which is congruent with the majority of teachers which responded they do not have any instructional

resources for renewable energy. Based on the findings of the study the researcher concluded that alternative energy instructional units should be developed with regard to the following areas:

Fossil fuels verses Alternative Energy

Oil crop/Biofuels

Solar

Ethanol Production

A limitation of this study was the opinions of agriculture teachers who chose not to participate were not contacted to determine if they were different than the respondents. A second limitation is the findings cannot be generalized for any other agriculture teacher population.

5. References

Boudet, Hiliary. (2019). Public perceptions of and responses to new energy technologies. *Journal of Nature Energy*, 4, 446-455.

Department of Energy's National Renewable Energy Laboratory (NREL) "Renewable Electricity Futures Study". May 2019.**https://www.nrel.gov/analysis/re-futures.html**

Pew Research Center Science & Society"Public opinion on renewables and other energy sources." October, 2016. https://www.pewresearch.org/science/2016/10/04/public-opinion-on-renewables-and-other-energy-sources/ Science Daily. "Societal values and perceptions shape energy production and use as much as new technology." May, 2019https://www.sciencedaily.com/releases/2019/05/190528193013.ht

U.S. Energy Information Administration. "Primary Energy Production by Source"(PDF). *July, 2017.* https://www.eia.gov/totalenergy/data/monthly/archive/00351707.pdf

U.S. Energy Information Administration. "Energy for growing and harvesting crops is a large component of farm operating costs." October, 2014.https://www.eia.gov/todayinenergy/detail.php?id=18431