

REVIEW OF THE B.S. IN SUSTAINABLE AND RENEWABLE ENERGY

Classification of Instructional Programs (CIP) Code: 15.0503
Energy Management and Systems Technology/Technician

OVERVIEW

The B.S. in Sustainable and Renewable Energy program at Illinois State University is housed in the Department of Technology within the College of Applied Science and Technology. The department also offers an undergraduate minor in Technology; a B.S. in Construction Management; a B.S. in Engineering Technology; a B.S. in Graphic Communications; a B.S. in Industrial Technology; a B.S. in Technology and Engineering Education; an M.S. in Technology; and four graduate certificate programs: a Project Management Graduate Certificate, a Quality Management and Analytics Graduate Certificate, a STEM (Science, Technology, Engineering, or Mathematics) Education and Leadership Graduate Certificate, and a Training and Development Graduate Certificate.

The B.S. in Sustainable and Renewable Energy program was authorized by the Illinois Board of Higher Education on October 18, 2007, as the B.S. in Renewable Resources. The program was the first interdisciplinary undergraduate renewable energy degree program in the U.S. The program name has been changed twice since its establishment to reflect changes in the discipline and field. The name cited in this report became effective May 20, 2019. This is the first review of the program on the eight-year program review cycle. All other programs of the Department of Technology are scheduled to submit program review self-study reports in fall 2020.

The B.S. in Sustainable and Renewable Energy program prepares students for work in energy sustainability; energy efficiency; wind, solar, biofuels, and biomass energy development; and regulatory and government policy analysis. Graduates are employed by renewable energy consultants, renewable energy distributors, equipment manufacturers, governmental agencies, and non-profit organizations. The program maintains relationships with more than 50 industry partners, which helps with job placement. Many program graduates have pursued graduate degrees in diverse fields such as energy management, environmental policy and planning, landscape architecture, energy engineering, project management, economics, and business administration.

At the time of its establishment, the program had two sequences: a technical sequence and an economic/public policy sequence. The sequences were disestablished in 2011-2012 to create one all-encompassing plan of study.

Enrollment by Plan of Study, Fall Census Day, 2011-2018

B.S. in Sustainable and Renewable Energy, Illinois State University

First Majors Only

	2011	2012	2013	2014	2015	2016	2017	2018
Economics and Public Policy sequence	27	24	13	7	1	0	0	0
Technical sequence	53	47	19	7	0	0	0	0
No sequence	0	22	49	69	69	60	63	40
Total	80	93	81	83	70	60	63	40

Degrees Conferred by Plan of Study, Graduating Fiscal Year 2011-2018

B.S. in Sustainable and Renewable Energy, Illinois State University

First Majors Only

	2011	2012	2013	2014	2015	2016	2017	2018
Economics and Public Policy sequence	9	9	8	6	3	4	0	0
Technical sequence	14	15	25	10	7	0	0	0
No sequence	0	0	0	5	17	20	19	27
Total	23	24	33	21	27	24	19	27

[See table notes on the following page]

Table notes:

Graduating Fiscal Year consists of summer, fall, and spring terms, in that order. For example, Graduating Fiscal Year 2018 consists of the following terms: summer 2017, fall 2017, and spring 2018.

The economics and public policy sequence and the technical sequence were disestablished effective May 14, 2012.

EXECUTIVE SUMMARY PROGRAM REVIEW SELF-STUDY REPORT

Program goals

- Provide students with high quality educational experiences by featuring a modern, up-to-date curriculum that will develop the technical and managerial knowledge, skills, and attitudes that are foundational to success as renewable energy professionals.
- Recruit and graduate a diverse group of individuals to support the companies and organizations that will employ renewable energy professionals in Illinois and throughout the United States.
- Provide opportunities for students to interface with renewable energy professionals.
- Provide service to companies and organizations that employ renewable energy graduates through applied research, consulting/workshops, and participation in professional organizations.
- Develop industry and renewable energy alumni relationships in support of the program.

Students learning outcomes

- Describe the physical laws and resources that constrain our energy systems.
- Define the operation of renewable energy systems in terms of basic electrical and physical principles.
- Apply basic business, economic, and technical management principles in a variety of technical and non-technical contexts.
- Explain and defend their positions on energy/political/social issues.
- Design residential and commercial solar photovoltaic systems using renewable energy software.
- Analyze wind data using professional software.
- Optimize renewable energy business decision-making.
- Develop a business case for a commercial renewable energy project.

Program curriculum (2018-2019)

Graduation requirements:

120 credit hours consisting of 38 credit hours in required core courses in the discipline; 23 credit hours in specified General Education courses that prepare students for courses in the discipline; 6 credit hours of courses in finance, sociology, or technology; additional courses to fully meet General Education requirements; and electives to complete the 120 credit hours. Students are required to complete a minor in business administration, business environment and sustainability, economics, environmental studies, geography, or technology.

Program delivery

The program is offered on the Normal campus.

The program is delivered primarily through face-to-face or blended face-to-face/online instruction.

The Department of Technology sponsors a semester-long study abroad experience with Aarhus School of Marine and Technical Engineering in Denmark.

Department faculty (Fall 2018)

15 tenure track faculty members (6 Professors, 6 Associate Professors, and 3 Assistant Professors)

20 non-tenure track faculty members (5 full-time and 15 part-time, totaling 8.97 FTE)

Undergraduate student to faculty ratio: 18.5 to 1

Undergraduate student to tenure-line faculty ratio: 30.8 to 1

Two tenure-line faculty members in the department share primary responsibility for instruction and student mentoring in the Sustainable and Renewable Energy program.

Specialized accreditation

The B.S. in Sustainable and Renewable Energy program is not affiliated with a specialized accreditation association.

Changes in the academic discipline, field, societal need, and program demand

Since inception of the renewable energy program in 2007, sustainability has been increasingly emphasized in the field and discipline. Most large corporations now have a sustainability manager or an office of sustainability. To better prepare students for their renewable energy careers, faculty has increased coverage of sustainability in the renewable energy program curriculum and in co-curricular experiences. Recognizing the increasing emphasis on sustainability, the advisory board for the renewable energy program recommended a program name change. A change, to the B.S. in Sustainable and Renewable Energy, was subsequently recommended by program and department faculty to the college and provost. The name change was approved in September 2018 (after the program review self-study report was completed) and became effective May 20, 2019.

Responses to previous program review recommendations

Not applicable. This is the first review of the B.S. in Sustainable and Renewable Energy program on the eight-year program review cycle.

Major findings

Keys to program success at graduating students prepared for sustainable and renewable energy careers are its faculty members, who have strong, positive reputations for the quality of their scholarship and who hold state, national, and international leadership positions in the discipline, the numerous co-curricular experiences available to students (principally through the registered student organization associated with the program), class sizes that allow for individualized attention to students, and ongoing oversight by faculty of program and course quality. Strong connections with alumni have helped faculty maintain a curriculum that reflects changes in the profession and have benefited students through increased awareness of professional practice, networking, and job opportunities. Fall enrollment in the B.S. in Sustainable and Renewable Energy program has averaged approximately 75 students since program inception. Enrollment surged to 93 students in fall 2012, then declined to more a manageable 63 students by fall 2017. Based on current and anticipated resources available to the program, its faculty aims to maintain fall enrollment between 65 and 70 students in the coming years.

Initiatives and plans

- Continue to adapt and implement a curriculum that is representative of the field.
- Continue to upgrade laboratory facilities, to help prepare technically-capable renewable energy experts.
- Develop additional customized professional development strategies for renewable energy majors who wish to focus on a specific renewable energy system such as solar or wind.
- Work with the Illinois Board of Higher Education to develop a new renewable energy center to continue work done by the Center for Renewable Energy at Illinois State University (disestablished in 2018).
- Increase the diversity among students in the program.

PROGRAM REVIEW OUTCOME AND RECOMMENDATIONS FROM THE ACADEMIC PLANNING COMMITTEE

Review Outcome. The Academic Planning Committee, as a result of this review process, finds the B.S. in Sustainable and Renewable Energy program to be in Good Standing.

The Academic Planning Committee recognizes the fall 2018 self-study report compiled by faculty of the B.S. in Sustainable and Renewable Energy program as the first self-study report on the eight-year program review cycle completed for the program since its inception. The committee thanks the program for a concise yet descriptive report that is critical and forward looking.

The committee recognizes the Department of Technology for successful implementation of the first interdisciplinary renewable energy degree program in the U.S. and the first and only undergraduate renewable energy program in Illinois. Program faculty members have developed a curriculum that combines theory, practice through hands-on activities and internships, and research. The committee recognizes faculty efforts to maintain the currency of the program relative to the fast-changing sustainable and renewable energy field. Among the program changes made by faculty since inception of the program are merging of the two sequences in place at program inception, adding renewable energy courses, and changing the name of the program to reflect changes in the field (on May 20, 2019, the name of the program changed to the B.S. in Sustainable and Renewable Energy).

The committee commends faculty members for their involvement of students in sustainable and renewable energy scholarship. Faculty members mentor students completing their capstone research projects that often involve community stakeholders and presenting their findings at the annual university-wide student research symposium. Since 2012 at least nine articles co-authored by faculty and students in the program have been published.

The committee recognizes efforts by faculty to help students complete the program and to do so within four years. Retention rates and six-year graduation rates consistently exceed rates across all undergraduate programs at the University. The percentage of renewable energy program completers graduating from the program within four years also consistently exceeds the percentage across all undergraduate programs at the University. In Fiscal 2017, for example, 83.3 percent of renewable energy program graduates completed the program within four years compared to 67.3 percent university-wide. It follows that average credits to degree for first-time-in-college students completing the program are consistently below the university-wide average. With respect to external transfer students, the committee commends the program for its collaborations with community colleges to streamline the transition of community college graduates into the renewable energy program at Illinois State. Faculty members have worked with several community colleges to develop articulation agreements and maintain regular communication with community college faculty and staff regarding progress of students seeking to continue their education at Illinois State. The committee also recognizes faculty members for their efforts to seek external funding to provide funds to support the program, including scholarships to students who might not otherwise be able to enroll in the program. The committee encourages continuation of those efforts.

Critical to program success in preparing students for employment and post-baccalaureate education in the field is involvement in the program by external stakeholders. Those include representatives of industries, professional associations, public interest groups, and regulatory entities, as well as program alumni. Venues for external stakeholder involvement include the Renewable Energy Advisory Board and the Renewable Energy Society, the latter a registered student organization sponsored and facilitated by program faculty. Involvement of external stakeholders continues to benefit the program and its students through input regarding program design and content, sponsorship of internship opportunities, mentorship of students, and hiring of program graduates. Students also have opportunities to learn from practitioners in other countries through a study abroad experience based in Denmark. As the program has matured, its faculty has made concerted and sustained efforts to maintain contacts with the growing number of program alumni, to document their career trajectories, and to encourage their involvement with current students in the program. The committee commends faculty for those efforts.

The committee commends faculty for developing and implementing a methodologically sound assessment plan that includes both direct and indirect measures and for continuously using assessment findings to help guide program changes. Particularly noteworthy is the focus across all methods, including surveys of external stakeholders, on assessment of student learning relative to learning outcomes adopted by faculty.

Recommendations. The Academic Planning Committee makes the following recommendations to be addressed within the next regularly scheduled review cycle. In the next program review self-study report, tentatively due October 1, 2026, the committee asks the program to describe actions taken and results achieved for each recommendation.

Recruit to stabilize and grow program enrollment. When Illinois State University applied to the Illinois Board of Higher Education (IBHE) for authority to offer the B.S. in Sustainable and Renewable Energy degree (then called the B.S. in Renewable Resources), its Department of Technology forecast having 50 students enrolled in the program by its fifth year. By its first fall census day, in 2008, the program had already enrolled 42 students. Thereafter, enrollment steadily increased to 93 students in fall 2012. Since then, however, enrollment has declined, to a low of 40 students in fall 2018, while applications for admission to the program have declined from 37 in 2012

to 11 in 2017. These declines have happened during a period in which interest in sustainable and renewable energy remains high in Illinois and the Midwest, as additional wind power and solar power installations are under construction or being planned, and as several states, including Illinois, mandate use by electric utilities of energy generated by renewable energy sources.

The committee recommends that the program and Department of Technology work with Enrollment Management and Academic Services at the University to develop and implement a plan for reversing enrollment decline and for growing enrollment within the constraints of available faculty resources. One component of the plan could involve actions associated with the recently approved NSF-funded project to recruit area community college graduates to STEM (Science, Technology, Engineering, or Mathematics) programs. Other components of the plan might include expanded outreach to secondary schools in the state, collaborative student recruitment with other units at the University that sponsor academic programs related to the environment (e.g., the new B.S. in Environmental Systems Science and Sustainability program), or partnerships with renewable energy companies operating in the region.

Recruit for student diversity. The committee commends the program for recognizing the need to increase the diversity of its student population with respect to gender and race/ethnicity. From 2014 through 2017, representation of women among students in the program as of fall census day averaged 12.4 percent compared to 44.5 percent across all undergraduate programs of the College of Applied Science and Technology and 55.1 percent across all undergraduate programs university-wide. During that same period, the percentage of students in the program as of fall census day who self-identified with traditionally underrepresented racial or ethnic groups averaged 15.5 percent compared to 21.7 percent across all undergraduate programs of the college and 23.0 percent across all undergraduate programs university-wide. The committee recommends that program faculty work with the Department of Technology to develop and implement a plan for recruiting and retaining students from traditionally underrepresented groups. The plan could be integrated with the student recruitment plan recommended above or could be developed as a separate plan.

Continue to maintain a program that is current, relevant, and supportive of student success. The committee recognizes substantial work by former and current faculty members to review and update the program and its curriculum. Among the most significant changes made by faculty is disestablishment of the two sequences (the Technical sequence and the Economics/Public Policy sequence) to ensure that all students are exposed to both technical and policy aspects of the field. The committee recommends continued periodic review of the program structure and content to remain current with changes in the field and to maintain program retention and graduation rates (including the percentage of graduates completing the program within four years).

In addition to studying assessment findings, the committee suggests that faculty members study graduation exceptions data to identify any current or potential obstacles to timely program completion, particularly for transfer students. Findings from that study could inform honing of existing articulation agreements with community colleges and inform development of similar agreements with other community colleges. The committee notes that participation by renewable energy students in the Honors program has been lower than the average across all undergraduate programs at the University during six of the last eight years for which data are available. The committee suggests that faculty members investigate student interest and participation in the Honors program to ensure that students desiring to complete the Sustainable and Renewable Energy program with honors have sufficient opportunities to do so.

Continue to upgrade laboratory equipment and facilities. The committee recognizes the importance of specialized laboratory facilities and equipment for supporting faculty and student research and for preparing students for work in sustainable and renewable energy positions. Among the energy equipment currently available in the Department of Technology are solar photovoltaic workstations, wind energy workstations, a wind tunnel, and a heliodon. The committee supports faculty efforts to periodically upgrade the equipment to best support learning and research and to expose students to the technologies they will most likely encounter in the field after graduation. The committee suggests that the program consider involving its industry partners in efforts to upgrade laboratory equipment and maintain state-of-the-art laboratory facilities.

Continue collaborating with Milner Library in providing information fluency instruction and research resources for students and faculty. The committee recognizes the collaboration between program and library faculty to provide information fluency training in the research and capstone courses of the Sustainable and Renewable Energy program. The committee recommends expanding that work by identifying information literacy

learning outcomes for the program, mapping those outcomes to the curriculum, and including information fluency assessment strategies in the students learning outcomes assessment plan for the program. In addition, given the rapid nature of technological changes in the field, the committee suggests periodic, systematic assessment of library resources intended to support the program for their continued relevance to the curriculum and to faculty research. The committee suggests coordination between the department and the library as research materials are acquired for either the library collection or the core resource collection located in the sustainable and renewable energy laboratory.

Explore establishing a research and service center for sustainable and renewable energy. Contemporaneous with establishment of the B.S. in Sustainable and Renewable Energy program in 2007 was the establishment of the Center for Renewable Energy to support learning and research in the field. The center was jointly sponsored by the College of Applied Science and Technology and the College of Arts and Sciences and was housed in the Department of Economics. The center ceased operations in 2016 and was officially disestablished in 2018. The committee supports Sustainable and Renewable Energy program faculty plans to explore establishing a new center to continue work done by the Center for Renewable Energy. A new center could be a valuable contributor to the Sustainable and Renewable Energy program by helping maintain and grow industry partnerships, and the benefits to students and faculty accruing from them, and by helping secure external funding in support of research in the field.

Continue efforts to assess student learning and utilize assessment findings to inform program design and implementation. The committee encourages faculty to continue assessing student learning, utilizing assessment findings to make program improvements if deemed necessary based on the findings, and documenting its assessment work, including the rationale for program changes. The committee encourages faculty to periodically review the assessment plan for its effectiveness in guiding program evaluation and for its sustainability in light of department resources.