BS Renewable Energy Engineering

2014-15 Assessment Report

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The Bachelor of Science in Renewable Energy Engineering (BS REE) program at Oregon Institute of Technology (Oregon Tech) has been designed to provide interdisciplinary education in mechanical, electrical, and chemical engineering topics as they apply to renewable energy. Students take coursework in communications, natural sciences, mathematics, and the humanities and social sciences to support their engineering coursework.

The BS REE program goal is to provide graduates for careers in areas of renewable energy engineering such as but not limited to: solar, solar thermal, wind power, wave power, geothermal energy, transportation, energy storage, hydroelectric and traditional energy fields such as power systems, smart grid, energy management, energy auditing, energy systems planning, energy economics, energy policy and development, carbon accounting and reduction, and controls and

Northwest convinced us that an engineering degree, the BS REE degree, was the only suitable option for our students.

The BS REE program has strong relationships with industry, particularly through its program-level Industry Advisory Council (IAC) and REE alumni. The IAC has been instrumental in the success of the BS REE program. Representatives from corporations, government institutions and non-profit organizations comprise the IAC, giving the BS REE a broad constituent audience. The IAC provides advice and counsel to the REE program with respect to the areas of curriculum content advisement, instructional resources review, career guidance and placement activities, program accreditation reviews, and professional development advisement and assistance. In addition, each advisory committee member serves as a vehicle for public relations information and potentially provides a point of contact for the development of specific opportunities with industries for students and faculty.

(i) an ability to engage in independent learning and recognize the need for continual professional development[2]

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

[2] During Convocation in Fall 2010, the EERE faculty agreed to change outcome (i). Previously, the faculty had adopted the outcome (i) developed by ABET: "a recognition of the need for, and an ability to engage in life-long learning".

Assessment of the program outcomes is conducted over a three year-cycle. Table 1 shows the minimum outcomes assessed each year. The assessment cycle was changed during the 2014-15 assessment year from the previous assessment cycle, shown in Table 2. This change was implemented at an assessment coordination meeting on February 2, 2014. At this meeting, assessment coordinators representing each program within the Electrical Engineering and Renewable Energy (EERE) Department aligned their assessment cycles so that each program assesses similar outcomes on the same years. The intention for this change is to better organize the assessment process and produce more meaningful data for comparison between different programs in the EERE Department.

Effective the 2014-15 academic year, the assessment cycle begins in the Spring. In previous years, the assessment cycle started in the Fall. This change reflects a shift on an institutional level to begin data collection in the spring term. In 2012-13 the Assessment Comm

The MSREE faculty conducted formal assessment during the 2014-15 academic year using direct measures, such as designated assignments and evaluation of coursework normally assigned. Additionally, the student

proper assessment methodology may lead to more accurate numbers); for example, this could be the suggested course of action if an outcome was assessed in a lower-level course, and the faculty decide that the outcome should be assessed in a higher-level course before determining whether curriculum changes are truly needed.

Implement changes to the curriculum (if the faculty conclude that a curriculum change is needed to improve attainment of a particular outcome). A curriculum change will be the course of action taken when the performance on a given outcome is below the target level, and the evidence indicates that there is sufficient data and an adequate assessment methodology already in place, and therefore there is no reason to question the results obtained.

If the faculty decide to take this last course of action and implement curriculum changes, the data from the

application of mathematical tools. The design, implementation, and integration of the different sub-circuits requires knowledge and application of science and engineering principles. Students were required to write a complete reports following the guidelines of the IEEE Transactions Journals (IEEE Transactions Publication-Ready Template and Instructions for Authors).

Fourteen BS REE students were assessed in Winter 2014 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 2 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome, that is, over 80% of students were able to apply knowledge of mathematics, science, and engineering to the solution of an engineering pro a165.tude

students were able to apply knowledge of mathematics, science, and engineering to the solution of an engineering problem.

Table 3 - Outcome (a): Wilsonville, EE 321, Fall 2014, Dr. Crespo 1

Outcome (a): an ability to apply knowledge of mathematics, science, and engineering				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1 - Mathematics	1	11		

This outcome was assessed in EE 355 –

with 5 in one group, 2 in one group, 1 in group, and 4 in other group. During the implementation process, 3 presentations were scheduled for students to present the progresses on their projects. And final reports with collected data and data analysis were collected to evaluate their performance and assess the outcome.

The first team designed a photovoltaic system beside highway to use road surface to collect sunlight and generate power. The team collect data and estimate the power generation on the selected portion of I-90 near

team was required to write laboratory report for each experiment detailing the objectives of the experiment, materials and methods, analysis and interpretation of results, and conclusion and recommendation.

Twenty five students were assessed in Winter 2015 using the performance criteria listed below. Team participation, communication, management and delegation of responsibilities were observed by the instructor during lab experiments and when grading the team reports. The minimum rite6b5am

The outcome was assessed using the senior capstone projects of ENGR465 II Winter 2015. All senior projects are team based. The student teams are formed through two different ways. (1) Senior project topics are offered by course advisor or external sponsors for students to select. The advisor and external sponsors give presentations to introduce the background of the offered projects. Then students register for their selected projects. During this process, students may randomly register for some projects and the students who register for the same project form a team or students team up to register for a project. (2) Students team up and propose their own projects. In the senior project sequence of 2015-2015 Academic Year, 5 student teams are formed and work on 5 different projects, namely, "The Rainbow Golf Youth Education Project (Solar Photovoltaic Golf Court Irrigation System and Micro Power Grid Project)", "Biochar Supercapacitor", "An Automated Enzymatic Biodiesel Production Plant", "A Compound Parabolic Concentrator Hybrid Solar Thermal and Photovoltaic System", and "A Self-sustaining Water Purification System". The interdisciplinary teams are formed. The students from electrical engineering, renewable energy engineering, mechanical engineering and manufacture technology, teamed up to work on the interdisciplinary projects. The student groups were asked to give three presentations to demonstrate their project progresses and submit wr

were asked to give three presentations to demonstrate their project progresses and submit written report to conclude their project. Students demonstrated their ability to function on multi-disciplinary teams. Students with different background demonstrated their ability to collaborate each other to work on the different parts of the projects. In this assessment, one of the student team is formed by registering to the assigned project, the other team is formed by selecting their own project and teaming up their own team.

Six senior students were assessed in term Winter 2015 using the performance criteria listed below. The minimum acceptable performance level was to have 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 11 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all performance criteria for this program outcome. Students met or exceeded expectations; they demonstrated their abilities to function on multi-disciplinary teams. The two teams showed outstanding team work skills and worked out fabulous projects.

Table 11 - Outcome (d): Klamath Falls, REE 307, Winter 2015, Dr. Shi

Outcome (d): an ability to function on multi-disciplinary teams				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	% student >=2
1 - Team participation, communication	0	0	6	100%
2 - Management of team, delegation of responsibilities	0	0	6	100%

This outcome was assessed in REE 412 - Photovoltaic Systems, and REE 469 - Grid Integration of Renewables.

This outcome was assessed in REE 469 – Grid Integration of Renewables in Spring 2014 by means of a written paper. The assignment consisted of reading and reviewing two professional journal papers (with a publication date later than 2012) or a technical book/publication chapter (with a publication date of later than 2010) in order to familiarize themselves with contemporary issues associated with integrating renewable resources into the power grid. Finally, the students were required to write a two-page summary (one page per reviewed paper or two pages per book chapter) following the guidelines of the IEEE Transactions Journals (IEEE Transactions Publication-Ready Template and Instructions for Authors). This shows student's ability to think critically about the contemporary issues studied and to condense digested information.

Thirteen students were assessed in Spring 2014 using the performance criteria listed in the table below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 12 summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was met on all three performance criteria for this program outcome, that is, over 80% of students were able to demonstrate knowledge of contemporary issues.

Table 12 - Outcome (j): Wilsonville, REE 469, Spring 2014, Prof. Rytkonen

Outcome (j): A knowledge of contemporary issues				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1 - Demonstrate knowledge of contemporary issues	0	9	4	100%
2 - Recognize the temporal nature of contemporary issues	0	9	4	100%
3 - Recognize the historical context of contemporary issues	0	13	0	100%

A total of 13 students were assessed using the performance criteria listed below. The minimum acceptable performance level was to have above 80% of the students performing at the accomplished or exemplary level in all performance criteria.

Table 13 summarizes the results of this targeted assessment. The results indicate that the performance level higher that 80% was met on the performance criteria for this program outcome, demonstrating that the students in the evaluated class have the ability to design, conduct experiment and analyze data.

Table 13 - Outcome (j): Klamath Falls, REE 412, Fall 2014, Dr. Shi

Outcome (j): A knowledge of contemporary issues				
Performance Criteria	1-Developing	2-Accomplished	3-Exemplary	%Students >= 2
1 - Demonstrate knowledge of contemporary issues	0	0	12	100%
2 - Recognize the temporal nature of contemporary issues	0	0	12	100%
3 -				

In addition to direct assessment measures, the student outcomes (a) through (k) were indirectly assessed through a senior exit survey. Question 16 in the survey asked students "Below are the ABET student outcomes for the BS REE program. Please indicate how well the BS REE program prepared you in each of the following areas". Figures 1 and Table 15 show the results of the indirect assessment of the BSREE student outcomes for the 2014-2015 graduating class. Twenty two BS R

Outcome	Inadequately prepared	Prepared	Highly prepared
a. an ability to apply knowledge of mathematics, science, and engineering	1	8	13
b. an ability to design and conduct experiments, as well as to analyze and interpret data	1	9	12
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	0	13	9
d. an ability to function on multi-disciplinary teams	1	8	13
e. an ability to identify, formulate, and solve engineering problems	0	10	12
f. an understanding of professional and ethical responsibility	1	9	12
g. an ability to communicate effectively	0	9	13
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	1	10	11
i. an ability to engage in independent learning and recognize the need for continual professional development	0	7	15
j. a knowledge of contemporary issues	2	13	7
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	0	12	10

Figure 2 - Results of the indirect assessment for the BSREE Student Outcomes as reported in the Senior Exit Survey (2014-15)

This section describes the changes resulting from the assessment activities carried out during the year 2014-

Table 14 -

The results of the 2014-15 Assessment indicate that the minimum acceptable performance level of 80% was met on all performance criteria for all assessed outcomes. Areas of improvement to the curriculum were discussed during the Closing the Loop Meeting in May 2015 with respect to these results. These areas include:

- The results show that the threshold of attainment of this outcome was exceeded in all performance criteria. These results are consistent with those obtained the last time this outcome was assessed in the 2011-12 assessment cycle.
- The faculty identified no problem with this outcome, and therefore recommended no changes at this time.

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- The results show that the threshold of attainment of this outcome was exceeded in all performance criteria. These results are consistent with those obtained the last time this outcome was assessed in the 2010-11 assessment cycle.
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